ENERGY EFFICIENCY PARTNERSHIP PROGRAM BEST PRACTICE AWARDS APPLICATION FORM

Submission Deadline: March 7, 2012, 6:00 p.m., no exceptions

Eleventh Annual CA Higher Education Sustainability Conference - hosted by UC Davis

This form is only for nominations in the Water Efficiency/Site Water Quality category

I. Contact Information

1. Campus: Cal Poly State University, San Luis Obispo
2. Department: Facility Services
3. Contact name/title: Dennis Elliot, Assistant Director of Energy, Utilities, and Sustainability
4. Telephone: (805) 756-2090
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II. Project Information

1. Project name: Irrigation Water Conservation and Site Water Quality Program

2. Project location: Campuswide

3. Completion date: December 2011

4. Brief narrative description of project goals and strategies (200 – 300 words)

   In addition to ongoing implementation of low flow plumbing fixtures and educational outreach, Cal Poly has actively been implementing water conservation measures through planting of native and drought tolerant plant species, composting and mulching, and careful application of irrigation controls in both the campus core landscape and agricultural farm areas.

   Due to the size of the Cal Poly campus, a unique set of challenges and opportunities are presented for land and water quality management, resource conservation, habitat restoration, and integration of these management practices into teaching and research. Cal Poly continues to implement water conservation measures in both the campus landscape and farm areas including:

   - A new central station irrigation control system to regulate irrigation of the major turf fields based on evapotranspiration rates.
   - Conversion of three Sports Complex soccer fields from natural to artificial turf.

- Restoration of a 4 acre site of excavation spoils from the recently constructed Poly Canyon Village student housing complex, using native and drought tolerant species, campus compost and mulch for soil amendment, water retention, and erosion control.
- Improved water management practices for animal herd management and crop production including improvements to wells and springs, runoff/erosion control, improved use of drip irrigation/controls, use of reclaimed water in spray fields for production of silage crops, and improvements to storage reservoirs.

With a grant from the Regional Water Quality Control Board, numerous site water quality measures were implemented. These sought to reduce and control sedimentation of Brizzolara Creek from an abandoned landfill and gravel quarry, and improve riparian habitat within the Brizzolara and Stenner Creek areas using native plantings and fencing improvements to control animal grazing access.

In total, these measures have resulted in:

- No increase in indoor water usage since 2004/2005, in spite of the addition of 2,700 beds of on campus housing with the construction of Poly Canyon Village.
- Reduction of campus core irrigation water use by 14% since 2009.
- Reduction of agricultural water use by 20% since 2009.
- Restoration and/or erosion control of over 10 acres of disturbed land and brownfield sites.
- Replacement of 1250 feet of riparian fencing.
- A 75% reduction in soil loss from the gravel pit and landfill.

5. Project budget (please briefly highlight any special/grant funding sources that were obtained for the project, if applicable):

ET Irrigation Control System Upgrade: $12K
Sports Complex Artificial Turf Project: $4M
Poly Canyon Village spoils restoration and landscaping: $265K
Agricultural irrigation upgrades: $175K
Improvements to wells, springs, and reservoirs: $175K
Riparian Enhancement Project: $222K ($130K funded from RWQCB grant)

6. Estimated annual water savings and/or estimated annual amount of water treated (in gallons):

From City of SLO water invoice records, which would also include effects of low flow plumbing fixtures, dorm energy/water competitions, educational outreach, and other conservation efforts:

- Potable irrigation water use (campus core): 14% reduction – 45 acre feet/year (15M gal)
- Non potable water use (farm areas): 20% reduction – 130 acre feet /year (42M gal)
- Improved storm water from restored/mitigated areas: 20 acre feet/year (6.5M gal)
- Reclaimed/recycled water used for Dairy washdown: 34 acre feet/year (11M gal)
- Reclaimed water used for spray field irrigation: 40 acre feet/year (13M gal)

7. Estimated annual cost savings (please state assumptions used for these calculations):

From reductions in usage due to conservation efforts:
Potable water savings: $107K per year (at $5.44 per hcf)
Non potable water savings: $2,800 per year (at $0.05 per hcf)

From use of reclaimed/recycled water:
Non potable water savings: $1,600 per year (at $0.05 per hcf)

8. Relevancy to the Best Practice Program – Please provide a detailed narrative of the project or practice, highlighting those features that qualify it as a best practice of potential interest to other campuses.

Cal Poly Water Resources Overview

Cal Poly is fortunate to have acquired extensive land holdings over the last 110 years, making it one of the largest land holding public universities in the nation. The lands managed by Cal Poly include:

- The landscaped campus core: 155 acres
- The extended campus core ranches: 1,166 acres
- East Ranches (San Luis Creek watershed): 1,614 acres
- West Ranches (Chorro Creek watershed): 3,043 acres
- Swanton Pacific Ranch in Santa Cruz: 3,200 acres
- **Total land holdings: 9,178 acres**

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On this land, Cal Poly has a wealth of water resources, including:

- 57 miles of drainages capable of transporting sediment
- 7 miles of perennial streams
- 10 earthen reservoirs for agricultural irrigation and stormwater control
- 7 wastewater ponds
- 100 isolated areas with wetland characteristics
- 11 springs, 6 wells and numerous animal watering storage facilities
- 3 potable water storage reservoirs totaling 1.5M gal capacity
- 34% ownership of the Whalerock municipal water reservoir above Cayucos, with storage capacity of 13,500 acre feet for Cal Poly's share alone – over 10 years of total campus supply needs. Cal Poly's storage is currently at approximately 90% of capacity.
- Surface water rights to Brizzolara Creek, Stenner Creek, and Old Creek

Cal Poly is unique in that virtually all Cal Poly land is used for hands on teaching and research. Some of the academic programs that make use of Cal Poly's natural resources (especially as relate to water use and/or water quality) include:

- Architecture
- Landscape Architecture
- City and Regional Planning
- Horticulture and Crop Science
- Agribusiness
- Animal Science
- Dairy Science
- Food Science and Nutrition
- Natural Resources Management and Environmental Sciences
- Recreation, Parks and Tourism Administration
- Wine and Viticulture
- Bioresource and Agricultural Engineering
- Civil Engineering
- Environmental Engineering
- Master of Science – Water Engineering
- Biological Sciences
- Chemistry and Biochemistry

ET (Evapotranspiration) Based Irrigation Control System

In Winter Quarter of 2012, Cal Poly implemented an ET based central irrigation control system for control of the campus' largest turf areas – Spanos Stadium, the track fields, and the Sports Complex - a total of 11.7 acres. Cal Poly installed a Rainmaster Evolution DX2 ET control system running OASIS software. The system automatically adjusts irrigation rates based on calculated evapotranspiration rates, optimizing the amount of water delivered based on actual measured atmospheric and soil conditions.

Cal Poly is just starting to monitor the performance of the system, but is expecting a reduction in water usage of 20-30%. This should result in a savings of approximately 6 acre feet of potable water per year at a cost savings of $14,000, and 14 acre feet of non-potable water at a cost savings of $300. There will also be a savings in maintenance labor due to the reduced frequency of inspection and adjustment of irrigation controls, as well as instantaneous notification by the control system of system malfunctions that could affect the health of the landscape. The new system establishes a backbone for future expansion to add ET control to additional zones of turf and planting bed irrigation as time and funds allow.

Sports Complex Artificial Turf Project

In July 2009, Cal Poly completed an artificial turf replacement project at the Sports Complex, replacing the surfaces of three multi-sport recreational and intramural sports fields totaling 5.7 acres with artificial turf. In addition to the goal of conserving water and reducing maintenance costs, the project was largely driven by ASI's desire to increase the playability of the fields during the rainy season. In wet/muddy conditions, the fields had to be repeatedly closed in order to protect the natural turf from significant damage and subsequent recovery time. The field closures had an adverse impact on the scheduling of intramural and club sporting events. The project was performed as a design-build and had a total cost of $4M. The synthetic turf was specified as a monofilament fiber system with crumb rubber infill, brock underlayment, sand bedding, and porous aggregate sub-base with perforated drainage system. The carpet system was manufactured with factory applied permanent striping for soccer and flag football. The fields are temporarily striped with removable paint for football or lacrosse.

By eliminating mowing, fertilization, weed control, and frequent irrigation, annual turf maintenance costs (not including the cost of water) were reduced from an average of $0.188

per square foot to $0.059 per square foot – a 69% reduction in the cost of labor and materials, or an annual savings of $32,000 per year.

The elimination of watering for irrigation purposes was expected to achieve significant savings. Based on results of other projects reviewed during planning, it was expected that the irrigation system would have to be used during warm weather to control field surface temperatures. Due to the features of the open space utilized by the site and the steady and cool coastal winds which typically blow right down the Highway 1 corridor from Morro Bay, it has not been necessary to use the sprinklers to cool the fields, except during rare events of extreme heat and low winds.

By the elimination of irrigation of these three fields, Cal Poly is saving 25.2 acre feet of water per year. If these fields used potable water for irrigation, the annual savings would be $60K per year. However, Cal Poly irrigates the Sports Complex with non-potable ag water, which is cheaper by a factor of 100, resulting in an annual water cost savings of $550.

Poly Canyon Village Construction Spoils Restoration

Residents and visitors to the Poly Canyon Village student housing development have been able to watch a slow but steady transformation of a once barren mountain of soil into a restoration of the native and urban landscape interface. The 4 acre restoration site was created from approximately 100,000 yards of spoils excavated during construction of the Poly Canyon Village housing project, which otherwise would have been disposed of offsite as construction fill material or in the local landfill.

The 2,700 bed LEED Gold Certified student residential community, completed in Fall 2009, is situated on 30 acres of former College of Agriculture land at the entrance to Poly Canyon and the Brizzolara Creek drainage, an area designated as environmentally sensitive. In an effort to prevent the establishment of non-native plant species on the site, Landscape Architecture student Serena Conti, in consultation with campus faculty and Facility Services staff, developed an extensive landscape design utilizing drought tolerant native plant material to restore the location.

The design took into account the varied topography, grouping species into various plant communities from a wet riparian swale to the open sloped dry scrub. While the plants selected for the site are low water use varieties, temporary drip irrigation was designed to aid in

establishment of the plantings, with zones tailored to the specific water needs of each associated plant community.

Hundreds of cubic yards of wood chip mulch, created from campus tree maintenance operations, were used to blanket the planting area to aid in water retention and suppress weed growth. The overall effect has been to create a restoration of a disturbed area using regional native species selection, while providing a transitional landscape planting between the native environment of Poly Canyon and the developed landscape of the campus core.

The project successfully prevented the need to transport and dispose of an enormous amount of construction spoils, while creating an attractive, water efficient landscape area and handicapped accessible travel path for student foot and bicycle traffic between Poly Canyon Village and the academic campus core.

Dairy Washdown and Sprayfield Irrigation

The Cal Poly Dairy currently manages a herd of approximately 240 dairy cows, and has a maximum capacity of about 400. The cows are kept and fed in a series of free stall barns with concrete floors. Animal waste is washed down several times a day into two large holding ponds. Solids are separated and transported to the campus compost unit where they are blended with greenwaste from campus landscape maintenance activities. A portion of finished compost is used as animal bedding. Finished compost is used for soil amendment and mulch on campus landscape and agricultural production fields and pastures.

The remaining water is recycled for the next washdown cycle, where it again passes through the solids separator and back into the holding pond. The Dairy uses approximately 30,000 gallons per day of water for washdown, or 34 acre feet per year.

A portion of the Dairy's washdown water, as well as waste water from the Swine Unit, are sprayed on silage crop fields under RWQCB permit. This practice reclaims approximately 40 acre feet of waste water per year.

Improvements to Ag Irrigation and Management of Wells and Reservoirs

In 2010 the College of Agriculture, Food and Environmental Sciences in collaboration with Cal Poly's Irrigation Training and Research Center completed an extensive program evaluating the

agricultural irrigation system. The evaluation has led to upgrades to existing wells, design of a new reservoir pump station, and initiating the future design of state-of-the-art water management technologies that aims to increase water efficiency, improve water delivery and decrease electricity used for pumping irrigation water. Examples of improvements implemented to date include:

- A poorly performing well in field C25 was replaced and upgraded with a variable frequency drive (VFD) that allows the submersible pump to start and stop slowly. This allows for water pressure to increase or decrease gradually, reducing water hammer impacts to the existing older pipeline infrastructure. With the use of the VFD, the well operates within a pre-set water pressure range, enabling the well to supply water to the irrigation system only when needed. This feature is expected to increase pumping efficiency and decrease electrical use. First year data will be available in Fall of 2012. A second well is currently being evaluated for installation of a VFD system to further compliment the management of irrigation water.
- Seven magnetic flow meters were installed on agricultural wells and one pump station as of December 31, 2011. These flow meters were installed as part of an effort to improve agricultural water management and provide monthly accountability for water uses associated with wells and pump stations for agricultural production, as required by the RWQCB. Monthly metering of water pumped and electricity consumed will allow regular monitoring of well and pump efficiencies to identify problems quickly and conserve both energy and water.
- Future plans involve the installation of a new agricultural pump station to improve water delivery, water quality and decrease electricity used for pumping irrigation water.

In 2011 the College of Agriculture, Food and Environmental Sciences in collaboration with Facility Services, the Morro Bay National Estuary Program and the California Conservation Corps., entered into an agreement to construct a rain catchment system at the Beef Center Facility located within the Chorro Creek Watershed. This rain catchment system will be designed to capture enough rainwater to reduce groundwater withdrawals, saving both water and power. The project is expected to be completed by 2013.

Water Quality and Riparian Restoration Project

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This project, partially funded by a grant from the Regional Water Quality Control Board, addressed the protection and enhancement of water quality from non-point sources of pollution on the Cal Poly campus in two main areas:

1. Control of sediment discharge into Brizzolara Creek from Poly Canyon Road and from the old Landfill, Gravel Mine and Red Rock Pit Road.
2. Improvement of riparian habitat within Brizzolara and Stenner Creek by planting indigenous species in the riparian zone and installing/replacing fencing to control grazing access.

Management practices were implemented that reduced and/or prevented pollutants, and protected and enhanced riparian areas within the San Luis Creek and Chorro Creek (Morro Bay Estuary) Watersheds. Specific objectives addressed the reduction of erosion and sediment loading, implementation of Best Management Practices (BMPs) as outlined in the Cal Poly Water Quality Management Plan (http://www.afd.calpoly.edu/ehs/docs/WQMP_Jan_2005.pdf) and protection and enhancement of riparian areas within the Brizzolara Creek Riparian Corridor and Stenner Creek. Both sides of Brizzolara Creek below the former Beef Unit, Feedlot, and Abbatoir were designated in the grant for this Riparian Corridor Enhancement project.

The drainage along Poly Canyon Road was improved through grading, ditching and culvert renovation and replacement. Drainage was controlled by installing 1 culvert extension, replacing 2 existing culverts and headwalls, and improving the ditch drainage of 0.2 miles of road. Disturbed areas were landscaped and seeded to prevent erosion and encourage re-vegetation.

A curtain drain and drainage pipe was installed along the length of Red Rock Pit Road, moving water from the two detention basins at the Gravel Mine and the slope adjacent to Red Rock Pit Road to the creek. The mine and abandoned Landfill sites were contoured, terraced, and landscaped to reduce erosion and channel overland flow to designated areas. The east slope of Red Rock Pit Road was stabilized through wattles, broadcast seeding, and hydroseeding.

The Riparian Corridor Enhancement Area on the eastside of Brizzolara Creek was stabilized by seeding and planting over 200 container plants of indigenous woody species identified in the vegetation pallet. In addition, approximately 340 ft of fence was installed along the riparian corridor of Stenner Creek and approximately 600 ft of fencing was replaced in the Chorro Creek Watershed. There were no known threatened or endangered species found on the work sites.

During major storm events, overland flow in the gravel mine area was channeled to detention basins that removed the majority of sediment and silt from surface runoff such that water passing through the Middle Culvert to Brizzolara Creek was clear. Two slopes failed during the latter part of the last storm events. These slopes were re-countered and graded to facilitate water movement to the detention basins.

The Revised Soil Loss Equation (RUSLE) was used to estimate sheet and rill erosion from the Gravel Mine, Landfill, and the slope adjacent to the Red Rock Pit Road. In this equation soil loss is expressed by values from a low (less than 50) to an extreme (more than 75). The before value calculated for the site was 128, which is well beyond the extreme. The after value was calculated at 32, which is well below the 50 range.

Future management of the restoration areas will be taken over by Cal Poly Facilities Department. Presently, Red Rock Pit Road, which leads to the closed Gravel Mine and capped Landfill, is closed to unauthorized vehicle use. Both of those areas are used primarily for education purposes. The riparian habitats that were fenced and/or re-vegetated are designated as conservation areas and will be used to meet the educational mission of the university. Student research will continue to monitor the vegetation and assess the BMPs that were implemented.

9. Collaborative design and implementation – Describe the way in which this project incorporated stakeholders from multiple disciplines into the project's design and implementation. Describe how this collaboration produced sustainable solutions and improved the project's performance.

These projects involved a wide variety of stakeholders across Cal Poly and in the local and state communities. Within Cal Poly, these included:

- Facility Services
  - Landscape Services
  - Plumbing Shop
  - Environmental Health and Safety
  - Energy/Utility Management
- Facilities Planning and Capital Projects
- College of Agriculture, Food, and Environmental Science
  - Farm Operations

  - Irrigation Training Resource Center
  - Animal Science
  - Dairy Science
  - Horticulture and Crop Science
- College of Architecture and Environmental Design
  - Landscape Architecture
- Associated Students, Incorporated
  - Administration
  - Intramural and club sports
- University Housing

Outside Cal Poly, the following stakeholders were also important partners:

- City of San Luis Obispo Utilities Department
- Regional Water Quality Control Board
- State Water Resources Control Board
- State Department of Fish and Game
- Army Corps of Engineers

Cal Poly strived to work with all concerned stakeholders as early as possible in the process of each project, from clients to expert advisors to local and state regulatory agencies. By establishing early and frequent communication with each group, the projects were able to more clearly identify scope of work, goals, challenges, obstacles, and regulatory requirements. The projects were tied to the educational mission of the University by incorporating students in analysis and design, and making use of Cal Poly's Irrigation Training and Resource Center as an adviser, consultant, and peer reviewer. Many of the projects and initiatives described herein are used for teaching and demonstration purposes as part of Cal Poly's hands on, "learn by doing" philosophy.

10. If applicable, describe how the project has been received by campus stakeholders. Describe what has been met with satisfaction or dissatisfaction, and why.

These projects were very well received by the campus community. Students are pleased with the appearance of landscaped areas and the enhanced playability of the Sports Complex fields. Campus Landscape Services staff have been able to reduce their workload thanks to the artificial turf and ET control projects, allowing them to devote more time and resources to

other maintenance efforts. The campus administration is enjoying the benefit of reduced operating costs during these extremely challenging budget times, and has been able to utilize the savings to help pay for other sustainability initiatives.

11. If applicable, describe how you collaborated with members of your local or regional (off-campus) community in implementing your project. See #9 above.

III. Additional information

Please provide any additional information necessary to assist the selection committee in understanding and evaluating the project.

IV. Speaker bio

Please submit a brief speaker bio or bios (max. 80 words; limit two speakers per project).

Dennis Elliot is the Assistant Director of Energy, Utilities, and Sustainability at Cal Poly SLO. Dennis holds a Bachelor's Degree in Mechanical Engineering, is a registered professional engineer, and a certified energy manager. Dennis has worked at Cal Poly for 29 years in a variety of energy related positions. Dennis manages the campus' energy and utilities, leads efforts to incorporate sustainability into operations, planning, construction, and academics, lectures part time in the ME Department, and oversees the Green Campus Program.

Kim Busby-Porter is the Water Quality Management Specialist for California Polytechnic University at San Luis Obispo. She received her Bachelor of Science degree in Forestry and Natural Resource Management concentrating in Environmental Management in 1999. Mrs. Porter implements the University's Water Quality Management Plan which manages the discharge of animal wastewater as well as the campus' Stormwater management. Mrs. Porter is also a part-time lecturer in the Natural Resources Management Department, teaching Ecology, Natural Resource Assessment and Environmental Impact Analysis.

Speakers will present at the Sustainability Conference if their project is selected for a best Practice Award. Speaker bios will appear in the conference program.

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At least one of the speakers listed here must be a student, staff, or faculty member. Co-presenters from non-campus entities (e.g. architecture firms, consultants, etc.) are permitted.

V. Nomination submittal

Send completed Nominations to Andy Coghlan, Sustainability Specialist at the University of California Office of the President. All submittals must be received by 6:00 p.m. on March 7, no exceptions.