

PLANNING A LANDSCAPE THAT QUALIFIES FOR THE LEED  
WE CREDIT 1: WATER EFFICIENT LANDSCAPING

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## **ABSTRACT**

The green building movement has recently gained strength and is becoming a major driver in a wide array of construction industries. The USGBC is a nonprofit organization composed of industry leaders who have developed a quantifiably rating system known as LEED®. Leadership in Energy and Environmental Design is a point based ranking system that measures building performance based on a set of measurably sustainable criteria. A major point category set forth by LEED is water efficiency and has application for those in the landscape design, construction and maintenance industries. The focus of the project is to design a landscape based on LEED WE credit 1, Water Efficient landscaping, through following the instructions for attaining the credit as specified by the 2009 LEED Reference Guide for Green Building Design and Construction. The project will serve as a guide explaining the LEED rating system and how it relates to landscaping and water efficiency.

## ACKNOWLEDGEMENTS

The author wishes especially to thank Michael Montoya of the Cal Poly Construction Management Department for his invaluable assistance in the development of the project from conception to completion. The author also would like to thank senior project advisor, Tiffany Faulstich, for introducing the topic and aiding the project's development and completion.

# TABLE OF CONTENTS

Section	Page
I. Introduction.....	7
II. Literature Review.....	8
Background on the USGBC and LEED®.....	8
How LEED® is Used to Rate Building Performance.....	9
WE Credit 1 Water Efficient Landscaping.....	10
Plant Materials.....	10
III. Materials and Methods.....	11
IV. Results and Discussion .....	25
References .....	28

# LIST OF TABLES AND FIGURES

	Page
Water Requirement Calculations.....	14
Sample LEED® Template.....	15
Estimated Watershed.....	19
Planting Plan.....	20
Hardscape & Irrigation Plan.....	21
Shadow Profiles.....	22

## I. Introduction

The idea of environmental stewardship and sustainability has recently gained popularity throughout the developed world. Population growth and rising pollution are major catalysts for this movement. Water consumption is rising overall on average throughout the nation while supplies remain relatively static. Accordingly, improving water conservation and efficiency standards has become a major focus for various levels of governments throughout our nation and the developed world as well. The demands for higher standards and new technologies have found their way into legislation, and as a result many sectors of the building industry are beginning to advocate use of 'green' building practices. Passed in 2010 by the California legislature, the Model Water Efficiency Ordinance seeks to control landscape irrigation by regulating new landscape projects at the design phase of completion. This law, as well as many others reflects a growing trend in the building industry toward more sustainable operations. In an attempt to define sustainable building practices, a standard has been set by the U.S Green Building Council. Leadership in Energy and Environmental Design, referred to as LEED®, is an internationally recognized certification system for those seeking a concise and standardized set of regulations that explicitly identifies what green buildings should possess. LEED defines green building practices from design, development, and construction, to completion and maintenance of the building and property. The project will focus on landscape design and WE credit 1 using a new site or existing building retrofitted with sustainable landscaping.

There is literature currently available which clearly articulates what goes into landscapes seeking LEED certification, yet this information is available exclusively to registered projects and LEED approved professionals. An investigation will be made in order to clarify several questions that have arisen from preliminary research conducted on the topic. What does LEED define as water efficient landscaping and how are existing systems modified in order to qualify? How are the existing plant materials adapted or changed to exist in the modified landscape? How are management practices tailored to fit a LEED certified landscape? These and some other questions should be answered for the project's development. They will assist in the planning of a conceptual or real life design or re-design of an existing landscape.

The information collected during the inquiry will be used to plan a schematic landscape design for a project house in Atascadero, Ca. The design will contain the required elements for a project seeking 4 points for W.E. credit 1, Water Efficient Landscaping, as specified in the LEED 2009 Green Building Design and Construction Reference Guide.

## II. Literature Review

### Background on the USGBC and LEED

The U.S. Green Building Council is 501 c3 nonprofit organization run by a community of leaders with different engineering, architectural, and construction backgrounds. The USGBC is dedicated to sustainable practices or “green building practices,” and provides 3<sup>rd</sup> party verification for project buildings and communities wishing to receive certification under the LEED® rating system. Energy savings, water efficiency, CO2 emissions reduction, as well as improved indoor and outdoor environmental quality are key goals of LEED. This system requires the parties involved in the construction of buildings or communities to quantitatively measure environmental performance of the building for ranking based on a set of parameters established by the USGBC. It is the first system to gain real traction in the industry and is gaining popularity internationally as the standard for green building practices using a point based certification system. Currently, 35,000 building projects are seeking LEED certification, for a total of 4.5 billion square feet in 50 states and 91 countries. These figures are expected to grow as the movement gains momentum.

Those who want to be competitive in the building business must retain LEED Accredited Professionals who can get involved in this fast growing part of the industry. LEED AP's distinguish themselves as people having expert experience in the green building industry and are certified by the USGBC after taking exams demonstrating their knowledge. This growing aspect of the industry represents a great opportunity for young aspiring professionals who are looking to get ahead of the competition in their respective sector of the building industry. Many established landscape companies are currently seeking to employ people with LEED credentials to be part of their design and construction teams as this area of the industry is sure to experience much growth in the future.



How is LEED used to rate green building performance?

The LEED rating system awards points for compliance in six overall categories. These include Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation in Design. Additional points may also be awarded for buildings that have regional priorities. A range of values are given based on specific design, construction, and maintenance parameters articulated in the LEED reference manual available to registered projects and LEED A.P.'s.(Accredited Professionals). Projects must attain a minimum point value in order to attain LEED Certification, but they may also be awarded higher certification for increased point value achievements above the certification standard. A total of approximately 100 available points may be achieved with 40 to 49 points qualifying for standard certification. Higher certifications may also be achieved; 50 to 59 points for Silver, 60 to 69 points for Gold, and 80 points for Platinum. These certifications are awarded for projects that go above and beyond the standard certification level set by the USGBC.

Projects pursuing LEED certification must undergo a series of steps in order to achieve certification. To begin the process, the owner, developer, or other party and the design team may discuss the level of desired certification, and its feasibility given the specific prerequisites and credits articulated by the LEED rating system. Once a project plan is established, the team may register the building project with the USGBC. Upon registration the USGBC will furnish the party with the literature and tools needed to prepare their applications for certification. Certain submittals may be made after the design phase, but no points are awarded until the construction phase is completed. Each category in the rating system requires individual submittal documents. For example, WE credit 1 would be a single submittal within the overall group of credits being pursued. Once all the documentation is in order, the application is submitted to the USGBC for review. The building is then certified upon approval. If the submittal is not approved, it is possible for the building party to appeal the contested credits in order to achieve certification.

## WE Credit 1: Water Efficient Landscaping 2 – 4 points

The Reference clearly articulates how to achieve 2 – 4 points in LEED credit for water efficiency by implementing water saving strategies such as use of adapted plant materials, efficient irrigation, non-potable water for irrigation, water-wise design principals, and mulching. Specific landscape calculations for estimating total water use of the proposed landscape are given and explained as well. This information is supplied to registered projects in order to assist building project participants in achieving credits.

### Plant materials

The Sunset Garden Book gives general information for plant usage in western landscapes. It includes the biotic and abiotic conditions for plant growth and success. This includes climate tolerances, water needs, soil and nutrient requirements, and any pest problems associated with particular plants. Additionally it provides suggestions for use in the landscape.

Slobg.org is an electronic edition of a booklet from the San Luis Obispo Botanical Garden designed for plant selection in SLO area landscapes. Several of the selections are sturdy drought tolerant plants that perform well in the areas landscapes. Selections such as these are desirable as they contribute greatly to water efficient landscaping strategies.

The Atascadero plant reference guide is intended for selecting plants for use in landscapes in northern San Luis Obispo County. Its purpose is to help landscape professionals and homeowners select plants that have low water requirements and may thrive with very little supplemental summer irrigation. In addition, it will aid in the selection of plants that are well suited the areas environment. This will impact maintenance and long term costs associated with plant replacements and other long term expenses.

### III. Materials and Methods

#### Materials

After initial site analysis and hand drafting, designs were completed using AutoCAD® and Land FX® software for all plan view design work. Other models and shadow profiles will utilize Google Sketch-up to re-create three dimensional designs for site analysis and as specified by the LEED® 2009 reference guide. Plant selections will be based on several criteria including water needs, climatic tolerances, pest resistances, ease of maintenance, and mature size and attractiveness in the landscape with respect to aesthetic compatibility of different plant materials. Some general landscape materials will be called out for the various aspects of the landscape design. Hardscape, irrigation, retaining walls, planter beds, and other such features will be specified in the hardscape site plan. Some examples of documentation will be included for viewers to gain further insight into the certification process.

#### Methods

After initial research and review of the USGBC and its rating system, the design process ensued. Developing the site maps showing existing and planned structure, topography, orientation, sun, use of space and existing vegetation was completed first. This was accomplished through several meetings with the client to discuss the objectives and requirements of the design. Two specific site maps were developed with AutoCAD drafting software; a planting plan and a hardscape plan with an irrigation layout. Landscape maintenance suggestions were provided with the plans in adherence with the LEED 2009 reference manual. The planting plan gives a variety of suggested materials and expressly locates them with the landscape. The materials selected were chosen based on adapted natives local to the region using the horticultural publications previously mentioned. Specific plant selection will be left to the discretion of the client based on personal preferences. The plants chosen for each symbol within the design mature at relatively similar sizes, so each could be used interchangeably within the design pursuant to the owner's wishes. Hardscape and irrigation layout remained relatively conceptual, though an irrigation plan could be easily implemented with the specs and materials listed within the design. After completing the site maps, it was important to design shadow

profiles of the proposed landscape for each season based on the mid-day conditions and illustrate the plant selections within each profile as specified by the reference manual.

Creating the shadow profiles required the basic site map to be imported into Google Sketch-up for further development. The 2-dimensional design was manipulated into a 3d rendering in order to further illustrate the character of the proposed site and graphically represent the shadow profiles associated with the design. This facet of the proposal would serve to communicate how daylight shadows may affect the water demands of the landscape, and also provides the client with a better idea of what the proposed landscape would actually look like. This software would serve as an instrument in deciding the microclimate factor associated with the landscape coefficient, and a help sell the project to the customer. All sketch-up worked would be viewed electronically as an interactive fly through or by snapshots. After finishing the design work, several calculations needed to be made in order to assess the water demands of the site. Planned water use zones based on plant selections were mapped and the instructions provided in the LEED 2009 reference guide were used to calculate the summer baseline and design case. Calculations were completed as follows.

First, calculate the landscape coefficient by multiplying the three area characteristics (species factor, density factor, and microclimate factor) shown by equation 1 in the 2009 LEED reference guide under WE credit 1. The area characteristics influence water use of the landscape and are clearly explained in the reference manual. Determine the reference evapotranspiration Rate (ET<sub>o</sub>) for the month of July in the region. This is a measurement of the total amount of water needed to grow a reference plant in the area. CIMIS uses turf grass as a reference plant. Other regions may use alfalfa or some other reference material. The ET<sub>o</sub> can be found using databases online. Local ET<sub>o</sub> rates can be found through CIMIS, The California Irrigation Management Information System. Now calculate the project -specific ET rate for the landscape areas by multiplying the ET<sub>o</sub> by the landscape coefficient as illustrated by equation 2 in the 2009 LEED reference guide under WE credit 1. Determine the irrigation efficiency using the table in the 2009 LEED reference guide. If applicable determine any controller efficiency (CE) supported by manufacturer guarantee or calculations by the landscape designer.

Calculate the area in square footage of the landscape. If the landscape is broken up into separate sections with different plant types (i.e. turf grass vs. mixed woody perennials), then calculate each area separately. Calculate the total water applied (TWA) using equations 3 and 4 in the 2009 LEED reference guide under WE credit 1. Equation 4 will only be used if non-potable water sources are being implemented such as grey water or captured rainwater.

The baseline case follows a similar methodology as the design case but some coefficients must be changed in order to accurately calculate conventional landscape water use. The species factor, density factor, and irrigation efficiency are set to average values representing a conventional landscape for the area. The same microclimate factor and reference ETo are used in both cases understandably. Use equation 5 in the 2009 LEED® reference guide under WE credit 1 to calculate the baseline case. Calculate the percentage reduction of total water. The total water reduction would come to be 100% decrease by selecting the pathway for non-potable water supplemental irrigation. On site available water from seasonal precipitation would be used to justify this reduction in potable water use. Depending on the option (either 50% or 100% potable water reduction), use equation 6 and 7 in the LEED 2009 reference guide under WE credit 1. All calculations were summed and explained in an excel spreadsheet. Refer to Water Requirement Calculations for further explanation. An example LEED submittal form was also provided for further explanation of the credit process.

**Table 1 . LANDSCAPE WATER REQUIREMENT CALCULATIONS**

<b>Baseline Case (july)</b>								
Landscape Type	Area (Sf)	Species Factor (Ks)	Density Factor (Kd)	Microclimate Factor (Kmc)	KL	ETL	IE	TWA (gal)
Shrubs	3105	0.7	1.0	1.0	1	4.5	0.63	13934
Mixed Planting	2473	0.5	1.0	1.0	1	3.21	0.63	7917
Turfgrass sub.	1360	0.8	1.0	1.0	1	5.14	0.63	6971
Subtotal TWA								28822
<b>Design Case (july)</b>								
Landscape Type	Area (Sf)	Species Factor (Ks)	Density Factor (Kd)	Microclimate Factor (Kmc)	KL	ETL	IE	TWA (gal)
Shrubs	3785	0.2	1.0	1.0	0	1.29	0.9	3371
Mixed Planting	2473	0.2	1.0	1.0	0	1.29	0.9	2203
Turfgrass Sub.	680	0.5	1.0	1.0	1	3.22	0.9	1514
Subtotal TWA								7088
Rain water or grey water harvest								-7088
TPWA(gal)								0

<b>Equation # 1</b>	$K_L = K_L \times K_d \times K_{mc}$
Example	$K_L = 0.5 \times 1.0 \times 1.0 = 0.5$

The operations in equation 1 multiplies 3 factors associated with total landscape water needs including species factor, density factor, and microclimate factor. Table values are selected based on species of plant, spacing, and microclimate characteristics of the site.

<b>Equation # 2</b>	$ET_L(\text{in}) = ET_0(\text{cimis data}) \times K_L$
Example	$ET_L(\text{in}) = 6.43 \times 0.7 = 4.5$

The ET0 average for Atascadero is used in the calculation and is derived from the CIMIS. This figure is multiplied by the landscape coefficient to calculate ETL in inches

<b>Equation # 3</b>	$\text{Design Case TWA}(\text{gal}) = \text{Area}(\text{Sq. Ft.}) \times (ET_L(\text{in.}) / IE) \times CE \times 0.6233 (\text{ gal/sq. ft./in})$
Example	$\text{Design Case TWA}(\text{gal}) = 3785 \times (1.286/0.9) \times 1 \times 0.6233 = 3371$

The landscape type area, ETL, Irrigation Efficiency, and any controller efficiency are multiplied by a constant to calculate the total water applied.

<b>Equation # 4</b>	$\text{Design Case TPWA}(\text{gal}) = \text{TWA}(\text{gal}) - \text{Reuse Water}(\text{gal})$
Example	$7088 - 7088 = 0 \text{ gal} = \mathbf{100 \% \text{ Water reduction}}$

The 7088 gallons of reuse water is justified by the watershed associated with the site and the irrigation cistern specified in the design

<b>Equation # 5</b>	$\text{Baseline Case TWA}(\text{gal}) = \text{Area}(\text{Sq. Ft.}) \times (ET_L / IE) \times 0.6233 (\text{ gal/sq. ft./ in})$
Example	$\text{Baseline Case TWA}(\text{gal}) = 3105 \times (4.5/0.625) \times 0.6233 (\text{ gal/ sp. Ft./ in}) = 13934$
<b>Equation # 6</b>	$\% \text{ Reduction of total Water} = 1 - \text{Design Case TWA} / \text{Baseline Case TWA} \times 100$
Example	$\% \text{ Reduction of total Water} = 1 - (0/28822) \times 100 = \mathbf{100 \% \text{ Water Reduction}}$

water reuse factors may become applicable in the design case.



# LEED 2009 for Retail: New Construction and Major Renovations

## WE CREDIT 1: WATER EFFICIENT LANDSCAPING

All fields and uploads are required unless otherwise noted.

### ALL OPTIONS

This static sample form has been modified for offline access. All sections of the form are visible. Sample forms are for reference only.

Select one of the following:

- The project is part of a multi-tenant complex and the project team is using a master plan to meet credit requirements.
- The project team is not pursuing the multitenant complex path for this credit.

Select one of the following:

- Upload L-6** from PI Form 4 is a master site plan showing the landscaped areas of the multitenant complex and associated grounds.
- OR  **Upload WEc1-2.** Provide a master site plan showing the landscaped areas of the multitenant complex and associated grounds.

Select one of the following:

- Upload L-2** from PI Form 4 is a site plan showing the landscaped areas of the project building and associated grounds.
- OR  **Upload WEc1-1.** Provide a site plan showing the landscaped areas of the project building and associated grounds.

- Project conditions do not allow for installation of vegetation on the grounds. Therefore planters, a vegetated roof, and/or a courtyard landscape have been installed to achieve credit compliance. (Optional)

Planter, vegetated roof and/or courtyard landscape area:  sf

Total development gross square footage:  sf

Percentage of planter, vegetated roof, and/or courtyard landscape area:  %

*The project is ineligible to apply for this credit because the landscape area is less than 5% of the total site area.*

- Project conditions do not allow for installation of vegetation on the grounds. Therefore planters, a vegetated roof, and/or a courtyard landscape have been installed to achieve credit compliance. (Optional)

Planter, vegetated roof and/or courtyard landscape area:  sf

Total site area within the LEED project boundary:  sf

Percentage of planter, vegetated roof, and/or courtyard landscape area:  %

Select one of the following:

- The landscaping and irrigation systems have been designed to reduce irrigation water consumption from a calculated baseline case.
- The landscaping installed does not require permanent irrigation systems. Temporary irrigation systems used for plant establishment will be removed within 18 months of installation.

## IRRIGATION WATER CONSUMPTION REDUCTION

Reference evapotranspiration rate (ET<sub>o</sub>):

**Table WEc1-1.** Irrigation Baseline Case (July)

Landscape Type	Area (sf)	k <sub>s</sub>	k <sub>d</sub>	k <sub>m</sub> c <sup>1</sup>	K <sub>L</sub>	Et <sub>o</sub>	ET <sub>L</sub>	Irrigation Type	IE	TWA (Gal)
Total area		Baseline Total Water Applied (TWA) (gal)								

**Table WEc1-2.** Irrigation Design Case (July)

Landscape Type	Area (sf)	k <sub>s</sub>	k <sub>d</sub>	k <sub>m</sub> c <sup>1</sup>	K <sub>L</sub>	Et <sub>o</sub>	ET <sub>L</sub>	Irrigation Type	IE	1-CE <sup>2</sup>	TWA (Gal)
Total area:		Design total water applied (TWA) (gal)									
										Nonpotable water used (gal)	
										Design total potable water applied (TPWA) (gal)	

<sup>1</sup> For each landscape type, the microclimate factor (k<sub>m</sub>c) must be the same for the baseline and design case.

<sup>2</sup> The '1-CE' value can range from 0.7 to 1, as the CE value is not to exceed 30% for the peak month of July.

Percentage reduction of potable water:  %

Percentage reduction of total water:  %

A 50% reduction in potable water use is required for 2 points. A 100% reduction in potable water and a 50% reduction in total water is required for 4 points.



# NO PERMANENT IRRIGATION

## Required Signatory WEc1-1. RLA, RA or Owner

The landscaping installed for the project building and associated grounds does not require permanent irrigation systems. Temporary irrigation systems used for plant establishment will be removed within a period not to exceed 18 months of installation.

Select one of the following:

- RLA, RA or Owner Signature.** Provide a digital signature affirming the Required Signatory WEc1-1 statement in gray directly above.
- Initial here:
- OR  **Upload WEc1-RS1.** Provide a document with the statement copied directly from Required Signatory WEc1-1, signed and dated by the Registered Landscape Architect, Registered Architect, or Owner on letterhead.

Describe how the landscape has been designed for no irrigation.

# ADDITIONAL DETAILS

- Special circumstances preclude documentation of credit compliance with the submittal requirements outlined in this form.

## SPECIAL CIRCUMSTANCES

Describe the circumstances limiting the project team's ability to provide the submittals required in this form. Be sure to reference what additional documentation has been provided, if any. Non-standard documentation will be considered upon its merits.

- The project team is using an alternative compliance approach in lieu of standard submittal paths.

## ALTERNATIVE COMPLIANCE PATH

Describe the alternative compliance path used by the project team. Include justification that this path meets the credit intent and requirements. Be sure to reference what additional documentation has been provided, if any. Non-standard documentation will be considered upon its merits.

**Upload WEc1-ACP.** Provide any additional documents that support the alternative compliance path approach. (Optional)

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## SUMMARY

WE Credit 1: Water Efficient Landscaping Points Documented:

REFERENCE

Estimated Site Watershed



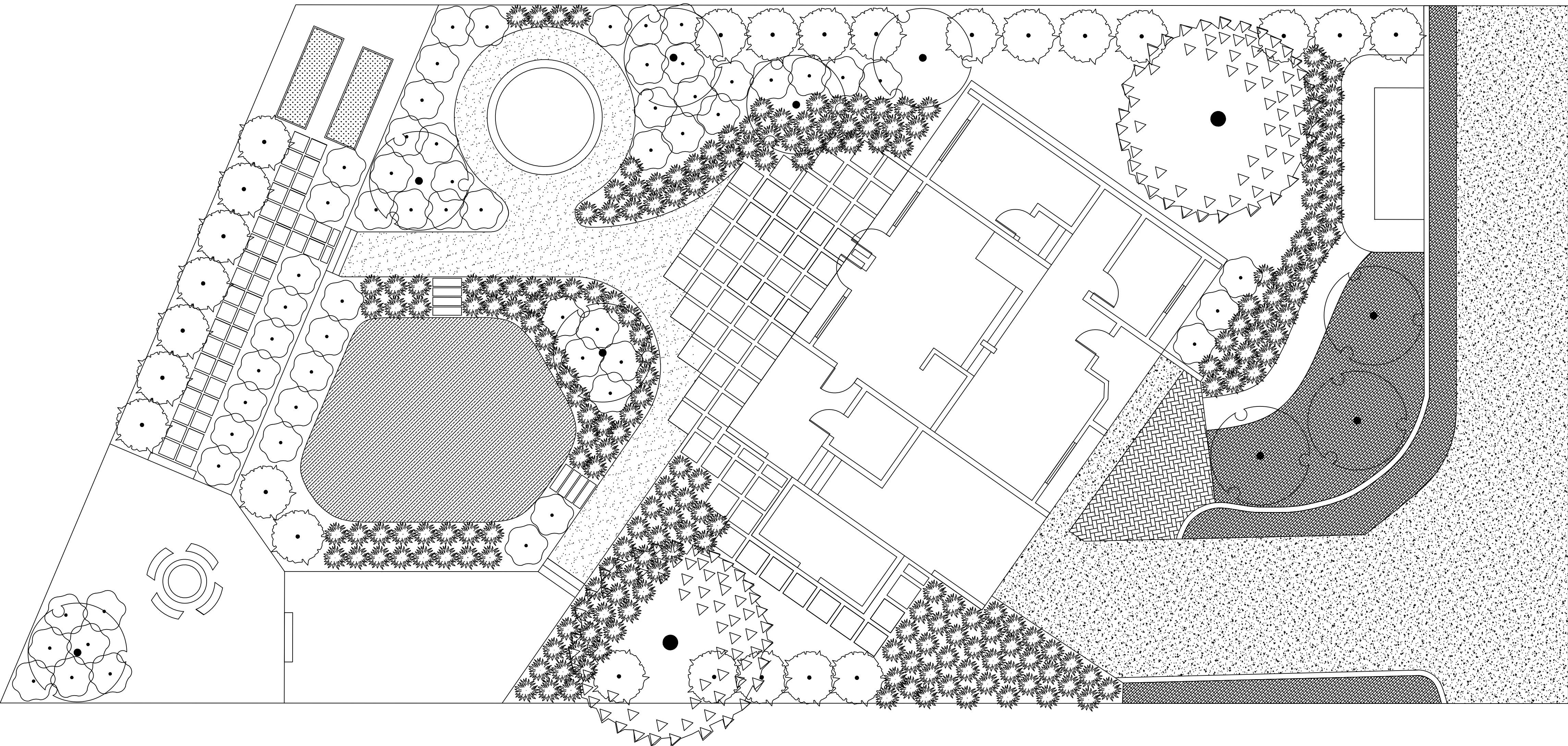
©2011 Google  
Image ©2011 DigitalGlobe  
Imagery Date: 6/30/2007 1994  
35°27'51.43" N 120°40'09.51" W elev. 940 ft  
Eye alt. 1212 ft

# PROJECT SITE - PLANTING PLAN

PROJECT NAME AND ADDRESS

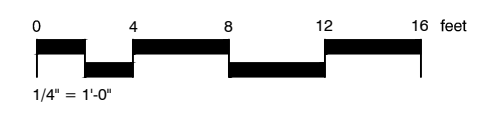
Montoya Residence  
7985 Santa Rosa Street  
Atascadero Ca, 93423

Owner: Michael Montoya  
James  
Designer: Van Nieuwenhuyzen



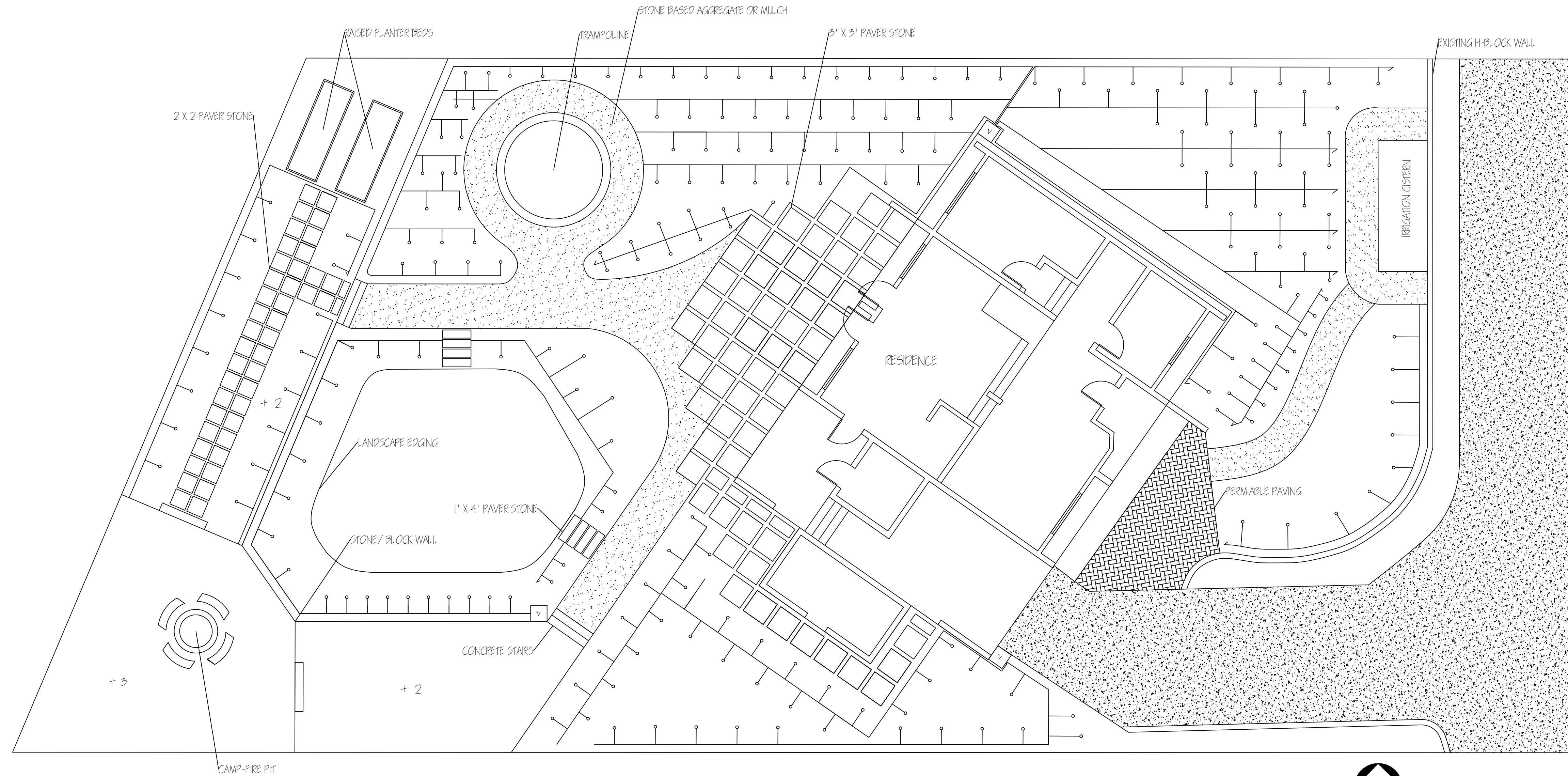
## CONCEPT PLANT SCHEDULE

	<b>SMALL TREES</b> Aesculus californica / California Buckeye Arbutus menziesii / Pacific Madrone Arctostaphylos manzanita / Manzanita Ceanothus x "Ray Hartman" / California Lilac Chilopsis linearis / Desert Willow Cotinus coggygria "Royal Purple" / Royal Purple Smoke Tree Heteromeles arbutifolia / Toyon Myrica californica / Pacific Wax Myrtle Ornithostaphylos oppositifolia / Baja Birdbush Prunus ilicifolia lyonii / Catalina Cherry	9
	<b>MIDSIZE TREES</b> Cupressus torresii / Torrey Cypress Fraxinus dipetala / California Ash Quercus douglasii / Blue Oak Umbellularia californica / California Laurel	2
	<b>LARGE SHRUBS</b> Arctostaphylos densiflora "Howard McMinn" / Howard McMinn Manzanita Dendromecon harfordii / Island Bush Poppy Fremontodendron californicum / California Flannel Bush Garrya elliptica / Coast Silk-tassel Rhamnus californica / California Coffee Berry Rhus integrifolia / Lemonade Berry	26
	<b>MIDSIZE SHRUBS</b> Artemisia californica / California Sagebrush Baccharis pilularis "Al's Blue" / Dwarf Coyote Brush Muhlenbergia rigens / Deer Grass Rhus ovata / Sugar Bush Salvia apiana / White Sage Salvia mellifera / Black Sage	58
	<b>SMALL PERENNIAL SHRUBS</b> Achillea tomentosa / Woolly Yarrow Eriogonum fasciculatum / Common Buckwheat Kniphofia uvana "Dwarf Yellow" / Dwarf Yellow Poker Plant Mimulus aurantiacus / Sticky Monkey Flower Salvia clevelandii / Cleveland Sage	203
	<b>SHRUB AREAS</b> Agave shawii / Coastal Agave Calamagrostis foliosa / Reed Grass Leymus condensatus "Canyon Prince" / Native Blue Rye Mahonia aquifolium "Compacta" / Compact Oregon Grape Zauschneria californica / California Fuchsia	880 sf
	<b>TURF REPLACEMENTS</b> Achillea millefolium / Common Yarrow Aster chilensis / Pacific Aster Carex praegracilis / Slender Sedge Festuca californica / California Fescue Nassella pulchra / Purple Needle Grass Sisynchium bellum / Blue Eyed Grass	0 sf



IRRIGATION LEGEND	
RAINBIRD - XSP XERT	○
3/4" PLUBB EP	—
RAINBIRD - XT 700	—
VEEL - TUBING	—
RAINBIRD - XZZ - PIP	—
3/4" LOW FLOW VALVE	Ⓜ

# HARDSCAPE & IRRIGATION SITE PLAN



## LANDSCAPE MAINTENANCE PROTOCOL

- KEEP LANDSCAPE AREAS MULCHED TO REDUCE ET AND DECREASE THE NEED FOR SUPPLEMENTAL IRRIGATION.
- DO NOT IRRIGATE TURF REPLACEMENT FROM NOVEMBER THROUGH APRIL.  
DO NOT WATER SHRUBS OR TREES FROM SEPTEMBER THROUGH JUNE.
- REGULARLY CHECK IRRIGATION SYSTEM FOR EFFICIENT AND EFFECTIVE OPERATION. A IRRIGATION MAINTENANCE SCHEDULE SHOULD BE IMPLEMENTED AND MAINTAINED. FILTERS, EMITTERS AND LINES SHOULD BE INSPECTED MONTHLY AND CLEANED AS NEEDED.
- SOIL SHOULD BE ANALYZED AND AMENDED AS NEEDED BASED ON PLANT SELECTIONS.  
EACH PLANT SPECIES SHOULD BE TREATED UNIQUELY AS SEVERAL MAY PRESENT RICH SOIL ADDITIVES.
- ALL PLANT MATERIALS SHOULD BE PRUNED TWICE YEARLY IN MID-SUMMER AND WINTER. HEDGE PRUNING SHOULD BE AVOIDED IF POSSIBLE. AVOID PRUNING IN WET CONDITIONS TO AVOID PATHOGEN SPREAD.
- PLANT FERTILIZING SHOULD BE KEPT TO A MINIMUM. PLANTS MAY BENEFIT FROM AN ORGANIC NITROGEN SOURCE APPLIED IN THE FALL SEASON OF EACH YEAR.
- PEST MANAGEMENT SHOULD BE BASED ON AN INTEGRATED APPROACH IMPLEMENTING CULTURAL AND BIOLOGICAL CONTROLS WHEN APPLICABLE. WEED MANAGEMENT SHOULD BE LIMITED TO MECHANICAL AND CULTURAL CONTROLS IN MOST CASES. ANY APPLICATION OF CHEMICALS SHOULD BE LIMITED TO LESS HARMFUL PESTICIDE COMPOUNDS.

## PROJECT NAME AND ADDRESS

Montoya Residence  
7985 Santa Rosa Street  
Atascadero Ca, 95425

Owner: Michael Montoya

Designer: James Van Nieuwenhuizen

Figure 6 – Summer Shadow Profile

**Front Yard**



**Back Yard**



December Shadow Profile

**Front Yard**



**Back Yard**



General Site Plan Views





#### IV. Results and Discussion

The main objective of the project was to interpret the guiding design principals articulated by the USGBC in the 2009 LEED® 2009 reference guide for WE Credit 1, Water Efficient Landscaping, and employ that information in designing a concept landscape plan for the site selected. The LEED Reference guide served as a manual to achieving this specific credit just as it would in an implemented commercial or residential design. A total of 4 credit points or 100% potable water reduction for landscape irrigation was the main design parameter in completing the project. To facilitate this goal of total water reduction with respect to the climatic factors at the site, the design process required several extra provisions in order to create a design that was acceptable.

When investigating how the USGBC and the LEED rating system operated, initially research was somewhat difficult due to the restrictedness of some of the information. Meeting with Mike Montoya assisted in this effort. Being a long time LEED Accredited Professional, his knowledge assisted in understanding the broader context to which the project belonged. The Montoya residence would also serve as the project site for the design exercise.

The first goal of the project was to meet with the resident of the property to discuss their needs for the site. This portion of planning centered more strictly on conventional landscape design, with less attention paid to the LEED parameters that would come into focus as the design progressed. After meeting with the client and initial site analysis, preliminary design work centered on spatially defining some of the broader site functions desired by the client. For example, definite entertainment and recreational areas, garden spaces, a look-out area, and privacy were requested. These ideas came to fruition explicitly through designing several patios for entertainment and relaxation, a campfire pit, raised vegetable beds, a space for an existing trampoline, and a planted recreational area. Additionally, a site for placement of an underground cistern was selected. This feature of the design would assist in meeting summer water demands in the landscape. Validation for this provision was is found by realizing the average annual precipitation rate and the large water shed associated with the site. Another meeting with the client was scheduled to discuss these specific design ideas in more detail. The next step involved further defining the site areas into various sections of hardscape and landscape. This proved to be somewhat challenging due to the unique orientation of the house on the site. After initial

sketches were completed, several mock-ups were drafted in using AutoCAD design software until one of the most promising designs was selected. The rendering was presented to the client and the design approved. These plans would be further manipulated into 3 dimensional profile renderings as specified by the LEED Reference Manual.

Google Sketch-up® was used to develop the shadow profiles and is a free design tool available for download from the net. The shadow profiles are specifically recommended by LEED because shadows within the landscape may have significant effects on Evapotranspiration rates and consequent irrigation requirements for the site. Substantial microclimate influences from shadows are usually associated with sites containing tall structures, large trees or topography that casts shade over large areas. Rates of evaporation and transpiration will decrease accordingly in these areas. For the site used in this design, there were very few objects that created substantial shade, so the sketches served primarily as an illustrative tool to help the customer better visualize the design. A value of 1 was used for the microclimate factor because the site did not contain features that would create any substantial climate differences. The landscape water use requirement was calculated next.

The LEED rating system recognizes 2 – 4 points under the Water Efficiency category for water efficient landscaping. Project teams may receive this credit by demonstrating a quantifiable reduction in potable water use, when compared with a conventional landscape practices in the area, by means of various water reducing landscaping strategies. Two credit options are available; 50 % reduction in irrigation awards 2 points and 100% reduction of potable water use awards 4 points. Either option may be met through a single tactic, or a variety of sustainable solutions including highly efficient irrigation strategies, use of captured rainwater, use of recycled waste water, and use of native adapted materials that require no irrigation. In this specific instance, environmental factors of the site lent two promising approaches in reducing the potable water use for landscaping by 100% for 4 theoretical credit points.

Firstly, the large variety of garden worthy plant materials native to the region would be specifically used to reduce the water dependence of the landscape. These plant types are adapted to the regional Mediterranean climate and would not need water in addition to natural rainfall. Placement of plants materials remained at the concept level. The completed planting plan was designed to provide the resident with a variety of plant choices for the various site zones. See the site planting plan for further detail. Many of the plant materials selected may exhibit summer

dormancy behaviors or be generally unappealing aesthetically during the dry season. For this reason, a second factor involving the topography of the surrounding site would assist in capturing substantial winter rainfall and storing it within a cistern for summer irrigation purposes. Using Google earth software and the resident's knowledge of the site, an estimate for total available seasonal runoff was determined to be well above the required water needed for summer irrigation. The supplemental water would be used to extend the active growing season and increase the aesthetic value of the landscape through the summer months. Both strategies would assist calculations demonstrating 100 % reduction of water use as compared to a conventional landscape.

Other lesser design strategies were implemented in concert with this approach to reduce the water demands of the site. Conventional turf was excluded from the site and substitute plants were selected. The turf area was also limited to 680 square feet as opposed to an expansive lawn area more typical for the region. The materials selected require much less water and may be left un-irrigated throughout the summer months, if so desired. They provide a similar utility of a standard turf, but are less wear tolerant in general. Under all but the most intensive uses, the selections made would perform quite well. A drip irrigation system would be specified for this landscape zone and the rest of the landscape areas. The efficiency of the system would increase the amount of irrigation events that could occur over the growing season, and would increase the value of the cistern. Plant materials were also placed closely together to increase the canopy coverage by plants and reduce the amount of bare soil exposed. This tactic would reduce evapotranspiration and water loss of the site improving conditions for the plant species. These strategies were used in concert with the aforementioned methods to justify the 100 % irrigation decrease in table 1. Much of the calculation from this table is used to fill out the LEED letter template which provides documentation of improved performance.

In a real life LEED project, construction and design submittals would be used to document the design and justify the water reduction in a quantifiable manner. This project did not necessitate such a process, but example an example LEED template was provided for the reader to peruse. This documentation is the primary form of communication between the USGBC and registered projects so accuracy in form submittal is crucial to ensure a smooth submittal process and ultimate certification of the building project.

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