

A California Garden

Designing a Water Efficient Landscape for Granite Bay Village



A California Garden:

Designing a Water Efficient Landscape for Granite Bay Village

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“Every plant has fitness and must be placed in its proper surroundings so as to bring out its full beauty...” Jens Jensen (1860-1951)

Abstract

California's current water use is unsustainable. The state is facing the potential of future water shortages due to increasing population and to the uncertainty of our water supply. California can cut its urban water use by a third through efficient irrigation technology, simple changes in policy and improved public education. A large percentage of water wasted in California is attributed to residential and commercial outdoor use for lawns and ornamental plants. Part of the approach to outdoor conservation is focused on reducing water use through water efficient landscaping and using efficient irrigation systems. The project at Granite Bay Village Homeowners Association in Granite Bay, California is aimed at designing a water efficient landscape by converting existing common areas to a more sustainable and ecologically friendly environment. Converting a traditional lawn landscape into a water-efficient landscape using California native and drought-tolerant plants and adding efficient irrigation technology yields a significant increase of savings in water and maintenance costs. To get a better sense of the design elements required to implement a water efficient project, I visited several local water efficient demonstration gardens in the Central Valley to learn about this type of landscaping. Further research shows that water efficient landscape, if maintained and installed correctly, are beneficial for both the residents and the environment. Through careful plant selection and design according to water efficient landscaping principles, this Granite Bay Village project yielded a savings of 123,756 gallons of water per year based on a water budget calculation.

Acknowledgements

To Joe - you are a trooper and I am forever grateful for your encouragement and support. Thank you for sticking through it with me.

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Introduction

Outdoor landscaping typically accounts for at least half of all residential water use in California and with the growing population and increase demand in our water supply, water utilities are paying more attention to urban water conservation than ever before.

This research examined the effects of water efficient landscaping and irrigation efficiency on residential properties, it also examined the legislative efforts to increase awareness of the water crisis in California and the role that demonstration gardens have in public awareness. The case studies offered insights to the potential water savings if landscapes were retrofitted to be more efficient. A personal look at the designs of Water Efficient Landscaping (WEL) demonstration gardens within the Sacramento area gave me an opportunity to learn about planting choices and irrigation efficiency and inspiration for the Granite Bay Village project. Local demonstration gardens within the Sacramento area provided a personal look at this type of landscape for inspiration, ideas and educational opportunity to learn about how it's designed. At the end of the research, a concept plan was proposed to redesign the common areas of Granite Bay Village with water efficient landscaping and applying the Model Water Efficient Landscape Ordinance (MWELO).

Granite Bay Village Homeowner's Association (HOA) is in need of a landscape "overhaul" – one that would provide an inviting and vibrant community space for the residents. By using the principles of water efficient landscape design for the HOA common area, the community will have an exciting place for gathering and entertaining as well as provide an ecological hub for wildlife and increase the HOA's water savings. The HOA is taking advantage of a water rebate program offered by San Juan Water District, who will pay 50 percent of qualifying expenditures (up to \$1,500) for landscape improvements.

At the end of this research, the HOA project will have the following deliverables: 1) A final Landscape Concept Plan; 2) Planting and Irrigation Plan; 3) Construction Documents; 4) and a water budget calculation based on the Maximum Applied Water Allowance (MAWA) and Estimated Total Water Use (ETWU).

What is Water Efficient Landscaping?

Many people envision that every water-saving landscape looks like a desert. The most misunderstood notion about alternative landscapes that promote water conservation is that they require eliminating and replacing turf grass with hardscapes and dry climate plants such as cactus and rocks. Nothing is further from the truth. There are many examples of plants that use very little, if any, water other than cactus.

A water efficient garden is a “balanced landscape,” one that uses water efficiently and balances the lawn area, shrubs, and flowers with the hardscapes. Water efficient landscape planning and design involves careful consideration of site, soil and climate and regional characteristics. Using climate-appropriate and drought-tolerant plants often require less water beyond a normal rainfall. These plants have the ability to survive on limited water supply, while still keeping their appearance and requiring less maintenance than a traditional landscape of lawn and water-loving plants.

There are seven principles to water efficient landscaping:

Soil Preparation and Improvements. Healthy soil plays an important role to water efficient landscaping. Conducting a soil analysis and adding amendments to soil that may include other materials that are not organic, such as gypsum, with organic materials provides nutrients

to to soil plants and keeps them healthy.

Create Functional Turf Area. Lawn is an integral component of many landscapes and a water efficient landscape does promote a practical turf area that is based on function. However, it should only include no more turf area than what is required for recreational activities. Grass does require more water and maintenance than most other plants, so the importance of evaluating the landscape to see where it is practical and functional is the key.

The Right Plant in the Right Place. Water requirements are important to consider when selecting plants. Grouping plants with similar water requirements divides the landscape into hydrozones which results in water conservation. Designating water zones help conserve water and reduce the amount of time, effort, and natural resources needed in landscape maintenance. It is also the most efficient way to irrigate because it delivers water to individual plants based on their moisture requirements. "SMART" automatic controllers are available to customers. The main feature of SMART controllers is the ability to adjust irrigation to plant water use. This is usually done by estimating plant water use utilizing weather data. Then the irrigation program is adjusted to replace the water used by the plants in the irrigation zone. Installing a smart controller can do an efficient job of watering the landscape. Some controllers have special features that have multiple program controllers that allow varying watering times for different garden areas controlled by separate valves. Other features include water budgeting and rain shut-off device that allow adjustment of watering times depending on the season, weather or if significant rainfall occurs.

Mulch! Mulch! Mulch! Mulch can be organic or inorganic. Both provide a protective layer of material that covers the soil surface. Mulch reduces the amount of evaporation and increases water availability in the soil. It also reduces soil erosion, runoff and controls weeds in the landscape.

Water Wisely. The most common problem in urban landscaping is overwatering. Overwatering combined with poor soil quality can reduce plant growth and unnecessary water use. An efficient irrigation system that is well designed saves money and promotes plant health by applying the right amount of water to the landscapes. Typical irrigation installations apply water faster than the soil can absorb it which results in runoff. In technical terms: the precipitation rate of the irrigation system exceeds the infiltration rate of the soil.

Proper Maintenance. Proper maintenance preserves and enhances the quality of the landscape. This includes a maintenance schedule to check, adjust and repair broken sprinkles or leaky valves or to check if drip systems are distributing water evenly. Without checking the irrigation system regularly to ensure that it is working properly defeats the purpose of establishing a water efficient landscape.

Water efficient landscape and efficient irrigation system go hand in hand. They are beneficial both economically and environmentally. Some of these benefits include: reduces water demand and green-waste production; improves air quality; creates habitat for wildlife; avoids cost of energy to maintain landscapes and to produce water; retains stormwater; reduces maintenance costs and saves on water bill.

(U.S.EPA, 2011)(Ellefson, 1992)(Gleick, 2003)(Eching, 2006)(Bamezai, 2001)

Water Issues in California

Introduction

Water is an important resource and is unique in that there is no other alternative substance that can meet our needs. As population growth increases in the next decade, the daunting reality is that our water supply will not increase. According to the 2009 California Water Plan Update, the state's population is expected to increase by 28 million over the next 40 years if current population trends hold. A large amount of water in California is used outside of homes to water lawns and gardens especially during the summer season when water demand for outdoor use rises and supplies are low. Of the total residential water use, outdoor water use is estimated to range from 50 to 70 percent and about 30 percent of that is wasted (Gleick, 2003)(Griffiths-Sattenspiel & Wilson, 2009)(Asano, 2007)(US EPA). Outdoor water can be reduced through improved irrigation techniques, smart water irrigation controls and water efficient landscape designs.

Because population growth and water demand pose financial and environmental concerns, many water districts in California are launching conservation programs to curb water use outdoors (Eching, 2007). Since conservation is often the cheapest way to decrease the demand for water, efforts have been aimed at lowering outdoor use by improving the efficiency of landscape irrigation and replacing lawns with less "thirsty" plants. Reducing outdoor water use focuses on landscape choices as key elements because Californians have tended to use plants more suited to humid climates. The typical California lawn, for instance, is a cool-season turf grass that can require several times more water than native or drought-tolerant plants. . Inefficient water systems, such as incorrectly timed automatic sprinklers, can create overwatered lawns and excess water that spills into our water systems. Along with the resource costs associated with water waste, overwatering generates run-off, which damages rivers, lakes and coastal waters.

To put in perspective, water used for landscape irrigation in California is equivalent to 84 inches of rainfall each year. This is as much rainfall in the Amazon jungle, two and a half times the rainfall in Seattle, and four times the rainfall of Honolulu. These estimates in water use and population trend show that reforms to conventional landscaping choices and management practices are necessary to reduce water consumption.

(Mayer, 1999)(Gleick, 2003) (Lund, 2003)(Sterman, 2007)(EPA, 2008)(Department of Water Resources, 2009)

Legislation in California – the Model Water Efficient Landscaping Ordinance (MWELO)

Policy efforts in California have included incentives and technological fixes to encourage residents to water their yards more efficiently and to design landscapes with California native and drought-tolerant plants. Some of these technological fixes include water saving practices such as repairing leaks in irrigation systems, providing water audits and rebates for replacing lawns with water efficient landscapes and installing new irrigation systems. Since conservation is key when decreasing the demand for water, former Governor Schwarzenegger called for a 20 percent reduction in per capita water use by 2020 demanding reductions in all water uses

The California Legislature enacted the Water Conservation in Landscaping Act in 1992, (Assembly Bill (AB) 325), requiring the adoption of water efficient landscape ordinances by cities and counties throughout the state. To assist local agencies, the California Department of Water Resources (DWR) developed a Model Water Efficient Landscape Ordinance that established water efficient landscape design standards for urban landscapes. This Model Ordinance served as a template for local agencies to use in the development of their own local water efficient landscape ordinances. This Model Ordinance served as a template for local agencies development of their own local water efficient landscape ordinances.

to use in the development of their own local water efficient landscape ordinances. modify it to meet its local needs, or adopt an entirely different ordinance.

The intention of AB 325 was to ensure that landscape design, installation and maintenance were water efficient. Some of the provisions specified in the statute included plant selection and grouping of plants based on water needs, climate and topographic conditions, efficient irrigation systems, practices that help long term water conservation, and routines and maintenance of irrigation systems. One element of the Ordinance adopted by the DWR was a landscape water budget. In the water budget, a Maximum Applied Water Allowance (MAWA) was established based on the landscape area and the location. AB 325 required that if a local agency had not adopted a water efficient landscape ordinance by January 1, 1993, they were required to adopt the model ordinance set by DWR. In addition, local agencies had to enforce these laws unless the local agencies were able to prove that a model ordinance was unnecessary based on their findings.

The Western Policy Research reported that the maintenance was the biggest source of the problem in the design, installation, and maintenance aspects of a landscape. Many local agencies also reported problems with implementing water efficient landscape ordinances. Some of these problems were within the agencies: lack of knowledge and experience for checking plan designs and schedules, lack of code enforcement officers and inspectors, and the lack of funding for audits and auditors.

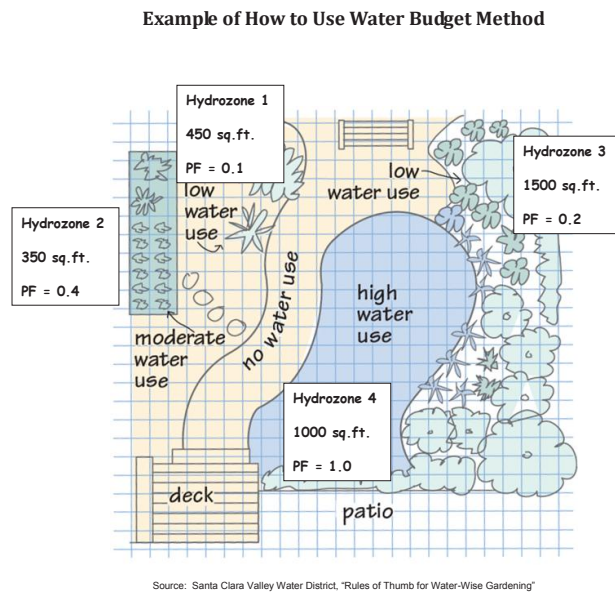
In response to the deficiency of the ordinance, AB 2717 was enacted, which requested that the California Urban Water Conservation Council (CUWCC) establish a Landscape Task Force consisting of stakeholders from the water and landscaping sectors. These stakeholders evaluated existing practices and recommended proposals for improving the efficiency of water use in new and existing urban irrigated landscapes in California. In addition, the Task Force submitted a report to the Governor and Legislature which addressed updating

of the State Model Ordinance (AB 325). In the report, it specified that DWR had to maintain the existing Model Ordinance Water Budget approach but had to make it more user-friendly and provide a variety of training opportunities and resources on a regional basis. This included the production of simple, attractive and educational resources such as a manual and companion brochures.

As a result of the findings from the Task Force, the Water Conservation in Landscaping Act of 2006 (AB 1881) was enacted. It required DWR to update the Model Water Efficient Landscape Ordinance based on the recommendations made by the Task Force. AB 1881 required local agencies to adopt the updated Model Ordinance or one that was “at least as effective” as the State’s Model Ordinance by January 1, 2010. AB 1881 also directed DWR to maintain the water budget component in the Model Ordinance for determining landscape water use.

The Model Ordinance applies to new and rehabilitated landscapes over 2,500 square feet, or 5,000 square feet for homeowner-installed single-family homes and new construction. Applicants must provide professionally prepared landscape and irrigation plans that include a water budget. A water budget establishes limits on allowable consumption in a given landscape area. To establish a water budget for a given site, it is necessary to know the irrigated area and the region’s annual evapotranspiration (ET) rate. ET is the measure of water depleted from the soil due to evaporation and transpiration through plant foliage. The ET rate is determined by heat, temperature, wind, humidity, and plant and soil types. Annual ET data has been developed by plant type and by region which can be accessed through CIMIS, California Irrigation Management System, a website database which estimates water use of a crop in inches per day. It is available through the DWR website for more than 120 locations in California and is generated by weather stations located on irrigated grass. Since most landscapes have a variety of plant materials, the ET rate for a cool season is used for reference. A plant’s

supplemental water requirement or annual water budget is based on effective precipitation and its ET rate, called net ET. A water budget can then be established for a given area once the plant types and ET rates are known. An example of ET reference material and water budget calculation is cited on Figure 1.



Total Landscape Area (LA) (including water feature and excluding hardscape) is 3,300 sq.ft.

Note: This example does not have a special landscape area (SLA). A Special Landscape Area is an area solely dedicated to one or more edible plants, or areas with recycled water, or water features using recycled water or areas open to the public, which are dedicated to active play such as parks, sports field, golf courses where turf is playing surface.

See next page

Figure 1. ET Reference material and an example of a water budget calculation

Step One: Use the equation below to determine **Maximum Applied Water Allowance (MAWA)**.

$$MAWA = (26.536) [(0.7 \times LA) + (0.3 \times SLA)]$$

Where:

LA = Total Landscape Area including SLA in square feet

SLA = Special Landscape Area in square feet (See previous page for definition)

In this example the total Landscape Area (LA) is **3,300 square feet** and there is not an area considered to be a Special Landscaped Area (SLA).

So, the Maximum Applied Water Allowance is:
 $(26.536) [(0.7 \times 3300) + (0.3 \times 0)] = 61,298$ gallons per year

Step Two: Fill out Hydrozone Table for use in Step 3.

To determine plant factors for hydrozones, use "A Guide to Estimating Irrigation Water Needs of Landscape Planting in California- Landscape Coefficient Method & WUCOLS III" that can be downloaded from California's State Department of Water Resources (<http://www.water.ca.gov/wateruseefficiency/docs/wucols00.pdf>)

Hydrozone Table for Calculating ETWU

Hydrozone	Plant Water Use Type(s)	Plant Factor (PF)	Area (HA) (square feet)	PF x HA (square feet)
1	Low water use	0.1	450	45
2	Moderate water use	0.4	350	140
3	Low water use	0.2	1500	300
4	High water use- Water Feature/Pool	1.0	1000	1000
Sum of PF x HA =				1485

Step Three: Use Hydrozone Table Results and equation below to determine the Estimated Total Water Use (ETWU).

$$ETWU = (26.536) \left(\frac{PF \times HA}{IE} + SLA \right)$$

Where:

ETWU = Estimated Total Water Use

PF = Plant Factor in relation to hydrozones from WUCOLS

HA = Square feet of Hydrozone Areas

IE = Irrigation Efficiency (assumed to be 0.7)

SLA = Square feet of Special Landscape Area

Using the data from the hydrozone table, the **Estimated Total Water Use (ETWU)** is:

$$(26.536) (1485/0.7 + 0) = 56,294$$
 gallons per year

Step Four: Compare ETWU and MAWA. The Estimated Total Water Use (ETWU) CANNOT EXCEED Maximum Applied Water Allowance (MAWA). In this example, the ETWU is 56,294 gallons, which is less than budgeted MAWA 61,298 gallons. Therefore, this example complies with the water ordinance.

Along with the water budget calculation, the Model Ordinance also requires drip or low-volume irrigation and weather-based controllers for automatic irrigation systems to be used to improve efficiency. Overhead sprinklers are prohibited in areas more than eight feet wide or 24 inches of non-permeable hardscapes.

Other significant requirements of the updated state Model Water Efficient Landscape Ordinance include the following:

- Water purveyors are required to offer landscape surveys and/or incentive programs targeting landscape irrigation efficiency for new and existing landscapes.
- Local agencies are required to regulate existing landscapes for water waste and address smaller landscaping projects including single-family residential projects.
- A Landscape Documentation Package (LDP) is required for certificate of completion which include soils analysis, an irrigation audit, irrigation scheduling and maintenance, and Maximum Applied Water Allowance (MAWA) and an Estimated Total Water Use (ETWU) for a given project.

The ultimate goal for the Model Ordinance is to reduce the amount of water used in outdoor irrigation and water consumption. With regulations and policies, public education and outreach can also offer information and provide alternative landscapes ideas to household residents.

(Bamezai, 2001) (Gleick, 2003) (California Urban Water Conservation Council, 2005)(Eching and Simon 2007)(Department of Water Resources, 2009)(UC Cooperative Extension, 2010)(Official Legislative Bill Information, accessed March 20, 2012)

The Process

Demonstration gardens are designed to increase public awareness of the beauty and variety of plants offered at the local and regional level. Water efficient landscape demonstration gardens show that beautiful gardens can thrive on low amounts of supplemental summer water. They also include water efficient techniques such as the use of compost to improve soil structure, drip irrigation, swales to capture water, and permeable concrete walks and patios to prevent stormwater run off.

Studies show that water efficient landscaping improves quality of life, increases wildlife habitat and helps with water conservation. The following case studies show how water efficient landscaping can have a significant impact on water savings. The first two case studies show comparisons and estimates of the total water saved by converting a traditional landscape into a water efficient landscape. The third case study explored three local demonstration gardens within the Sacramento area to serve as guidance and inspiration. There were three aspects I analyzed: the aesthetic, the main focus and the features of each garden in hopes that some of the ideas would be translated in the final design project at Granite Bay.

Case Study #1: Garden\Garden:A Comparison in Santa Monica

Over 90 percent of Santa Monica's water is imported from Northern California and the Colorado River. The need to raise awareness for water conservation was important. Garden\Garden is a 2004 demonstration project in the city of Santa Monica composed of two adjacent front yards that contrast the benefits of climate-appropriate planting and efficient water use versus the type of garden traditionally planted in Santa Monica. To prove its case, the city created one front yard that featured California native plants, a water-efficient drip irrigation system, a weather-sensitive irrigation controller, permeable paving, mulch, and a system for capturing stormwater



Native Garden

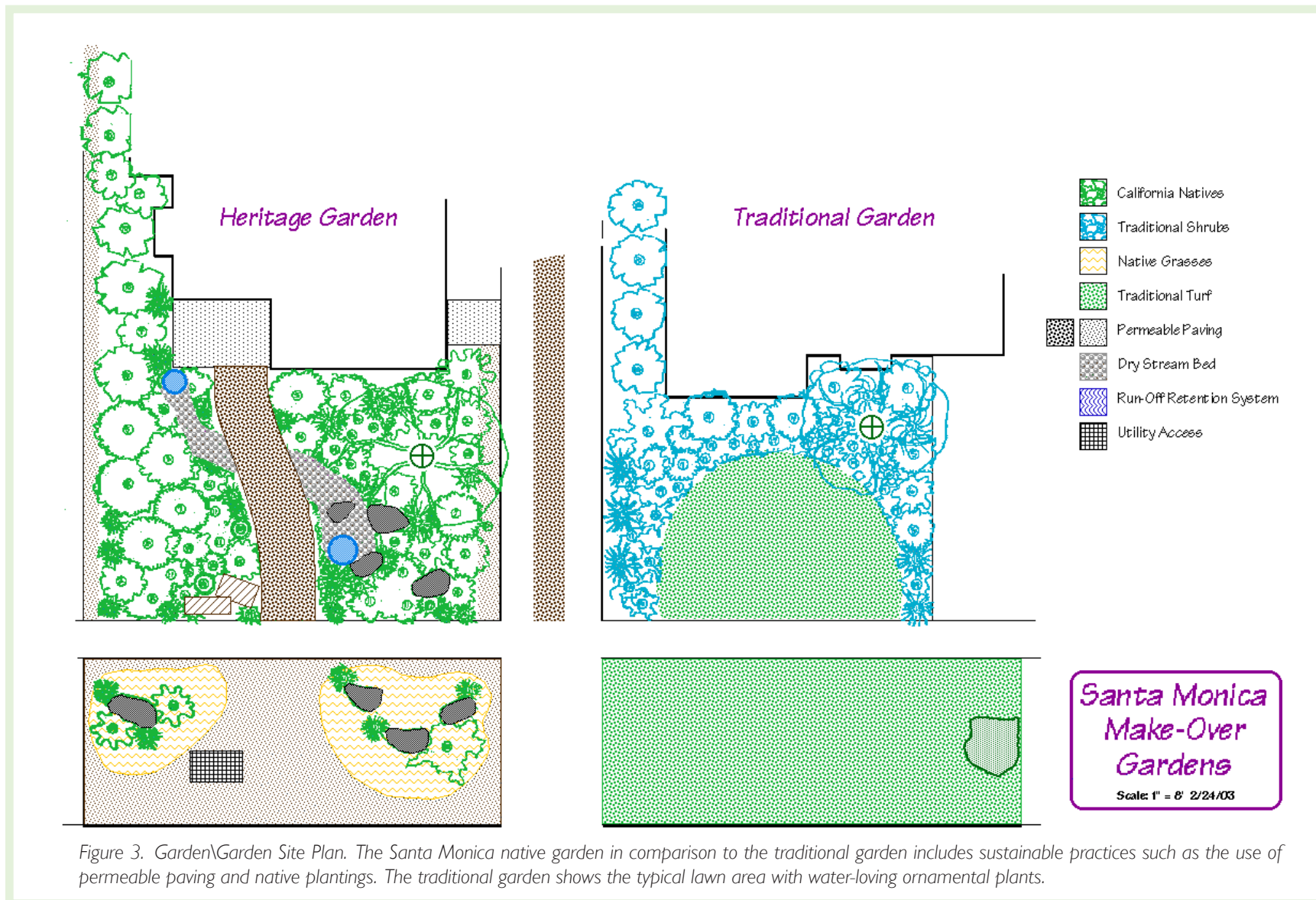


Traditional Garden

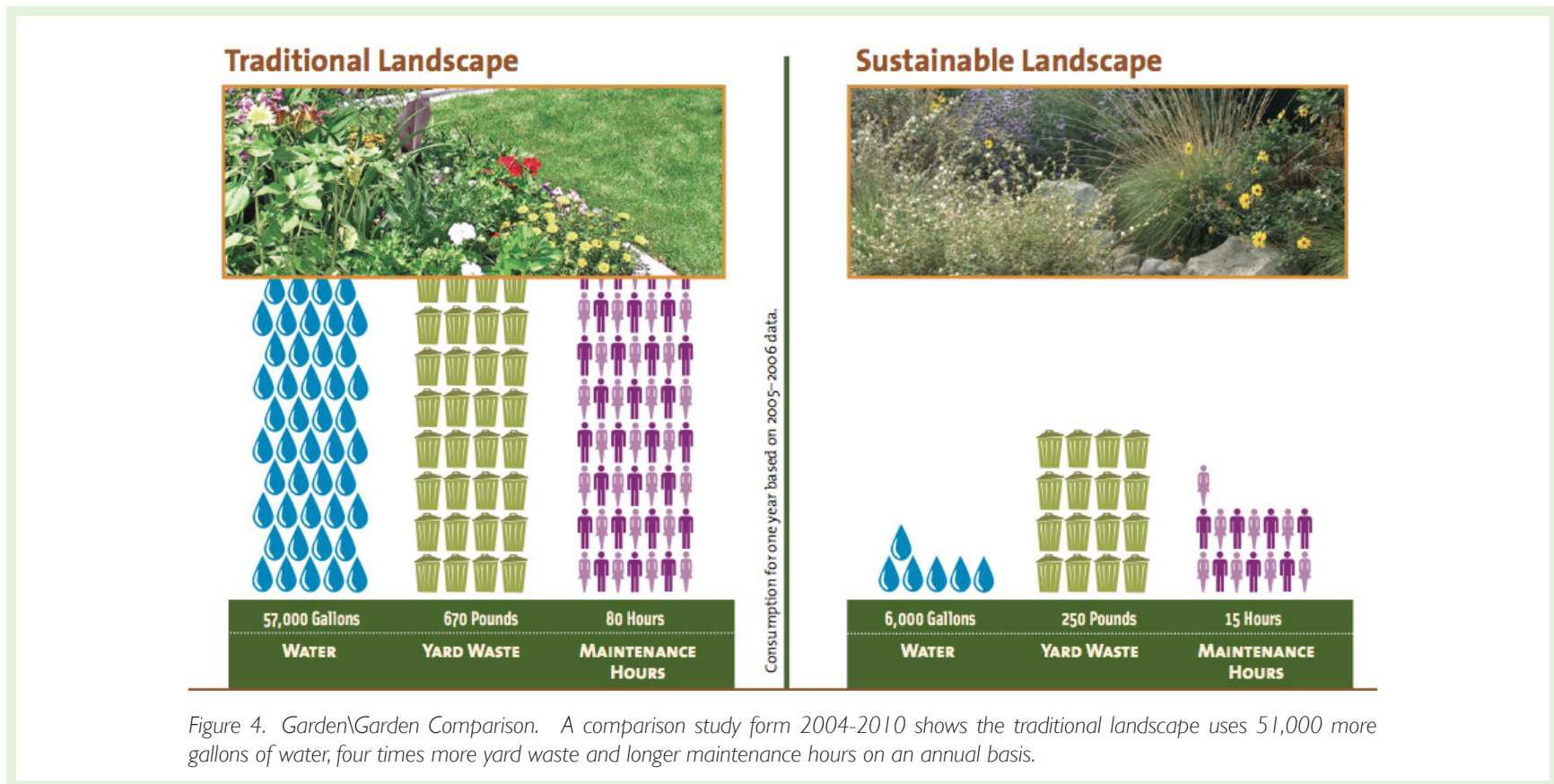
Figure 2. Garden\Garden. Santa Monica Demonstration Garden study by compared two residential homes side by side: one with a sustainable garden and the other a traditional lawn typical of the neighborhood.

runoff for groundwater recharge. The other front yard represented the typical front yard garden found in Southern California. The style of the garden featured exotic plants from Northern Europe and Eastern United States with standard and user controlled sprinkler irrigation systems. These 1,900 square feet gardens were side-by-side functioning as a living laboratory that allowed visitors to directly compare and evaluate the two landscapes. Figure 2 shows the comparisons.

Data was collected throughout the life of the demonstration project from 2004-2010 to track water use, green waste, and maintenance labor. The initial cost of the native garden was \$4,300 more than the traditional garden. This is in part due to the construction of a storm water management system, which includes rain gutters, an infiltration pit, and permeable pavement, none of which



were installed on the traditional site. Despite the higher initial cost, the native garden is more economically sustainable than the traditional garden, saving the homeowner \$2,200 per year in reduced maintenance costs. According to the data, the native garden uses 77 percent less water than the traditional garden because local climate-adapted local plants require less water to grow. The native garden also created a new habitat for local birds and wildlife and supports ladybugs, butterflies and bird species.



Even though there was already a demonstration garden installed at the Santa Monica City Hall, the city aimed to convince residential homeowners that they could also install similar water-efficient landscapes in their own yards through the Garden\Garden demonstration project. The challenge was to persuade both homeowners and landscape professionals that sustainable gardening was not only better for the environment than traditional gardening, but also attractive and made good economic sense. The project was a success. Planting a sustainable landscape improved the look of the property, the quality of the neighborhood and the environment and saved the resident money. For landscape professionals, design sustainable projects sustainably offers their clients an excellent return on their investment, the landscapes are much easier to live with, and they are better for the environment. Trying to convince homeowners to accept sustainable landscapes is not just for environmental benefits anymore – it's more money in their pockets in the long-run.

Case Study #2: The Maloney Waterwise Demonstration Garden, Sonoma, California

The Sonoma County Master Gardeners partnered with the City of Sonoma, the Sonoma County Water Agency, and the Sonoma Community Center to create a water efficient demonstration garden. The demonstration and teaching garden is over 4,000 square feet and was designed to demonstrate the principles of water conservation low-water gardening and drip irrigation that focuses on various drip benefits. Completed in 2009, the garden also demonstrated that reduced water use can go hand-in-hand with an aesthetically appealing landscape.

There were four gardens to view at the Sonoma demonstration project: one with native plants, one with Mediterranean plants, one with desert plantings, and a children's garden. They also kept spaces for public art, benches and future cisterns for water catchment. Signs on both sides of the building were designed to direct visitors to the garden and identify the plantings in each of the four areas. The City

uses the demonstration garden as a tool to send those who are hesitant about removing their lawns for ideas and to show that replacing lawns with water efficient landscaping can be aesthetically beautiful.

It was estimated during the first full year since it opened that the garden water usage was reduced by 70 percent. With 16,000 square feet of roof, it was estimated that two cisterns at the corners of the building captured enough water to use in the garden during dry months

(UC Sonoma County Master Gardeners, 2012).



Figure 5. The Maloney Waterwise Demonstration Garden in Sonoma, California.

Case Study #3: Local Water Efficient Landscaping (WEL) Demonstration Gardens

Most demonstration gardens are intended for learning through passive or active opportunities and they offer new information, new insights and new experiences. The main reason for including this study is to be inspired and derive ideas that can be incorporated into my design project. The review of each of the gardens below focused on types the aesthetics (personal), the main focus of the garden and the features.

University of California, Davis - Ruth Risdon Storer Garden: A Valley-Wise Garden (Davis, California)

The Ruth Risdon Storer Garden is a valley-wise public garden, completed in 2008, that features perennials and shrubs suited to the Central Valley climate. The garden uses many U.C. Davis Arboretum All-Star plants and features a demonstration planting of roses with companion plants. The valley-wise garden is watered only once every two weeks for seven months out of the year (April-October). The design features year-round color for different times of the season. For example in the spring and summer, colors of purple and pink hues cover the landscape area and in the fall, warm colors of reds and oranges. These plants are also featured in the UC Arboretum All-Stars and are designed to help gardeners choose plants for their landscape that are valley wise. The Storer garden has decomposed granite pathway that meander through the garden. There is a sculptural wall at the Nature's Gallery Court that composes of 140 tiles that showcase a different drought-tolerant plant from the Storer Garden. The Storer garden was inspiring and had amazing overall beauty. There were so many choices of plants that several of them were included in this plant list for this Granite Bay project. (UC Davis Arboretum Brochure, 2010)(UC Davis Arboretum website, accessed March 12, 2012)



Figure 6. UC Davis Arboretum, Davis, California - The Ruth Storer Garden is a valley-wise garden that is irrigated only twice a month.

Fair Oaks Horticulture Center: Water Efficient Landscape (WEL) Garden (Fair Oaks, CA)

The Fair Oaks Horticulture WEL Garden features a one half acre of landscaping, including four backyard exhibits with four different themed gardens. The water efficient landscape was designed by Quadriga Landscape Architects in Sacramento with assistance from a UC Master Gardener. It is divided into four interconnected “backyard” landscapes that are California native, Mediterranean, perennial/bunchgrass, and common variety gardens. This is a fairly new garden and plans for a turf demonstration area will be developed at a later date. The four major landscapes were meant to represent typical residential yards and display different designs and plant themes. Each of the backyard landscapes employs and demonstrates the principles of water efficient landscape. The exhibits showcase different design possibilities for water efficient landscaping and demonstrate water conservation techniques.



Figure 7. Fair Oaks Horticulture Center, WEL Demonstration Garden, Fair Oaks, California.

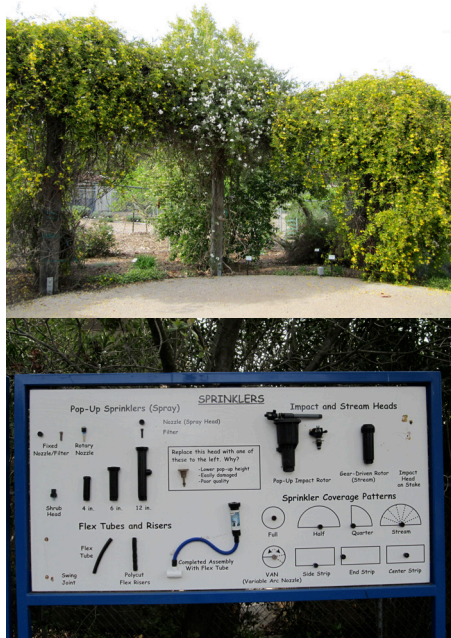


Figure 8. The Fair Oaks WEL Garden demonstrates 4 themed “backyard gardens” - California Native, Mediterranean, Perennials and a Common Variety. They also have educational boards about irrigation.

The garden is a self-guided tour and the Center offers regularly scheduled irrigation demonstration and water efficient gardening workshops. This demonstration garden focused on irrigation techniques offering the public an interactive display of irrigation products to use and what not to use, as well as information about water efficient landscaping. The educational boards show low-flow and drip irrigation systems and proper placement of trees. The pathways along the garden feature a variety of permeable paving options such as pervious pavement, interlocking pavers, porous asphalt and using decomposed granite. The visit to the garden helped me see the different possibilities of using pervious materials as well as help me understand different types of irrigation products.

(Fair Oaks Water District, March 2012) (U.C. Agriculture and Natural Resources, 2011)

Antelope Water Efficient Landscape (WEL) Garden (Antelope, California)

The Antelope Water Efficient Landscape (WEL) garden is located at the district's Antelope reservoir site. It is filled with a variety of drought-tolerant plants. The two-acre garden was established in 1998 and it contains hundreds of species, both native and nonnative. The garden offers many ideas for home landscape plantings, plus innovative irrigation systems to reduce water use and run off. It features a simple-looking, yet impressive weather station, designed to collect data and program the irrigation system so it automatically responds to changing weather conditions. This garden has a river-like water feature that meanders throughout the site. It has two different structures, one a pergola-like gazebo and a round gazebo that features a seat wall made of stacked granite stones. There is a pathway to a pergola walkway that leads into a courtyard incorporated with a small water fountain feature. Near the pergola gazebo, there is a small patch of grass and sand "box" to demonstrate that water efficient landscape design can incorporate turf. Their parking lot is designed with pervious interlocking pavers so water can infiltrate into the ground. This garden is by far the most developed and my favorite out of the three I visited. Because the site was larger, they were able to incorporate different types of 'backyard' landscape possibilities and alternatives for those who are interested in rehabilitating their landscape.

(Sacramento Suburban Water District, accessed April 12, 2012)



Figure 9. Antelope WEL Demonstration Garden in Antelope California. Above left: Pervious flagstone patio incorporated in the design for Granite Bay Village. Above middle: Massive pergola for shade provided inspiration for the pergola design for Granite Bay. Above right: Natural river rock feature meanders through the site. Bottom left: Recirculating water feature for the garden. Bottom right: A weather station that collects data to monitor ET (evapotranspiration).



Site Survey, Inventory and Analysis of Granite Bay Village

Granite Bay Village is located 24 miles from Sacramento bordering the City of Roseville and Folsom. The neighborhood was developed in the late 1980s to early 1990s and consists of 56 single-family homes with a community pool and a meeting house. Those who live in the neighborhood are mostly middle-age families and seniors. There are three areas to rehabilitate: 1) the neighborhood's community pool landscape area; 2) the front entrance of the building; and 3) two small planting strips located on Shoreside Court and Stillwater Court.

Research and Preparation -- Client's Design Expectations and Designer Goals

The Granite Bay Village HOA board members provided a list of goals to incorporate and implement in the landscaping project, particularly the landscape area around the pool. The general goal is to take advantage of the San Juan Water District rebate program which will cover some of the expenses for the site.

The HOA requirements and needs are to:

- Provide shade for picnic tables and bbq area
- Add a pergola or covered beam near the meeting house for protection from sun exposure
- Reduce turf and replace the irrigation system
- Design a low-maintenance garden
- Add hardscapes that would enliven the site
- Bring color to the landscape

In addition to the HOA requirements, the goals I had for this project included:

- Provide interests throughout the year
- Create an informal space with enclosures, contrasting with a sense of openness in certain areas
- Add focal points and vertical elements to bring interests to the site

Site Survey

To produce an accurate plan of my intentions for the design, I needed to produce a scale drawing of the site. Typically, there is an existing base plan to use as guidance but in this case there was none. Measuring allowed me to become much more familiar with the site and at the same time gave me the opportunity to notice all aspects that needed to be considered. For the survey, I located the house, boundaries and existing features that remain unchanged. Some of these features consisted of the house, the redwood trees, the light pole, the fences and the fire hydrant. Besides locating all the fixed features, visual elements were considered such as views, the style of the house, the state of existing plants and local conditions such as climate, orientation and ambient noise. Figure 9 shows my initial site survey that is not to scale.

Site Inventory

The next step was to prepare a scaled drawing. To represent the plan clearly, I used 1/4" = 1'0" architectural scale measurement. Watching the site take shape on paper was an exciting stage in the design process even when it exposed a few inaccuracies of measurement. Because I was inexperienced, it was easy to make a mistake in reading the dimensions of the tape measure and not noticing the error until I drew the survey to scale. This required that I return to the site to check the suspected errors. It seems difficult to be completely accurate when surveying, and a small amount of "artistic license" seems forgivable.

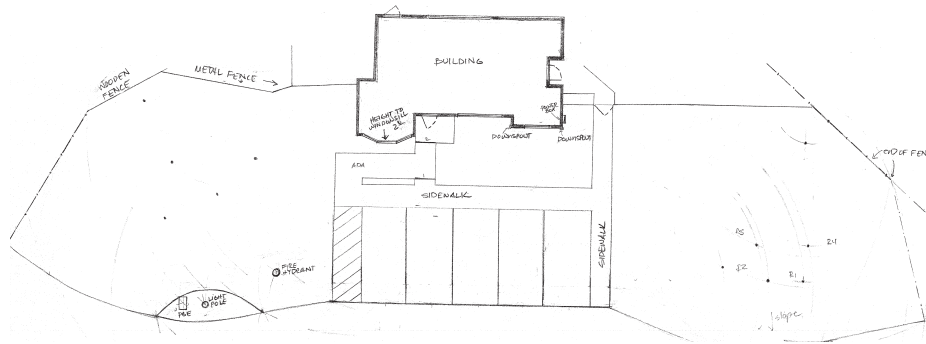
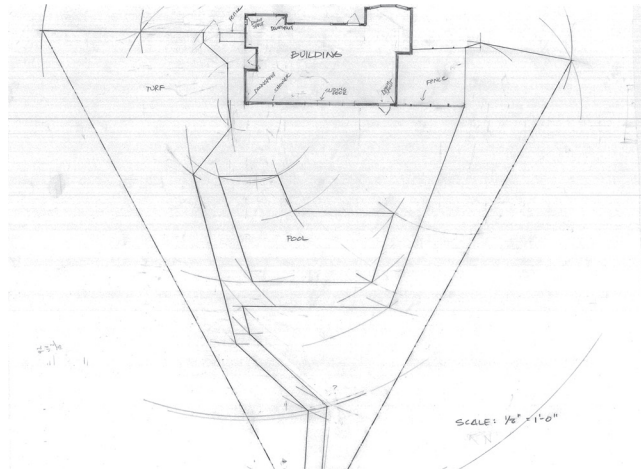
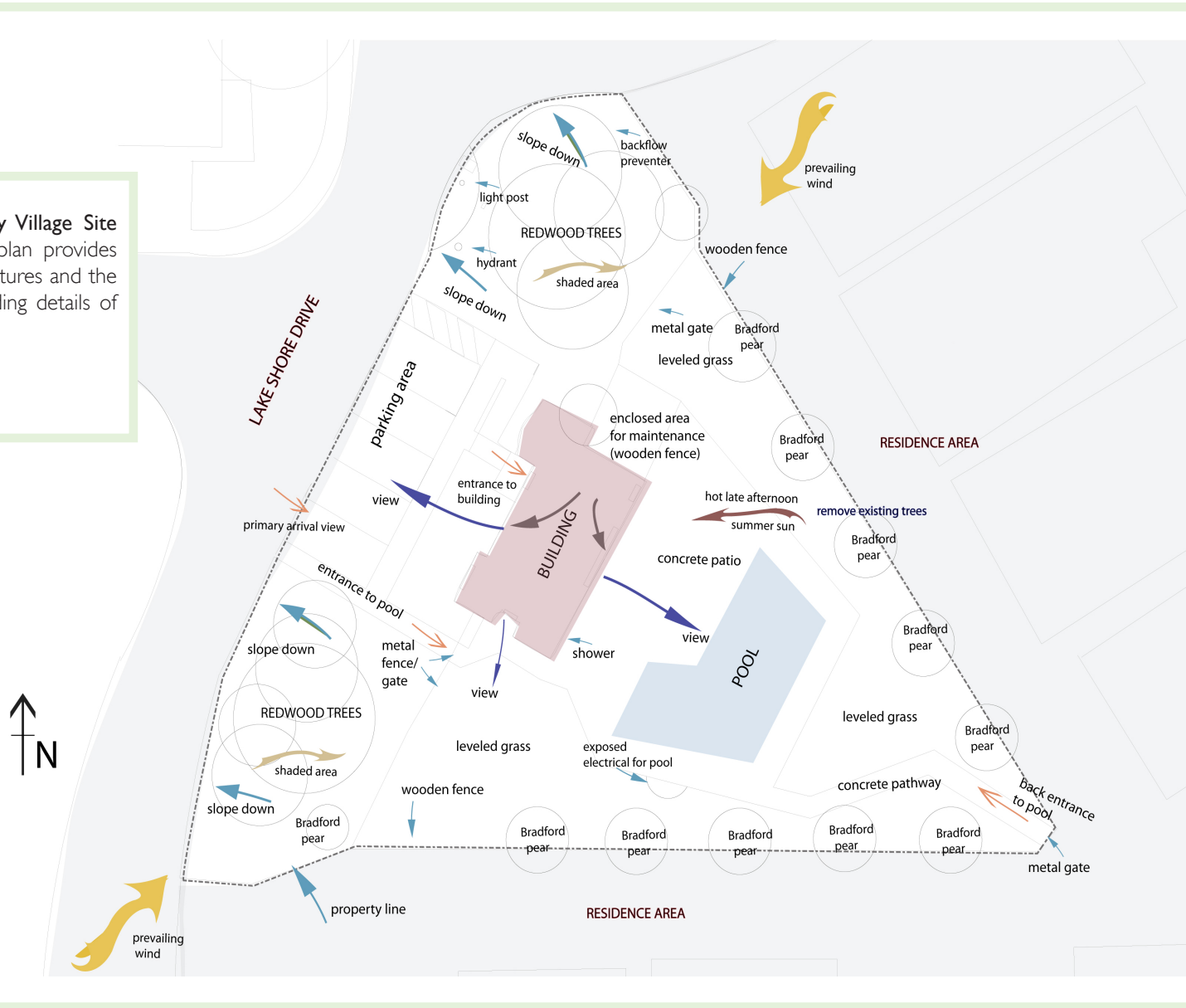


Figure 10. Site Survey (Left)

Granite Bay Site Survey. The site did not have an existing scaled base plan so existing structures and elements had to be measured including the building, pathways, location of the fences and immovable elements. I used the triangulation method to create the base plan from scratch.

Figure 11. Photos of the existing site conditions (upper right).

Figure 12. **Granite Bay Village Site Inventory Plan.** This plan provides a record of existing features and the state of the site, including details of local conditions



Opportunities and Constraints - Analysis

The opportunities and constraints involved more thought than the surveying and inventory stages, because it took some time to evaluate the importance of the information I collected and noted. The plan shown on Figure 10 shows a detailed explanation of the existing problems and provided suggestions for improving the site. Some areas I considered as opportunities within the sites include the following: the shade around the mature redwood trees could offer a quiet activity area; the flatness of the site provided opportunities to add vertical elements for interest. Though I consider constraints as opportunities, there were several aspects to consider such as choosing the right plant palette for a low-maintenance garden, ensuring the placement of trees would not add to the maintenance of the pool, and providing shade around the pool area.

Program and Concept Development

With the research and preparation phase completed, I moved on to preparing a concept diagram (as shown on Figure 11) that listed all of the elements to be included in the design taking into consideration how each were going to function in relation to one another. The gathering and entertaining areas, for example, were placed near the building where most activity will take place. The following program elements served to mitigate the issues addressed in the site analysis: a distinct area for gathering and entertaining; an overhead structure (pergola) by the pool to create shade; a “pocket” garden for passive recreation; and adding seating areas throughout the site.

Figure 13. **Granite Bay Village Opportunities and Constraints.**
 The plan evaluated existing problems and provided suggestions for improvements for the site.



Figure 14. **Granite Bay Village Program and Concept Development.** The initial plan shows hardscape elements to be incorporated in the site including: a pergola, seatwall, seating areas, picnic benches, boulders and mounds for vertical interest.

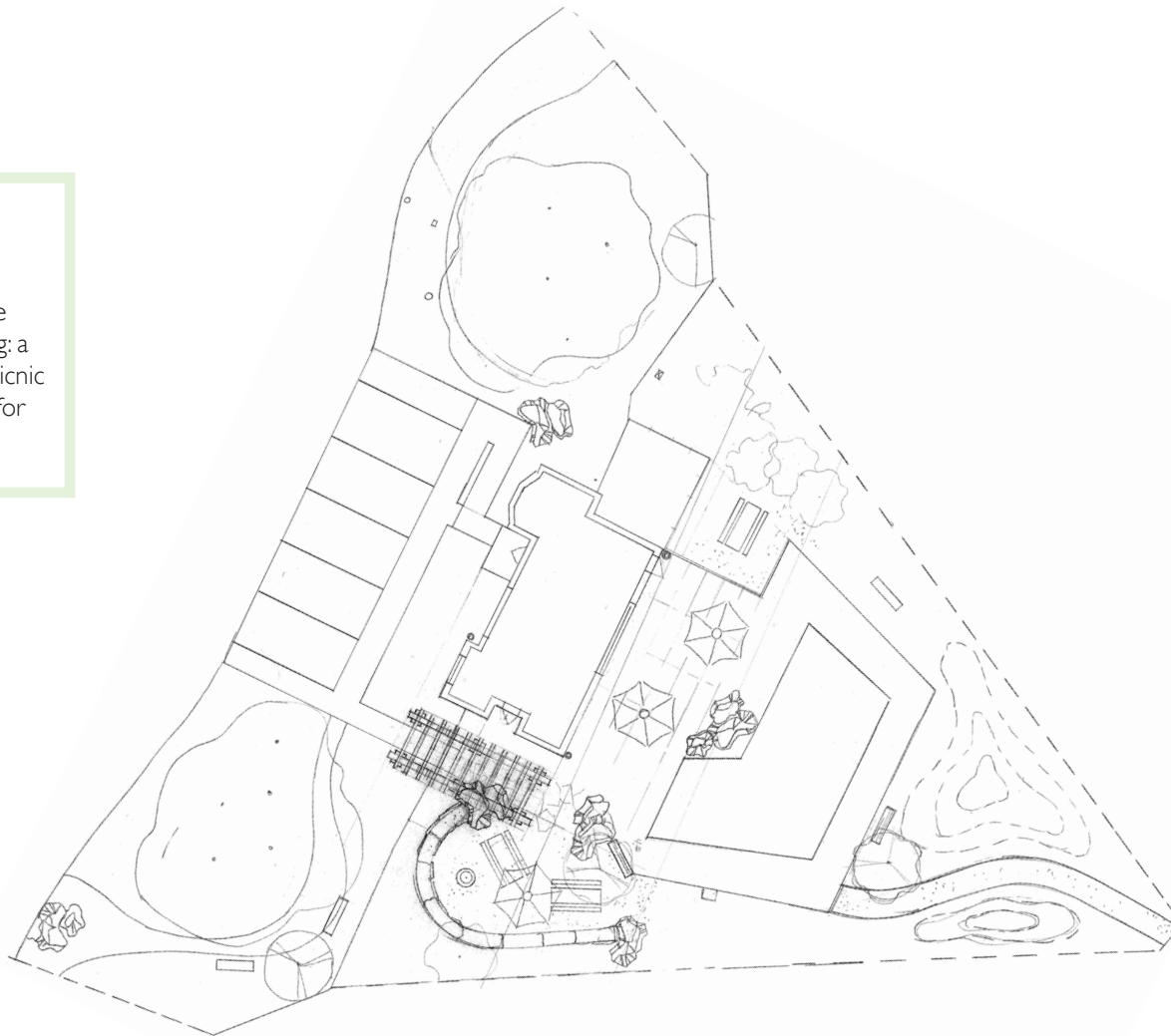
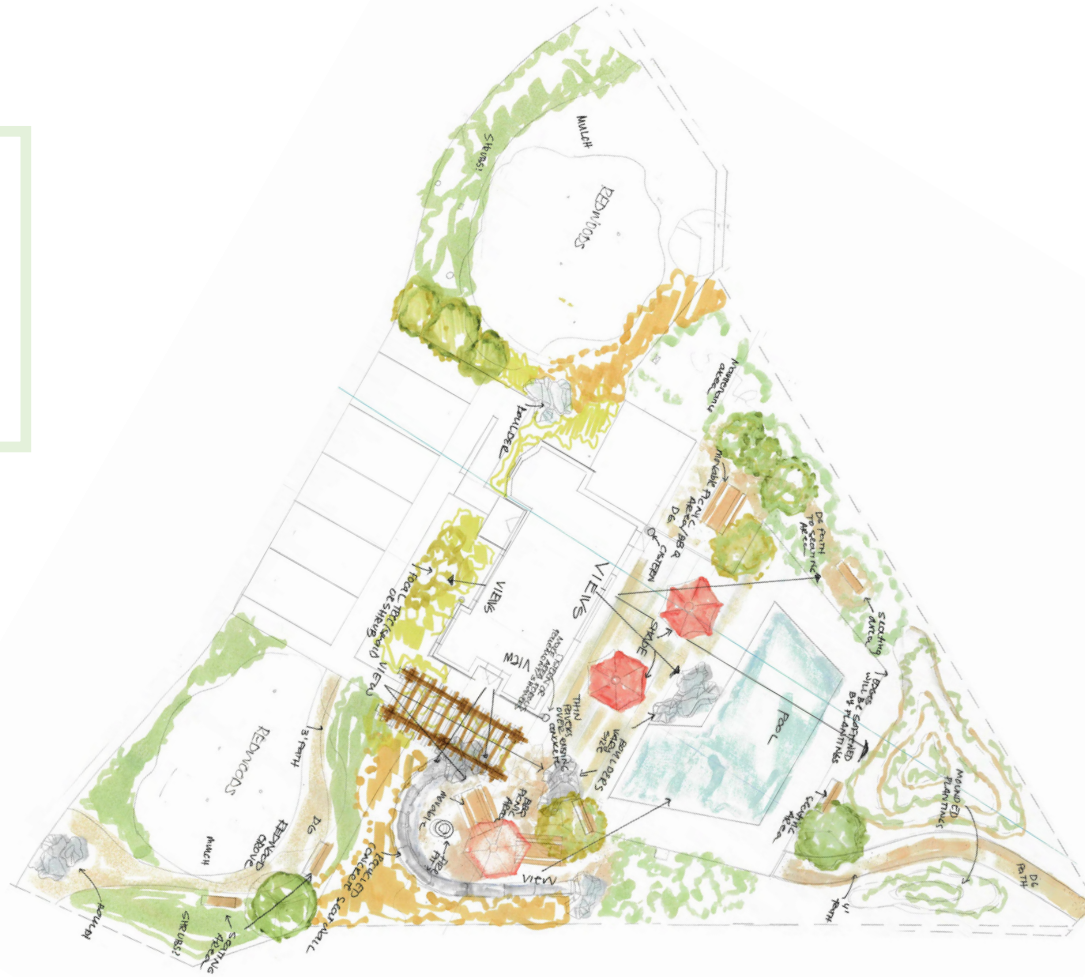


Figure 15. **Granite Bay Village Concept Development.** The plan shows the initial concept incorporating plantings and looking at opportunities for interesting focal points and views.



The Product

The concept of the proposed master plan for the HOA common area is a sustainable garden that reflects California's planting communities. The design concept aimed to improve the existing conditions of the site by creating areas for entertainment and relaxation, especially by the pool area. Features such as granite boulders to soften the geometric shape of the pool, small mounding hills, and a pergola walkway were added for vertical. The concept plan was divided into four distinct spaces for a year-round interest, including a:

- Shaded hideaway;
- 'Foothill' courtyard/entertainment area;
- Woodland garden; and
- Grassy meadow

These spaces were meant to mimic the character that reflects California landscape communities. This concept of a California garden is a miniature version of what can be seen in parts of the state. By adding native plants to the landscape, it invites local wildlife and pollinators and offer habitats for them. The next few paragraphs will explain the concept behind each section.

Shaded Hideaway

Redwood trees in the forest create a shady, silent cathedral-like atmosphere that I wanted to mimic at the site. The existing site had mature redwood trees at the front entrance in both the north and the south corners that provided an ideal situation for an understory garden comprised of plants from the Redwood community. Before entering the pool area at the south end of the building, residents have an opportunity to take a relaxing walk on a decomposed granite and flagstone pathway that meanders around the

Figure 16. **Granite Bay Village Concept Plan “A California Garden”** The concept divides sections of the spaces within the site with different ecotones and planting communities. The woodland garden scattered throughout the site ties them altogether.



Under the Redwoods, the curved path leads to a recycled concrete bench, which is framed by bush anemones and is surrounded by low-growing Western sword ferns, Douglas irises, coral bells and manzanitas. The understory planting on the south side is carried out on the north side where it is left to its natural state.

Foothill Courtyard

After entering through the pool gate on the south entrance, residents walk through the inviting pergola walkway, covered with drought-tolerant yellow trumpet vines, and are welcomed by a courtyard with recycled concrete seat wall adjacent to the side entrance of the building. This courtyard setting is designed for outdoor entertainment and features a picnic table, a barbecue grill area and a fire pit nestled around the curved wall. Planting palette features a mix of Mediterranean drought-tolerant and native plants such as Jerusalem sage, California Wild lilac and Western Red bud.

Woodland Mixed

Different areas of mixed evergreen forest found in California (coastal and foothills) experience different microclimate so the variety of plant life is a mix because of the site conditions. Some thrive in better lighting conditions with drought tolerant perennials, grasses and bulbs. In the site, the transitions between the redwood forests to the foothill garden is met by a mixture of evergreens ranging from California lilac, Cleveland sage, monkeyflower and rosemary. The mixed-evergreen plantings are meant as transitional spaces between the other gardens and offer a variety of textures, adding interest to the site.

Grassy Meadow

A large part of California's hills and valleys are covered with grasses creating seasonal displays of colorful wildflowers. For this concept, small mounding hills adjacent to the pool display no mow fescue grass and silhouettes of pink muhlys meandering around it. There is also a hidden sitting area behind the mounds where people can sit under a western red bud and enjoy a relaxing day near the pool. An alternate option is to fill the mounds with perennials, annuals and bulbs that bloom as early as March and continue into June like yarrows, California fuchsia, poppies and purple needlegrass.

This concept attempts to create an inspiring California landscape garden by using diversity of plants, by following the principles of water efficient landscaping and by adding natural features such as boulders and mounds that create an artful and functional elements to the site.

Figure 17. Final Concept Plan.

The design theme: A California Garden. To support the ideas of sustainable design, this project focused on water consumption and how, through careful attention to design and plant selection, one can achieve a beautiful, functional, and environmentally-friendly landscape. In addition to water efficient landscaping, the design included gathering and entertainment spaces for the residents to enjoy.



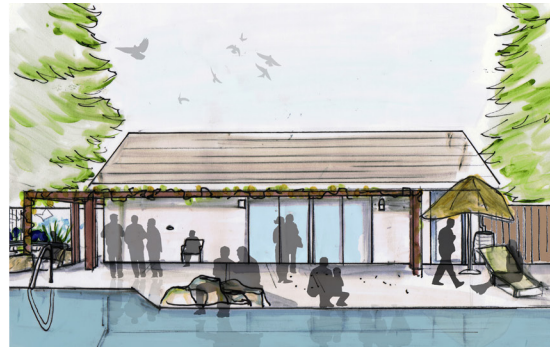


Figure 18. Perspective drawings. Views from the patio, the grassy meadow and shaded garden.

Figure 19. Plant Palette. California native and drought tolerant plants were used in this project.



Granite Bay Village Water Budget Calculation

MAXIMUM ALLOWABLE WATER ALLOWANCE AND ESTIMATED TOTAL WATER USE CALCULATIONS

Hydrozone Information Table

Hydrozone	Plant Water Use	Plant Factor (PF)	Hydrozone Area (sq ft)	PF x HA (sq ft)
1	High	0.8	540	432
2	Medium	0.5	1,045	522
3	Low	0.2	2,862	572
4	High	0.8	304	243
5	Medium	0.5	1,378	689
6	Low	0.2	702	140
7	Low	0.2	1,296	259
8	Low	0.2	2,296	459
9	Low	0.2	2,327	465
10	Low	0.2	746	149

$$\begin{aligned} \text{MAWA} &= (\text{ET}_o) (.62) [(0.7 \times \text{LA}) + (0.3 \times \text{SLA})] \\ &= (54.96)(.62) [(0.7) \times 15,798) + (0.3 \times 0)] \\ &= 54.96 \times 0.62 \times 11,093 \end{aligned}$$

MAWA = 376,824 gallons per year

$$\begin{aligned} \text{ETWU} &= (\text{ET}_o)(0.62) [(PF \times \text{HA})/\text{IE} + \text{SLA}] \\ &= (54.96)(0.62) [(5,273)/0.70 + 0] \\ &= (54.96)(0.62)(7,427) \end{aligned}$$

ETWU = 253,068 gallons per year

ETWU < MAWA

Based on calculations, the ETWU is less than the MAWA which means Granite Bay Village can save an estimate of 123,756 gallons of water per year.

Conclusion

Within the context of sustainable landscape architecture, water efficiency serves a pivotal role. Population growth in California will significantly put pressure on the state's water systems over the coming decades. Outdoor water conservation is an important focus in many parts of the state to limit water demand and free up water supplies to accommodate new residents. Key elements that were mentioned in this research were efficient irrigation and water efficient landscaping changes that reduces water use. This project hopes to raise awareness within the Granite Bay Village community of unsustainable water use by showcasing the aesthetic, environmental, and economic advantages of native and drought-tolerant landscapes. As a result from the water budget calculation based on ETWU and MAWA, Granite Bay Village will save an estimated of 123,756 gallons of water per year. The results of this project shows that just because a landscape is ecologically balanced does not mean that it has to be unattractive or be full of rocks and cactus.

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