
**Resilience Team**

2016 Sustainability Action Research

Final Report

Adam Gushansky

Austin Park

Kathleen Knight

William Chen

George Yang

Stakeholder: Nurit Katz, Chief Sustainability Officer; Executive Officer, Facilities Management

**Resilience Planning**

*Introduction*

Over the past two quarters, the Resilience Team explored the emerging field of resilience planning and began to research best practices, with the hope of developing UCLA's own resilience plans. With the help of our stakeholder, Nurit Katz, we have been able to utilize existing university connections and forge new ones as we have ventured into largely unexplored areas of research, addressing an increasingly important issue. Resilience, as The Rockefeller Foundation defines it, is the "capacity of individuals, communities, and systems to survive, adapt, and grow in the face of stress and shocks, and even transform when conditions require it" (*The Rockefeller Foundation*, 2016). Our research concluded that UCLA is unprepared to deal with the level of risk posed by natural disasters and man-made frailties in infrastructure. We further recognized that climate change will exacerbate severity and frequency of the risks UCLA faces. UCLA can mitigate these risks through planning and proactive collaboration with key stakeholders, including staff, faculty experts, and outside experts such as Marissa Aho, L.A.'s Chief Resilience Officer (CRO). By developing a comprehensive, dynamic resilience plan, UCLA will prepare itself to meet current policy goals, minimize human suffering, develop a more integrated and supportive community, and further solidify itself as one of the world's most forward-thinking universities. Pursuant to that goal, our work has culminated with sharing our research findings and suggesting a list of stakeholders that will form the resilience planning task force at UCLA.

*Background*

As members of SAR's first Resilience Team, we relished the opportunity to start the conversation of resilience at UCLA. In recent years, "resilience" has turned into somewhat of an environmental buzzword; it can mean many things, but the definition we pursue here is more rigorous than responding well to emergencies. Much like the word "sustainability," resilience has systemic roots. It encourages intelligent growth in order to allow an area to adapt to change in all forms. True resilience requires preparation for unknown shocks and stressors. In light of this, resilience is closely linked with climate change. Sea level rise, shifts in weather patterns, and increased demand for energy and water are all outcomes that can threaten the stability of a particular region. By anticipating such changes and quantifying their respective risks, we can outline a plan to make our cities and college campuses more resilient.

Last year, Chancellor Gene Block signed Second Nature's Campus Resilience Commitment. This commitment entails creating a Climate Action Plan to increase resilience. Our stakeholder, Nurit Katz, used this as the impetus and the high-level backing to initiate resilience planning on our campus. This is a brand-new topic, and it is not at all clear how best to approach it. The planning process is staggeringly broad and comprehensive. It requires tremendous intellectual capital. It requires stakeholders and experts from many sectors of campus. It requires interdepartmental working groups, which can jointly allocate attention and resources to different projects. It requires structure and dedicated management to lead the process forward. And because the planning process is so intensive, by the time the first draft is published, it will be ready for an update; the resilience plan requires maintenance. Developing our own resilience plan was far beyond the scope of time-frame or knowledge of our Resilience Team. For that

reason, our goal was to research best practices and incorporate that knowledge in developing our own structure for a Resilience Task Force. This group will then create and maintain the plan over the next few years.

The first step in forming a resilience plan was to research best practices at other universities. Much to our surprise, not a single university that we contacted had established a comprehensive resilience plan for its respective campus. Several institutions--including the University of Connecticut and The Ohio State University--founded resilience centers, but did so in service of outside entities. The University of Massachusetts Amherst produced a comprehensive risk assessment for natural hazards, from which we utilized the meeting minutes in order to get a sense of which stakeholders were involved. Our findings were altogether underwhelming, and hence indicative of the urgency with which we must forge forward in establishing a resilience plan at UCLA.

*Methodology*

Our research on resilience started with a basic question--what is resilience? In its broadest sense, resilience is the ability of a system to thrive in spite of its challenges. In recent years, resilience planning has become more common in cities--especially those from The Rockefeller Foundation's 100 Resilient Cities initiative. As the effects of climate change compound, municipalities and universities have acknowledged the need for adaptation strategies in addition to mitigation. With over 45,000 students, UCLA is the largest University of California (UC) campus by population, but the smallest UC campus by area. It can be modeled as a small, densely populated city. Despite UCLA's reputation as a leader in academia, our

campus does not have an integrated resilience plan. This was evident when, in the summer of 2014, an LADWP water main ruptured under Sunset Boulevard and partially flooded UCLA's campus. Communication was sparse as well as delayed, and subsequently millions of dollars were lost in damages.

Our main source of information in regards to resilience planning guidelines came from The Rockefeller Foundation's *City Resilience Framework* (The Rockefeller Foundation, 2016). This document incorporates information from literature, case studies, and cities to establish guidelines which outline what makes a city resilient. It details twelve indicators, which describe "the fundamental attributes of a resilient city" (The Rockefeller Foundation, 2016). The twelve indicators fall into four categories: the health and wellbeing of individuals (people), infrastructure and environment (place), economy and society (organization), and leadership and strategy (knowledge). Each of the four categories has three indicators. Additionally, each of the twelve indicators are noted as having specific qualities which distinguish a resilient city from one which is simply sustainable and livable. The twelve indicators are as follows: minimal human vulnerability, livelihood & employment, and safeguards to human life & health (health and wellbeing); reliable mobility & communications, continuity of critical services, and reduced physical exposure (infrastructure and environment); finance including contingency funds, social stability & security, and collective identity & mutual support (economy and society); effective leadership & management, empowered stakeholders, and integrated development planning (leadership and strategy).

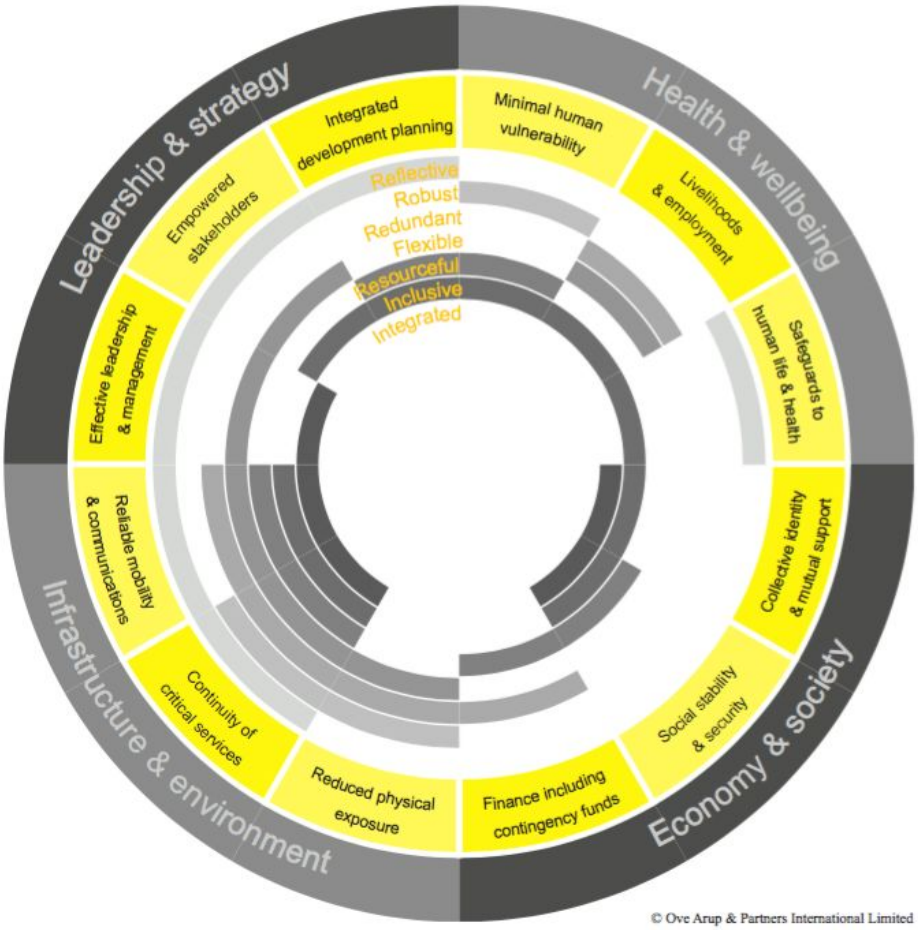


*Figure 1: The Rockefeller Foundation's Twelve Resilience Indicators*

These indicators are essential in our research process. Resilience can seem like a nebulous concept, but the indicators enable us to categorize the specific actions and plans of cities and college campuses that we assessed. The Foundation's 100 Resilient Cities initiative motivates 100 international cities to take the pledge to develop resiliency plans pursuant to the Rockefeller indices. Although the Framework was intended to be applied to cities, it nonetheless continues to serve as a useful tool to assess the resilience of both UCLA and campuses across the nation.

The 100 Resilient Cities Initiative helped provide the framework under which Los Angeles hired its first Chief Resilience Officer, Marissa Aho. At the end of Spring quarter, Austin Park and Nurit Katz met with Ms. Aho and several other resilience experts, including Andy Lipkis, founder of TreePeople; Heather Rosenberg, USGBC Building Resilience Program Leader; Claire Fox, sitting member on the LA Food Policy Council; Alicia Jones, Researcher at the Headington Institute; and Aaron Wong, consultant for HR&A Advisors. Collectively, they prioritized issues by potential short- and long-term impacts, as well as by magnitude of impact. It became immediately apparent that resilience challenges are interdependent, not isolated. For instance, poverty is highly entangled with the current state of the economy, welfare programs, mental health, education issues, food issues, and much more. Addressing one issue in isolation is fruitless. This meeting did more than education the Resilience Team on the complexity of addressing interconnected issues; it allowed the team to make valuable connections with members of the nonprofit and city government communities. These both proved valuable. Mr. Lipkis referred us to members at TreePeople who we hope will provide us with guidance in designing our stormwater catchment system.

As described in our Background section, various campuses have recognized the need for resilience planning. We decided to first research what other colleges in America had achieved; we felt that this would give us a sense of what had already been accomplished, what still needed to be done, and how UCLA would fit into this scale. Schools such as Harvard University stood out to us for their resilience planning in response to climate change threats, while schools such as UC Davis were notable for their extensive planning and training programs for specific events (in this case, the evacuation of equine facilities in the event of local natural disasters). Our team

further compiled a list of questions regarding the state of resilience planning on the campus level to survey other universities.

We then researched US universities that were in the process of becoming more resilient either through improving emergency management programs, or through related research projects. We contacted Colorado State University, Columbia University, Tulane University, University of Massachusetts Amherst, University of Maryland, University of Oregon, University of Connecticut, Harvard University, Ohio State University, and University of California, Davis. Of the 10 universities, we did not hear back from Columbia, UC Davis, or Harvard. From the responses we got, we learned that resilience planning on a campus level is still largely a new concept and that a comprehensive resilience plan does not currently exist. With that said, all universities provided our team with useful information and resources that will be constructive to UCLA's resilience planning. For example, University of Oregon has an Incident Management Team similar to the function of a Resilience Task Force that we want to assemble at UCLA (UO-IMT, 2016). UO Incident Management Team is connected to different departments with specific point of contact from each department. For UCLA Resilience Planning, we will refer to UO-IMT for the construction of our Resilience Task Force in terms of management structure.

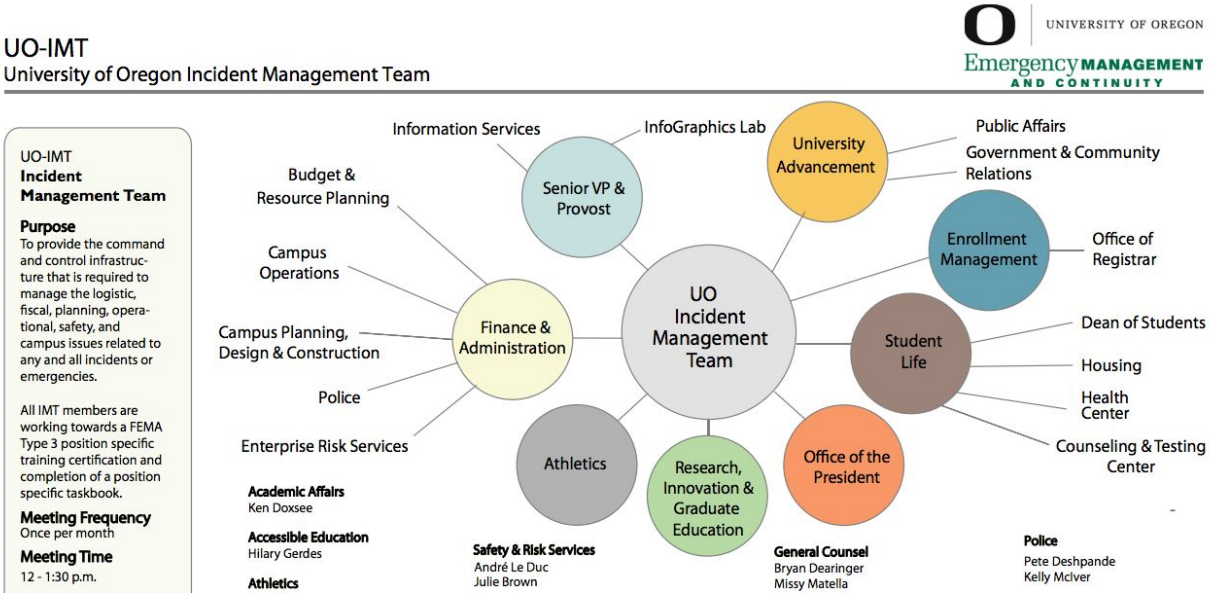


*Figure 2: University of Oregon's Organizational Chart*

UCLA's current state of resilience is robust in some areas, and insufficient in others. Services including the UCLA Police Department under UCPD, UCLA Fire and Life Services, UCLA EMT, the Ronald Reagan Medical Center, and the UCLA Office of Emergency Management provide direct response during emergencies. The UCLA Office of Emergency Management provides information regarding basic guidelines and response protocols, which are readily available online to the UCLA and local communities. The UCLA Bruin Alert System, a service of UCLA's Office of Emergency Management, has proved valuable in many instances. Just two days ago, on June 1st, 2016, an unforeseeable and devastating event took place. An incredibly misguided former UCLA graduate student murdered a professor and ended his own life. A shock wave of panic and fear tore through our campus. Rumors departed from truth, severely. There were reports of four coordinated gunmen with assault rifles and gunshots throughout every corner of campus, though nothing of the sort happened. The Bruin Alert system

did not provide extensive coverage, but it did provide the essentials. It relayed updates and gave instructions that kept the campus safe. Additionally, hundreds of brave first responders thoroughly and efficiently secured the campus. This was a dark day for our community, but it did highlight the strength of our emergency response planning.

However, there is still significant room for improvement. The areas we lack most are still in communication, community involvement, integrating pre- and post- disaster planning, and addressing long-term stressors. In the case of an emergency, UCLA is more likely to island itself than to integrate with the local community and share resources and knowledge. This is a weakness on both sides, and requires serious attention. Further, communication of emergency procedures could be improved. During the very recent campus lockdown, many professors were unprepared. Some professors reportedly continued lecturing, not realizing the gravity of the situation. Others were not confident or not fully aware of what steps they should take. UCLA's Office of Emergency Management has a website with information on what to do in emergencies such as hazardous materials spills, earthquakes, fires, or lockdown events. The information is simple and easily digestible. However, it is voluntarily read, which may account for low absorption among faculty. It also fails to address preparation or prevention. The UCLA Center for Public Health and Disaster appears provides a step in this direction; it provides instructions on preparing emergency medical kits and links to LA community resources. Post-trauma recovery services are advertised through many means. Following June 1st's murder-suicide, many of our team's professors and administrators have directly reached out to make us aware of counseling services. UCLA also has strong business continuity preparations under the Office of

Insurance and Risk Management. The planning lacks integration between pre-, mid-, and post-event procedures. Without this aspect, we cannot be deemed a resilient campus.

We were able to present our research to a group of stakeholders from different operational departments of UCLA. We opened up the conversation on UCLA resilience planning with representatives from office of emergency management, office of insurance and risk management (which also includes a business continuity planning committee), as well as health system's emergency management team. David Eisenman, a resilience researcher, director of the Center for Public Health and Disasters, and a professor at the David Geffen School of Medicine, also joined the discussion. With the help of Nurit Katz, we plan on expanding our research to incorporate the direct steps that UCLA needs to take in order to ensure a resilient campus. Before achieving this, however, we want to simply bring all relevant parties into the same room. Our goal is to encourage UCLA affiliates with an important voice on resiliency to join the UCLA Resilience Task Force, the main resilience planning body.

*Results and Discussion*

We have gathered useful information and resources that will be constructive to UCLA's resilience planning. Although none of the universities had completed comprehensive climate and resilience planning, we obtained valuable information on structuring task forces and conducting large-scale resilience planning. The University of Oregon's plan reinforced the importance of grouping together normally disparate operational departments for resilience planning on campus. After developing a preliminary list of stakeholders, we have two main tasks left: finalize members of the Resilience Task Force, and determine an effective working structure.

Our team also had the opportunity to attend several conferences about or related to resilience and sustainability planning. We went to a Los Angeles Regional Collaborative for Climate Action and Sustainability meeting in spring quarter to join a discussion about water policies, a topic central to both resilience planning and stormwater catchment. Our team members also attended Smart & Sustainable Cities Conference on campus on May 19th when Mayor Eric Garcetti voiced his commitment to a technology driven approach of building a more sustainable and resilient city. These experiences helped our team understand both the intricacy of building a resilient community and the dynamics between different stakeholders during such processes. Ultimately, we were able to modify our suggestions to better fit the real world situations.

*Challenges and Difficulties*

Within our resilience planning research, lack of resources was our central issue. This is the difficult and exciting reality of being a trailblazer. UCLA is among the first universities to attempt to develop a comprehensive resilience plan with consideration of climate change. No universities in the country have published a climate and resilience plan. Harvard is the closest, claiming they have a draft to be released at some undisclosed time in 2016. The next closest areas for study were existing, non-comprehensive resilience plans, and city resilience plans.Both of these alternatives have fairly robust resources available. When reaching out to different universities across the US, we found it difficult to contact universities. There was the consistent, expected lag time in response, but there was also a fairly high rate of nonresponse. Even more fundamental, there is a simple lack of knowledge. Few universities have developed resilience

plans. It also highlights but also to the lack of coherence and organization among administrators and faculty members involved in different types of emergency management departments, both educational and operational. We took this as further reinforcement that in order to establish sound resilience plans at UCLA, we needed to facilitate open communication and transparency.

Within the team, it was initially difficult get buy-in for the resilience planning project. Many team members were more interested in taking on a hands-on, tangible project. There were also concerns as to the amount of autonomy and control we would have on the project. It took some education on the team's part before we truly understood the scale of impact we could have, and the importance of the work. We were then more motivated and better able to make headway on resilience planning. Since then, we have made significant progress in forming a Resilience Task Force.

*Conclusion*

Our resilience planning research has the ability to catalyze a wave of resilience investigation, not just at UCLA, but nationwide. As mentioned before, we are conducting pioneering work in determining the structure and roles to be played by our Resilience Task Force. Regardless of the outcome of the planning at UCLA, our work will better inform other universities of methods and structure for resilience planning.

Within UCLA, the impacts could be truly enormous. This document will have the ability to prepare UCLA to thrive in the face of stresses and shocks more severe and unpredictable than any faced by previous generations. Since UCLA does not have a formal sustainability plan, the resilience plan will act as a goal-setting and scheduling mechanism for initiatives that concern

both resilience and sustainability. UCLA has goals for water, waste, carbon, construction, biodiversity, food, purchasing, transportation, community engagement, and education. The following is a non-exhaustive highlight of the most pressing and ambitious goals: We aim to reach zero waste by 2020 and carbon neutrality by 2025. We have set goals to reduce per capita potable water use by 36% before 2025. All of these goals are highly ambitious and require significant planning. Resilience planning may provide frameworks and schedules for accomplishing each of these goals. Furthermore, it has the ability to connect, combine, and streamline efforts to achieve each of these goals. Instead of working on each target in isolation, the plan will tie these goals together in a holistic manner.

Furthermore, combining climate and resilience planning will increase our ability to shoot for accurate targets. In light of the increasingly volatile climate, it is impossible to predict the future conditions. We cannot always anticipate timing or severity of stresses or shocks. Nevertheless, predicting conditions to the best of our ability allows us to set and achieve accurate targets, and to prioritize resource allocation. For example, if we plan to achieve carbon neutrality, we need to account for that fact that in the future we will experience more intense and common heat waves. This heat will amplify air conditioning use, which will amplify energy use, which will amplify our emissions. Furthermore, we must account for continuous university growth. Thus, if we aim to achieve carbon neutrality without accounting for an increase in energy demand we will under-plan and not achieve our goals. UCLA operational staff are required and expected to prepare the campus now for future conditions.

Resilience and sustainability are mutually-dependent. Full-scale planning will require considering a huge variety of resources and services that the university offers. However, as a

consequence of its breadth, it will require an intense, committed, and continuously updated planning effort, from many different parties. The effort will require expertise and time that extend beyond the scope of this year's resilience team. As a result, our goal is to create a task force—a group of stakeholders that we want involved in planning. We also want to establish a functional framework for planning. That is, identify who will meet, how frequently, and how to separate different components of the plan. The actual climate and resilience planning will then be led by experts over a much longer period.

Future resilience teams have wonderful opportunities in this realm. They can assist in the actual planning process in one of two ways. They can specialize in one area and working collaboratively with experts on that section of the report, or they can act as the interdepartmental glue, connecting different sections of the report and ensuring interdepartmental communication channels stay open. Additionally, future teams can perform evaluations of how effective this year's planning framework and group of stakeholders is. If necessary, they can add or remove stakeholders from the Resilience Task Force.

**Stormwater Capture**

*Introduction*

Upon establishing our focus of research for resilience, we decided to supplement our work with a tangible project. We held a couple of brainstorming sessions and came up with nine ideas, which we then presented to Nurit Katz for consideration. The prevailing project proposal, a stormwater capture system, filled an urgent need for UCLA and directly tied in with promoting resilience on campus. As it stands, UCLA does not have a system for capturing and repurposing stormwater in any capacity. (It does, however, house a five-million-gallon chilled water tank.) Our proposed 200,000 gallon cistern–estimated to collect about 1.22 million gallons of water annually–would supply our campus with an emergency water resource that can be replenished, and reduce UCLA's reliance on LADWP, which imports much of its water. Many of UCLA's critical services, like the Ronald Reagan UCLA Medical Center, research labs, and drinking fountains, require water. In 2013, the LADWP reported about three water main breaks per day (LADWP, 2016), a number that is expected to rise in the coming years. L.A.'s water infrastructure, much of which is approaching 100 years in age, is ill-equipped to deal with stress to the water distribution system. A rising urban population, coupled with intensified heat waves and droughts due to climate change, will only exacerbate the risk. An investment in local water resources is an investment in UCLA's water security. That starts with our cistern.

*Background*

Unlike our research into campus resilience, investigating water capture and reuse across university campuses proved to be fruitful. Among other precedents, The New Mexico Highlands University has installed a 90,000 gallon underground cistern, which supplements the University's irrigation supply. NMHU is also planning to add an additional 200,000 gallons of rainwater capture capacity in the near future (New Mexico Highlands University, 2010). On a smaller scale, students from The College of Charleston partnered with its Early Child Development Center, which challenged them to design water catchment systems and educate children on the benefits of water-saving techniques (College of Charleston, 2016). In addition to making a physical difference on campus, our project emphasizes the value of student work and education, and provides a living example of how, with support, students have the capacity to identify large-scale problems and drive meaningful, positive change.

*Methodology*

In addition to resilience planning, our team also worked on a rainwater catchment project. This project will take advantage of a valuable, free resource that is currently wasted to provide an emergency water source as part of the resilience planning. Also, this water retention program project falls directly in line with UCLA's Grand Challenges goal of 100% locally sourced water for LA County by 2050. Therefore, a pilot program would pave the way for a campus wide rainwater retention project that will have huge impact on the resilience of UCLA. The rainwater catchment system involves capturing precipitation from the roof of Boelter Hall, funneling the

rainwater into a cistern, and repurposing that water for irrigation in the interior courtyard of Boelter Hall.

In winter quarter, out of our nine hands-on project proposals, Nurit suggested pursuing a rainwater catchment system at UCLA. To begin the project, we conducted preliminary research to as mentioned in the background section above. After consulting with Dr. Don Kendall of the Civil and Environmental Engineering Department, we decided to narrow down the project to a pilot rainwater catchment system on Boelter Hall. We then met with Campus Architect Jeff Averill and Campus Engineer Carl Newth and received support to consolidate the design. With a preliminary plan in place, we proceeded to apply for funding of this project. Based on our initial research, we believed a 5000 gallon cistern would best fit our project in terms of financial feasibility and capacity. We came up with a budget of $20,000 accordingly and applied for TGIF (The Green Initiative Fund) in the winter quarter. Although we only had five days to work with between the conception of this project and the deadline of TGIF application, we managed to submit a complete application to the funding in time. However, due to a limited funding pool and a lack of consensus among the committee members, we were not able to secure the funding. With that said, we received positive feedback from the TGIF committee, which encouraged us to re-apply in spring quarter.

Another concern we had was the cost estimation of this project. Jeff Averill and Carl Newth estimated the total cost of this project would amount to about $100,000. Even with an increased pool of funding for TGIF in the spring quarter, the total available funding would be much lower than the estimate of Jeff and Carl's assessment. In short, we were unable to quote an accurate budgeting of this project due to a plethora of uncontrollable factors. Therefore, we

decided to pivot our project to be more nimble. Our main goal is to demonstrate the viability and sustainability of such a project. Based on the funding situation, we can easily pivot our project towards any of three different scales (with the original 5000 gallon cistern being the medium option). The smallest possible water catchment system to demonstrate proof of concept of such a project consists of rain barrels on a smaller roof. We would then be able to measure the efficiency of the system and calculate the payback period. So our smallest project scale is a system of 12 55-gallon rain barrels. On the other hand, Associate Vice Chancellor for Environment and Sustainability, Dr. Mark Gold, actually suggested that we install a one-million-gallon cistern. With a larger system, rainwater catchment will become more efficient and the amount of water reserve could potentially become a backup water supply in case of emergencies. We modified Dr. Gold's suggestion to make our largest project scope a 200,000 gallon cistern.

In spring quarter, we reviewed our winter TGIF application and made changes before re-applying. One major change we made was pivoting our project to three different scales. In addition to the original project idea we proposed in winter quarter (Option Two), we added a smaller scale rain-barrel system as a proof-of-concept (Option One), as well as a large scale rainwater catchment system with a 200,000-gallon cistern as Mark Gold suggested (Option Three). With three different project scales, we are nimble enough to implement the most fitting systems with the amount of funding we get. After doing research in the cost of components of the three different systems, the estimated costs for them are $4,900 for Option One, $21,075 for Option Two, and $83,000 for Option Three. We then examined several models for annual water catchment before Dr. Kendall provided us with the most relevant one in our case. With this

model, we estimated total water catchment will be 5,900 gallons for Option One, 47,000 gallons for Option Two, and 1,221,000 gallons for Option Three. Also, with more time on hand in spring quarter, we were able to better prepare for the TGIF hearing by brainstorming potential questions and their best responses. In winter quarter, understandably, some members on the TGIF committee could not get across the idea of installing rainwater catchment system in a drought-stricken area. So this time, we focused on a data-driven approach to convince the TGIF panel of the feasibility and effectiveness of a rainwater catchment system. Eventually we received $18,000 from TGIF for Option Three.

The timeline of this project will extend beyond the spring quarter, and the benefits from a rainwater catchment system are long-term. Our team plans to reach out to UCLA Facilities Management for installation of the cistern and other funding sources. We'll also be working with Jeff Averill and Carl Newth to come up with drawings. With structural design in hand, we expect the integration of the cistern with current drainage system to be no more than two weeks. After that, we will start measuring the efficiency of the system should precipitation occurs. Our team will follow up on this project and present our findings once we've collected enough data. And at that point, a reevaluation of this project will be performed to determine whether or not to expand the system.

*Results and Discussion*

Below are budgets for the three different water catchment systems. Note that Option Three, the largest scale system, was funded in preference to Option One and Option Two.

*Table 1: Budgets for three different scales of water catchment systems*

| **OPTION ONE** | | |
|---|---|---|
| **Item** | **Cost** | **Request** |
| 55 Gal. Rain Barrel with Brass Spigot x12<br>Link:<br>http://www.homedepot.com/p/FreeGarden-RAIN-55-Gal-Rain-Barrel-with-Brass-Spigot-EWC-10/204841191<br>Calculation: (12 barrels)($89.99/barrel + $8.10tax)=$1177.08 | $1177.08 | $1180 |
| Enclosure and construction site renovation costs | $1000 | $1000 |
| Installation labor costs<br>Calculation: ($20/hr/worker)(2 workers)(12 hours) + ($60/hr/manager)(1 manager)(12 hours) | $720 | $720 |
| Piping, sealant, elbow, and valve costs | $500 | $500 |
| Contingency costs | $1500 | $1500 |
| **Total**: | $4897.08 | $4900 |

| **OPTION TWO** | | |
|---|---|---|
| **Item** | **Cost** | **Request** |
| Cistern: Xerxes fiberglass 5,165 gallon cistern, below ground<br>Visual Representation of polyethylene cistern by Core-Roison<br>Link:<br>http://www.polyprocessing.com/pdf/ tank_offerings/ 11004925.pdf | $12,000 | $12,000 |
| Shipping cost | $1,000 | $1,000 |
| A) Installation costs<br>B) Estimation: ($20/hr/worker)(6 workers)(40 hours) + ($60/hr/manager)(1 manager)(40 hours) + ($85/hr/plumber)(1 plumber)(15 hours) | $6,075 | $0 |
| Piping, sealant, elbow, and valve costs | $500 | $500 |
| Contingency costs | $1,500 | $1,500 |
| **Total:** | **$21,075** | **$15,000** |

| **OPTION THREE** | | |
|---|---|---|
| **Item** | **Cost** | **Request** |
| 200,000 below ground Xerxes cistern | $38,000 | $20,000 |
| Shipping cost | $3,000 | $0 |

| | | |
|---|---|---|
| A) Capital Programs Planning Costs<br>B) Calculation: ($100/hr/engineer)(1 engineer)(40 hours) + ($100/hr/architect)(1 architect)(10 hours) | $5,000 | $0 |
| Installation costs<br>Calculation:($20/hr/worker)(6 workers)(120hours) + ($60/hr/manager)(1 manager)(120hours) + ($85/hr/plumber)(1 plumber)(40 hours) | $25,000 | $0 |
| Piping, sealant, elbow, and valve costs | $2,000 | $0 |
| Contingency costs | $10,000 | $0 |
| **Total:** | $83,000 | $20,000 |

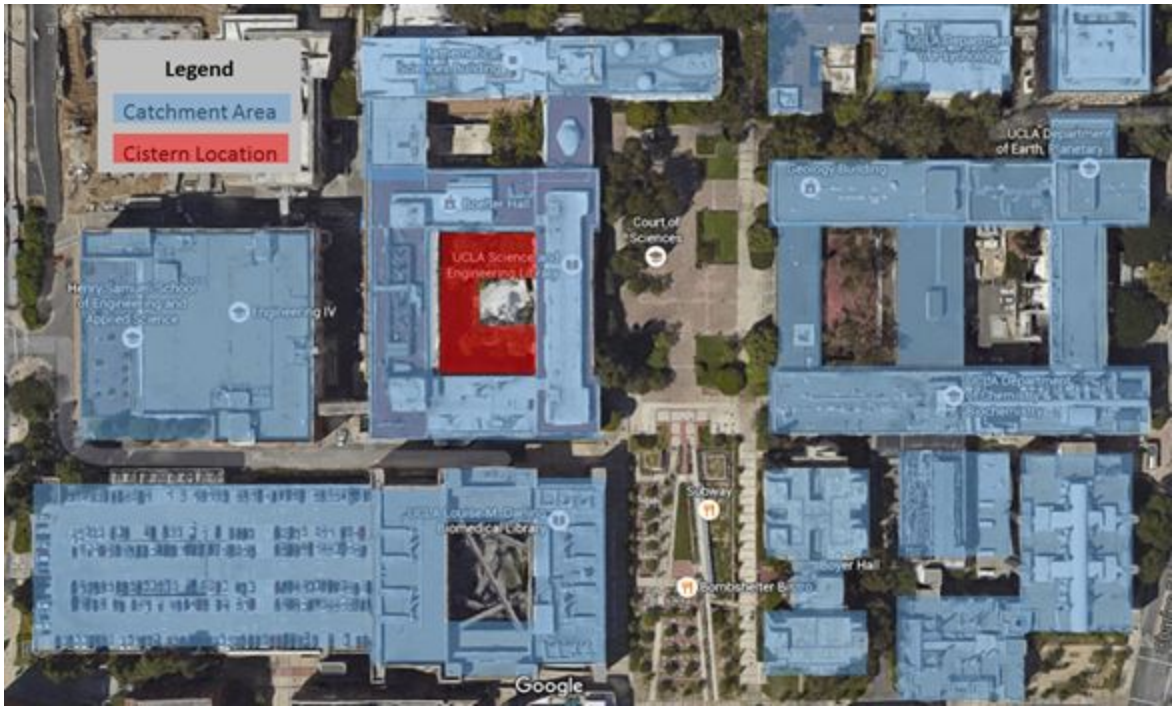


*Figure 3: Option Three Visualization. Blue indicates roof area from which rain will be collected. Red indicates cistern location.*

*Figure 4: Boelter Hall Interior Courtyard. The cistern will be placed around the protruding lecture hall.*

After a thorough investigation of cost and technical potential, we turned in our spring TGIF application and presented our case at a hearing on April 29th. The following is the closing statement from the proceedings, written and presented by Austin Park:

> *What is the value of our project? Education, water savings, and water security.*
>
> *First, education. Rain barrels always draw the eye, and cistern construction in the middle of Boelter Hall will certainly help people take notice. Simply creating our catchment system will provide free marketing for sustainability at UCLA and for TGIF. Additionally, including the catchment system in campus sustainability tours and co-programming cistern info sessions with TreePeople offers another avenue through which this project will ripples waves of education.*

*Second, water savings. Depending on the scale of the project we can fund, our water catchment system will capture approximately 5,900 gallons, 47,000 gallons, and 1,220,000 gallons each. We have extremely high water reduction targets—36% reduction by 2025. Every drop saved is important. Of course, it is useful to compare the gallons saved per dollar of investment. From this perspective, our project fits in the middle. It's not as cheap as drought tolerant landscaping retrofits, and not as expensive as building a desalination plant.*

*But it has far more value than any other water project because of its third benefit: improved water security. Just four days ago, a water main broke on Charles E. Young, causing flooding just uphill from Ronald Reagan Medical Center. Two years ago a much larger main broke, submerging Pauley Pavilion and Parking Lot 7 in several feet of water. LADWP's pipe infrastructure is old and corroded, which caused both of these breaks under normal conditions. I want you to imagine now that a magnitude 7.5 Earthquake hits Los Angeles—an earthquake for which LA is long overdue. All of the water mains serving UCLA break, causing flooding and completely cutting off our water supply. How do we provide water for the 70,000 people on our campus? The answer right now is, "we don't." That is neither resilient nor sustainable. We can do better, and that starts now, with this project, by developing resilient and sustainable infrastructure.*

We were extremely fortunate to receive an $18,000 grant from TGIF in order to begin building catchment system. This money will first be used to fund a professional engineering study that will determine a more detailed cost breakdown, timeline and description of the

technical solutions. Nurit Katz has agreed to help co-manage the project. It will either be managed by Carl Newth at Capital Programs, or by a manager within Facilities Management. There is also a strong possibility that we offer subcontracting to an engineering agency that specializes in stormwater capture and repurposing. Furthermore, the project opens a wonderful opportunity to connect with the Los Angeles-based nonprofit, TreePeople. Because TreePeople's 200,000 gallon underground cistern is similar to our proposed project, we may be able to emulate their designs to a great degree.

*Challenges and Difficulties*

When planning for the water cistern itself, we encountered some difficulties. Upon consulting with the campus architect Jeff Averill and campus engineer Carl Newth, we realized that a lot of our previous assumptions about constructing a water cistern project had been wrong. As a public institution, UCLA is required to follow a multitude of guidelines when hiring contractors and workmen, constructing new campus developments, and budgeting for projects. In this way, it was difficult for us to accurately estimate the overall cost structure of such a project. These revelations caused us to have to change our project timeline and budget, and lead us to reapply for TGIF funding in the spring with an almost entirely different project proposal. Due to the economic scale of our project, we focused on incorporating different levels of water catchment systems in order to emphasize the importance of water catchment at any size level, and to secure funding for at least one project. After receiving grant money from TGIF during spring quarter, our next challenges will be securing more funding to support and sustain our

project, and working together and with the necessary UCLA administrators to engineer and install our water cistern.

*Conclusion*

The stormwater capture project is still in its nascent stages, and has a long way to go before our campus can reap its benefits. However, with the goals we've established, in addition to the intellectual and financial resources we've gathered, our team is in a hopeful position to move forward. Our initial allocation of funding will allow us to hire a professional team of engineers to produce a project assessment report that will include a more accurate cost estimate and timeline. UCLA Capital Programs and UCLA Facilities Management will be our first points of contact. Once we consolidate our proposal, we will re-apply to The Green Initiative Fund as well as external funding sources, and shortly thereafter commence construction. Our current timeline estimates a project completion date of June in 2018. With the exception of George Yang, our team's only senior, Resilience Team members plan to follow through with the stormwater capture project well after the conclusion of this year's SAR program.

Our team's dedication to this project is a reflection of how strongly we feel about its potential impact on the UCLA community. It presents an opportunity for UCLA to secure an additional local water resource, while helping the campus approach its 2050 Grand Challenges goal of 100% locally sourced water (as well as other intermediate goals). Looking beyond the physical impacts, our hope is that this project will encourage other UCLA students to take on sustainability initiatives, no matter how grand in scale or resource-intensive. Should the project achieve completion, we plan to incorporate an educational component, which might include

organizing quarterly tours to inform students about the value of local water sources in light of the current drought in California and the compounding effects of climate change. Lastly, we will produce a fact sheet that we will present to the Institute of the Environment and Sustainability (IoES) to disseminate through social media. It is imperative that we use our platform as students to spread the word on our campus.

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