San Nicolas Wetland Rethinking Urban Runoff

Problem: Water quality, function and aesthetics of the Campus Lagoon and wetlands across the nation are impacted by excessive nutrient-rich runoff.

Students Assess Lagoon Water Quality

Since 2005, the Cheadle Center for Biodiversity and Ecological Restoration (CCBER) has been researching lagoon water quality. Students collected stormwater for nutrient and heavy metal studies; monitored dissolved oxygen, temperature, and salinity; measured algae cover and collected soil cores from the bottom of the lagoon to assess carbon content and benthic invertebrate diversity.

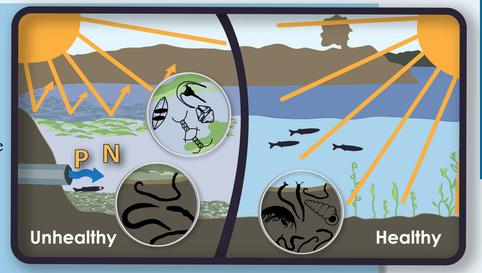
Students monitor wetland and algae cover.

What did they find?

High Nutrients — Low O_2 — High Algae — Low Biodiversity

Students found high nutrient levels in both the dry season (from irrigation runoff) and during storm events. They found consistently low dissolved oxygen levels in the dry season, especially at the bottom of the lagoon, which creates a challenging environment for fish and bottom dwelling (benthic) organisms. Soil cores showed that the bottom is covered with a deep muck of half-decomposed organic matter and a low diversity of benthic organisms. Together, these studies have demonstrated that the campus lagoon is suffering from **eutrophication**, indicating the need to treat runoff before it reaches the lagoon.

Eutrophication



Eutrophic or unhealthy system: Unfiltered, nutrient-rich runoff (high in nitrogen 'N' and phosphorus 'P') from irrigation and storm events supports dense algal blooms. This algae layer blocks sunlight and eventually dies and sinks to the bottom. Low-oxygen conditions are created at the bottom by the oxygen-demanding activity of decomposers working to break down the annual additions of dead algae. Because the lagoon doesn't experience tidal flushing, these low-oxygen conditions effectively reduce the diversity of organisms that can survive.

Healthy system: Wetlands without excessive nutrient rich inputs have a healthy balance of algae and phytoplankton. This allows the sun's light and energy to reach the bottom of the wetland and support a diversity of organisms and natural nutrient cycling.

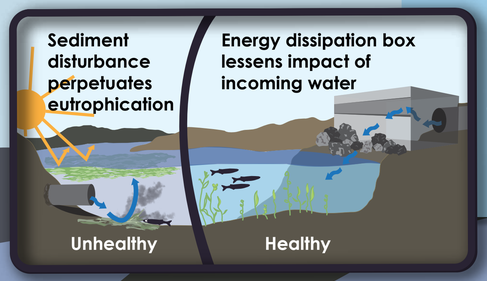
Working Toward a Solution

Transforming a site: This site was dominated by invasive, non-native plants such as ivy, castor bean, kikuyu grass and pampas grass. Student research on the site's hydrology demonstrated the presence of a near-surface water table. Their findings led to a vision for wetland restoration. A 2010 campus-funded project to upgrade the storm drain system provided the opportunity to translate the research and planning into a multi-faceted project designed to address lagoon water quality issues. The Coastal Fund, The Wetlands Recovery Project, and Housing and Residential Services provided additional funding that made the full restoration possible.

Pre-project: weed dominated

Post-construction & before planting

Solution: A multifaceted treatment process improves water quality, enhances aesthetics and supports diverse habitats.



Challenge: Storm drains concentrate runoff into a powerful force that can churn up wetland sediment, release sequestered nutrients into the water column, and support algal blooms, which perpetuate eutrophication even if water entering the system is clean.

Solution: This system has an energy dissipation box that absorbs the concentrated storm water energy, spreads out the flow and directs it over a series of boulders, which oxygenates the water and reduces impacts to bottom sediments.

Fresh water is an **important resource for wildlife**. By creating this wetland, the project provides resources for a wide range of birds and local wildlife that the saline lagoon cannot provide.

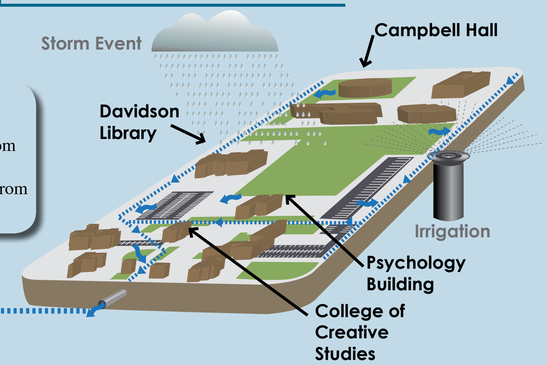
Willow Woodland

Large storm events bypass the wetland through a 42 inch diameter pipe and enter the energy dissipation box before tumbling over the rocks and into the lagoon.

This **treatment wetland** is designed to handle low-flows from irrigation runoff and first-flush from storm events. The pool slows the water down and provides the opportunity for microbial action and plant uptake, which reduces nutrient loads before water runs under the path, through the **willow woodland** and into the lagoon.

Hydrodynamic separator: Runoff's first encounter with the system is in this unit, which separates floatables (trash and oils) and sediment from water. It then directs low-flows (from irrigation and small storms) through the wetland and high-flows (from large storms) into the overflow system.

The 50 acre watershed for this project stretches from Campbell Hall to the lagoon and incorporates one-third of the lagoon watershed. Dry season runoff includes nutrient-rich reclaimed irrigation water.



What is the green film on the pond?

Depending on the season, this pond may look different since temperatures and nutrient concentrations impact plant growth. In the winter, cool temperatures and flushing events keep water clear. As temperatures warm up and rainfall declines, algal growth increases. In order to remove nutrients from the system, CCBER manages the pond by removing algae from the surface before it settles to the bottom.

Clear water
Cooler times of year

Floating algae
Spring & summer

Duckweed & water fern
Late summer and fall

Coastal Fund
UC Santa Barbara Associated Students
www.CoastalFund.org

CCBER
ccber.ucsb.edu