SLO Botanical Garden – Greenhouse Propagation Tables

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This paper describes the planning and construction involved in retrofitting the San Luis Obispo Botanical Garden propagation greenhouse. When trying to determine a senior project, the author of this paper met with multiple non-profit organizations. After interviewing with them, the author determined that the San Luis Obispo Botanical Garden was the organization he wanted to work with. After meeting with the facility director, Chenda Lor, many potential projects were identified but the organization determined this would be of the most use immediately. Upon selection, the scope of work was determined as helping refurbish the propagation greenhouse by removal and/or demolition of the tables in the existing facility as well as the installation of new propagation tables. This paper will explain in detail the planning, financing, and construction phases of the project. The author along with several peer volunteers completed this project over a 3-month period. Planning and financing of this project occurred during March and April of 2020 and Construction began in May 2020. The final product was delivered to the San Luis Obispo Botanical Garden propagation team on June 2nd, 2020.

Key Words: Construction, Propagation Table, Demolition, Refurbish, Greenhouse

Background

This project is located at the SLO Botanical Garden in San Luis Obispo, California. The SLO Botanical Garden is a non-profit dedicated to showcasing and preserving unique drought-tolerant plants from the five different Mediterranean climate zones of the world: the Mediterranean Basin, regions of California, Chile, Australia, and South Africa. Currently the non-profit is funded from donations and plant sales through the propagation team. The retrofitting and installation of uniform propagation tables will give the propagation team a more comfortable and more efficient use of space, helping the non-profit in its plant selling endeavors.

When determining a senior project, Garrett coordinated a meeting with Chenda Lor, the executive director at the SLO Botanical Garden. She showed him multiple potential projects but really expressed the need to retrofit the propagation greenhouse and install new tables. The existing space was an assemblage of various tables all different and disorganized. The existing space did serve its purpose, but it was an eyesore and didn't allow for the most

effective plant propagation. After meeting with the senior project director at Cal Poly SLO, Phil Barlow, it was determined that this would be a project worth pursuing that would help a great organization.

Throughout the project Garrett relied on advice from Chenda Lor with the SLO Botanical Garden, as well as Roger Henley and Mark English from Henley & Co., and additionally his subject matter expert, Phil Barlow with the Cal Poly Construction Management department.

Fundraising

Once Garrett determined that this was a project worth pursuing, he needed to determine a source of funding. The initial step in this process involved doing a rough material take-off based from a design that Chenda had requested to be used, in order to determine rough expenses. Per initial estimates, each propagation table would cost roughly $150-$200 with a discount from Hayward lumber. This included all wood, hardware (bolts, washers, screws, etc.), as well as the custom metal screen to be used as the tabletop, allowing for the plants to drain properly. Garrett was fortunate to have his family's business Henley & Co., willing to step in and help contribute $1200 to this project. The funding was used to purchase all tools and materials necessary in the building of this project. Working with this budget in the preliminary phase, Garrett determined that he would be able to build approximately 6-8 propagation tables.

This fundraising process is similar to the industry but on a much smaller scale. In the real world, a client would come to multiple builders with a rough idea and a budget. It is than up to us as construction managers to plan the best way to build a project that meets and exceeds the clients needs within the given budget constraint in a certain period of time.

Construction Process

Construction began immediately after funding was received beginning with material acquisition. The majority of materials including lumber and hardware were purchased from Hayward Lumber in San Luis Obispo. After a discount for the Cal Poly senior project was applied, a total of $730.13 of the funding was used for the main material purchase. In order to initiate the first phase of this project, some tools and accessories were purchased from Home Depot which totaled $216.46.

In order to determine the best approach to building multiple tables, a prototype was built on May 15th, 2020. A total of 9 man-hours were used during the prototype phase. After seeing

how things needed to go together, a more efficient “manufacturing process” was determined. With the assistance of volunteers, Garrett built all of the table-top frames on May 16th. This was the easiest process and allowed for efficiency with repetitive tasks of cutting lumber and screwing the frames together. On that day, 5 table-top frames were built with a total of 11 man-hours.

On May 19th Garrett and multiple volunteers cut all of the table legs and bolted them to the table-top frames. This activity took 7 man-hours but could have been more efficient with the use of more than one drill.

During the course of construction, Garrett ran into a problem trying to acquire the custom metal mesh that was identified for the table-top. This material was located at Cal Poly in the agriculture department but due to Covid-19 implications and campus closure, he wasn’t able to get what was requested. Garrett went to a few material suppliers and called custom steel manufacturer B&B Steel in Santa Maria, CA. After getting a quote for a custom steel top, it was determined to be to expensive and outside of the project budget. To improvise, Garrett came up with a solution to use high-rib metal lath as the table-top material. This would allow for more structural integrity than a material like standard 3.4 lb/sy galvanized expanded metal lath, while allowing water from the plants to drain properly. Additional supports were also added to the table-top frame to ensure that the tops wouldn’t sag when loaded with plants. The only material supplier that carried high-rib metal lath in the area was identified as El Camino Building Supply in Atascadero, CA. The cost associated with this material was $133.66.

After the solution to the table-top was addressed, construction continued on may 28th, 2020. The final finishes of the table were coming together. Garrett and a volunteer started by trimming the metal lath to match the dimensions of the table. Once each sheet fit the dimensions of the table, it was attached with wood lathing screws. Each table had 2 sheets of the high-rib galvanized metal lath to ensure the tables sturdiness. After the metal lath was attached, it was determined that a border would need to be placed around the perimeter of the table to satisfy two requirements: 1. Ensure the plants did not fall off of the table, and 2. Cover up any sharp edges on the lath, preventing the propagation team from getting cut while working. The border material was made of 1”x2” wood furring strips. On the 28th, 4 tables were completed with the contribution of 15 man-hours. The other two tables were finished in 7 man-hours on May 29th, 2020.

During the course of construction, Garrett and 5 other volunteers contributed a total of 52 man-hours to the project not including the planning and final delivery of the project. The costs incurred on the project were very close to preliminary estimate numbers with a total of $1202.46. Each table had an average cost of $200 at project completion. Provided below is a chart showing the distribution of funding used for the project.

Final Deliverables

The final deliverable of 6 tables for the propagation team was delivered to the San Luis Obispo Botanical Garden on June 2nd, 2020. Garrett and a volunteer used 2 trucks to transport the tables to the facility. Upon arrival, they assisted the propagation team with the refurbishment of the greenhouse. This portion of the project involved helping the team in moving plants and the existing tables that were in poor condition. Upon removal, they were replaced with the new tables. The tables exceeded the requirements set forth by the client and they were happy with the final product. Below is a picture of the greenhouse with the tables in place.

Lessons Learned & Industry Connections

This project taught Garrett invaluable skills including how to be a better builder, student, community member, and manger of not only construction but of people. As construction progressed, the building process of the tables continually gained efficiency. This is due to the manufacturing affect that is associated with any repetitive task. The project also gave the author an appreciation for the work that the nonprofit San Luis Obispo Botanical Garden does and for charitable work within a community that needed it during an unfortunate time. The women of the propagation team were very appreciative of the work.

Not only did the author gain knowledge in the physical practice of building, but also in the management of people. By organizing a team in a manner of efficiency, Garrett was able to build a successful project. In the construction industry, it is important to find a team that will work well together to complete successful projects. When it is time to work, it is important to have a strong team, but it is also important for the team to enjoy the task being performed and each other's company. With his project team, Garrett was able to achieve this working harmony that would be of benefit to any project in the construction industry.

Future Actions

The San Luis Obispo Botanical Garden is a great non-profit organization that is always working to improve the facility. If students need assistance in any future projects, the facility is always happy to accommodate. By using this project as a guide, students could pursue the option of building more table for the propagation team. I was able to build 6 tables working within my budget, but the facility would be happy to have even more. If building

propagation tables is not of interest, the organization has many other projects in need of assistance.

Figures

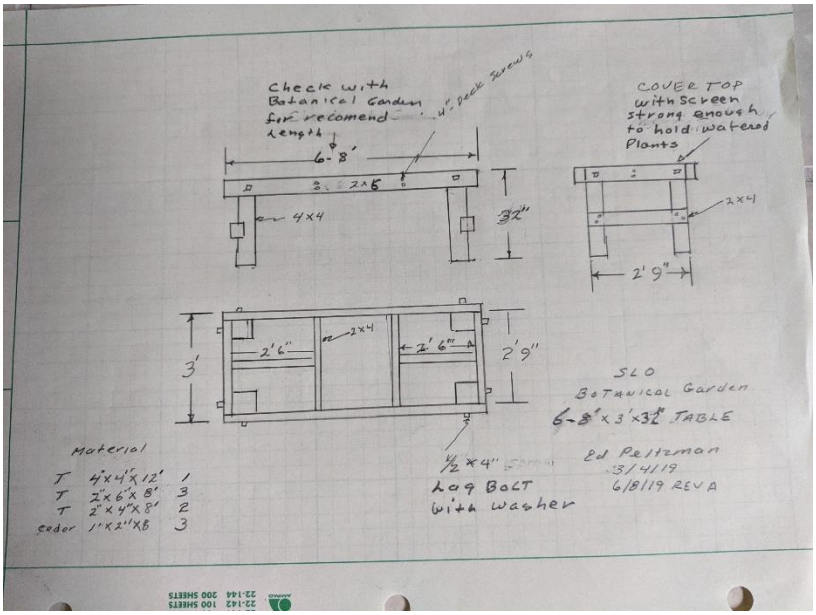

Figure 1. Preliminary table design used for budget estimate and construction planning

Figure 2. Material procurement from Hayward Lumber


Figures 3a. & 3b. Volunteers helping build propagation tables


Figure 4a. Completed propagation table & 4b. Propagation table inside greenhouse

Figures 4c. & 4d. Completed propagation tables inside the greenhouse

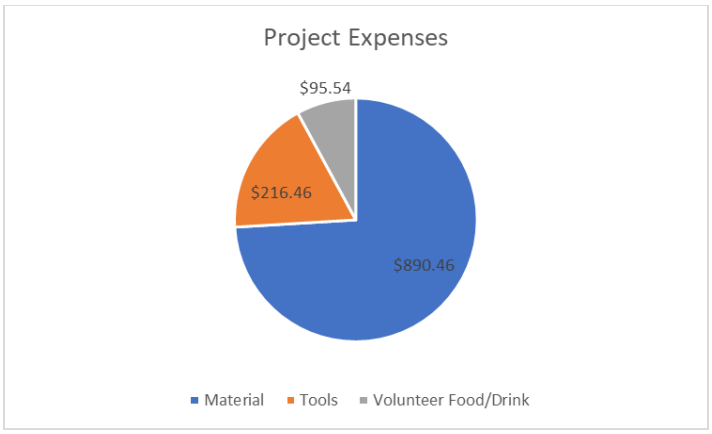

Figure 5. Pie chart showing distribution of funds used on project

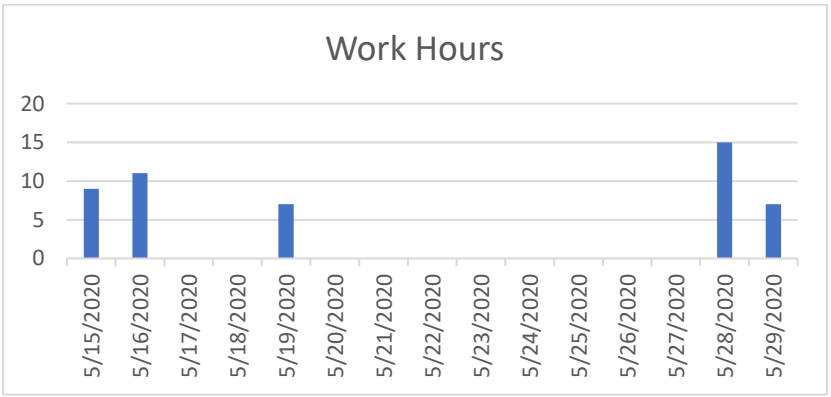

Figure 6. Construction work hour distribution (52 hours)