

Landscape Design, Cost Estimate, and Management Plan

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## Abstract

The purpose of this project is to evolve a bleak landscape into something that the home owner can appreciate and love. This project will demonstrate the knowledge of this process to provide as a guide for others. This project gives an overview of all aspects of a landscape project including: drawings of an irrigation layout, planting plan, drainage plan, and a construction plan. This project takes place in Riverbank, California, which is located in the Central Valley. The property's main centerpiece is a pool and adjacent waterfall. However, the landscape currently surrounding the pool is very bare and lacks aesthetic appeal. This location is subject to scorching heat in the summer and freezing temperatures in the winter. Dealing with vast temperature fluctuations requires consideration in choosing ideal plant species. Also, an estimate plan and maintenance plan was constructed in accordance to the design. In addition, this project should serve as a template for someone interested in hiring someone to design, install, and maintain residential landscapes.

## Acknowledgements

There are two people that I would like to show acknowledgment and gratitude to: my mother, Jody, and sister, Shania. Battling with multiple surgeries and enduring the pain for a number of years, my father, Grant, past away from melanoma in 2003. During this hard ache, which no family should ever suffer, my mom, sister, and I became closer than ever before. Shania was only seven years old then and had a very difficult time dealing with this. However, she has grown up to be an amazing student and athlete and continues to amaze me in everything she does. My mother on the other hand was forced to burden the responsibilities of having to raise two children on her own. No easy task to ask of anyone, but she rose to the occasion and did an amazing job in raising both of us. Growing up and seeing her persevere through this tragedy has fueled me to make her proud, which I work hard to do each and everyday. Without her dedication to my life, I can honestly say without question, I would not be in the position I am in today. You have made me the person I am today and I will forever love you for that.



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## I. Introduction

As temperatures start to increase, people start to migrate outside to appreciate the environment and landscapes. Why do people pay so much attention to their landscapes during this time? Is it just an excuse to get outside? Is it because they're about to sell their house? Is it because they simply just love getting their hands dirty? Everyone has their own individual motives behind what they do, but there is one sole underlying reason. The main motivation is simply to please others. According to Behe and his colleagues, a beautiful landscape can increase the value of a home from five percent to eleven percent (Behe et al., 2005). Hiring a landscape contractor is an easy way for a homeowner to take advantage of this statistical figure. So how does a landscape contractor accomplish this while still operating a company?

As a landscape contractor, designing a landscape entails knowledge from every aspect of horticulture. Knowing these aspects makes this seemingly overbearing task that much easier. Knowing soil types, temperatures for a given location, how to read design plans, and types of irrigation allows the design phase of a project to run smoothly. Frankly, blending of all these aspects together creates a beautiful landscape.

Another aspect of being a landscape contractor is estimating. Estimating projects is a very intense and time consuming, but very worthwhile task. An estimate includes everything from irrigation parts to labor. In order for a landscape contracting company to survive, the company needs to make a profit. So, making a detailed estimate ensures a profit will be made and guarantees the longevity of the company.

The last aspect of a landscape contractor's job is maintenance. In this economic situation, the majority of landscape companies are making their money through maintenance. Maintenance covers anything from mowing lawns to fixing irrigation parts and most homeowners are willing to pay for these duties to be done for them. The majority of the tasks involved in maintenance are rather simple and easy to perform, but ultimately make a company.

## II. Literature Review

### Design

When designing a landscape many things need to be considered. Temperature, along with many other factors, dictates what exactly the landscape can possess. In Riverbank, California during the harshest months, January and July, temperatures vary dramatically. During January the record low temperature is eighteen degrees and in July the record high temperature is one hundred and eighteen (Anonyms, 2012e). With such a huge variation between the two given months, special precautions must be taken when selecting plants. One way of selecting plants is to refer to *The Sunset Magazine*. *The Sunset Magazine* is a great reference for determining where plants can survive. According to sunset.com, Riverbank, California is in Zone 14 (Anonymous, 2012f). Sunset.com gives valuable information regarding plant selection. By using sunset.com, selecting plants can be as easy as clicking a few buttons. Knowing what type of theme the homeowner desires and selecting what types of plants desired i.e. trees, perennials, annuals, etc. and entering the climate zone, gives a cornucopia of plants adequate in accordance to the specifications (Anonyms, 2012f). In addition to Sunset's reference guide, a great plant book that is a useful tool is *Ornamental Plants Their Care, Use, Propagation, and Identification*. In this particular book, there is information about 1,002 different plants, specifically their survival temperature range. For example, *Myrtus communis* 'Variegata' is half hardy to fifteen degrees, which will often survive in Riverbank. In addition to their temperature range, a picture of each plant is given alongside the characteristics of the plants growth habit and information regarding soil reference (Wait, 1994).

To select a turfgrass for this area, the same amount of consideration needs to be taken as in selecting plants. Turfgrass is a vital part of the landscape. With a poor turf selection, a well installed landscape can quickly turn into a horrible one. When determining which turfgrass to select, temperature, foot traffic, soils, and water needs must be taken into consideration. Because of the hot summer months, in Riverbank, California a warm-season grass is needed. Ideally for this region and for a homeowner that wants to eventually start a family, Tall fescue is ideal. According to *Fundamentals of Turfgrass Management*, Tall fescue is well adaptive to areas of heat, drought, and wear. In addition, tall fescue is also adaptive to shaded areas (Christians, 2011). However, *Sunset* is also a very viable commodity in selecting turfgrass. Just knowing the climate zone gives a good amount of options for turfgrass. Putting climate zone 14 in the database gave ten options to choose from: Buffalo grass, Zoysia, Bent, Creeping bent grass, Sheep's fescue, Creeping red fescue, Tall fescue, Chewings fescue, Red fescue, and Emerald Zoysia all came up as viable options. This database eliminates the hassle of going through hundreds of varieties and narrowing them down to only a handful.

The second consideration that needs to be accounted for is soil type. As mentioned above, soils play an imperative role in the long-term success of plants. Soils are comprised of three distinct particles: sand, silt, and clay. Each of these entirely different particles exhibit different characteristics. Sand, which is the largest of the three, .05 to 2mm, exhibits drainage properties because of the amount of pore space between them. With such relatively huge pore space, water has no other option but to percolate downward. Silt, .05 to .002mm in diameter, holds on to water much better than sand. Silt is also naked to the eye thus making its texture feel very smooth. Clay, .002 mm and smaller, exhibits water holding capabilities that silt and sand cannot compare to. However, too much clay in the soil makes it very difficult to manage. Since clay

exhibits such a high water retention capability, water can be suspended there for numerous days (Brady and Weil, 2008). By having a generalized idea about soil particles, a landscape contractor can determine what type of irrigation needs to be installed and what type of plants can be planted.

The third consideration that needs to be accounted for is irrigation. There are many types of irrigation available to the public, however not all are compatible for certain areas in a landscape. Usually, pop-up and rotor sprinklers are used for sod areas. These types of sprinklers are ideal for turf areas because of their ability to pop-up when turned on and retract back down when water is not running through the system. These systems are both appealing to the eye and very functional. Functionally, having the ability to retract below the surface of the lawn enables the homeowner to mow the lawn without worrying about damaging sprinkler heads and having to replace them.

Choosing whether to use a pop-up or rotor sprinklers is a relatively simple task to complete. Typically, when compared to rotary sprinklers, pop-up sprinklers have a smaller coverage radius (eight to fifteen feet). This can greatly affect the number of heads that need to be installed in order to cover the desired area. On the contrary, rotary sprinklers have a coverage radius that can range from fifteen to thirty-five feet, spread water slowly, and virtually reduce the number of heads that need to be installed by half.

An additional option for a turf setting is MP rotators. The “MP” stands for matched precipitation, which is an essential for using water to its full potential. No matter what head is used, each sprinkler delivers the exact same water as the one placed next to it. In other words, many different MP rotator heads can be used without worrying about the precipitation rate matching. With radius playing a vital role in selection, the amount of area covered is the next

step in determining which type should be used. For smaller sod areas, pop-up sprinklers are best because of their smaller throwing radius. While for larger turfgrass areas, rotary sprinklers are best because they cover a wider area.

In shrub beds without ground cover, the most efficient use of water is to install drip irrigation. Also, a drip irrigation system should be installed if the homeowner has a clay soil. Drip irrigation is easy to install and requires little to no professional knowledge. Simply taking the drip line and staking it down where desired is half the battle. The next step is to install the emitters. Emitters should be installed as closely as possible to the root zone of each individual plant. Drip irrigation runs on very low pressure and only emits a half to two gallons per hour, making this one of best choices for planting beds.

Even though sprinklers are a key tool in irrigation, many other aspects are involved. Mainlines, valves, and lateral lines are also vital to an irrigation system. To give a basic overview of irrigation, one must first start with the mainline. Mainlines, which are connected to the direct source of water, run to the valves. Once the mainline is located, valves can be installed. Valves allow the flow of water to the sprinklers. In addition, valves possess the capability to act as a backflow prevention device. A backflow prevention device stops irrigation water from entering the house. Each valve operates a section within the landscape. For instance, if the homeowner wants to turn the sprinklers on for the lawn that designated valve needs to be opened. Lateral lines are connected to the valves and run throughout the landscape. Lateral lines are connected to one another using fittings which are glued together by glue and primer. Ultimately, sprinklers are connected to these fittings by a swing joint.

The main idea behind irrigation is to make it as efficient as possible. Defining efficiency in terms of irrigation is very simple, “make the coverage as uniform as possible” (St. Hilaire et



al., 2008). If a landscape's irrigation is poorly designed and uniformity is not achieved, one undeniable consequence will occur, dry spots (St. Hilaire et al., 2008). Dry spots are detrimental to efficiency and ruin the esthetic appeal.

Designing is a very intricate job which requires a massive amount of attention to detail. Drafting or design programs enable a landscape contractor to easily complete their job. If a designer specifies everything that he/she wants and how it should be done, there should be no confusion once the construction phase begins. Before actually putting the design on paper, depending on the homeowner and their wants and needs, principle of design need to be figured out. There are many ways to design a landscape and choosing the correct one is vital.

As stated above, there are multiple ideologies that are used to achieve an eye-appealing landscape. One method of designing is balance. Balance has three types associated with it: symmetric, asymmetric, and proximal/distal. A symmetric balance, each side of the landscape is an exact replication of the other. For instance, going down a narrow pathway, each plant that is on the left side of the path is in the exact same position on the right side of the path. Asymmetric balance is very close to symmetric balance. The only difference is that in asymmetric balance, the types of plants used on either side of the landscape are not exactly the same. Asymmetric has the same form on either side of the landscape, but different materials and colors of plants may be used. The last type of balance is proximal/distal. Imagine viewing a mountain in the foreground with a tree, which is closer than the mountain, on the right side. This image achieves proximal/distance balance (Ingles, 2009).

Another way to design is focalization of interest, which centralizes the landscape to a specific location. For example, looking at a house from a street view, bigger plants are on the outside perimeter and the following plants descend further and further down until the front door

is reached. With the descending heights of the plants, the viewer's eyes are drawn to the front door. Simplicity is another type of landscape design. Simplicity makes the viewer feel comfortable within the landscape and eliminates the feeling of being overwhelmed. More specifically, simplicity eliminates the use of too many plants, colors, textures, shapes, curves, and angles.

Proportion is solely a size relationship. Size not only includes height but also width. If too many plants are exceptionally bigger than the surrounding species, then the landscape will seem out of form. The landscape should lie in the viewer's eye level. If the viewer has to view a landscape by continually looking up and down, they will feel uncomfortable. There are many different design principles out there, but choosing the right one depends on the client and how the existing property is laid out (Ingles, 2009).

Now that most considerations have been dealt with (drainage, irrigation, turfgrass and plant selection, soil type, and the principle of design), the last one consideration is to interview the client and determine exactly their needs and wants. After all of those aspects have been dealt with the next step in achieving a successful landscape is the actual design. When designing a landscape there are multiple pages of design drawings that may include the following: irrigation, planting, detail drawings, hardscape plan, grading plan, drainage plan, and lightening plan. Even though it may seem overbearing, each individual draft has a very specific job to convey.

An irrigation plan specifies exactly how the designer wants the irrigation system to be installed and what type of material to use. Using this plan, the contractor can see which type of sprinkler is needed and the type of nozzle associated with it. Also, it shows where exactly the water meter is, where the control valves and mainlines should be installed, and anything else that is specified for installation i.e. backflow prevention, rain sensor, isolation valves, ect...

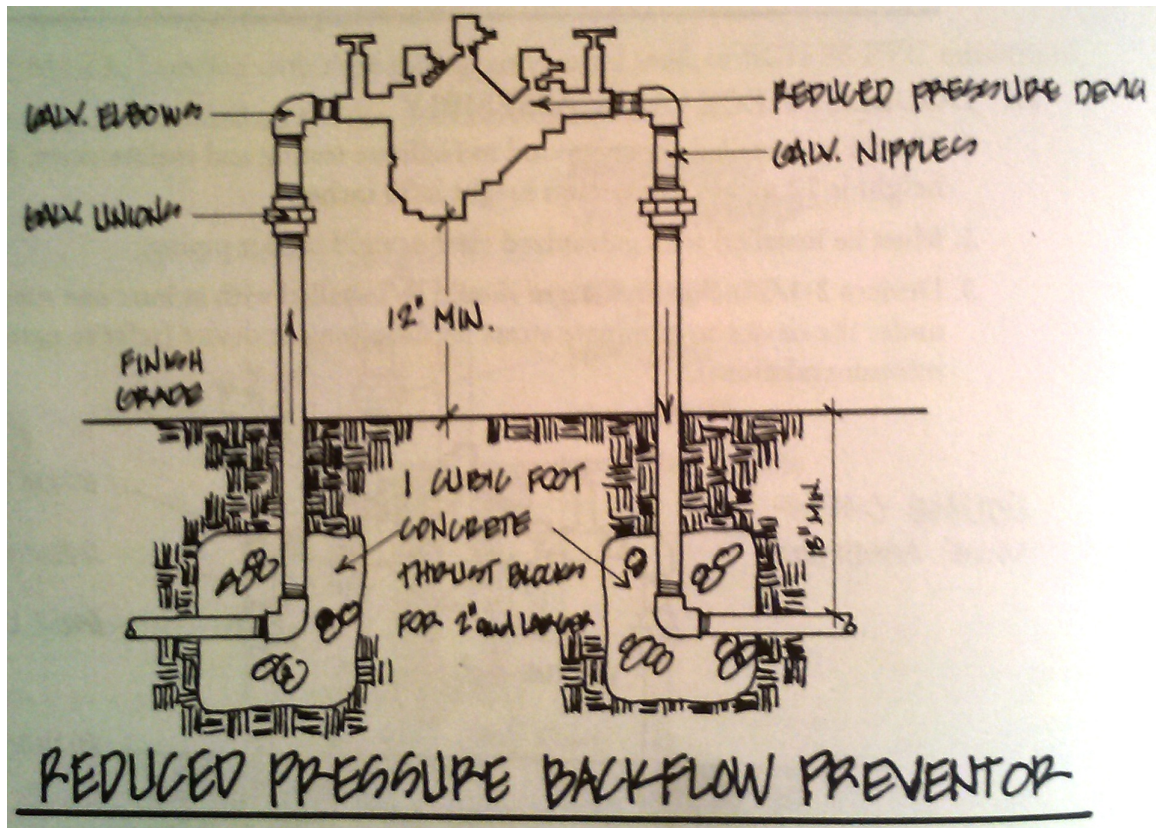
A construction plan involves everything that requires building of a structure or removal of existing structures. This section entails fences, boulders, benches, and concrete slabs and curbs. Also, it shows exactly where everything is placed.

A planting plan is exactly what it sounds like, a plan for plants. In this type of drawing, plants are denoted by specific symbols, usually circles with variation lines within them, to make them distinguishable from other plants in the landscape. In addition, there is a planting tablet on this drawing as well (as seen on Appendix C). A planting palette is a quick reference to types and quantities of plants that are in the landscape.

Detail drawings are also added to the landscape drawings. Detail drawings are very important because they show exactly how something should be built. An example of a detail drawing can be found at Rain Bird's website (Anonymous, 2012a). At this particular website, detail drawings are available of all types of sprinklers and denote how they should be installed. There is usually a detail drawing for each individual type of drawing. Irrigation and planting plans both have detail drawing that go along with them. A detail drawing for an irrigation plan consists of valves, backflow prevention, pop-up sprinklers, rain sensors, and trenches. Each detail drawing specifies exactly what is involved in its installation. Construction detail drawings are a little more detailed than irrigation. For instance, a plan shows exactly how to build a fence: how deep the post should be dug, spacing between posts, type of nails to be used, and what type of wood.

*California Landscape Standards* is an excellent reference book that doesn't require a landscape contractor's knowledge to understand; it is a great resource for anyone. This book gives detail designs on everything an outdoor living environment could possibly possess. Benches, arbors, drains, trenches, decks, stairs, retaining walls, header boards and how to stake a

tree are only some of the drawings that are shown. For instance, for a reduced pressure backflow preventor, *California Landscape Standards* specifies exactly how it should be installed. In the detailed drawing of a backflow preventor it illustrates that it must be at least twelve inches above ground level, and galvanized nipples, unions, and elbows must be used (Fiske, 1989). The following is an example of the above mentioned specification.



Detail drawing of a backflow prevention device.

## Estimating

To the ordinary person, estimating seems like a very simple thing. However, it entails multiple tasks that need to be incorporated into an estimate. Labor, materials, equipment, subcontracting, contingencies, sales tax, and profits are all things that need to be incorporated to ensure a correct bid with a profitable outcome, which are described in full as follows:

- Labor costs: wages and benefits of work crew.
- Materials costs: materials required for the project.  
Plants, boulders, fertilizers, mulch, PVC, sprinklers, valves, controllers, wood, concrete, etc...
- Equipment costs: equipment needed to complete a project, whether it is rented, making payments, or completely owned. Tiller, backhoe, etc...
- Subcontracting costs: Even if the landscape contractor isn't doing a specific task on site it still needs to be included in the bid. Usually subcontracting occurs if it falls out of the realm of the contractor's expertise.  
Subcontracting can range from concrete to pools, to rubberized surfaces and everything in between.
- Contingencies: this is a backup plan in case something comes up during a project that wasn't accounted originally for; this can range from missing certain tasks to missed items. However, the contingencies only account for a fraction of the overall bid so if too many items are forgotten a landscape contractor will be losing money.
- Profits: profits need to be included into a bid or the job is practically being done for free. This section in a bid usually ranges from seven to fifteen percent. Having

a profit section in a bid ensures that the company performing the tasks makes enough money to keep thriving for a long-term (Anglely et al., 2002).

## Construction

Any landscape contractor that performs a job that is over \$500 needs to have a license. As a homeowner, it is your responsibility to know whether or not a contractor is licensed. This is a relatively simple task to complete and only takes minutes to do. On the California State License Board website, by either entering a license number, business name, personnel name, HIS number or HIS name can find out immediately whether the contractor they are in association with is legal or not (Anonymous, 2012c). In addition to this, before any construction takes place a written contract must be issued to the homeowner (Anonymous, 2012g). These contracts are particularly important for the customer's and contractor's safety. Signing a contract both ensures that the contractor will be paid and the customer will get the job completed. As a homeowner, there are times where there may be a need to change the previously agreement. For instance, maybe the homeowner wants to change the type of turfgrass. In this case, a change order must be completed. A change order is a revision of the original contracted. After all plans have been made and agreed upon, the construction process can begin. As a landscape contractor, it is vital to complete task on time and as professionally as possible. A time frame is a very effective way to completing task on time. Each given task should be given an allotted time to complete. Again, if each task is completed on time, the landscape contractor will be on schedule. Keeping on schedule is not only for the homeowners benefit, but for the contractor as well. Based on the contract, usually payments are made when certain tasks have been completed. Acquiring these payments allows the landscaper to make payroll, cover overhead costs, pay insurance, rental, and anything else that is associated with running a business.

## Maintenance

Once everything has been installed to specifications, a maintenance plan must be instilled to ensure that the longevity of a landscape withstands the test of time. The type of plants used determines how intense or low maintenance the landscape will be. Many things need to be considered when determining a maintenance plan: watering, fertilization, aeration, mulching, edging, pest control, pruning, and weed control. Watering depends on the types of plants in the landscape and is especially important in the hot summer months. Water is a very scarce commodity and shouldn't be wasted. Watering needs to establish deep-rooted plants and keep the plants healthy and growing actively. Most professionals recommend deep and infrequent watering.

Fertilization is also a key factor in maintaining healthy looking plants and a beautiful lush landscape. Incorporating fertilizers in a landscape will drastically increase plants vigor and overall health. Shrubs require fertilizers in the early spring; roughly 100 square feet of bedding area should be applied with one to three pounds of fertilizer. Trees should be fertilized once annually. When fertilizing lawns, special attention must be given. The most important fertilizer for lawns is nitrogen and potassium. D.E. Webster and J.S. Ebdon conducted a study showing the effects of potassium and nitrogen in late winter and early spring. Their results are rather surprising and eye-opening. Since most homeowners love lush green lawns, usually they apply large amounts of nitrogen in summer months all the way up until winter. Unfortunately for homeowners, Webster and Ebdon found that a high nitrogen application rate in September through February significantly reduces the survival of the lawn in late winter. The reason that high nitrogen application rates affect the temperature tolerance is the high rate of shoot growth, which correlates to crown moisture. When observing the potassium as a survival enhancer, high



to very high application rates increases the low temperature survival rate. In conclusion, low to moderate nitrogen rates with a combination of high to very high potassium rates increases the survival of lawns. Knowing this can give homeowners and turfgrass managers a better understanding of how to increase low temperature tolerance (Webster and Ebdon, 2005). Nitrogen can have a positive affect as well as negative affects. Too much nitrogen can decrease its disease resistance and also decrease its cold tolerance (if applied too late in the season).

Aeration is also a key implementation in sustaining a beautiful lawn. Aeration is particularly important in areas of high foot traffic or vehicles. Tree's roots can become suffocated through compaction and can eventually proceed to necrosis. Aeration allows oxygen and water to enter into the root zone and loosens the soil surrounding the plugs. This in turn allows the roots to expand. If aeration is conducted properly the rewards will be significant and plants will become healthier.

Mulching is also a very import aspect in maintenance. Mulch allows the soil temperature to be much lower than the surrounding air temperature. Not only does mulch provide cooling by radiating heat away from the soil, but it also provides moisture retention. Retaining water also lowers the water rates needed to provide plants the adequate water.

Edging not only means keeping a crisp line around lawns using a weed-eater or edger, but also means separating planting beds away from the lawn area. Edging around trees ensures that roots will not be clipped by a lawn mower and ensures that mower blight will not occur. Mower blight is an abiotic term used when a lawn mower is continuously hit along the base of a tree, causing girdling to occur. Edging also keeps undesirable weeds from entering certain areas of the landscape. Lawn areas are susceptible to infestations of weeds if left unattended or special attention is not given.

Pest control also needs to be evaluated to the surrounding elements. Knowing which types of plants are susceptible to pest is vital in maintaining them for long periods of time. Majority of diseases can be eliminated if the correct measures are taken. For example, some plants cannot be watered with over head watering sprinklers, so keeping their leaves dry maintains the integrity of the plant. If a branch or a section of a tree or plant shows obvious signs of disease, quickly remove the infected parts and dispose of them. Do not compost infected materials because it will only produce more of the disease. Nevertheless, some diseases cannot be corrected by simply manipulating the environment they are in. Sometimes fungicides or pesticides need to be used to ensure the plants survival.

The last part of maintenance that needs to be mentioned is pruning. Pruning not only makes a landscape clean and well maintained, it is also visually appealing. Pruning trees and shrubs doesn't mean simply hacking away. A general rule of thumb is to prune right before a flush of growth occurs. If pruning takes place too early in winter or in the middle of summer serious repercussions can occur. Pruning in the wrong time in winter makes the plant more susceptible to cold temperature and too cold of temperature can kill the plant. The same basic principal applies in the summer, if pruning is poorly timed, burning can occur (Ingles, 2009).

All of these things need to be considered when developing a maintenance plan. In addition to above mentioned, tasks, frequencies, and seasons need to be accounted for. During the summer months when plants are actively growing, maintenance needs to be performed weekly. In the winter months twice monthly or once monthly is recommended. Tasks that need to be performed also need to be involved. Trees, shrubs, and hedges don't require pruning every week. While other plants such as vines and turfgrass may need to be done every week. All of

these tasks are dependent on what the homeowner wants and needs. An example of a maintenance spreadsheet can be seen in Appendix I.

### III. Methods and Materials

#### Client Interview/Site Analysis

The first step of any project is to get an understanding of what the client wants and is expecting. To accomplish this, a visit was taken to the homeowner's house. Measurements need to be taken to get a better understanding how much material would be needed (plants, hardscape, ect...) and to ultimately be able to put the property onto paper. After all measurements are taken, the next step is a client interview. The client interview is relatively basic but also gives a better understanding of what the client wants. If this step is skipped and the project is open to multiple bids, more than likely the client would be disappointed and would ultimately give the job to someone else. The questions are very basic but allows for a better understanding of what the client is expecting, especially if they value a landscape.

In addition to the client interview, a soil test needs to be conducted to better understand how plants will react and which type of irrigation is preferred. This particular test is only intended to determine what type of soil texture a property possesses. For this particular site, soil samples were taken from the surface and from two feet below grade. Both of these samples were placed in their respective jars. The jars were approximately 60% filled with sample; the remaining 40% was filled with water. The jars were then shaken fully and were allowed to settle for two days. After the two days, measurements were taken to determine the two soil textures. Looking at the jars, one can clearly see three distinct layers: the bottom layer being sand, the second layer being silt, and the third layer being clay. Measurements were taken of each layer and calculated into percentages. The surface soil measurements are as follows: sand – 50mm, silt – 38mm, and clay – 2mm. The next step was to multiply each layer by their respective bulk

density. The bulk density for sand is 1.5, silt is 1.3, and clay is 1.2. In total, sand equaled 75, silt equaled 49.4, and clay equaled 2.4. The totals were added together to equal 126.8. Using 126.8 one could find the percentages in that specific jar by dividing layer by that number. With that being said, sand had a percentage of 59.2, silt was 38.9, and clay was 1.9. With those percentages one could find the soil texture by simply using a soil texture triangle. Using this triangle, the property had a surface soil which was a sandy loam. The same concept was applied to the sub soil jar expect for one alteration, it possessed only two layers, sand and silt. Going through all the calculations and using the soil texture triangle, it possessed a soil texture of a silt loam. The implications of the soil types can greatly change a landscape's planting material as well as irrigation method and need to be completed before any installation occurs.

## Design

Following meeting with the client and figuring out what his/her needs are, the next process is to come up with a design that meets the client's expectations. Multiple layouts need to be given to the client to ensure the right landscape is designed. Once the client and the designer reach an agreement, the next process is to start putting it down on paper.

The first step that is taken is to construct a base plan. Designing a base plan ensures all proceeding plans can be expanded upon. A base plan is a simple plan that outlines what the plan will look like other than irrigation, plants, and drainage. It basically shows how the hardscape will look when the project is completed. Multiple sheets need to be scanned and copied in order to use for later plans.

Once the base plan is constructed and multiple sheets are made, the next step is to create a construction plan. The construction plan shows what is to remain and what is to be taken out. Things such as concrete driveways/patios, fences, decks, sod, and plants are all examples of tasks that can be executed. For this particular site, the only things designated for removal are existing sod, removal of partial concrete, and existing deck. The only thing that is to remain is existing fence due to it being aesthetically and functionally pleasant. Anything else that the client wants or doesn't want to keep is indicated on this sheet such as: an arbor, deck, pond, and/or edging.

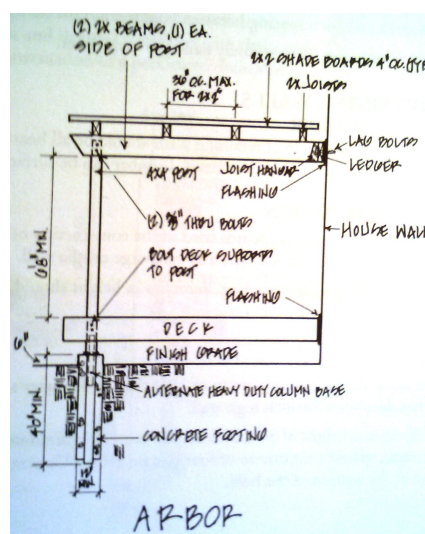
After the construction plan is created, the planting plan begins. The planting plan needs careful consideration because each and every plant has specific needs that need to be accounted for. Shade, sunlight, plant type, climate zone, and water requirements are things that need to be kept in mind when designing a planting plan. All of these considerations can be found at [Sunset.com](https://www.sunset.com). Designing a planting plan is solely based on the designer's discretion; there is no right and wrong way to design a landscape. Each landscape is uniquely different in its own way.

When designing the landscape, starting with the biggest plants and finishing with the smallest is a good way to go about completing a design. For this site, *Sequoia sempervirens* was the biggest plant so that is where the design started. Placing these throughout the landscape gave an idea of where the remaining plants could possibly go. Going through the process of biggest to smallest was followed until all plants were used and all planting material requirements were met. After the planting plan was finished, it was reviewed by the owner of the property owner and approved.

The next step is the irrigation design. The main concern with an irrigation plan is to maintain equal pressure throughout the system and having great distribution uniformity. Also, having experience in irrigation installation is needed to understand how things work and blend into one another, such as grouping similar water requirement plants together. Grouping watering loving plants in a specific zone ensure that they will be getting enough water, while not over watering others. The easiest way to install an irrigation system is to start from the farthest sprinkler on a given valve. Each individual sprinkler, in combination with the nozzle associated with it, puts out a given amount of water. There are charts associated with each nozzle that designate which size piping can be used to put that amount of water out. For instance, if a nozzle at optimal pressure puts down one gallon of water per minute, one needs to find the right size of pipe that can supply that sprinkler with the appropriate amount of water. This process continues for each sprinkler head. However, the previous sprinkler needs to be added to the total amount of water because that pipe is feeding all the sprinklers preceding the current one. Economically, the smallest size pipe needs to be installed while maintaining the optimal pressure to decrease the overall costs of the irrigation system.

The last step that takes place is to create a drainage plan. To start the drainage plan planting areas needed to be specified. Once the turf and shrub beds are designated the layout can begin. For this site, the entire design is all connected into one system which ran through a 3" perforated drain pipe. Sporadically throughout the system, catch basins with either a drain or atrium grate were designated for installation. These catch basins were only located in areas where drainage may eventually be a problematic area. The system eventually runs to the side walk with a pop-up drain. This pop-up drain allows any overflow that may build up in the system to drain out to a designated area. In addition to the system, fabric needs to be wrapped around the pipe to ensure the longevity of the system. Most importantly the system must have a declining slope of at least one degree every twenty feet.

Sometimes there is another plan, a hardscape plan. This plan is specifically used for structures that the client wants in their landscape. Structures such as arbors, ponds, decks, concrete work, ect... are all possibilities that fall into this category. The following is a detailed hardscape plan for an arbor. This is only one example that a hardscape plan can consist of (Fiske, 1989).



Detail drawing of an arbor.



## Estimate

Estimating an entire landscape is a very detailed process where everything needs to be accounted for to ensure a profit is made at the very end of the process. If this process is skipped and / or is guessed, the margin of error is relatively high.

The easiest way to go about completing this section is to put together an excel sheet. Once a given plan is completed, put all the material that is required to build/construct the design into the sheet. Experience is needed to understand what is required to build a specific structure or install an irrigation or drainage system. Once exposed to these types of construction, the process of putting all the required material together becomes easier and easier.

For the estimate itself, multiple formulas need to be made in the excel sheet to ensure the correct price is calculated. The most critical part of this process is figuring out how fast a specific task can be completed. For instance, if it takes two minutes to install one PVC fitting the labor rate that needs to be used is .03 repeating, which can be seen on Appendix H. The .03 repeating comes from the two minutes divided by sixty, this will give a labor rates in hours. Anything that requires labor needs to have its specific production rate formula with it. This again comes through experience and can differ from contractor to contractor.

Once all material and labor is accounted for, a labor rate needs to be incorporated as well. This section is based on how much money it costs for a laborer to perform work. It is important to keep in mind that this number is not just his or her hourly rate. Insurance, truck, and bonds are all incorporated into the labor rate. If the contractor is just bidding at the same price he / she is paying the laborer, the contractor will more than likely go out of business. The going rate in Riverbank, California is at or near twenty-five dollars an hour.

The final process in determining how much a project will cost is incorporating a contingency, sales tax, and profit margin into the bid. Contingency is a category to account for anything that is forgotten. For instance, if a backflow isn't accounted for then a contingency will account for this. Also, if numerous tasks or materials are forgotten then most likely the contractor will lose money. Specifically, the contingency for this bid only accounts for three percent of the entire bid.

The next category, sales tax, also needs to be added into the bid. The sales tax in Riverbank, California is 7.375% which is found at California State Board of Equalization website (Anonymous, 2012b). Sales tax can only be added to materials needed for the landscape, it cannot be added to labor or equipment.

The last category for a bid is a profit margin. If it is an open bid sometimes a specific profit margin is outlined. However, if it is a residential landscape, as this one is, it is up to the contractor's discretion to determine the profit margin. However, to make a competitive bid the profit margin needs to be reasonable. For this specific bid, the profit margin that was used was eighteen percent of the entire bid.

If the client wants to put this specific design out for bid, the homeowner needs to convey all of these aspects to the contractors that are bidding on the project. As a homeowner, it is their responsibility to interview a minimum of three contractors to ensure there is an equal opportunity for all. In addition to this, it is also the homeowner's obligation to make sure the contractor that wins the bid has a valid contractor's license which can be found at the California State License Board website. Lastly, even though there are specific specifications on the designs themselves, the client needs to make sure short cuts (installing the correct pipes, plants, and correct materials) are not taken through the process of installation. Also, if permits are needed, ensure that the

landscape company has received them and that a binding contract has been agreed upon. In terms of permits anything that is being attached to housing structures, altered in some matter, or removed may need a building permit depending on the city (Anonymous, 2012d).

## Maintenance Estimating and Tasks

Bidding for maintenance is a lot less detail intense as bidding an entire landscape project. However, it is just as equally important to account for everything that will or should be done. The maintenance side of business is very competitive and has unfortunately turned the landscape industry into a blow and go procedure. A lot of companies offer just the essentials such as edging and mowing. However, if the client wants more than that, the client needs to convey those needs to the maintenance company. The landscape maintenance company will then make specifications in accordance with the homeowner. Specifications such as: pruning back any shrubs that may overhang walkways or sidewalks, blow all existing hardscape, remove broken or damages material, ect... A list of these can be seen in Appendix I.

For a bid, many tasks should be accounted for such as: mowing, edging, pruning, blowing, fertilizing, aeration, debris removal, spraying for weeds, tree care, and irrigation maintenance. Just like the project estimate, maintenance bids also have production rates. Again all of these rates are dependent on the contractor and can vary to small degrees.

When bidding for a maintenance job, frequency needs to be accounted for. Frequency regards how often the contractor is planning on doing certain tasks. For instance, mowing does not need to be done every week, especially during the cooler time of months. On average, turfgrass is mowed forty-two times a year. If the contractor is charging \$100 for mowing the turf that number must be multiplied by forty-two. Also, tasks, such as pruning, vary greatly depending on the type of plant. Each plant requires different pruning requirements, so each plant needs to have a different frequency rate to ensure the proper bid is assembled. Once all tasks are accounted for, in combination with the production rates, a total number of hours will be calculated based on the excel sheet capacity. The total hours calculated are for the entire year so

in order to calculate the number of hours per visit the contractor needs to know the number of visits he / she will be doing. For this bid, the total number of visits is forty-two. So, dividing the total number of hours by forty-two gives the number of man hours per visit. If there is a two-man crew, divide the number just calculated by two and so on if there are more crewmembers, see Appendix I.

## IV. Results and Discussion

### Client Interview / Site Analysis

To begin this project a client interview was conducted and is as follows:

Name: Matt Bungum

Address: 6049 Willow Song Court, Riverbank, CA 95367

Home phone: N/A Cell phone: 209-402-7561

1. Family members and hobbies: Wife Brittany. Enjoys playing golf and football and working in the yard.
2. Pets which may need special attention: None.
3. Medical conditions or allergies: None.
4. Fencing or enclosure requirements and height restrictions: None.
5. Front door entrance-walkway and enclosure preference: Wants a shrub/ tree on both sides of the garage.
6. Utility area-storage for garage and recycling, woodpile, compost pile? Wants a storage unit in the backyard on the right side of the property.
7. Kids play area needed? How large and what would you like it to contain?: None.
8. Vegetable/herb/fruit trees desired: None.
9. Lawn areas desired? How much? In the front yard re-sod the turf. Backyard wants turf on either side of the pool. No turf behind the waterfall.
10. Outdoor entertaining area desired? – Seating, cover area, patio, BBQ: Wants a BBQ with seating area where existing wood deck is.

11. Maintenance – who will be maintaining? Low-high level of maintenance: Homeowner would like to maintain the property. Wants a relatively low maintenance landscape.
12. Pathways and circulation requirements? None.
13. Specific color and plant preference: Pink, purple, and yellow.
14. Decorative features i.e. bird baths, water feature, boulders? Wants boulders throughout the landscape.
15. Theme desired? Natural woodland, Japanese, Modern architectural: Woodland.
16. Water restrictions for plant materials: Can only water three times a week.
17. Privacy or screening desired and where: Wants to have trees lining the neighbor on the right side.
18. Any special requests or needs i.e. sustainable practices, regulations, micro-climate areas: None.
19. Who do you plan to install the landscape and time frame (self or contractor)? Contractor. He wants the landscape to be completed in one month.
20. Budget for design? Budget for installation? His budget for the project is \$25,000.
21. Any other information regarding your property, family, areas to be aware of: None.
22. Site Observations: Morning sun in the front. Can get hot in the summer months, especially in the back yard.

That very same day soil samples were taken as previously mentioned in the methods and materials section. The two soils were sandy loam and silt loam. Given this information allowed for a better understanding of what type of plants could be used and also the irrigation materials.

## Design / Estimate

After the client interview and site analysis took place, the design part of the project began. Following the client's budget took a big part in completing the designs. Since the client only had a budget of \$25,000 little could be done in the construction plan other than removal of certain existing hardscape and planting material. The only tasks were removal of existing deck, removal of concrete, removing existing sod, see Appendix A. Once the design was completed all of the tasks were put into a spread sheet, Appendix E, and calculated accordingly. As previously stated, production rates are based solely of the contractors and there is no standard number used worldwide.

The next step in the design process was the planting plan, Appendix B. The planting plan consisted of only seven plants and one turfgrass. Special needs needed to be in consideration especially with the Japanese maple and Camellias. Both of these plants needed cooler environments to thrive, and need to be planted in shade. All plants were given a specific design so they could be distinguished from one another. In addition to the plan, a planting palette was constructed and put onto the drafting paper. The palette is essential and denotes exactly the plant size, cultivar / variety, and any addition remarks associated with it. The layout of the plants was rather simple since it is up to the designer's discretion. Just like the construction plan, the next step was to put all tasks into a spreadsheet with the appropriate production rates, see Appendix F.

Since the locations of the turfgrass and plants were now know, the irrigation plan was constructed. In order to have a well operating irrigation system, a couple of things needed to be known: gallons per minute (GPM) and pounds per square inch (PSI). However, the mainline connected to the meter as opposed to connecting it to an existing faucet, so GPM and PSI numbers could not be calculated exactly. Nonetheless, since seeing other irrigations similar to



the one being designed, an estimate of fifteen to twenty sprinklers could operate on one given valve. With that being said, valves were placed throughout the landscape and had ten sprinklers on each side of the valve. Doing this ensures that equal pressure is achieved. Also, on the lateral lines, spacing is vital and needs to be accurate, otherwise water will not be applied evenly (some spots wetter than others). The same concept was applied to nozzles as well. In this landscape, the average head spacing is eight feet and adjusts accordingly based on irregular shapes within the landscape. The overall design can be seen in Appendix C. After all valve and lines were drafted, a spreadsheet was put together which incorporated all the materials needed and the proper production rates. All the material for irrigation was at list price set by Ewing Irrigation, see Appendix G.

The very last step in the design process was the drainage plan. The drainage plan is vital to plant health because standing water encourages rot root and unwanted pests. With a proper drainage design this will be avoided. Since already being on the property and no grading is accounted for, high elevated spots as well as low spots were noted. In those specific low areas, a catch basin and some type of grate (atrium or drain grate) was noted for installation, see Appendix D. When the drainage system is installed it is vital that the perforated pipe be slightly sloped to avoid any back up from occurring. This is noted in the legend on the design. Again, after the design was completed, adding up the material and labor hours was completed, see Appendix H.

When all the production rates are calculated and put into the spreadsheet and the total number of hours were calculated. This number is at the bottom of every spreadsheet under labor hours. That number is then divided by eight (one work day) to give the total number of days to completion. For instance, in the irrigation spreadsheet it is calculated to take 46.31 labor hours to

complete the entire irrigation system. So, dividing 46.31 by eight would take one person 5.78 working days to complete it. That was done for every plan and the end result, as seen in Appendix J, will take one man approximately twenty one working day to complete the entire project. The total for the entire project came to \$21,803.58, which included irrigation, planting, drainage and construction. This total is an approximation and should be used to determine, if it goes out to bid, if a contractor is following the guidelines set forth by the designer. If a bid comes in well below this estimate the homeowner should know short cuts are being taken. On the other hand, if a bid comes in a lot higher, the owner will know that a contractor is either making his / her profit margin larger or may not be using the designated materials.

## Maintenance Estimate / Tasks Performed

Now that the entire design is completed the next step was to construct a maintenance plan in accordance with the design. Tasks not only included the basics, i.e. mowing, pruning, edging, and blowing, but also tree care, spot spraying for weeds, fertilization, aeration, and irrigation inspections. The goal of this maintenance plan, as stated earlier, is for the homeowner to have no need to work in the landscape and ultimately have it be the best looking one in the neighborhood. Calculating the maintenance estimate is the same as the installation phase. Production rates and tasks need to be accounted for in order to have an accurate estimate, see Appendix I. For this specific site the total for the entire year came to \$7,905.47. In addition, with a two man crew, it is calculated to take approximately one hour and fifteen minutes per visit to complete all the required tasks, see Appendix J.

Looking back on the project as a whole, the hardest part was the irrigation estimating process. This part of the project was highly underestimated and required a great amount of detail. Since piping changed within a given irrigation zone, being able to calculate the total length of pipe and the number of appropriate fittings was time consuming.

The entire design process was simple in terms of actually drafting. However, making sure the irrigation was designed efficiently was stressful. Each valve could only operate so many nozzles and if too many nozzles were added to a specific valve that entire zone wouldn't run as hoped. Every nozzle; depending on if it was a quarter, half, full, or VAN; all had varying flow rates that needed to be accounted for. Making sure each individual valve supplied each sprinkler with the recommended PSI was a task in its self. Irrigation is not only mathematically difficult but also an art. Extensive field experience is required for anyone attempting to design an irrigation plan of any scale. If planning on tackling an irrigation design, a good place to start

looking is at the Jess Stryker's website, [www.irrigationtutorials.com](http://www.irrigationtutorials.com). This website specifies exactly what needs to be done in terms of pipe sizing, gallons per minute (GPM), pounds per square inch (PSI), and nozzles (Stryker, 2012).

The homeowner was very easy to work with and was open to any suggestion. The only problem that arose during this process was the dollar amount associated with the project. He and his wife had no idea what the cost of installation would be and significantly underestimated it. They would have loved to of had a pond, concrete work, and a new deck in the design but the budget didn't allow for that.

Having some field experience helped greatly with completing this project. However, more would have definitely helped. In addition, this project has shed light on how intense and detailed bidding competitively can be.

## Literature Cited

### References

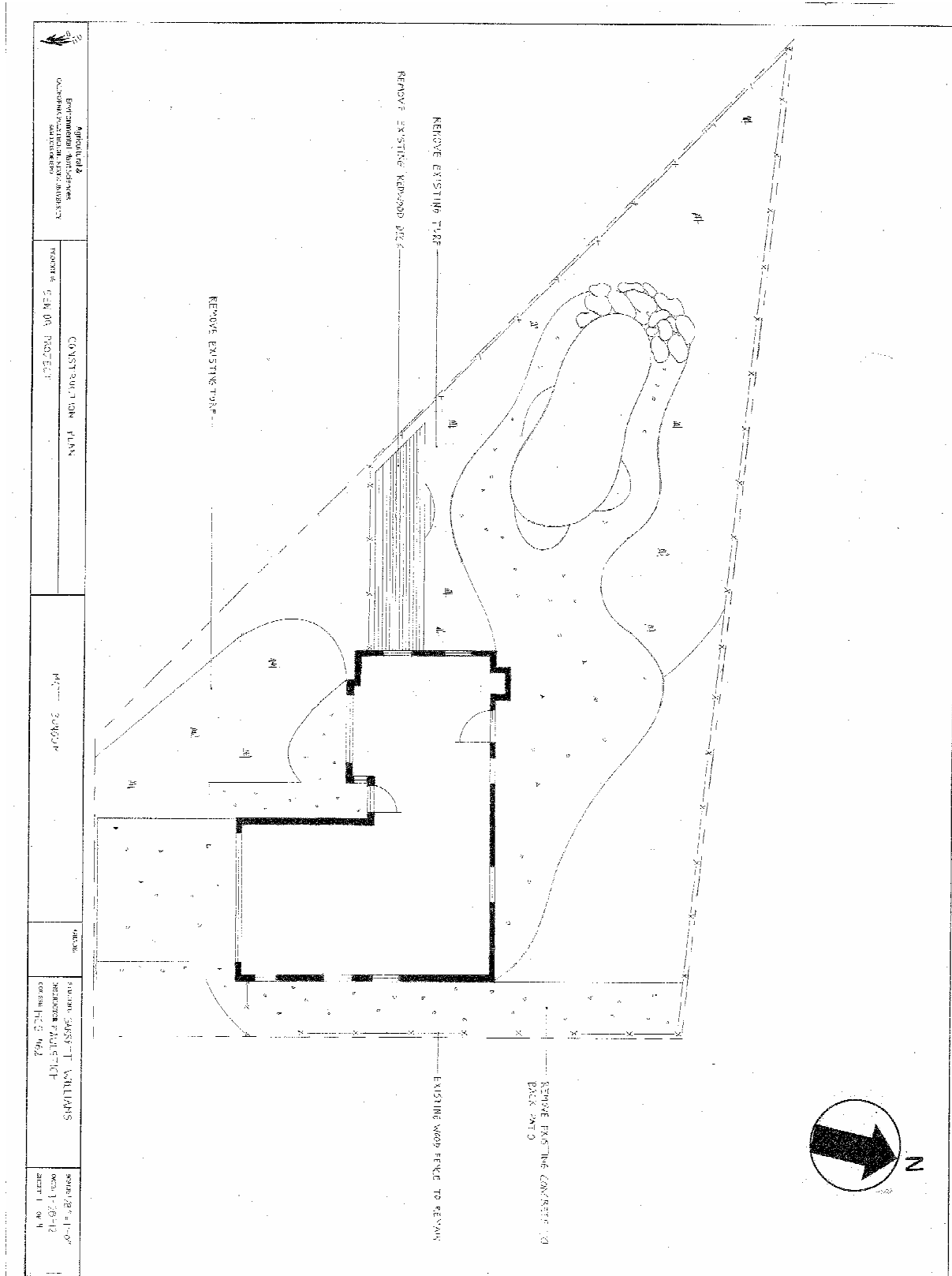
- Angle, S., Horsey, E., Roberts, D. 2002. Landscape Estimating and Contract Administration. Chapter 10, pp.103-104.  
<http://www.cslb.ca.gov/Consumers/HireAContractor/BuildingPermitRequirements.asp>
- Anonymous. 2012a. CAD Detail Drawings. Rain Bird. Web. 05 Dec 2012.  
<http://www.rainbird.com/landscape/resources/CADdetailDrawings.htm>
- Anonymous. 2012b. California City & County Sales & Use Tax Rates. California State Board of Equalization. Web. 05 Dec 2012. <http://www.boe.ca.gov/cgi-bin/rates.cgi>
- Anonymous. 2012c. Check a Contractor License or Home Improvement Salesperson (HIS) Registration. Contractors State License Board. Web. 05 Dec 2012  
(<https://www2.cslb.ca.gov/OnlineServices/CheckLicenseII/CheckLicense.aspx>)
- Anonymous. 2012d. Do I Need a Building Permit for My Project. California State License Board. Web. 05 Dec 2012.  
<http://www.cslb.ca.gov/Consumers/HireAContractor/BuildingPermitRequirements.asp>
- Anonymous. 2012e. Monthly Averages for Riverbank, CA. The Weather Channel. Web. 23 Feb 2012. [www.weather.com/weather/wxclimatology/monthly/graph/95367](http://www.weather.com/weather/wxclimatology/monthly/graph/95367).
- Anonymous. 2012f. Plant Finder. Sunset. Web. 28 Feb 2012.  
<http://plantfinder.sunset.com/plant-home.jsp>.
- Anonymous. 2012g. What Should I Look For in a Contract and Binding Agreements. Contractors State License Board. Web. 11 Mar 2012.  
<http://cslb.ca.gov/Consumers/HireAContractor/ContractsAndBindingAgreements.asp>.

- Behe, B., Hardy, J., Barton, S., Brooker, J., Fernandez, T., Hall, C., Hicks, J., Hinson, R., Knight, P., McNeil, R., Page, T., Rowe, B., Safley, C., and R. Schutzki. 2005. Landscape Plant Material, Size, and Design Sophistication Increase Perceived Home Value. *J. Env. Hort.* 23:127.
- Brady, N. C., Weil, R.R. 2008. *The Nature and Properties of Soils*. Chapter 4, pp.123-a25.
- Christians, Nick E. 2011. *Fundamentals of Turfgrass Management*. Chapter 3, pp.31-72.
- Fiske, Rodger D. 1989. *California Landscape Standards*. Section IV, pp. 49 and 94.
- Ingels, J.E. 2009. *Landscape Principles and Practices*. Chapter 8, pp.139-143. Chapter 27, pp. 420-432.
- St. Hilaire, R., Arnold, M. A., Wilkerson, D. C., Devitt, D. A., Hurd, B. H., Lesikar, B. J., & Zoldoske, D. F. 2008. Efficient Water Use in Residential Urban Landscapes. *Hortscience*, 43(7): 2081-2092.
- Stryker, Jess. 2012. Welcome to the Irrigation Tutorials Homepage. Web. 05 Dec 2012.  
[www.irrigationtutorials.com](http://www.irrigationtutorials.com)
- Wait, D. Dwight. 1994. *Ornamental Plants: Their Care, Use, Propagation, and Identification*. Pp. 386.
- Webster, D.E., and J.S. Ebdon. 2005. Effects of Nitrogen and Potassium Fertilization on Perennial Ryegrass Cold Tolerance During Deacclimation in Late Winter and Early Spring. *HortScience*. 40(3): 842-849.

## Appendices

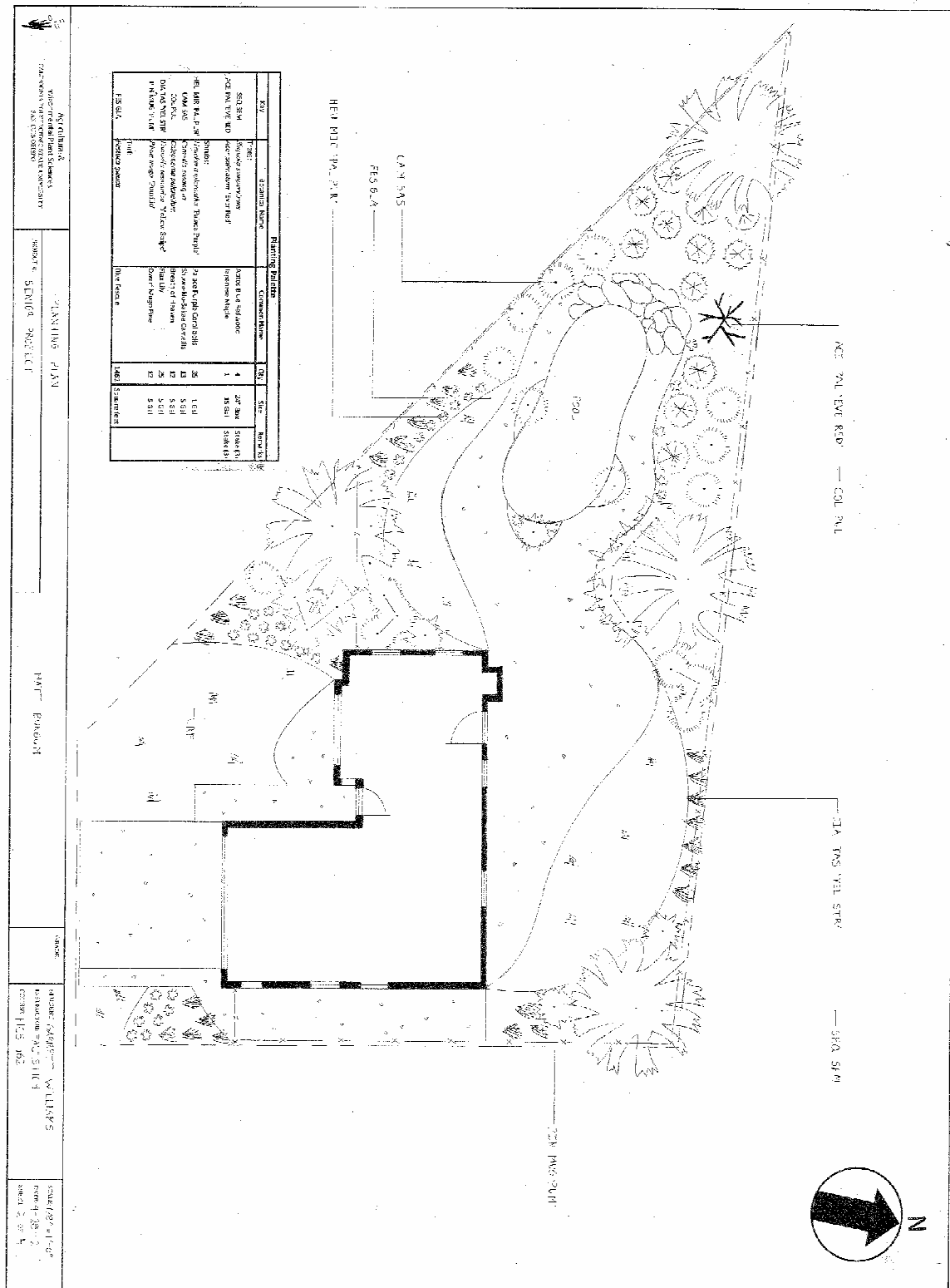
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# Appendix A. Construction Plan

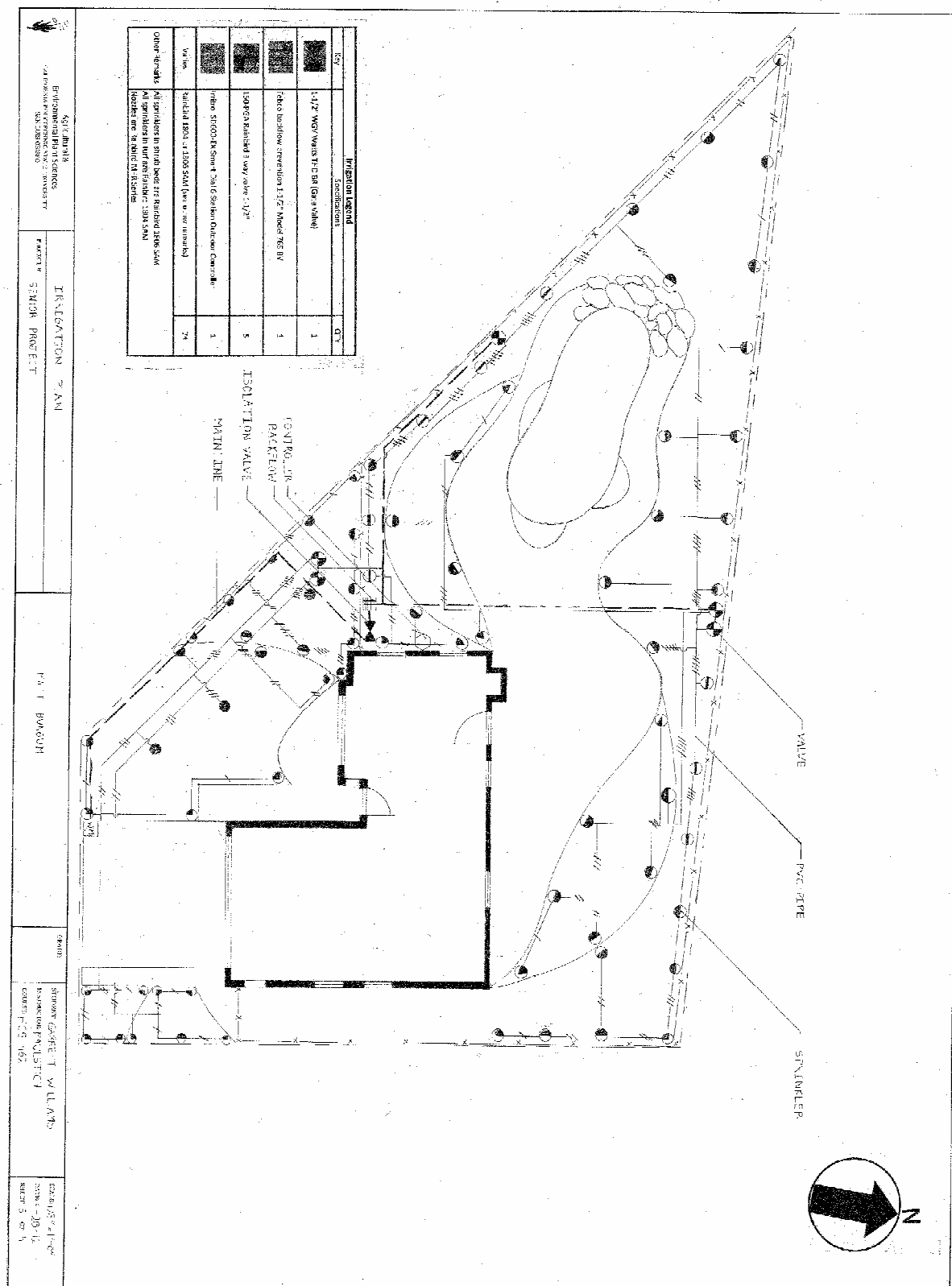




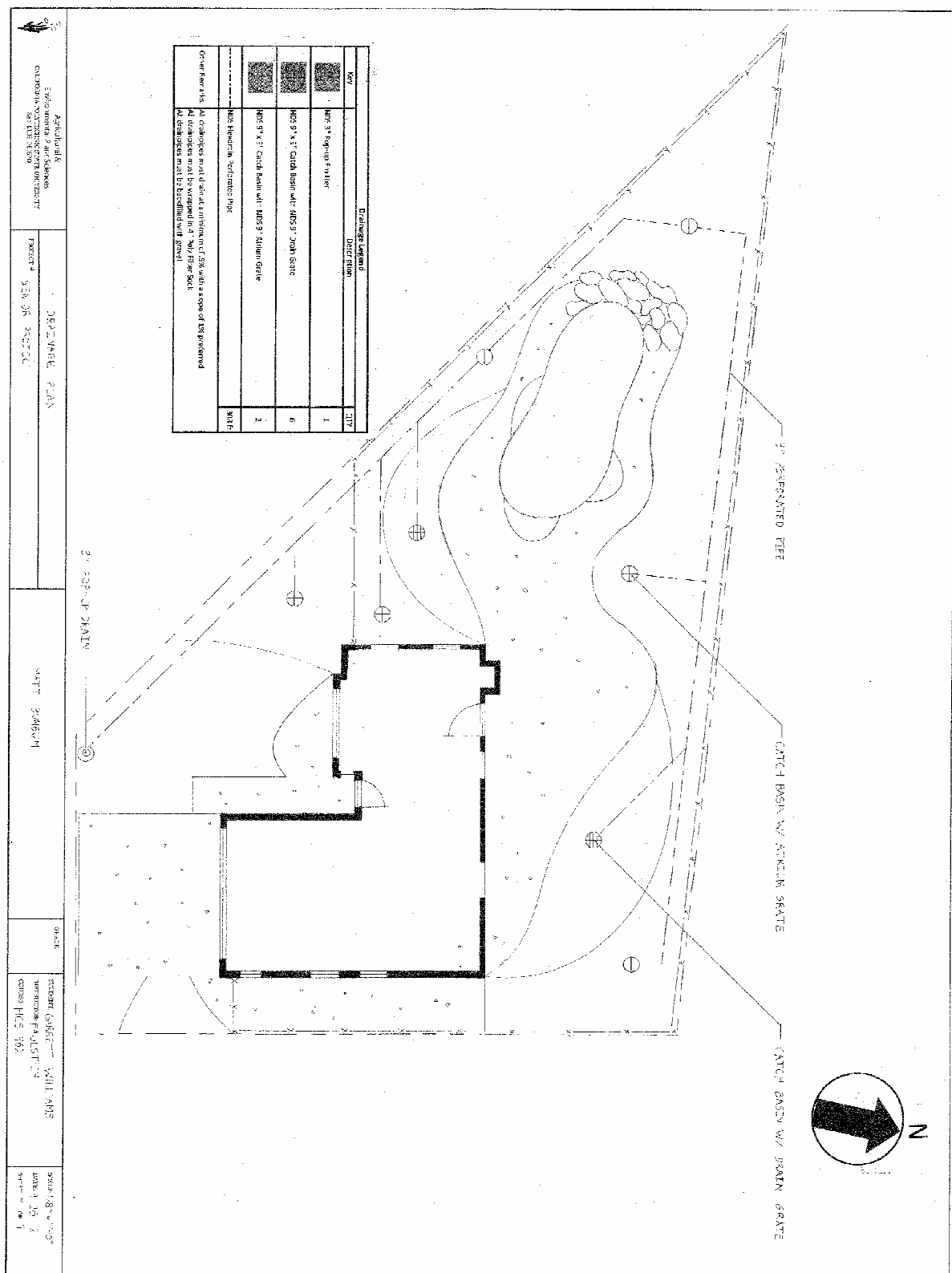
## Appendix B. Planting Plan



## Appendix C. Irrigation Plan



# Appendix D. Drainage Plan



[illegible]

|                              |  |                    |
|------------------------------|--|--------------------|
| Contractor: Garrett Williams | Architect: Garrett Williams                          | Project #: 1       |
| Phone #: (209) 402-7561      | Address: 6049 Willow Song Court, Riverbank, CA 95367 | Bid Date: 11-11-12 |

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# Appendix G. Irrigation Estimate

Contractor: Garrett Williams  
Phone #: (209) 402-7561

Architect: Garrett Williams  
Address: 6049 Willow Song Court, Riverbank, CA 95367

Project #: 1  
Bid Date: 11-11-12

| TASK/OPERATION   | QTY | UNIT | MAT.<br>CPU | MAT.<br>EXT | LABOR<br>PR RATE | LABOR<br>HOURS | LABOR<br>\$/HR    | LABOR<br>EXT | EQPT<br>\$/HR   | EQPT<br>EXT | TOTAL      |            |
|--|-----|------|-------------|-------------|------------------|----------------|-------------------|--------------|-----------------|-------------|------------|------------|
| Materials  |     |      |             | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| PVC  |     |      |             | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| Lateral 1/2"   | 131 | lf   | \$0.02      | \$2.88      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$2.88     |            |
| Lateral 3/4"   | 237 | lf   | \$0.03      | \$6.64      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$6.64     |            |
| Lateral 1"   | 124 | lf   | \$0.04      | \$5.08      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$5.08     |            |
| Lateral 1 1/4"   | 121 | lf   | \$0.06      | \$7.62      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$7.62     |            |
| Lateral 1 1/2"   | 111 | lf   | \$0.07      | \$7.33      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$7.33     |            |
| Mainline 1 1/2"  | 178 | lf   | \$0.07      | \$11.75     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$11.75    |            |
| Backflow 1 1/2"  | 1   |      | \$299.18    | \$299.18    |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$299.18   |            |
| Galvanized unions 1 1/2"   | 2   |      | \$12.63     | \$25.26     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$25.26    |            |
| Galvanized nipples   | 4   |      | \$2.34      | \$9.36      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$9.36     |            |
| Gate valve   | 1   |      | \$35.84     | \$35.84     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$35.84    |            |
| Sprinklers   |     |      |             | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| RB 1804 SAM (turf)   | 25  |      | \$1.21      | \$30.25     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$30.25    |            |
| RB 1806 SAM (shrub)  | 49  |      | \$5.16      | \$252.84    |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$252.84   |            |
| Elbows (ST) 1/2"   | 16  |      | \$0.32      | \$5.12      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$5.12     |            |
| Elbows (ST) 3/4"   | 1   |      | \$0.39      | \$0.39      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.39     |            |
| Elbows (ST) 1"   | 8   |      | \$0.76      | \$6.08      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$6.08     |            |
| Elbows (ST) 1 1/4"   | 6   |      | \$1.42      | \$8.52      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$8.52     |            |
| Elbows (ST) 1 1/2"   | 7   |      | \$1.59      | \$11.13     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$11.13    |            |
| Elbows (SS) 1/2"   | 2   |      | \$0.26      | \$0.52      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.52     |            |
| Elbows (SS) 3/4"   | 2   |      | \$0.55      | \$1.10      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$1.10     |            |
| Elbows (SS) 1"   | 2   |      | \$0.51      | \$1.02      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$1.02     |            |
| Elbows (SS) 1 1/4"   | 0   |      | \$0.96      | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| Elbows (SS) 1 1/2"   | 0   |      | \$1.03      | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| Elbow 45 1/2"  | 0   |      | \$0.42      | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| Elbow 45 3/4"  | 4   |      | \$0.69      | \$2.76      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$2.76     |            |
| Elbow 45 1"  | 0   |      | \$0.83      | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| Elbow 45 1 1/4"  | 0   |      | \$1.22      | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| Elbow 45 1 1/2"  | 0   |      | \$1.45      | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| Tees (SST) 1/2"  | 1   |      | \$0.42      | \$0.42      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.42     |            |
| Tees (SST) 3/4"  | 19  |      | \$0.71      | \$13.49     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$13.49    |            |
| Tees (SST) 1"  | 2   |      | \$1.34      | \$2.68      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$2.68     |            |
| Tees (SST) 1 1/4"  | 6   |      | \$2.59      | \$15.54     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$15.54    |            |
| Tees (SST) 1 1/2"  | 4   |      | \$3.15      | \$12.60     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$12.60    |            |
| Tees (SSS) 1/2"  | 1   |      | \$0.32      | \$0.32      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.32     |            |
| Tees (SSS) 3/4"  | 8   |      | \$0.37      | \$2.96      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$2.96     |            |
| Tees (SSS) 1"  | 1   |      | \$0.68      | \$0.68      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.68     |            |
| Tees (SSS) 1 1/4"  | 9   |      | \$1.18      | \$10.62     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$10.62    |            |
| Tees (SSS) 1 1/2"  | 15  |      | \$1.37      | \$20.55     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$20.55    |            |
| Valve 1 1/2"   | 5   |      | \$52.61     | \$263.05    |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$263.05   |            |
| Union  | 10  |      | \$33.54     | \$335.40    |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$335.40   |            |
| Nipples  | 10  |      | \$1.23      | \$12.30     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$12.30    |            |
| Valve Box 12"  | 5   |      | \$23.25     | \$116.25    |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$116.25   |            |
| Nozzles (Rainbird MPR Series)                                    | 74  |      | \$0.89      | \$65.86     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$65.86    |            |
| Swing joint  | 74  |      | \$0.47      | \$34.78     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$34.78    |            |
| Irritrol SD600-EX Smart Dial 6 Station Outdoor Controller        | 1   |      | \$230.40    | \$230.40    |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$230.40   |            |
| Wire   | 1   |      | \$50.00     | \$50.00     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$50.00    |            |
| Glue   | 2   |      | \$10.35     | \$20.70     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$20.70    |            |
| Primer   | 2   |      | \$10.35     | \$20.70     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$20.70    |            |
| Couplers (male adapter)  | 25  |      | \$0.87      | \$21.75     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$21.75    |            |
| Gravel underneath valves   | 0.5 | cy   | \$49.00     | \$24.50     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$24.50    |            |
| Sand   | 1   | cy   | \$49.00     | \$49.00     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$49.00    |            |
| Reducer 3/4" to 1/2"   | 12  |      | \$0.49      | \$5.88      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$5.88     |            |
| Reducer 1" to 3/4"   | 12  |      | \$0.84      | \$10.08     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$10.08    |            |
| Reducer 1 1/4" to 1"   | 12  |      | \$1.41      | \$16.92     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$16.92    |            |
| Reducer 1 1/2" to 1 1/4"   | 12  |      | \$1.50      | \$18.00     |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$18.00    |            |
| Labor  |     |      |             | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
| Trencher (4 hour) rental   | 1   |      |             | \$0.00      | 1                | 1              | \$0.00            | \$0.00       | \$59.00         | \$59.00     | \$59.00    |            |
| Mainline and lateral line (16")                                  | 979 | ft   |             | \$0.00      | 0.003            | 2.937          | \$25.00           | \$73.43      |                 | \$0.00      | \$73.43    |            |
| Backfill and compact   | 13  | cy   |             | \$0.00      | 0.25             | 3.25           | \$25.00           | \$81.25      |                 | \$0.00      | \$81.25    |            |
| Sand (for mainline) fill and spread                              | 0.5 | cy   |             | \$0.00      | 1.5              | 0.75           | \$25.00           | \$18.75      |                 | \$0.00      | \$18.75    |            |
| Sprinkler (includes swing joint, nozzle, and sprinkler)          | 74  |      |             | \$0.00      | 0.07             | 5.18           | \$25.00           | \$129.50     |                 | \$0.00      | \$129.50   |            |
| PVC fittings   | 171 |      |             | \$0.00      | 0.03333          | 5.6943         | \$25.00           | \$142.49     |                 | \$0.00      | \$142.49   |            |
| Valve (includes unions, nipples, couplers, valve box, and wire)  | 5   |      |             | \$0.00      | 4                | 20             | \$25.00           | \$500.00     |                 | \$0.00      | \$500.00   |            |
| Installation of controller                                       | 1   |      |             | \$0.00      | 4                | 4              | \$25.00           | \$100.00     |                 | \$0.00      | \$100.00   |            |
| Backflow (includes unions, nipples, and gate valve)              | 1   |      |             | \$0.00      | 2                | 2              | \$25.00           | \$50.00      |                 | \$0.00      | \$50.00    |            |
| Gravel (moving and compacting)                                   | 0.5 | cy   |             | \$0.00      | 3                | 1.5            | \$25.00           | \$37.50      |                 | \$0.00      | \$37.50    |            |
| Adding an outdoor outlet for irrigation controller (subcontract) | 1   |      | \$600.00    | \$600.00    |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$600.00   |            |
|  |     |      |             | \$0.00      |                  | 0              | \$0.00            | \$0.00       |                 | \$0.00      | \$0.00     |            |
|  |     |      | Mat. Total  | \$2,706.10  | Labor Hours      | 46.31643       | Labor Total       | \$1,132.91   | Eqpt. Total     | \$59.00     | Total      | \$3,881.09 |
|  |     |      |             |             |                  |                | # of Working Days | 5.78955375   | TOTAL LABOR     |             | \$1,132.91 |            |
|  |     |      |             |             |                  |                |                   |              | TOTAL MATERIALS |             | \$2,706.10 |            |
|  |     |      |             |             |                  |                |                   |              | TOTAL EQUIP     |             | \$59.00    |            |
|  |     |      |             |             |                  |                |                   |              | SUBTOTAL        |             | \$3,898.01 |            |
|  |     |      |             |             |                  |                |                   |              | OVERHEAD        |             | \$1,169.40 |            |
|  |     |      |             |             |                  |                |                   |              | TOTAL JOB COSTS |             | \$5,067.41 |            |
|  |     |      |             |             |                  |                |                   |              | PROFIT          |             | \$912.13   |            |
|  |     |      |             |             |                  |                |                   |              | CONTINGENCY     |             | \$152.02   |            |
|  |     |      |             |             |                  |                |                   |              | SALES TAX       |             | \$199.71   |            |
|  |     |      |             |             |                  |                |                   |              | GRAND TOTAL     |             | \$6,331.28 |            |

[illegible]

Contractor: Garrett Williams  
Phone #: (209) 402-7561

Architect: Garrett Williams  
Address: 6049 Willow Song Court, Riverbank, CA 95367

Project #: 1  
Bid Date: 11-11-12

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Project #: 1  
Bid Date: 11-11-12

|                         |           |            |                        |
|-------------------------|-----------|------------|------------------------|
| <b>Maintenance</b>      |           |            | <b>\$7,905.50</b>      |
|                         |           |            | <b>Monthly Payment</b> |
|                         |           |            | <b>\$658.79</b>        |
| <b>Hours per visit:</b> | One man   | 2.53542129 |                        |
|                         | Two men   | 1.26771064 |                        |
|                         | Three men | 0.84514043 |                        |
| <b>Tree care:</b>       | One man   | 16.25      |                        |
|                         | Two men   | 8.125      |                        |
| <b>Irrigation:</b>      | One man   | 0.75       |                        |