Backyard Landscaping Design and Irrigation

A Senior Project

presented to

the Faculty of the Environmental Horticultural Science Department

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In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Science

by

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Abstract

This project will involve designing and installing a drought friendly landscape in Los Angeles County, specifically in the San Fernando Valley where water restrictions are among the harshest. Along with being a landscape that needs little water, the design also needs to be safe for small children and pets. The backyard that will be designed has a large pool and a small rock garden area with a few succulent plants and some dying groundcover chaotically tossed in. The aim of this project is to design and install a landscape that is easily maintained, safe, and visually appealing while still following the strict water restrictions of the Los Angeles Department of Water and Power.
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I. Introduction

California has a more complex water resource management system than any other state in the country. The complexities of the system are a direct result of California’s water crisis. Currently, the state is just coming out of its third consecutive year of drought and, because California is prone to experiencing long and serious droughts, conserving water has become a major issue, especially in Los Angeles. Washing one’s car, the time of day one can water a lawn, even serving customers water in eating establishments has become regulated and violators of these new ordinances can find themselves fined anywhere from double to quadruple the previous fines. For homeowners in this area, the new regulations require that they must pay particular attention to the amount of water used in their households during everyday activities such as showering, washing clothes and maintaining landscapes. The new water regulations say that watering can only be done on Mondays and Thursdays from 4:00 PM to 9:00 AM for only fifteen minutes at a time. In addition to the ‘when’ restrictions, the ‘how much’ has changed too. The tier 1 water rates have been reduced by 15% as of late, and people who go over their allotted water supply end up paying the more expensive tier 2 water prices for every extra gallon.
II. Literature Review

1) Literature Review

2) Water issues in California
   a) Has this happened before?
   b) Why is it happening now?
   c) How long California has been in a drought

3) New laws in Los Angeles regarding water use
   a) New rules and regulations
      i) Tier 1 allotment reduction
         (a) http://www.ladwp.com/ladwp/cms/ladwp011946.pdf Tier 1 water rates will be reduced by 15%. People who go over their allotment will pay Tier 2 prices for every extra gallon.
         (2) 15% reduction
         (3) penalties
      ii) Watering plants
         (1) Day of the week
         (2) http://www.ladwp.com/ladwp/cms/ladwp011971.pdf It is now illegal to have your sprinklers running any days other than Monday or Thursday.
         (1) Time of day
      c) http://www.ladwp.com/ladwp/cms/ladwp011971.pdf It is illegal to water your landscape (including lawns) from 9:00 am to 4:00 pm.
         (1) Length of time
d) [http://www.ladwp.com/ladwp/cms/ladwp011971.pdf](http://www.ladwp.com/ladwp/cms/ladwp011971.pdf) It is illegal to water using sprinklers for more than 15 minutes per watering station, 10 minutes for other irrigation systems.

i) Automobile washing

4) [http://www.ladwp.com/ladwp/cms/ladwp011971.pdf](http://www.ladwp.com/ladwp/cms/ladwp011971.pdf) You cannot wash an automobile unless the hose has a shut off nozzle.

i) Restaurant water policy

5) [http://www.ladwp.com/ladwp/cms/ladwp011971.pdf](http://www.ladwp.com/ladwp/cms/ladwp011971.pdf) Restaurants are not allowed to serve water unless it is asked for.

a) Penalties for breaking the new rules and regulations

i) Fines increasing

(1) Homeowners

(2) Businesses

6) Los Angeles and Water

a) Drought history

b) Average temperature ranges

c) Current landscapes

7) What people in Los Angeles are doing to save water

a) Homeowners

b) Taking shorter showers

c) Planting drought-tolerant plants

d) Sweeping sidewalks instead of hosing them down

e) Doing full laundry loads instead of several half loads

f) Water-smart appliances
8) Plant Selection Options

a) Drought tolerant plants

(1) http://www.swfwmd.state.fl.us/waterres/drought/articles/tough-plants.htm

← Lists drought and heat tolerant plants

(2) Western Garden Book

b) Pet and child safe plants

(1) http://parenting.ivillage.com/baby/bsafety/0,,lz_6qvq,00.html

← Lists some child safe plants

(2) Western Garden Book

c) Irrigation

(1) Drip irrigation

(a) http://www.irrigationtutorials.com/dripguide.htm

← Drip irrigation is typically 90% efficient or more. Water will soak into the soil before it has a chance to evaporate, and is only applied where it is needed.

(b) http://www.rainbird.com/drip/

← Landscape drip and low volume irrigation options.
III. Materials and Methods

a. The Design

i. Existing conditions

The client’s house is located in the San Fernando Valley (zone 18 and 19 in the Sunset Western Garden book) with coastal influences no more than 15% of the time. As it is both hot and dry with a very heavy clay soil, this area is not an ideal place for growing a wide variety of plants. The San Fernando Valley is also currently under the heavy Los Angeles County water restrictions that makes landscape plant selection and establishment more challenging than it has been in the recent past. The client had a space (approximately 408 square feet) that was filled with dead or dying vegetation and bare soil. There was no irrigation system present. The existing pathway consisted of small, circular, and uneven stepping stones that presented a
safety issue for the client, a woman in her early 80s with limited mobility. Another client issue was the second occupant of the property. She owns a one-year-old 70 lb dog named Ella. The landscape design also needed to accommodate the energetic behaviors of this one year old pet.

**ii. Initial Meeting with Client**

At the initial meeting with the client, the discussion centered on what the client envisioned for her new landscape. She was looking for color and fragrance in her yard. She was also looking for low maintenance plants that would be hardy enough to withstand the dog and safe for children. Measurements were taken, noting the existing plumbing as well as sun orientation and paths most frequently traveled by both occupants. It was noted that this is a landscape that joins together two existing patios. The previous stepping stone path needed to be replaced because the stepping stones were both small and oddly spaced. Therefore they did not lend themselves easily to foot traffic. In addition, the stepping stones were awkwardly placed instead of being a direct connection between the two patios. A ribbon test was conducted to determine the type of soil. The ribbon test involves taking a small amount of soil between the fingers and rolling it into a worm, flattening the worm, and making a ribbon. The ribbon test indicated that the soil was a clay soil, making it hard to grow plants as well as difficult to dig through. Watering habits were discussed with the client and it was learned that she at one time had a drip irrigation system that was chewed on and subsequently destroyed by the dog. She was providing very little supplemental watering.
iii. Initial Concepts

Several different concepts were presented to the client for her new landscape. The three designs presented were an underwater theme, an English garden theme and a native California vegetation theme along with pictures of proposed plants to be used in each design. The problems and conditions of the area were discussed and after deliberation, the client chose an English garden-inspired design. A focal point for the English garden theme is a three-tiered fountain surrounded by colorful flowers. Lavender for fragrance as well as perennial color will be placed around the perimeter to complement the design.

Some of the plants that were considered were Spanish Lavender (Lavandula stoechas), Yarrow (*Achillea millefolium*), Sunrose (*Aptenia cordifolia*), Santa Barbara Daisy (*Erigeron karvinskianus*), Silver Carpet (*Dymondia margaretae*), and Hummingbird Mint (*Agastache spp.*). These plants were all selected because they are both sturdy and drought resistant plants. The client also wanted plants that would attract butterflies. Pet and child safe plants were important, and so was water tolerance. The plants chosen would fit that criteria nicely.

iv. Second Meeting and Problem Solving

One of the biggest obstacles to overcome was the lack of irrigation in the yard, causing the plants to receive little to no water. Because of the inconsistent watering habits, the backyard was sparse in its existing vegetation. It was determined that an automated system was necessary to ensure consistent watering and compliance
with local water restrictions. Another problem was Ella, the pit bill. She had a tendency to chew on any part of the previous watering system that was above ground. To prevent the dog from eating the new system, an underground system with water-wise pop-up sprinkler heads was designed. As a final method of conserving water, the area was topped with mulch to retain as much moisture as possible.

Safety was another important issue for this project. As previously mentioned, the stepping stones posed a problem for the client and her limited mobility. Though the client initially wanted to retain the small, round stepping stones in their current location, it was determined that a straight, level path was the best solution to join the two existing patios. It was recommended that the small, round stepping stones be replaced with larger, square stepping stones placed end to end, removing any gaps that could be tripped over. Another safety concern was the plant material selection. Because the client had many small great grandchildren visiting, as well as a dog that ate the leaves off of plants, non-toxic plant selection became critical.

Again, due to limited mobility, the client required a low maintenance landscape. Originally the client wanted to have sod but after some discussion, she was convinced that it was not practical for her situation due to the high-water requirement as well as the maintenance needs such as regular mowing and weed control. Drought-tolerant, low-maintenance groundcover plants were recommended and our client ended up selecting *Dymondia margaretae*, also known as Silver Carpet. For the rest of the plant materials, hardy plants were chosen that required little attention aside from the occasional watering.
The dog ended up being the biggest hurdle, and as she is no small dog, it was quite a large jump. Her digging, eating and romping had destroyed any previously existing landscape. To combat her digging, the irrigation water lines were installed at a one foot minimum depth and used pop-up sprinklers. Due to the dog’s chewing tendencies, a large fiberglass cover was placed over the irrigation controls to keep her away. While she could not be stopped from eating the leaves off of the plants, toxic plants were not considered. Her romping also proved to be a challenge. It was observed that she tended to romp through the middle of the landscape. In these areas, the *Dymondia* was placed because it could tolerate more foot traffic. Another existing dog romping path was from the upper pool level to the garden. Several large rocks were placed in this area to serve as stepping stones so the dog would not leap onto the plants.

b. Installation

i. The Irrigation System

With the previous measurements of the landscape area, it was decided that an underground irrigation system be used that would be hidden from view of both people and dogs. Plans were drawn to determine the ideal placement for the sprinkler heads. The radius of the sprinkler heads was measured at each location and it was decided that four sprinkler head locations would cover the entire backyard. Gear drive rotor sprinkler heads were chosen for their coverage, and pop-
up heads used so that the dog wouldn’t eat them. After designing and planning everything on paper, the design was laid out with PVC pipes in the yard.

Then came the trenching. In the 90°+ heat, the irrigation trenches were dug in the rock-like clay soil. Previously the larger stones that were in the path had been removed, but some of the stone pavers had been overlooked. Sure enough, one was broken in half with the pickaxe. The digging was delayed by the search for the remaining pavers, many of which were under several inches of clay soil by now. Once the pavers were moved to a different area of the backyard, digging (and in some cases re-digging, thanks to Ella) was completed in a back-breaking 7 hours, blisters and all. This was when it was noted that gloves were a necessity.

Once the ditches had been dug to at least a one foot depth, the PVC pipe was again laid out. To get the pipes to fit into the newly dug ditches, they were cut with a hacksaw down to the needed size. The PVC pipes were then all dry-fitted. When it was insured that everything came together well, the system was tested by turning on the water. The goal was to make sure that the water came out of the end of every
pipe and it did. Next, the ends of each PVC pipe and connectors were primed. After a minute or so, the purple primer dried. The pipes and connectors were then glued together.

Once the framework was in place, the risers and sprinkler heads were installed. The height from the connector elbow to the surface of the ground was measured for each of the future sprinkler head locations. The PVC pipes were cut down to the desired length and dry-fitted to the framework. The dry-fitted sprinkler heads were checked to ensure they were even with the ground. When everything was properly positioned, the new connectors and pipes were primed. While waiting for the primer to dry, Teflon tape was wrapped clockwise around the threaded ends of the sprinkler heads to help prevent any leaks. Everything was then glued and assembled. After waiting ten minutes for the glue to cement, the system was again tested to check for leaks. Three 180° heads, and one adjustable head (adjusted to approximately 60°), were used. After insuring that the new irrigation system was in proper working condition, the trenches were filled in with help from the dog.
For efficiency and to ensure consistent watering, a battery-operated irrigation controller was installed. This type of system was selected because an electrical outlet was not available. It is recommended that an electrical outlet be installed in the future, as budget permits. The irrigation system was set to go off on Mondays and Thursdays at 7:30 a.m. for only fifteen minutes, complying with the local regulations involving watering times and dates. To protect the newly-installed control system from the dog, it was covered with a fiberglass rock.

ii. The Path

The former layout had no convenient, direct access to connect the two existing patios. There were small round stepping stones that attempted to create a decorative path. The problem was that the stepping stones were too small and were awkwardly placed in a meandering “Y” shaped path. They actually were seldom used, and when they were used, they were a tripping hazard for the elderly client. The client originally wanted to retain the small round stepping stones for the new, straight path, but that
would still leave the tripping hazard. This was another budget hit, but the benefits of a larger, more solid path were eventually, very clear to the client. 18"x18" square aggregate stepping stones were utilized that blended well with the color and design of the house. In order to keep the path straight, two stakes were pounded into the ground at either end of the path. A string was stretched and tied it to both stakes to indicate the straight line. A flat shovel was used to dig out a shallow trench for the path to make it level with the two existing patios. Full tiles fit perfectly and no cutting was required. The tiles were made of concrete. Each tile was laid in the trench and lined up with the string to keep it straight. Each tile was leveled with sand and tested for stability. Once the tiles were laid end to end, the surrounding area was re-leveled, locking them in place.
iii. The Fountain

As a nod to the English Garden idea, the client had an old fountain that was to be reused as a focal point for the garden. The fountain had been damaged by the dog who had managed to knock it over and then chewed on the pump. Replacement parts were obtained to rebuild the fountain at minimal cost. The fountain was to be relocated to a more prominent, centralized spot in the garden. The chosen location for the fountain was leveled and a broken concrete stepping stone was used as the base for the fountain. The cracked stepping stone was ideal for the base because the two broken halves provided a path for the pump power cord to pass through without being compressed or disturbing the level. The cord was run underground in a ditch that had been dug to an existing electrical outlet in order to prevent any chewing damage from the dog that may occur. As each new fountain tier was added, it was checked for level, using plumbers putty as necessary. The pump was located behind a removable door in the bottom tier. Once the fountain was set up, minor adjustments to the pump pressure were made by moving a lever on the pump until the desired flow rate was achieved. The door was replaced and the fountain looked great. The dog was carefully watched to see what her reaction would be when the pump was turned on and water began to flow. There were no problems with the dog and the fountain at the time of construction and there have not been any problems since. In order to control algae, a product called Pond Block, (Active Ingredients: Copper sulfate pentahydrate 1.02%, diuron 0.51%) designed for
fountains and small ponds, was utilized. It is a small solid block which is placed inside the pump compartment as a safety precaution to keep it away from animals and children.

iv. The Plants

Armed with a list of previously selected plants, several local nurseries were visited. The majority of the desired plant material was located and, upon client approval, purchased and brought back to the property. Before planting, some time was spent laying the plants out taking into account, the dog’s favorite pathways. These areas were avoided. The majority of the plants were concentrated towards the parameter to minimize potential future damage. Osmocote 14-14-14, a slow-release fertilizer was used on all new plants. Osmocote contains encapsulated nitrogen, potassium and phosphorous granules which provide a controlled release of the nutrients for a period of 3-4 months. This fertilizer was applied at a rate of 1 teaspoon (6 grams) per plant. Freehand 1.75G, a pre-emergent herbicide, was used for the problematic weeds such
as: *Oxalis*, *Poa annua*, *Digitaria spp.*, *Conyza canadensis*, and *Euphorbia spp.*

Freehand contains the two active ingredients, dimethenamid-P: (S)-2-chloro-N-(1-methyl-2-methoxy) ethyl–N-(2,4-dimethyl-thien-3-yl)-acetamide (0.75%) and pendimethalin: N-(1ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzeneamine (1.00%). This material was applied in granular spreader at the labeled rate of 0.34#/100sqft. The 400 square foot garden required 1.36 pounds of Freehand. Natural bark mulch was applied to a depth of approximately 2 inches not only to give the landscape design a finished look, but to help with long term weed control, water conservation and as a way to help protect the new plant material from the client’s dog.

v. The Lighting

Landscape lighting was the final accent to the overall design. Solar-powered lighting was used to take advantage of the full-sun conditions of the landscape and to avoid any additional wires that might tempt the dog to chew. The two choices were the...
traditional low-voltage lighting or the newer LED lighting. The LED lighting required less energy, and that combined with the solar power made LED lighting a good green choice. Although plastic was available, the concern was that the dog could chew on the plastic lights. A durable metal in bronze was selected to complement the backyard. The placement of the lights was selected at night to determine the most logical places for the lighting, for both aesthetic and safety purposes.

c. Maintenance

The landscape was designed to be relatively simple to maintain.

General clean-up: A gardener comes once a week to do general clean-up and maintenance of both the front and back yards.
Weed control: Even though the preemergent herbicide, FreeHand 1.75G was applied and incorporated followed by a two inch mulch layer over the top, some weeds are expected to escape in the future. What few weeds appear will be mechanically removed by the client with a Hula Hoe.

Irrigation: For the new garden, drought tolerant plants were selected. An irrigation system with low precipitation heads was chosen for water conservation. Run times have been selected that will conform with the new City of Los Angeles Department of Water and Power regulations. Batteries for this system will be replaced yearly.

Lighting: The LED garden lights are solar powered and will not require any special care.

Fountain algae control: The manufacturer of Pond Block recommends replacement when blocks are fully dissolved. Treatments generally last approximately 30 days.
IV. Results and Discussion

Looking back, the irrigation was the hardest part of the project. The difficulty of digging ditches was underestimated and the difficulty of cutting and fitting the PVC pipes overestimated. The physical labor involved in this part of the project was more demanding than anticipated, especially when one takes into account the hot sun and high temperatures. In contrast, the PVC work was relatively easy. Attaching the pipes together was very simple and any mistakes were easy to correct.

Dealing with the customer was an interesting experience. On one hand, she is our grandmother and provided both food and ideas, but on the other hand, some of her desires for the area were not practical or achievable. She had to be convinced that sod was not a good choice due to water and maintenance issues. Also the reuse of the small stepping stones was not recommended for safety reasons. Financial considerations prevented purchasing as many plants as initially desired.

Perhaps the most underestimated factor on both the design and material selection was the presence of Ella. Everything chosen needed to be durable, safe and chew-proof. Her natural romping paths had to be taken into consideration and worked around, which cost both time and money.

According to the client, she has never enjoyed her backyard as much as she does now. She never before spent much time in her backyard but now she finds herself sitting outside every morning reading the newspaper on the patio overlooking her new, improved landscape. She enjoys the sound of the fountain and the fragrance of the lavender most of all. The dog also seems to enjoy the new
landscape. She romps, for the most part, along the new pathway but when she does veer off, the groundcover and mulch are relatively unharmed.
References


5. Anonymous. 2010. On February 15, 2010, the following web page provided information on drought tolerant plants and the colors they come in: http://www.squidoo.com/xeriscapes
6. Holsinger, Michael J. 2010. On February 15, 2010, the following web page provided information on drought tolerant plants:

http://www.swfwmd.state.fl.us/waterres/drought/articles/tough-plants.htm


http://www.irrigationtutorials.com/dripguide.htm
# Appendix

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Landscape Plan</td>
<td>24</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Irrigation Plan</td>
<td>25</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Freehand Label</td>
<td>26</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Osmocote Label</td>
<td>27</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Roundup Label</td>
<td>28</td>
</tr>
</tbody>
</table>
The Landscape Plan

Figure 1
The Irrigation Plan

Figure 2
Figure 3
**Suggested Application and Rates**

Product selection and application rates should be based on individual grower practices. Some factors that influence selection include:

- Climate
- Specific Crop
- Other Nutrient Sources
- Irrigation Type
- Rainfall Amount

For greenhouse applications Scotts recommends using low to medium rates. Contact your local Scotts Territory Manager for more information.

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**Surface Application Rates per Container (Grams)**

<table>
<thead>
<tr>
<th>Container Size (Volume)</th>
<th>Approx. No. of Containers per Cubic Yard</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in. Azalea (1.5 qt.)</td>
<td>539</td>
<td>3</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>8 in. Standard (1.75 qt.)</td>
<td>462</td>
<td>3</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>6.5 in. Azalea (1.8 qt.)</td>
<td>449</td>
<td>4</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>8 in. Mum Pan (3 qt.)</td>
<td>269</td>
<td>6</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>9 in. Mum Pan (1.25 gal.)</td>
<td>260</td>
<td>6</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>10 in. Hanging Basket (1.5 gal.)</td>
<td>166</td>
<td>10</td>
<td>23</td>
<td>36</td>
</tr>
<tr>
<td>12 in. Color Bowl (2 gal.)</td>
<td>150</td>
<td>11</td>
<td>26</td>
<td>39</td>
</tr>
<tr>
<td>12 in. Hanging Basket (2.25 gal.)</td>
<td>112</td>
<td>14</td>
<td>34</td>
<td>53</td>
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<tr>
<td>1 qt.</td>
<td>850</td>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>2 qt.</td>
<td>400</td>
<td>4</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Trade 1 gal.</td>
<td>300</td>
<td>5</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>1 gal.</td>
<td>210</td>
<td>8</td>
<td>18</td>
<td>28</td>
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<tr>
<td>Trade 2 gal.</td>
<td>125</td>
<td>13</td>
<td>31</td>
<td>47</td>
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<tr>
<td>2 gal.</td>
<td>102</td>
<td>16</td>
<td>38</td>
<td>58</td>
</tr>
<tr>
<td>3 gal.</td>
<td>70</td>
<td>23</td>
<td>55</td>
<td>84</td>
</tr>
<tr>
<td>5 gal.</td>
<td>52</td>
<td>31</td>
<td>74</td>
<td>114</td>
</tr>
<tr>
<td>7 gal.</td>
<td>35</td>
<td>45</td>
<td>110</td>
<td>169</td>
</tr>
</tbody>
</table>

**Larger Containers**

<table>
<thead>
<tr>
<th>Surface Area in sq. ft.</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 gal. - 17 in. diameter</td>
<td>1.4</td>
<td>55</td>
<td>133</td>
</tr>
<tr>
<td>15 gal. - 17.5 in.</td>
<td>1.5</td>
<td>59</td>
<td>143</td>
</tr>
<tr>
<td>20 gal. - 21 in.</td>
<td>2.3</td>
<td>90</td>
<td>219</td>
</tr>
<tr>
<td>25 gal. - 22.5 in.</td>
<td>2.8</td>
<td>110</td>
<td>267</td>
</tr>
<tr>
<td>30 gal. - 26.5 in.</td>
<td>3.8</td>
<td>149</td>
<td>362</td>
</tr>
<tr>
<td>45 gal. - 30 in.</td>
<td>4.8</td>
<td>188</td>
<td>457</td>
</tr>
<tr>
<td>65 gal. - 30 in.</td>
<td>4.8</td>
<td>188</td>
<td>457</td>
</tr>
<tr>
<td>100 gal. - 36 in.</td>
<td>7.1</td>
<td>279</td>
<td>677</td>
</tr>
<tr>
<td>200 gal. - 48.5 in.</td>
<td>12.8</td>
<td>502</td>
<td>1220</td>
</tr>
<tr>
<td>24 in. box</td>
<td>4.0</td>
<td>157</td>
<td>381</td>
</tr>
<tr>
<td>30 in. box</td>
<td>6.25</td>
<td>245</td>
<td>596</td>
</tr>
<tr>
<td>36 in. box</td>
<td>9.0</td>
<td>353</td>
<td>858</td>
</tr>
<tr>
<td>48 in. box</td>
<td>16.0</td>
<td>628</td>
<td>1525</td>
</tr>
</tbody>
</table>

**Other Larger Containers—multiply the actual container surface area in sq. ft. by these rates:**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>95%</td>
<td>39</td>
<td>95</td>
<td>146</td>
</tr>
</tbody>
</table>

---

**Incorporation Rates**

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lib. per cubic yard</td>
<td>3.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Kg. per cubic meter</td>
<td>2.1</td>
<td>5.0</td>
</tr>
<tr>
<td>Grams per liter</td>
<td>2.3</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**Landscaping Rates**

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lib. per 1000 sq. ft</td>
<td>7.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Kg. per 100 sq. m</td>
<td>3.4</td>
<td>6.8</td>
</tr>
<tr>
<td>Lib. of N per 1000 sq. ft</td>
<td>1.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Approximate Volume Measures**

<table>
<thead>
<tr>
<th>Scotts Yellow Spoons (level)</th>
<th>1 tsp. = 5 grams</th>
<th>1 partition = 15 grams</th>
<th>1 tbsp. = 15 grams</th>
<th>1/4 cup = 14 grams</th>
<th>1/3 cup = 14 grams</th>
<th>1 cup = 80 grams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Measures (level)</td>
<td>1 tsp. = 5 grams</td>
<td>1/3 cup = 95 grams</td>
<td>1/4 cup = 60 grams</td>
<td>1 cup = 160 grams</td>
<td>2 cups = 320 grams</td>
<td>4 cups = 640 grams</td>
</tr>
</tbody>
</table>

---

Figure 4
Figure 5