

Sustainable Water Management Plan for the Ventura River Watershed: Steelhead as Design Species

Prepared by: Jason Andrews for the California
Polytechnic University, Pomona: Studio 606



Figure 1: Transverse Range (photo by the author)

LA 652
Prof. Susan J. Mulley
May 31, 2009

Jason Andrews
3154 Foxtail Ct.
Thousand Oaks, CA. 91362

May 31, 2009

Paul Jenkin
Ventura County Campaign Coordinator
Surfrider Foundation
PO Box 1028
Ventura CA. 93002-1028

Dear Mr. Jenkin,

I am pleased to provide the following proposal for the Sustainable Water Management Plan for the Ventura River: Steelhead as a Design Species. The proposed project presents an opportunity to consider the human impact on the water cycle within a watershed that uses no imported water resources while investigating the interface between human and native species stakeholders. Solutions presented are expected to be accessible to all levels of users within the watershed and to enlighten other watersheds throughout the region.

The plan proposed here will present solutions accessible to all levels of users in the watershed and be applicable to other watersheds.

In early September, 2009 proposals accepted by the Department of Landscape Architecture at CSU, Pomona and approved for funding will be voted on by the Studio 606 students for project selection. Typically four projects from an anticipated twelve will be selected and proceed to contract approval. Work on selected projects would proceed in October 2009.

I look forward to an opportunity to work with you. Please feel free to contact either myself or the landscape architecture chairperson.

Best regards,

Jason Andrews
734-276-5474
Jason_andrews@comcast.net

Future Chair
909-869 6891
emailaddress

Executive Summary

The Ventura River watershed is unique in Southern California in that residents and agricultural users do not take advantage of water supplied by the San Joaquin Delta and Sacramento River via the infrastructure of the State Water Project. This aspect of self-reliance presents a unique opportunity to implement sustainable water management practices within the watershed.



Figure 2: Santa Susanna Mountains (photo by the author)

The Ventura Chapter of Surfrider Foundation has identified the region's need for a comprehensive management plan for the Ventura River Watershed. A comprehensive water management plan would address impacts on water availability and habitat within the watershed at an ecosystem wide level from current stormwater runoff management regimes, agricultural practices and domestic use. Other impacts on the watershed such as projected growth and development will be assessed while looking forward to anticipated changes in climactic patterns. The Sustainable Water Management Plan for the Ventura River Watershed proposes to use the Southern California Evolutionary Significant Unit of steelhead trout (*Oncorhynchus mykiss*) as an indicator species to gauge aspects of watershed health for steelhead and other biota.

This project proposes to conduct an inventory of the Ventura River watershed's current water use in order to create a "water budget" within the watershed. Analysis of this water budget will highlight opportunities and constraints related to the development of a sustainable water management plan for the watershed. Particular attention will be given to opportunities that foster community involvement in conservation, increase efficiency in wastewater treatment and address stormwater runoff with the goal of enhancing available habitat for steelhead. Recommendations will be provided for site, local and regional scales.

Work on the *Sustainable Water Management Plan for the Ventura River Watershed using Steelhead as a Design Species* will be conducted between September of 2009 and June of 2010. Surfrider Foundation will be delivered a professionally produced plan in printed and digital formats.

Table of Contents

Executive Summary	3
Table of Contents	4
Introduction	5
Background	6
Goals	10
Objectives:	11
Scope of work	12
Deliverables	14
List of Tasks:	15
Schedule of Work	17
Preliminary Budget	18
Summary	19
References	20
Appendix A - The 606 Studio	21
Appendix B - Contract and Payment Schedule	22
Appendix C - Selected List of Past 606 Studio Projects	23
Appendix D - Faculty Qualifications	24
Appendix E - Student Qualifications	26
Appendix F - Preliminary Project Issues	32
List of Figures	
Figure 1: Transverse Range (photo by the author)	1
Figure 2: Santa Susanna mountains (photo by the author)	3
Figure 3: Jean Rae Hewitt of Los Angeles	5

Introduction

This is a proposal to create an ecosystem based water management plan for the Ventura River Watershed. The Ventura River is the lifeblood of the watershed. Flowing from the Transverse Range through the agricultural valleys of Ojai to the sea, the river continues to provide essential resources for the sustenance of humans and animal species alike. The Ventura River Watershed provides a unique opportunity to create an ecosystem based water management plan in a watershed that is currently not dependant on imported water.



Figure 3: Jean Rae Hewitt of Los Angeles -February 16, 1919

The Sustainable Water Management Plan for the Ventura River Watershed using Steelhead as a Design Species provides a vision plan for the management of water resources in a watershed that uses no imported water. The use of steelhead as a design species focuses the investigation on water quality, resource availability and ecological function of the river while considering the future of water use and sustainability within the watershed. Measuring the viability of steelhead populations in

the river will provide a gauge of the river's health and suitability of proposed solutions.

Due to its distinct character as self-sustaining, the Ventura River Watershed provides a unique venue for the investigation of sustainable water management practices that would be applicable across a multitude of watersheds.

Background

The goal of this project is create an ecosystem based, *Sustainable Water Management Plan for the Ventura River Watershed* using steelhead as a design species. Due to their level of sensitivity to environmental disturbances, including pollution and habitat degradation, steelhead are the proverbial canary in the coalmine of the Ventura River Watershed. Using steelhead as an indicator species in the Ventura River Watershed is also appropriate because of their historic significance in the region, reproductive requirements and unique natural history.

Steelhead: History and Status

One thousand years ago, when the Chumash Indians attained their highest level of cultural sophistication (Triem, 1990), the anadromous steelhead had been inhabiting the coastal waterways and inland rivers of California for two million years (Nielsen, 1999). As late as the 1940s articles in the LA Times describe in sensational terms the number of anglers headed to the Ventura River in search of "the gamest trout of them all," the steelhead (Froelich, 1938). Estimated numbers of steelhead making the migration upriver to spawn in the 1940s ranged from four to five thousand fish. Today steelhead still inhabit the river, though in severely diminished numbers. Estimates of the number of fish traveling upriver to spawn in recent years have been in the range of approximately 100 fish (ENTRIX I. , 2003).

Historically present in most of California's coastal streams and rivers, steelhead are an anadromous species, spending a portion of their lives in fresh and saltwater. At sea, a juvenile steelhead spends as many as four years maturing in the ocean before returning to coastal freshwater streams to spawn for the first time. Juvenile steelhead are triggered to enter coastal freshwater streams during storm events which typically occur between the months of January and March in southern California. Once upriver, steelhead spawn in riffle sections of rivers with gravel bottoms, with young steelhead fry hatching within six to eight weeks. Steelhead typically spend between one and three years maturing before migrating to the ocean in the spring or early summer months (ENTRIX I. a.-C., 1997).

In August of 1997 the National Marine Fisheries Service, currently known as NOAA Fisheries listed the Southern California Evolutionary Significant Unit of *Oncorhynchus mykiss*, steelhead as an endanger species under the Federal Endangered Species Act (ENTRIX I. , 2003).

Steelhead: Impacts to Habitat

Steelhead are a tenacious species, able to navigate stretches of river with as little as seven inches of stream flow (Harrison, Keller, Kelly, & Mertes, 2006). However, in spite of this resolute nature, the steelhead's annual migration is

hindered by dams, diversions and diminished surface flows caused upstream consumption during dry summer months (Kelly, 2004). Also, because the groundwater system of the Ventura River is directly connected to easily depleted, shallow aquifers (California Regional Water Quality Control Board, Los Angeles Region, 2001), human extractions combined with southern California's dramatic climatological variability can result in abrupt losses of habitat, reduced invertebrate food supply and higher water temperatures. Low flow impacts vary by season with reduced winter and spring flows impairing migration patterns and spawning habitat and excessive warm weather human extractions leaving pools to dry and young steelhead to perish (ENTRIX I. a.-C., 1997).

While water availability is a major concern in the Ventura River, the single biggest contributors to the loss of steelhead habitat are human erected barriers, such as Matilija Dam (ENTRIX I. , 2003). In the sixty years since Matilija Dam presented spawning steelhead with the first "permanent," insurmountable physical barrier, the number of manmade obstructions, diversions and channelized sections has only increased further reducing spawning steelhead populations by as much as 99% (Fusaro, 2002).

Invasive species also pose a serious challenge to steelhead survival (ENTRIX I. , 2003). For example, *arundo donax*, a non-native giant reed, uses a disproportionate amount of available groundwater in the river while outcompeting and displacing native flora essential for steelhead migration and habitation. Invasive animal species such as the green sunfish and the striped bass prey on the steelhead fry, further limiting population numbers (ENTRIX I. , 2003).

Ventura River Watershed: Hydrology

The Ventura River Watershed collects water from a roughly 228 square mile area, covering a variety of eco-zones in southern California. Upper reaches of the Ventura River Watershed include the rugged mountains of the Transverse Range, the towns of Ojai, Meiners Oaks and Oak View with substantial portions of the valley floors devoted to agriculture. The lowest reaches of the Ventura River Watershed include the eastern most portion of the City of Ventura, coastal beaches, marine estuary and coastal sage scrub. Constructed in 1959 by the U.S. Bureau of Reclamation and situated x number of miles from the mouth of the Ventura River in the bottom half of the watershed, Lake Casitas is the largest body of water in the watershed impounding 254,000 acre-feet of water.

The Ventura River Watershed has the notable distinction of being one of the few watersheds in the region to receive no water from the State Water Project. This uncommon characteristic of the watershed presents its residents and water consumers and managers with the unique opportunity to

develop a “sustainable” watershed management plan in the truest sense.

Ventura River Watershed: Water Quality Concerns

Agricultural and urban runoff in the watershed pose water quality concerns for wildlife and humans. Over fertilization of agricultural lands results in nitrate laden runoff infiltrating through the soil and entering the aquifer. This nitrate rich water then flows through the aquifer along the shallow alluvium until reaching an uplift where it surfaces as groundwater. Where this nitrate rich ground water is exposed to sunlight, algae finds an ideal location to develop. When algae-photosynthesis takes place, water temperatures, dissolved oxygen and pH levels increase dramatically. After sunset when photosynthesis ceases, oxygen production stops, levels of CO₂ in the water spike and pH decreases leading to increasingly acidic water. These radical swings in dissolved oxygen and pH gradient are detrimental for many forms of aquatic life, including steelhead (ENTRIX I. a.-C., 1997).

As a result of urban development in the watershed, stormwater runoff from roads, driveways and parking lots carries not only transportation related pollutants but residential fertilizer and pesticides directly into local waterways, introducing them into the hydrologic cycle (Anderson, Nisenson, & Stoner, 2008). This can lead to toxic levels of chemicals in the streams and rivers and results in dangerous levels of pollutant in the near shore estuaries, affecting beach quality and wildlife.

Ventura River Watershed: Groundwater Use and Concerns

For decades, groundwater drawn from hundreds of wells in the Ventura River Watershed has been an important source of water for irrigation and municipal use. The two major groundwater basins in the watershed are the Ojai Valley groundwater basin and the Upper Ventura River groundwater basin. Both groundwater basins are prone to notable fluctuations in depth depending on climate patterns and groundwater extractions. Water levels in the basins react quickly to high levels of extraction during dry years, causing surface water levels to decline which in turn results in habitat degradation for incubating steelhead eggs and developing juveniles (ENTRIX I. a.-C., 1997).

To the first farmers who began growing oranges in the Ojai valley in the 1880s the Ojai Valley must have looked like Shangri-La and today there are nearly 10,000 acres of land under agriculture in the Ojai Valley. Recently increasing water rates for local farmers may mean that a growing number may choose to drill their own wells, provided that can afford it (Kelly D. , 2008). These “off the grid” wells are likely to deplete the groundwater supply even further and lead to increased habitat degradation for steelhead.

Increasing the rates that farmers pay may also mean increased pressure to develop current agricultural areas. As stakeholders in the future of the Ventura River Watershed, the agricultural community's concerns must be considered an integral component of a *Sustainable Water Management Plan for the Ventura River Watershed*.

Ventura River Watershed: Growth

With roughly 800,000 residents, the relatively moderate levels of growth Ventura County has experienced can only be considered an asset in light of the amount of water available. However, the county is expected to add approximately 10,000 people a year in the coming decades, with the unincorporated areas growing faster than the cities (Anderson, Nisenson, & Stoner, 2008). While this growth is lower than other counties in the region, without proactive measures to manage the available resources, water supplies will become insufficient.

Recently, Ventura County received a new Municipal Separate Storm Sewer Permit (MS4), from the Regional Water Quality Control Board, which will require all new, and redevelopment to attend to 100% of its runoff. This permit, however, does not apply to agricultural land and a more comprehensive approach to managing water for habitat is still necessary.

Ventura River Watershed: Climate Change

While the implications of climate change are not fully understood at this time, the California Department of Water Resources (DWR) warns that climate change is "already affecting California water resources" (California Department of Water Resources, 2008). Changes in climate patterns are expected to manifest as alterations to precipitation patterns (Miller, Bashford, & Strem, 2003) and many southern California cities are experiencing their lowest levels of precipitation twice in the last decade (California Department of Water Resources, 2008). As the Ventura River Watershed is exclusively dependant on precipitation, altered precipitation patterns and the realignment of seasonal flows have the potential to disrupt steelhead migratory patterns and may require a readjustment of water use and management assumptions.

Ventura River Watershed: Stewardship and Community Involvement

The only way for steelhead to thrive in Ventura River Watershed will be through a concerted community effort. Prioritization of the steelhead and the habitat required for a healthy Ventura River ecosystem will have to take

place community-wide in order for the steelhead habitat to be restored and maintained. An integrated water management plan is needed to bring together various stakeholders, and illuminate the issues. Success of the steelhead populations is depended on habitat, water quality, and water availability.

Ventura River Watershed: Reducing the Human Footprint

The *Sustainable Water Management Plan for the Ventura River Watershed* will identify opportunities to incorporate water conservation techniques throughout the watershed within the goal of creating healthy habitat for a sustained population of steelhead. The project will assess water use at all relevant levels with the goal of exploring methods of reducing water consumption, stormwater runoff and current wastewater treatment regimes. While traditional water conservation techniques have included things like specific day of the week irrigation schedules, new technologies are emerging to more effectively treat and use water closer to the point of consumption. At the same time, existing, but fringe methods of water recycling are becoming more acceptable. In addition to new technologies, increasingly effective ways of disseminating information to the general public are available for exploration. Currently approximately 50% of residential water use goes to irrigation suggesting that one possible solution to the dwindling water supply is an adjustment to residential landscape patterns.

Surfrider Coalition of Ventura County has initiated the creation of a *Sustainable Water Management Plan for the Ventura River Watershed* with the goal of increasing the public's awareness of the issues of water quality, consumption and regional growth. Through an examination of current water use, this project proposes to examine the confluence of projected urban and agricultural growth and steelhead habitat and create a management plan to accommodate both.

Goals

The goal of the Sustainable Water Management Vision Plan for the Ventura River Watershed is to provide an ecosystem based approach to water management using steelhead as a design species. This approach will identify issues within the watershed affecting the native habitat of the endangered steelhead and provide strategies to minimize the human footprint on the water cycle. The vision plan will explore issues of water quality and opportunities for conservation within the larger context of the Ventura River ecosystem. The resulting plan will serve as a comprehensive resource that will be useable at every level of interaction with the watershed – from the individual to the municipal.

Objectives:

Hydrologic function of the Ventura River Watershed (VRW)

- Analyze current hydrologic function of the watershed
- Understand aquifer dynamics
- Assess status of native species in the watershed
- Identify impacts to native flora and fauna

Water quality in the VRW

- Identify regional impairments to water quality.
- Investigate the nature and source of pollutants and containments within the watershed.
- Investigate run-off and stormwater management practices and impacts on the watershed.
- Explore the relationship between river water quality and near-shore ocean quality
- Identify issues related to aquifer contamination

Conservation

- Analyze historic, current and projected trends in water supply and demand within the watershed.
- Explore potential impacts of climate change.
- Identify and propose potential strategies to reduce water consumption.
- Evaluate the sustainability of water management practices.

Stewardship

- Identify participatory and non-participatory stakeholders.
- Promote coordination and awareness within the watershed community.
- Explore technologies for information dissemination.
- Explore opportunities to enhance the education of the public about the VRW.

Scope of work

Stage 1. Research and precedence:

The first stage of the project will focus on gathering and evaluating the necessary information on the endangered steelhead salmon and the VRW. Many agencies and organizations have looked into aspects of the watershed ranging from steelhead habitat restoration to agricultural runoff and irrigation effects on the watershed. A significant task of the 606 team will be to gather and review the existing body of work on the VRW to determine what further research needs to be done and how to integrate the information into the vision plan. A review of existing policies and planning precedents along with available GIS data will also be important in this first stage of research. A second important goal of this stage will be to establish relationships with existing stakeholders to gain a contextual understanding of the site. During this phase of the project, stakeholders will be contacted and interviewed, and the groundwork will be laid to ensure community support and participation. Obtaining community buy in and bringing stakeholders into the process to understand their concerns will be essential in formulating any solutions or design recommendations.

Stage 2. Site Inventory & Program/Cultural Inventory

A significant amount of time will be devoted to investigating and understanding the physical and geographic characteristics of the VRW. An essential component of the site inventory for this particular project is a thorough understanding of the hydrology of the watershed. Water quality, ecological zones, vegetation patterns as well as land use and development patterns will be fundamental components of the site inventory. Political boundaries contained within and outside of the VRW will also be investigated. A thorough understanding of the historic significance of the VRW including how past and present cultures use the land will inform future design recommendations. Effort will be made to understand stakeholders' relationships to the watershed to minimize potential insensitivities. Current demographics and projected trends will also be gathered. The current and projected human land use patterns will also be examined for their effects on the ecological and hydrologic function within the watershed.

Stage 4. Analysis

The data from the 606 research and inventories will be analyzed and any gaps in the data identified and filled. The human impact on the VRW and steelhead population will also be examined leading to the opportunities and constraints for the project. During the analysis phase, the key issues will emerge enabling a thorough understanding of the challenges presented within the watershed. Stakeholder and community input will be sought and

start the process of the formation of ideas to address issues that have been raised. The development of models and a thorough mapping of the site will aid in this analysis. Models and maps will be developed as needed to inform the analysis process.

Stage 5. Synthesis and Concept Development

This stage of the process will focus on the cohesion of a unified plan for the VRW and steelhead population. Issues identified in the preceding analysis will be addressed and a plan of action will begin to coalesce. The team will begin to develop means of disseminating the gathered information and continue to seek community and stakeholder input.

Stage 6. Final Design and Vision

A final document will be prepared to provide a long range vision plan addressing the overall goals and objectives of the project. The final plan will reflect solutions distilled from a thorough analysis of the sit as well as community input. The final vision plan will contain solutions that address the overall goal and objectives of the project and be presented to the client in a forum that will make dissemination across a broad level of stakeholders and user groups possible.

Deliverables

The project will produce a professionally printed and bound document that includes all relevant findings, guidelines and recommendations. This document will include research and findings at a number of scales concerning all appropriate stakeholders. Design recommendations will be included for a variety of scales, including site specific designs, municipal policy and facility recommendations and regional policy guideline suggestions.

A significant component of the project will involve site visits and community input. Public meetings and interviews with concerned stakeholders will be held in order to determine appropriate responses to issues presented during investigation and analysis.

Final document PowerPoint presentations will also be made available along with digital versions of all graphics in order to facilitate high quality reproductions in whole or in part. Final editorial document decisions will be made by California State Polytechnic University, Pomona and Studio 606 in order to maintain academic integrity.

List of Tasks:

Tasks accomplished by the Studio 606 team will include, but not be limited to:

Research and Precedence

- Research existing data on the steelhead population in the VRW
- Gather relevant data pertaining to historic and current hydrologic events
- Perform site visits as necessary throughout the course of the project
- Review existing data related to past, present and future projects within the watershed

Site Inventory

- Gather and review existing data related to physical aspects of the site including:
 - Topography, geography
 - Geology, soils and geomorphology
 - Hydrology and drainage
 - Land use and development
 - Vegetation and wildlife patterns
-

Program/Cultural Inventory

- Meeting and relationship development with initially identified stakeholders
- Interviews, community meetings and discussions as necessary with stakeholders to assess issues and concerns
- Identification of existing cultural and social resources
- Identify available opportunities for dissemination of accumulated data
- Identify resources for development of community involvement and access to accumulated data
-

Analysis

- Inventory and accounting of accumulated hydrologic data
- Analyze the constraints to the stated goal and develop opportunities consistent with the goal
- Analyze accumulated cultural resources and stakeholder concerns
- Identify gaps in accumulated data
- Analyze programs and interfaces for community access to accumulated data

Synthesis and Concept Development

- Develop strategies for dissemination of accumulated data to the

community

- Develop strategies for community involvement
- Develop initial graphic response to the project goal
- Develop alternatives for design solution
- Develop initial supporting textual responses to identified constraints and proposed opportunities

Final Design and Vision

- Assemble and refine all supporting text and graphics
- Assemble and refine all final design recommendations
- Assess potential gaps in design and policy recommendations
- Compile all relevant materials for inclusion in a final design/recommendation document and presentation
- Produce 100 professionally printed copies for presentation to client and department
- Provide all final presentation materials to client in digital format

Schedule of Work

	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10
Funding Secured										
Project Selection										
Data Collection and Research										
Site Inventory										
Site Visits										
Stakeholder Meetings										
Community Meetings										
Analysis: Opportunities & Constraints										
Synthesis and Design										
Community Presentations										
Publication										

Preliminary Budget

Travel Expenses	4 project team site visits and one 606 studio trip	\$5,000
Supplies	Office supplies, software, GIS data, maps	\$6,000
Community Meetings	Advertising, refreshments and incentives	\$3,000
Web Design	Professional services to host and program web site	\$3,000
Consultant Fees	Technical experts, copy editor	\$2,500
Printing & Copying	100 professionally bound copies of the final report, interim reports	\$10,500
Personnel	Faculty overload and summer salary	\$8,825
Subtotal of Direct Costs		\$38,825
Studio 606 Rate to the Cal Poly Foundation (46%)*		\$17,860
Total		\$56,685

*Required by the University

Summary

The Ventura chapter of Surfrider foundation has identified the need for a comprehensive water management plan for the Ventura River Watershed that addresses water use and impacts to habitat on an ecosystem wide scale. This proposal for the *Sustainable Water Management Plan for the Ventura River Watershed* endeavors to outline the issues involved in the creation of an ecosystem-wide planning document as well as the approach Studio 606 will take to identify opportunities and constraints associated with the creation of a comprehensive management plan for the Ventura river watershed.

The Ventura River Watershed is unique in the region in that it does not supplement it's natural supply with imported water from either the State Water Project or the Colorado River Aqueduct. This self-reliant nature presents an opportunity for water district managers, agricultural users, residents and commercial water users to formulate and foster sustainable water use practices that consider impacts to species other than humans. By developing a water management plan that uses steelhead as a design species, sufficient water resources are ensured for a broad range of habitats and biota.

This document proposes that Studio 606 conduct an extensive accounting of the water resources available annually in the watershed. This accounting process will be combined with an assessment of the requirements of the human and non-human habitats to create a "water budget" for the inhabitants of the watershed. The proposed water management plan will explore opportunities and constraints related, but not limited to: methods of reducing water consumption, more effectively managing and utilizing runoff from stormwater and the exploration of alternatives to the current model of wastewater treatment.

This study will be conducted during the 2009-2010 academic year with an estimated budget of approximately \$50,000. Surfrider foundation will be provided a professionally prepared document detailing the findings of this study in print and digital formats, as well as relevant digital images as deemed appropriate.

The *Sustainable Water Management Plan for the Ventura River Watershed* presents an exciting opportunity to create a new paradigm for water management and use through inventive and innovative approaches to resource allocation by considering a broad range of impacted species.

References

- California Regional Water Quality Control Board, Los Angeles Region. (2001). *Ventura River Watershed Draft Fact Sheets 2002 303(d) List of Impaired Waterbodies*. Los Angeles: California Regional Water Quality Control Board.
- ENTRIX, I. a.-C. (1997). *Ventura River Steelhead Restoration and Recovery Plan*.
- ENTRIX, I. (2003). *Ventura River Technical Investigation Summary Report and Recomendations*. Ventura: City of San Buenaventura.
- Froelich, B. (1938, January 23). Steelhead Run Starts. *Los Angeles Times* , p. F2.
- Fusaro, C. (2002, July 2). *Southern Steelhead Trout*. Retrieved 6 2, 2009, from Santa Barbara Audubon.org: <http://www.santabarbaraaudubon.org/sbassteelhead.html>
- Harrison, L. R., Keller, E. A., Kelly, E., & Mertes, L. A. (2006). *Minimum Flow Requirements for Southern Steelhead Passage on the Lower Santa Clara River, CA*. Santa Barbara: University of California, Santa Barbara.
- Kelly, E. (2004). *Information synthesis and priorities regarding steelhead trout (Oncorhynchus mykiss) on the Santa Clara River*. Santa Barbara: University of California, Santa Barbara.
- Los Angeles Sunday Times. (1919, February 16). *ProQuest Historical Newspapers Los Angeles Times (1881 - 1986)*. Retrieved April 23, 2009, from ProQuest Historical Newspapers Los Angeles Times (1881 - 1986): <http://www.proquest.com/en-US/aboutus/pressroom/05/20051213B.shtml>
- Nielsen, J. L. (1999). The evolutionary history of steelhead (*Oncorhynchus mykiss*) along the US Pacific Coast: Developing a conservation strategy using genetic diversity. *ICES Journal of Marine Science*, , 449-458.
- Tri-County Fish Team*. (n.d.). Retrieved May 26, 2009, from <http://fishteam.org/index.html>
- Triem, J. P. (1990). *Ventura County: land of good fortune*. San Luis Obispo: EZ Nature Books.

Appendix A - The 606 Studio

The 606 Studio at the California State Polytechnic University, Pomona is a collaboration between university faculty and 3rd year graduate students in the landscape architecture program. The studio focuses on issues of sustainability and restoration in natural and human systems through the application of intensive analysis and design. The human intersection with natural ecosystems and examined at a variety of interfaces, including urban, suburban and rural and are considered at the regional, local and site scale level. Teams of students under the direction of faculty carry out research, analysis, design recommendations and presentation. Projects engaged in by the 606 Studio teams are required to address significant issues concerning resources and the physical environment while addressing the needs of the public and the project client. The scope of time available to the 606 Studio is dictated by the academic calendar, but projects are required to be sufficiently complex as to display technical and professional expertise comparable to those routinely found in private practice. Project definition for the Sustainable Water Management Plan for the Ventura River watershed began in the Spring of 2009 and work can be expected to be completed by Summer of the academic year in 2010. The client agency provides funding for estimated direct costs and contractual agreements are with the Cal Poly Pomona foundation, a 501(c)(3). Results of the project must become public information. For more information on the 606 Studio please refer to the Cal Poly website at: http://www.csupomona.edu/~la/mla_606.html

Appendix B - Contract and Payment Schedule

Payment schedule and the final project contract will be negotiated through and managed by the Cal Poly Pomona Foundation, Inc. The foundation is a private, non-profit organization of the Cal Poly Pomona Campus.

This project is part of the requirements for graduation from the Department of Landscape Architecture Master's Degree Program and, as such, students are not paid for their time and services. However, the typical contribution to a project of this nature is at least 30 hours per student per week with a range of 1800 to 2000 hours per group.

There is no guarantee that this project will be selected by the students of the 606 Studio for implementation. The students will decide on projects in September 2008 and if selected, you will be notified immediately to begin the process for funding.

Appendix C - Selected List of Past 606 Studio Projects

- 2007 *Public Space as Catalyst for the Regeneration of South Los Angeles*
for the Community Redevelopment Agency of Los Angeles
Kids in the Creek: Planting the Seeds of Stewardship in Chollas Creek
for Groundwork San Diego
Transforming Urban Environments for a Post-Peak Oil Future: A Vision Plan
for the City of San Buenaventura
Urban Ecotones: Vision Plan for a Healthy Future
for California Resource Connections, Inc.
- 2006 *Master Plan for R-Ranch in the Sequoias*
for R-Ranch
Green Linkages
for the city of West Covina
Del Rey Lagoon and Parkway - Gateway of Ballona Watershed
for the City of Los Angeles
- 2005 *Carmel River Parkway Vision Plan*
for The Big Sur Land Trust.
Hahamongna Park Vision Plan
for the City of Pasadena
- 2004 *Lakeside River Park Conceptual Plan*
for the San Diego River Lakeside Conservancy
Watershed Design Guidelines for the San Diego Creek and Upper Newport Bay
for the County of Orange, California
- 2003 *Carr Lake Regional Park*
for the City of Salinas, California
Long Beach Riverlink: Connecting City to River
for the San Pedro Bay Estuary Project
Tecate River Park: A Framework for an Urban River Environment in Tecate, Mexico
for the Fundacion La Puerta
- 2002 *San Gabriel Confluence Park: A River Based Urban Nature Network*
for the Sierra Club
San Diego River Park Conceptual Plan
for the California Coastal Conservancy

Appendix D - Faculty Qualifications

606 Studio Faculty Members

Phil Pregill is a full Professor in the Landscape Architecture Department at California State Polytechnic University, Pomona and Director of the Landscape Architecture in Italy program. He also teaches design, history, construction, and graphics in both the graduate and undergraduate programs. He is co-author of *Landscapes in History*, and is currently conducting research on abstraction in the design process. Phil is also an accomplished painter, and his works have appeared in numerous juried competitions. He received his Bachelor of Arts and his Master of Landscape Architecture degrees from the University of Oregon.

Gerald O. Taylor, Associate Professor, ASLA, RLA teaches in both the graduate and undergraduate programs with a focus on landscape ecology, advanced landscape design, and planting design. He is committed to the pedagogy of community service-learning and his studio projects have recently won top student awards in the Community Service category from the American Society of Landscape Architecture (ASLA). He is actively involved in research and professional projects relating to ecological restoration, ethnobotany of indigenous peoples, sustainable campus ecology, and the healing and restorative properties of landscapes. In addition to being a Registered Landscape Architect in the State of California, Gerald is a Certified Arborist. He majored in Environmental Studies/Political Studies at Pitzer College, Claremont, CA and received his landscape architecture training at Cal Poly Pomona earning a BSLA and a MLA.

Dr. Susan J. Mulley, Assistant Professor of Landscape Architecture at California State Polytechnic University, Pomona, teaches in both the graduate and undergraduate programs with a focus on environmental design and planning, advanced landscape design, community design, research methods and historic landscapes. Her research deals with design for human health, ecological function of designed landscapes, conservation and stewardship behavior in landowners, and participatory action research. Her students have won the top national level awards in research and design from the American Society of Landscape Architecture (ASLA). She has a BSc in Environmental Science, a MA in History, a MLA, and a PhD in rural planning.

Doug Delgado teaches advanced landscape planning in the Master of Landscape Architecture program at California State Polytechnic University, Pomona. As a graduate student he co-authored a widely circulated and often cited 606 project, "Reconnecting the San Gabriel Valley." Professionally, he has been actively involved in watershed planning throughout Los Angeles County, especially the San Gabriel River Watershed. His past works include

the master plan and landscape design for the Rio Hondo and San Gabriel River Spreading Grounds and the open space plan for the San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy. He has also participated on the steering committees of the San Gabriel River Master Plan and the Ballona Creek Watershed Task Force and has been a frequent speaker at planning venues throughout the region. He received his Bachelor of Arts degree in economics from the University of California, San Diego, his Juris Doctorate degree from George Washington University and his Master of Landscape Architecture degree from California State Polytechnic University, Pomona.

Appendix E - Student Qualifications

Jason Andrews is a 3rd year Masters of Landscape Architecture candidate at California State Polytechnic University, Pomona. He received his B.S. from Eastern Michigan University with a major in Mechanical Engineering Technology. Jason grew up in a small suburb outside Salt Lake City, Utah and spent formative time between high school and college exploring the canyons and rivers of the Southwest. This experience galvanized an appreciation of the harsh fragility of the desert and continues to inform an ongoing concern over land and water use in the West. Prior to graduate school, Jason worked as a residential construction project manager in Ann Arbor, MI and at a landscape architecture firm in Southern California.

Merilee Atkinson is a 3rd year Master's candidate in Landscape Architecture. A California native, she grew up on a Central Valley ranch which has informed her lifelong interest in ecological systems. She holds an undergraduate degree in Psychology and utilizes this background to apply principles of behavior and motivation to the context of landscape. Prior to entering graduate school, Merilee worked in diverse fields including city government and as a professional pastry chef, a career which satisfied her need to combine art and science in much the same way as landscape architecture practice. During her studies at Cal Poly, Merilee had the opportunity to study abroad in Italy and in conjunction with this was able to travel extensively in Europe. During the study abroad term, she was a member of a student team working with local practitioners to develop an urban redesign proposal for a socially and environmentally degraded area of Ostia, a district of Rome. Merilee's interests include behavior in the landscape, land use history and planning, urban agriculture, and habitat preservation and restoration.

Nisreen Azar has a passion for art, adventure, craftsmanship, foreign language, environmental and physical health, and experiencing international culture. Nisreen is currently pursuing her Master's degree in Landscape Architecture from Cal Poly Pomona. Her passion for nature combined with art was the catalyst for Nisreen to merge into the field of landscape architecture. She was born in Saudi Arabia and raised in the Pacific North West. Her international background and extensive travel informs her artwork, life perspective, and career interests in sustainable international development. Nisreen has worked in sustainable community building and permaculture workshops in diverse global regions ranging from Nicaragua to Seattle. She graduated from Scripps College in Claremont, CA with a B.A. in Studio Art. Since then, Nisreen has lived and worked in Lebanon, Indonesia, Costa Rica, and Santa Cruz, CA. She is interested in the role of landscape architecture in cultural sustainability and the implications of globalization on traditional design throughout the international community. In her spare time, Nisreen volunteers at Ranch Santa Ana Botanical Gardens in the Seed Conservation

Program, surfs, travels, and makes art.

Rajan Leonardo Brown is currently pursuing a Masters degree in Landscape Architecture at California Polytechnic University Pomona. He received a Bachelors of Arts in Law and Society from the University of California at Santa Barbara. He entered the field of landscape architecture and environmental planning to pursue his interests in creating more sustainable and livable cities. Rajan works with the California Coastal Commission in habitat restoration design and planning, and he is currently employed by the Municipal Water District of Orange County as a Landscape Water Use Efficiency Intern.

Karen Chieng is currently pursuing her Master's degree in Landscape Architecture at California State Polytechnic University at Pomona. She received a Bachelor of Science degree in Business Administration and minor in Asian Studies from the University of California, Riverside. Prior to entering graduate school, Karen worked as a marketing coordinator in Irvine, California where she gained valuable experience in planning, strategizing and executing tradeshow and major events. While attending graduate school, Karen works as an interior design assistant where she is exposed to different aspects of design for living spaces. Her interests include urban revitalization, sustainable design, habitat restoration and international development.

Ieszic Formeller is a candidate for the degree of Masters of Landscape Architecture from California State Polytechnic University, Pomona for 2010. He holds a Bachelor's of Business Administration from the University of San Diego from which he graduated with high honors. Ieszic's professional background includes several years of successfully managing Internet advertising operations and production for the second largest independent yellow pages publisher in the United States. Having chosen to change careers to pursue his passions in landscape, Ieszic's primary areas of interest include the ecological health of developed land, conservation and protection of natural resources, design for human health, and development of environmental stewardship in landowners and policy makers. Ieszic's landscape related studies have included landscape design, theory and methodologies; landscape research methods; landscape planting design; landscape construction methods; urban and regional planning theory; environmental analysis; ecological processes; stream restoration and hand graphics. Ieszic has traveled extensively through the United States, Caribbean, Mexico, South America, and Europe, including a study abroad program in Italy, in an ongoing pursuit to discover and study the world's cultures and landscapes.

April Garbat is a third year Master of Landscape Architecture candidate at California State Polytechnic University, Pomona. She holds a Bachelor of Arts degree in History from Gordon College in

Wenham, MA, as well as a single subject teaching credential. Her work experience includes teaching history and French at an international school in West Africa, tutoring in group homes, leading mental enrichment classes in convalescent centers, and working as a student landscape architect for the Angeles National Forest. Informed by the experience of growing up in rural Pennsylvania, cities and villages in West Africa, and the greater Los Angeles area, her interests in landscape architecture include environmental justice, cultural landscape preservation, landscapes and health, safe routes to school, dark skies, habitat restoration, and incorporating local plants and indigenous knowledge into sustainable systems.

Scott Goodman is in pursuit of his Masters Degree in Landscape Architecture from Cal Poly Pomona and attained his B.A. in History from UCSD. He is an 8th generation Southern Californian who is motivated to become a leader in the advancement of restoring California's degraded natural landscapes through sustainable and ecological design. He currently holds two internship positions: one with the Rancho Santa Ana Botanical garden in Claremont, where he works in the Seed Conservation Program; the other with Orange County Parks, where he manages a project that focuses improving water quality through turf removal in exchange for native plants. His interests center on restoring landscapes toward a native ecology to create environments where humans, flora and fauna can coexist harmoniously. Having spent his life near the ocean, Scott is interested in the intertidal zone which lies between the land and the ocean. His goal is to understand the role of landscape architecture in serving this delicate ecosystem that is inextricably linked to the health of both our oceans and our landscapes.

Megan Leigh Juric is currently pursuing a Master of Landscape Architecture degree at California State Polytechnic University, Pomona. She earned a Bachelor of Science in Design of Architectural Studies, as well as a Minor in Landscape Studies, from Arizona State University. Megan has lived in the Southern California region for most of her life but has traveled quite extensively throughout the country. Her current interests in landscape architecture include creating sustainable urban and suburban environments, use of native and non-native drought tolerant vegetation in planting designs, habitat restoration and green building design with a strong interest in green roof design.

Douglas Kent has been working in California's landscapes for over 30 years. He has designed countless landscapes, worked on many public education campaigns, and has collaborated with communities throughout the state. Kent has a BA in Environmental Policy, an MS in Regenerative Studies, has had over 50 articles published, and is author of four environmental landscaping books. Kent is the principal of an environmental design firm.

Tyrone LaFay is currently pursuing his Master's degree in Landscape Architecture at California State Polytechnic University, Pomona. He received a Bachelor of Science degree in Environmental Science from Huxley College of Environmental Studies at Western Washington University in Bellingham, Washington. He also holds qualifications in Permaculture and Ecovillage Design from USA, Australia and New Zealand. Over the past ten years, Tyrone has been very active in the sustainable communities movement teaching ecological design and sustainable living skills in Canada, New Zealand, Australia, and the west coast of the US. For the past six years, he has been an Associate Faculty member with the Village Design Institute and coordinated the establishment of O.U.R. Ecovillage's Permaculture and Sustainable Community Design Programs from 2004 – 2006. While in graduate school, Tyrone has had the opportunity to study abroad in Italy while working on a sustainable urban development plan for the city of Sorso on the island of Sardinia, research for Cal Poly Pomona campus greenhouse-gas emissions and planning strategies for the potential of carbon sequestration of its landscapes, and work with a local non-profit for the ecological design of an AIDS orphanage village in Mozambique, Africa. His interests include participatory processes in sustainable community development, local food security, conservation design, eco-cities, green infrastructure, and transition town planning for resilience in response to peak oil and climate change.

April Marshburn began her study of three-dimensional form exploring the nuances of textiles and received a Bachelor of Arts in Consumer Studies and Clothing Design from San Francisco State University. However, her concern for environmental degradation and her interest in human engagement with the landscape compelled her to shift her professional direction. Intrigued by the tapestry landscape architecture weaves between creative expression and pragmatism + the land and human cultures, she is pursuing a Masters of Landscape Architecture at Cal Poly Pomona. Finding inspiration through service, her volunteer experiences have included domestic and international efforts in food security, habitat restoration, and urban forestry. A California native, she has lived across the state in rural, suburban, and urban landscapes and has traveled to over 30 countries. These experiences have profoundly shaped her perspective, giving her a balanced appreciation for the vibrant rhythm of a city and the serenity of a wild landscape. Her interests lie in creating environmentally, socially, and economically sustainable human landscapes which restore habitat and regenerate natural resources.

Kyle McEnroe Growing up on my family's farm immersed me into the farming culture, which I have since been using as a profession as well as a hobby. I worked on different divisions of my family's organic integrated agriculture system throughout high school and college. As a senior in high school, I decided to pursue a career in landscape development and committed to the Ornamental Horticulture program at SUNY Cobleskill. As

I focused on my school work in and out of the classroom, I used the men's lacrosse team as a recreational outlet on the field. After receiving an Associate degree in Ornamental Horticulture from SUNY Cobleskill, I decided to pursue a degree in Plant Science at Cornell University.

I quickly adjusted from a technical, "hands on" approach at SUNY Cobleskill to a research based program at Cornell. I took full advantage of the university's services by playing intercollegiate football, pursuing interests in many different clubs, creating networking opportunities and challenging myself academically before graduating with a Bachelor's of Science in Plant Science with a concentration in vegetable production and a minor in Agricultural business.

Re-injuring my lower back was the decision making factor for me to pursue a master's of landscape architecture. I decided to attend the distinguished graduate program at Cal Poly Pomona because of their hands on approach and affiliation with the agricultural industry.

I once again find myself taking full advantage of the all amenities Cal Poly has to offer. I am an active member of the Agricultural Education Club, played an interactive role on the intercollegiate horticulture team and have been working on a landscape development plan that physically links the hospitality college to a gourmet garden through an outdoor laboratory concept.

I have now directed my attention toward my master's thesis, "Linking Agritourism and Agricultural Education to the Landscape: A True Integrated Agricultural System." I am passionate about the subject and feel confident that I am well prepared to take on the challenge.

Katherine McNiel is a 3rd year master's candidate in Landscape Architecture at Cal Poly Pomona. She received her Bachelor of Arts from the University of California, Berkeley in Psychology with two minors; one in Fine Arts and the other in Landscape Architecture. After taking landscape design and identification courses at Merritt College in Oakland, California, she was excited about pursuing a Master's in Landscape Architecture. She recently traveled to Italy for the Landscape Architecture Study Abroad Program which helped solidify her design skills in culturally significant landscapes and help improve her sketching skills. She has also travelled abroad to Canada, the Czech Republic, England, France, Germany, Greece, Guatemala, Holland, Ireland, Italy, Scotland, and Spain. Her proficient work experience includes professional gardening and installation work, drafting and design work for a Landscape Design/Build firm in San Jose, and assistant teaching for a Landscape Design and Maintenance course at Washington State University. Her interests involve food, nature, and swimming. As a result, she loves implementing edibles and figuring out how to incorporate water for play in her designs. Katherine's projects focus on ecological conservation, environmental and community planning, sustainable landscapes, and urban revitalization.

Superna Datta Mehta is currently a second year Master of Landscape Architecture candidate at California State Polytechnic University, Pomona. She has Bachelors degree in Architecture from Sushant school of Art and Architecture, India. While pursuing her education in architecture she got selected for an educational exchange trip to Greece and Italy This further enlivened her passion for art and design and she pursued one-year course in fine art and sculpture. After working for several years with architects specializing in different fields, she found herself relating the most to the field of landscape architecture. Her desire to learn and innovate, to combine technical knowledge and creativity while giving something positively back to the earth and its people could be best satiated through landscape architecture. Her interests include sustainable landscapes, revitalization of neglected public spaces, community participation, social and environmental justice to provide a healthy and a sustainable society.

Greg Moeser is currently pursuing a Master of Landscape Architecture degree at California Polytechnic University, Pomona. He received his Bachelor of Science in Resource Development from the University of Rhode Island, majoring in Environmental Management with a minor in Resource Economics. He has over 10 years of business experience, including seven years in the music business. His interests in the field of landscape architecture include sustainable design, mixed-use development, urban revitalization, and ecological design.

Toni Pogue entered graduate school in Landscape Architecture to return to her first love, nature. A graduate of Occidental College with a BA in English and Comparative Literature, Toni later spent several years at environmental nonprofit Heal the Bay and City of Hope Cancer Center. Her experiences in volunteer development, environmental writing and graphic design led to a desire for a major career change where she could use these skills in service to the natural and built environments, and the people that interface with them. A Los Angeles native, Toni has a particular familiarity with the area's challenges and treasures. She is particularly interested in urban design to promote environmental justice, regenerative designs that "feed" themselves, urban and school agriculture, and community design that encourages active living.

Chris Tiffany is currently pursuing a Masters of Landscape Architecture degree at California State Polytechnic University, Pomona. He received his undergraduate degree in Global Studies from the University of California at Santa Barbara analyzing the socioeconomic and cultural systems that make up the global community. He was brought to the field of landscape architecture by a desire to improve the quality of the built and natural environment through intelligent design and resource management. His interests in landscape architecture lie in sustainable design from site to regional scales, water resource management, and ecological restoration.

Appendix F - Preliminary Project Issues

(Identified During Research)

1. Ecology

- a. Habitat
 - i. Watershed characteristics
 - ii. Impacted seasonal flows
 - iii. Groundwater level impact
- b. Barriers to spawning
 - i. Dams, diversions, channels
- c. Invasive species
 - i. Flora
 - ii. Fauna

2. Hydrologic Function

- a. Water supply
 - i. Human withdrawals
 - ii. Urban/Agricultural growth
- b. Water Quality
 - i. Runoff
 - 1. Urban
 - 2. Agricultural
 - 3. Industrial
 - ii. Aquifer recharge
 - 1. Nitrates/algae
- c. Stormwater management
 - i. Perceptions – municipal & public
 - 1. Liability vs. resource

3. Conservation

- a. Water availability/growth
 - i. Projections & Repercussions
- b. Climate change
 - i. Projections & Repercussions
- c. Efficiency
 - i. Water use
 - 1. Irrigation
 - a. Residential
 - b. Commercial

Appendix F - Preliminary Project Issues Continued

(Identified During Research)

- d. Sustainability
- 4. Stewardship/Community Involvement
 - a. Information access/dissemination
 - i. Emergent technologies
 - 1. Conservation/watershed friendly gardens
 - 2. Watershed friendly agricultural practices
 - b. Multiple stakeholder involvement
 - i. Residential/private
 - ii. Municipal/cities & counties