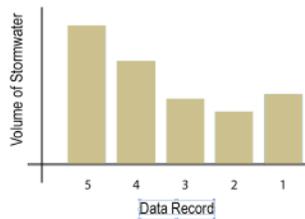


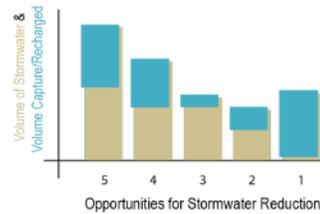
# WSAG17: *FOLLOW THE DROP*

## STORM WATER CURRICULUM, MOBILE APPICATION & RAIN GARDEN INSTALLATION

Stormwater Runoff



Stormwater Runoff & Volume Recharged





## **WSAG17: FOLLOW THE DROP – STORM WATER CURRICULUM, MOBILE APPLICATION, AND RAIN GARDEN INSTALLATION**

### **A. NARRATIVE**

#### **I. BACKGROUND & NEED**

In 2016, the Hawai`i Community Foundation (HCF) published *A Blueprint for Hawai`i's Water Future* that established quantitative Freshwater Initiative (FWI) goals for Hawai`i to be achieved by 2030 to safeguard Hawai`i's future water security. According to this HCF publication overall goal is to provide “100 million gallons of water per day (gpd) of new capacity to help manage risk, increase the predictability of our water supply, and make all of Hawai`i's freshwater supply more reliable and secure over the next 15 years.” To meet this goal the following actions are recommended:

- *Conservation* - Increase water efficiency by 8%
- *Reuse* - Double the volume of recycled water use to 30 million gallons per day
- *Recharge* - Increase storm water recharge within key watersheds with a goal of 30 million gallons per day of increased groundwater

There is an urgency to begin addressing these goals. According to scientists at the University of Hawai`i, statewide, annual rainfall has decreased by 18% and is projected to continue to do so under the auspice of climate change and with higher temperatures increased evapotranspiration rates are also expected. This all correlates to less water getting into our aquifers. Moreover, significant land use changes, in forest composition as well as increased urbanization, also decreases the amount of rainwater from entering into groundwater supplies. Currently Oahu, Maui and Hawaii islands each have designated areas where the percentage of sustainable yield of groundwater is approaching its maximum sustainable water withdrawal. These areas are also correlated to urban centers where population is also expected to continue to rise. Collectively these occurrences point to the need to implement the FWI goals. The FWI will require legislative and regulatory action, which has already been underway, however public outreach and education will also be critical so that there is public support and assistance to meet these goals. One of the identified actions in Hawai`i Community Foundation's (2015) *A Blueprint for Hawai`i's Water Future* publication is *education*. It states that education is needed “to insure consumer awareness of the origins and importance of freshwater as well as the need to conserve it as a resource.”

**Our goal is to create an educational program in alignment with the Freshwater Initiative goals and that demonstrates public-private partnerships.** The proposed *Follow the Drop* program aims to bridge the Freshwater Initiative goals into Hawai`i's classrooms and communities. The overarching goal is to unite and lay the foundation of knowledge for Hawai`i's youth to develop critical thinking skills and solution-based opportunities to meet our state's



water security goals. Although it is envisioned that the *Follow the Drop* project will eventually include all three of the Freshwater Initiative goals, *Recharge* was selected as the first focal point for the project development. As part of the proposed project we will also be installing (2) rain garden that could have direct measurable benefits of recharging up **232,000-305,000 gallons per year**.

## II. PROJECT PARTNERSHIPS

**Kupu (Principal Investigator):** Established in 2007 as a Honolulu-based 501(c)3 non-profit, Kupu empowers future generations to create a more sustainable, *pono* Hawai'i. The organization provides hands-on training programs that educate and mentor youth to become stewards of our culture and environment, helping them develop a strong connection to the place in which they live. Kupu's mission is "to empower youth to serve their communities through character-building, service learning, and environmental stewardship opportunities that encourage *pono* (integrity) with *ke akua* (god), self, and others."

Kupu's Environmental Education Leadership Program is aimed towards engaging students and the community in meaningful, educational hands-on activities and curriculum that broadens their knowledge of conservation and sustainability, encourage community service, and help to inspire the beginning of higher education and green careers. This program provides learning opportunities for the next generation and offers valuable skills that positively impact their lives and communities.

In Hawaiian, the word *kupu* means to "to sprout, grow" providing the backbone of the non-profit's efforts to revive the people, land and the sea across Hawai'i. Kupu's work has been likened to the role of the *Kupukupu* Fern which is one of the first plants to cultivate the land after a lava flow. The fern not only serves as a foundational species for rebuilding a healthy, native ecosystem, but it also symbolizes a place where knowledge can grow.

**Polynesian Voyaging Society:** Founded on a legacy of Pacific Ocean exploration, the mission of the Polynesian Voyaging Society (PVS) is to perpetuate the art and science of traditional Polynesian voyaging and the spirit of exploration, through experiential educational programs that inspire students and their communities to respect and care for themselves, each other, and their natural and cultural environments. PVS was established in 1973 as a non-profit research and educational corporation based in Honolulu to perpetuate traditional Polynesian voyaging methods. Hōkūle'a was the organization's first voyaging canoe to cross the Pacific over 40 years ago, demonstrating the revival in art and practice of traditional Polynesian navigation. The focus of their Worldwide Voyage is to care for Island Earth, to *Mālama Honua*.

PVS is sailing Hawai'i's iconic voyaging canoe, Hōkūle'a, using the stars, sun, and swell to guide their journey around the world, relying on signs from nature and ancient wisdom to guide these voyagers to each destination. Over the course of the multi-year *Mālama Honua* Worldwide Voyage, crew members have been sailing the Earth's oceans to visit and learn from those who are working to solve some of the greatest challenges we face in the world today.

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Included in this challenge is access to clean water. PVS believes that we are responsible for the future health of our Island Earth, and the health of our people, lands, and oceans. An integral component of the mission of PVS and the Worldwide Voyage, is to educate the youth to be responsible, sustainable stewards of our Island Earth home. Some of the programs that PVS offers and manages with its partners and supporters, include the global *Mālama Honua* movement, which curates and shares Stories of Hope from global and local communities. These stories offer hope and are a source of inspiration for us to act now. The stories help us understand how indigenous and local wisdom can guide us in solving some of the greatest challenges we face as a global society today. Other local programs PVS and partners offer include: *Crew Training* in the art and traditional practices of Polynesian Navigation, *Canoe to Classroom*, which is a series of learning experiences that connects crew members (while at sea) to their adopted schools and organizations, and *Wa‘a Talks*, an education-driven teacher-focused series that is community-grounded and globally-connected. *Wa‘a Talks* also combines STEM+Citizen Science Professional Development and is hosted by various education partners in the state.

The *Follow the Drop* project is a target goal directly supported by the Polynesian Voyaging Society and other partnering organizations in the Promise to Pae‘Āina Island Home Commitment, as it provides tools to “improve watershed health in the wao kanaka through coordinated action for sustainable and resilient communities.” These tools will be accessible, and easy-to-use resources for Hawaii’s public school educators to integrate into their respective sustainability initiatives and education curriculum. The project also works towards achieving the State of Hawai‘i’s Freshwater Initiative goals by the year 2030, as mentioned above. The overarching goal is to unite and lay the foundation of knowledge for Hawai‘i’s youth to develop critical thinking skills and solution-based opportunities to meet our state’s water security goals.

This project allows educators to easily integrate lessons on sustainability into their curriculum, and gives them the resources to adequately prepare our youth in leading our state towards a more sustainable future. Through our partnership network and collaboration, we are committed to the development phases and assisting the leaders in this project, and are excited to help in shaping a toolkit that will prepare and inspire Hawaii’s youth to fulfill the workforce needs of the future, while at the same time engaging adult participation. Our planet is facing many challenges and now is the time to be creative in our solutions. Our role in the *Follow the Drop* project is to help with the outreach of the program via Hōkūle‘a’s Statewide Sail (anticipated 2017 - 2018) and PVS’s extensive partnership network. We will assist in engaging with grassroots community networks, local schools and like-minded organizations that reflect innovative educational solutions and community engagement.

**Promise to Pae‘Āina (P2P)**: As Hōkūle‘a sails the Worldwide Voyage (WWV) and makes her way home to Hawai‘i, a main focus is to compel the global community to acknowledge that the issues facing our environment are ultimately shared problems, for which we must devise shared solutions. Underscoring this need, the Hawaiian canoes Hōkūle‘a and Hikianalia are sailing to locations throughout the world to seek out the worlds’ great leaders, or navigators, whose bold and innovative solutions are being put to task. Consequently, the natural questions arise: what does this mean for our home, Hawai‘i? During a Worldwide Voyage with worldwide

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implications, what will be done to improve our place? And how will the Hawai`i that the wa`a (canoe) comes home to be different from the Hawai`i we left behind four years prior? In response to these questions, 20 marine resource management organizations, spanning the federal, state, local government and private sectors, came together and penned the **Promise to the Pae`Āina** (the Hawaiian Archipelago) o Hawai`i. Today, more than 60 organizations and 150+ individuals have committed to and are supporting this unique collective impact initiative. The *Follow the Drop* project is a target goal directly supported by the working group of the Promise to Pae`Āina Island Home Commitment, as it provides tools to “improve watershed health in the wao kanaka through coordinated action for sustainable and resilient communities”, which is one of the targets of this commitment. The project further reflects how collaborative work can produce tools to advance the work of *mālama honua*, as it is a means of accomplishing one of the sub-target goals we set out for Our Island Home Commitment, while at the same time creating space and opportunities for new relationships.

**Roth Ecological Design International:** Roth Ecological Design International (REDI) is a leader in strategic water planning and green infrastructure design to provide innovative solutions that address the global challenges of the 21st century to manage both water quality and quantity. *REDI’s mission is to (re)connect developments to sustainable water management practices that biomimic the site’s natural hydrology, enhance resiliency and are regenerative by design.* To do so the hydrological, ecological and cultural and land use history of the site are analyzed to determine appropriate solutions for maximizing water security and pollution prevention practices. REDI’s goal is to provide a platform of solutions and tools that produce rather than reduce water resources by returning ecosystem services back into the built environment to restore water quality and build water resiliency, while also developing comprehensive water portfolios for communities and developments that meet triple bottom line principles.

A recent tool REDI developed in 2016 is a data collection mobile application coined, *Follow the Drop*, that was designed with the Freshwater Initiative principles in mind. REDI uses its mobile application with its clients to collect data and identify opportunities where conservation, reuse, and recharge could be achieved on their properties. Specifically, for this proposed *Follow the Drop* – Storm water project, REDI would further develop its *Follow the Drop* mobile application (app) tool to incorporate storm water data and green infrastructure analysis to extend its value as a decision-making tool for schools to identify opportunities to increase *recharge* on their campuses and within their communities. REDI will also participate in the teacher trainings to present the Freshwater Initiative goals, introduce the mobile app as well as provide technical assistance for developing the storm water curriculum and rain garden design.

**NOAA - Office of Coastal Management:** NOAA’s Office for Coastal Management is the federal agency tasked with implementing the Coastal Zone Management Act, the Coral Reef Conservation Act and the pending Digital Coast Act. NOAA OCM oversees the implementation of programs focused on the best ways to address storm preparedness, erosion, development, habitat loss, sea level rise, public access, and threats to water quality, to name a few. It supports



decisions and actions taken to keep the natural environment, built environment, quality of life, and economic prosperity of our coastal areas in balance. NOAA OCM will be supporting the project by providing technical assistance to access and utilize NOAA’s rainfall data to be incorporated into the *Follow the Drop* mobile application.

**The Nature Conservancy:** Through The Nature Conservancy’s extensive networks with watershed partnerships and management groups across the state, and various partnerships with community groups in Maui Nui and Hawaii Island, as well as our field staff and conservation programs on Oahu, Molokai, Kauai, and Hawaii Island, we will disseminate and promote this app and integrate it as an outreach and educational tool as well as explore how it can be used as a decision-support tool in hydrologic data-limited regions. Also, as a member of the Hawaii Conservation Alliance, we would find it very practical and useful to incorporate the data generated through this app and share it publicly via watershed groups and landowners and community stewards that want to initiate or improve watershed management in their respective ahupua’a.

### ***Leveraging our Public-Private Partnerships***

We aim to leverage our public-private partnerships by weaving together the skills and connections each of the partners offer to further develop the *Follow the Drop* app and Storm water curriculum to educate the community about the Hawaii Freshwater Initiative and specifically the importance of *recharge*. The *Follow the Drop* app and Storm Water Curriculum will be piloted and tested by incorporating it into a minimum of four schools where the Kupu Environmental Leadership Program is already established. The Kupu Environmental Leadership Program presently works with thirteen schools that serve K-12 students. In addition, the *Follow the Drop* program will be packaged and provided to PVS where it will be outreached into schools statewide via Hōkūle‘a’s Statewide Sail in 2017-2018. Moreover, with TNC’s support, the *Follow the Drop* program will be expanded into statewide watershed groups to further data collection and analysis outside of the classroom as well.

## **III. SCOPE OF WORK**

### **i. Project Summary**

The *Follow the Drop* project seeks to develop educational awareness of the Freshwater Initiatives, specifically for storm water and opportunities to support the *recharge* goals. To initiate this, it is proposed to pilot an innovative, educational program that utilizes and builds upon Roth Ecological Design Intl.’s *Follow the Drop* mobile application, by developing and piloting a storm water curriculum geared toward 5th grade level, including installing up to two rain gardens at two distinct schools. To enhance the potential impact, we are also leveraging the partnership with the Polynesian Voyaging Society (PVS) to take this educational program statewide by incorporating *Follow the Drop* program outreach during Hōkūle‘a’s Statewide Sail currently scheduled for 2017-2018.

## ii. **Methodology**

The project includes the following methodology to pilot the *Follow the Drop* program.

### Follow the Drop – Storm water Curriculum

Our team is seeking funding to develop the *Follow the Drop* - Storm water curriculum, which we aim to publish to be accessible to schools statewide and beyond. The *Follow the Drop- Storm water* curriculum would use the school campus as a mini-watershed. Where does the water come from? Where does the water go? What is storm water? How might this impact the watershed? Where are the opportunities to close-the-loop and recharge or capture storm water onsite? Students will learn about Hawaii’s Freshwater Initiative and how to identify (grey) storm water infrastructure features and identify those that could become “opportunities” to implement green infrastructure best management systems (such as rain gardens and rain catchment) to capture or recharge the storm water onsite.

The *Follow the Drop*: Storm water Curriculum, Mobile Application, and Raingarden Installation project will include the following main components:

- Two (2) *Follow the Drop* Trainings: Introduction to the Freshwater Initiative and the *Follow the Drop* program, lessons, and curriculum.
- Kupu Environmental Education Leaders deliver curriculum and lessons to students and community, in partnership with trained teachers and partners.
- Students participate in *Follow the Drop* lessons and projects: school facility and home assessment, designing and planning a storm water catchment or rain garden system.
- Four (4) schools will participate in the *Follow the Drop* program (app and curriculum); Two (2) schools will participate in building a storm water catchment or rain garden system.
- *Follow the Drop* partner's outreach to their network and communities.

**Kupu’s Environmental Education Leadership Program** selects and trains college graduates in fields of natural resource and environmental management or related areas to provide environmental education to students in K-12 grades. Environmental Education Leaders provide schools, teachers, and students extra support for school-wide environmental or sustainability projects, field trips to cultural or conservation sites & guest speakers, and day camps during school breaks. Kupu Environmental Education Leaders will assist to deploy the *Follow the Drop* curriculum to select pilot schools, including trainings and coordination of lessons, assignments, and raingarden installation projects.

Kupu identifies and partners with schools who have a supportive principal with a strong interest in the Environmental Education Program, a supportive teacher is critical to the program success. Four (4) schools will participate in the *Follow the Drop* curriculum, two (2) schools will obtain the storm water catchment or rain garden system. Ka’ewai and Lanikai elementary schools have committed their participation as the two pilot schools for the *Follow the Drop* program, which includes teacher training, mobile application and curriculum, and construction of a campus storm water catchment or rain garden.



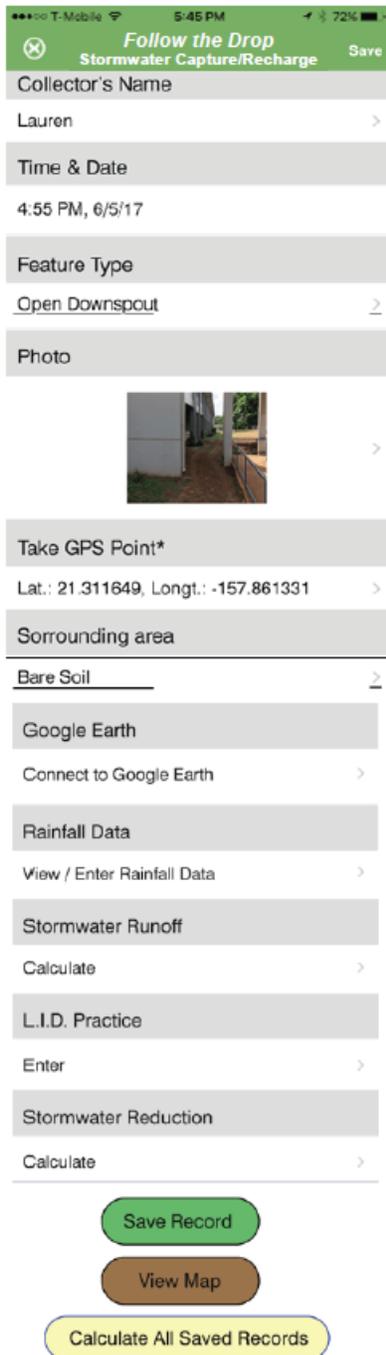
**Training** will include the 5th grade teachers of each of the four (4) schools and the partners listed above: The Nature Conservancy, Polynesian Voyaging Society, and NOAA, and Kupu Environmental Education Leaders. REDI and Kupu will coordinate and facilitate both trainings, including follow-up support throughout the project duration.

**Curriculum Development** for *Follow the Drop* will be geared for the 5th grade level, with the hope of adapting the curriculum to meet higher grade levels at a later time. The curriculum will adhere to the following educational standards to meet Hawaii’s Department of Educational needs: Next Generation Science Standards (NGSS), Common Core State Standards, Hawaii Content & Performance Standards III, and Na Hopena A’o (HA).

### Follow the Drop- Mobile Application

As part of the funding request, it is proposed to further develop Roth Ecological Design Intl.’s *Follow the Drop* mobile application (app) so that it can be used as a data collection and analysis - decision tool to support the *Follow the Drop- Storm water* curriculum. REDI initially developed the app as a data collection tool to undergo site water assessments following Freshwater Initiative principles of Conservation, Reuse, and Recharge. REDI piloted this data collection mobile application with several schools including Kamehameha Schools’ primary campuses located on Oahu, Maui, and Hawai`i Island. The updated version of REDI’s *Follow the Drop* app would build upon the data collection features to allow for it to also include data analysis within the app. By incorporating the data analysis inside the app, users would have an easy to use “decision tool” to evaluate and compare opportunities for recharging storm water on their properties. It is proposed to use REDI’s software engineer contractors who have over 8+ years’ experience in mobile application software development to further develop the *Follow the Drop* mobile application.

It is envisioned that once the *Follow the Drop* app is upgraded to include the analysis tools, that piloting the app’s use in schools would provide an opportunity to test the app as well as provide hands-on, experiential learning opportunities for students to learn about the complexities of water management and Hawai‘i’s Freshwater Initiative in an easy-to-use tool.



As part of the *Follow the Drop* - Storm Water Curriculum, students will learn about storm water runoff and how to identify types of drainage infrastructure (downspouts, catch basins, etc.) and landscapes that might contribute to storm water generation and/or pollutants. The *Follow the Drop* app would then allow the learners to identify these features and collect “opportunity” data points around campus to mitigate the effects of storm water runoff as well as recharge the resource back into the ground. All of the data points would include photo(s), summarized notes and data, and have a GPS reference so that the data could be exported and stored onto a map. For each data point, the collector could select the “drainage area” tool in the app and connect to mapping software (such as Google Earth Pro) to measure the drainage area, from the roof or parking lot for example, that is draining to the opportunity identified. This area would be recorded in the app and used as part of the embedded data analysis. The user would then click on the “rainfall” link and using the GPS coordinates the rainfall for that area will be automatically calculated (for example, by incorporating the NOAA rainfall data tools). Following both measuring the drainage area and collecting the rainfall data, the app user could then press “calculate” to see how much storm water volume is generated at that location. Multiple data points could be collected and analyzed in this way and then compared. The app’s “compare” button would compare for example storm water volumes between the data points. This would output into a bar graph. Next the user could input which type and size of a green infrastructure best management practice (rain garden, rain catchment, etc.) they would want to implement and the bar graph would show estimated storm water runoff reduction. The embedded data analysis in the app, would allow for not only data points to be collected and congregated into a single map for the campus to identify future *recharge* projects, but also be used as a decision-making tool to identify and prioritize these potential projects, offering real-world critical-thinking skills.

### Curriculum Implementation

Kupu Environmental Education Leaders will work with teachers and students throughout the spring semester of the 2017-18 school year to plan and deploy the *Follow the Drop* curriculum schedule that works best for each class and teacher. Ideally the Kupu Leader will meet once every 1-2 weeks with each class on surveys, assessments, and elements of the mobile application. *Follow the Drop* curriculum is rich with project-based learning, where students will learn through meaningful hands-on projects. Content areas such as math, science, engineering, and language arts are embedded throughout the curriculum. These areas will incorporate 5th grade standards in Next Generation Science Standards (NGSS), Common Core State Standards, Hawaii Content & Performance Standards III, and Na Hopena A’o (HA).

### Rain Garden Implementation

After all the data points have been collected, analyzed and mapped using the *Follow the Drop* app, as part of the curriculum, the faculty and students will identify the best location for implementing a rain garden to recharge storm water at this location. It is envisioned that materials and equipment to build the rain garden be covered by the requested funding, however an in-kind match would be provided by involving the students and the community in implementing the rain garden. It is proposed that the funding also cover the development of curriculum for the rain garden such that the rain garden would have continued use for project-based learning opportunities after installation. Post-construction learning opportunities would also insure that the garden is maintained after its installation.



### Curriculum Outreach to Statewide Schools

Höküle‘a will be returning to Hawai‘i in June 2017 after her inaugural voyage around the world promoting sustainability and preservation of culture. Shortly after her return in September of 2017, Höküle‘a will begin another Statewide Voyage which is expected to last one-year. Leveraging our partnership with PVS, we plan to first launch outreach materials regarding the Follow the Drop - Storm water curriculum so that when Höküle‘a is launched, outreach for the program will travel with her. As the storm water lesson plans are finalized by December 2016, it is envisioned to then package this curriculum so that it can also be introduced into the communities and schools that PVS will be engaging with during this Statewide Voyage.



## Curriculum Feedback

Using Kupu’s existing framework for teacher/school feedback, a survey will be provided to the participating schools to rate and provide feedback on the *Follow the Drop* storm water curriculum. During the first training, participants will have an opportunity to contribute to the curriculum where they feel would be best integrated and supported in the *Follow the Drop* program.

Upon completion of the *Follow the Drop* program, participants (students, teachers, and partners) will give feedback on the program, where all areas of the program will be scrutinized. Adjustments will be made to optimize the program’s goals, curriculum, delivery, and mobile app components.

### **III. POSSIBLE SHORTFALLS**

We believe that overall there should be great success with the implementing the project and that integrating the pilot into schools will be streamlined. One potential shortfall, could be the schools’ access to technology tools such as ipads for the students to use the *Follow the Drop* app. In foreseeing this as a potential issue, Kupu will provide in-kind support by providing up to four ipads for the classrooms to access and use the *Follow the Drop* mobile app.

### **IV. EXPECTED RESULTS**

We expect the results of this initiative to be significant and far reaching. To date there has been limited public outreach regarding the Freshwater Initiative and education on the complexities of water management and importantly actionable solutions the community could provide to help meet the water security goals. We believe this innovative program that addresses this educational gap will initiate the educational building blocks necessary to build capacity in the community as well as support needed to meet the Freshwater Initiative objectives. Moreover, due to the innovative nature of the program and via the partnerships formed, there is the potential for great impact even beyond Hawaii.

## Measurable Benefits

Due to the timeline and available funding of the WSAG 2017, it was decided to focus the installation of the rain gardens at two of the four schools where the *Follow the Drop* Storm Water Curriculum will be piloted. Lanikai Elementary and Ka’ewai Elementary were selected to install the rain gardens since these schools are representative of two different climates and locations within the watershed and both have existing environmental programs that could be enhanced with the inclusion of the rain garden. Ka’ewai Elementary is located in the middle of Kalihi watershed, adjacent to Ka’ewai stream, and has an annual rainfall of 54 inches. Lanikai Elementary is located at the bottom of Kaelepulu watershed near the coast with an annual rainfall of 34 inches.



Average building roof areas for Ka’ewai Elementary are between 5000-6000 sf. and annual rainfall for Ka’ewai Elementary is 54 inches. Assuming the rain garden would be applied to mitigate storm water from one of these buildings, the measurable benefit for this location could be between 168,000-200,000 gallons of storm water annually.

For Lanikai Elementary, the average roof areas range from 3000-5000 sf. and the annual rainfall for Lanikai Elementary is 34 inches. Assuming the rain garden would be applied to mitigate storm water from one of these buildings, the measurable benefit for this location could be between 64,000-105,000 gallons of storm water annually.

**Total estimated measurable benefits: 232,000-305,000 gallons per year.**

Indirect measurable benefits are also estimated to have significant impact. Kupu Environmental Education Leaders will teach the *Follow the Drop* Curriculum to 5th grade students at four schools: Ka’ohao Elementary (formerly known as Lanikai Elementary), Ka’ewai Elementary, Waikiki Elementary, and Sunset Elementary. At each of the four schools as part of the curriculum, each of the 5th graders will be tasked to analyze their own individual homes for storm water runoff using the *Follow the Drop* principles. They will be provided a toolkit including basic principles for installing a rain garden and increasing “recharge” at their homes. There are roughly 253 5th grade students total for all four campuses. Should even a small portion of the students’ families install a rain garden or storm water best management practice this could lead to additional measurable recharge volumes, but additionally build awareness and support of the FWI within communities. Moreover, it is proposed that the *Follow the Drop* curriculum travel with Hōkūle’ā during the 2017-2018 Statewide Sail. This would provide a considerable amount of outreach across the state and provide a significant pathway for the *Follow the Drop* Storm Water Curriculum to be dispersed and implemented where considerable additional measurable benefits would be realized.

## **Impact**

### **i. Project Outreach, Visibility and Demonstration Value**

The public-private partnerships for the project enable the *Follow the Drop* Storm water project to have a far-reaching stretch statewide throughout Hawai`i’s schools and beyond, using the alliances and programs established via PVS’s Worldwide Voyage educational program and Promise to Pae`Āina o Hawai`i commitments. Moreover, The Nature Conservancy is also committed to outreach the *Follow the Drop* program to their watershed partners. We believe that leveraging the expansive networks of our partners that the outreach and impact of this program to the community is great.



## ii. Project Sustainability, Longevity and O&M Strategy

It is expected that following the success of the *Follow the Drop* Storm Water Curriculum, that the curriculum will be continued to be used by the teachers at the schools where it was introduced and further built upon. The rain gardens that will be implemented at Kae'wai and Lanikai Elementary schools will have lesson plans put into place so that the students continue to care for the rain gardens through project-based learning. Moreover, with the statewide outreach initiatives for the program via Hōkūle'a's Statewide Sail, it is expected that numerous other schools and communities across the state will be introduced to the *Follow the Drop* app and Storm water curriculum. By publishing the curriculum and making it accessible to schools, the project will have sustainability and be able to continue to expand in schools statewide. Furthermore, following the success of the *Follow the Drop - Storm water* program, the other Freshwater Initiative goals of *Conservation* and *Reuse*, could be added to the program to further the education and importantly enable the community to help meet other water security goals for Hawai'i by 2030. For example, Roth Ecological Design Intl. envisions expanding on the features of the *Follow the Drop* mobile application following this pilot program where it could be further used as a data analysis and decision making tool for *conservation* and *reuse* opportunities as well. Together we feel the potential for this program can grow exponentially across the state and will build public support and participation to help meet the 2030 Freshwater Initiative goals.

## B. EXPERIENCE AND CAPABILITIES

See "Partnership" section above in the "Narrative" as well as statement of qualifications of Kupu and REDI in the Attachment H.

## C. STRATEGY, TIMELINE, PLAN AND PRICING

Our strategy as laid forth in the narrative section, is the following. Once awarded, during month one, we plan to initiate the first teacher training that will lay the foundation of introducing the Freshwater Initiative goals to the teachers as well as begin the storm water curriculum development by allowing the teachers to participate in the lesson plan development. Also during the first month, we will begin the mobile app software development phase (estimated to be 2-3 months) as well as package outreach materials to provide to PVS for their Statewide Sail scheduled to launch in the fall of 2017. The remaining of quarter four (Q4) of 2017 will focus on compiling and completing the *Follow the Drop* Storm Water Curriculum and Mobile App. By the end of 2017, we envision the curriculum and app will be completed and the 2nd teacher training will occur prior to the 2018 spring semester. The second teacher training will provide the *Follow the Drop - Storm water* curriculum and mobile application training for the teachers to help streamline the program's implementation in the classrooms. Kupu will then continue to work with the 5th grade classes at the (4) schools during the spring semester, providing curriculum support. Both REDI and Kupu will also provide technical training in the spring of 2018 to the Polynesian Voyaging Society crew members participating in the Statewide Sail, so



that PVS is equipped to outreach and share the curriculum to other Hawaii schools and the communities they

will be engaging with as part their existing programs. The installation of the (2) rain gardens would occur in April/May prior to the 2017-2018 school year ending. Teacher feedback on the Follow the Drop -Storm Water Curriculum would also occur prior to the end of the school year. Final reporting and wrap up is expected to be completed by summer of 2018.

Kupu will invoice the state twice during the project duration: once at project start in September and in December. Kupu will provide the state with a summary of completed work quarterly: at the end of the months of December, April, and August.

**Timeline**

TIMELINE	2017				2018							
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug
1st Teacher Training	█											
Curriculum Development	█	█	█	█								
Mobile App Software Development	█	█	█	█								
2nd Teacher Training				█	█	█						
Curriculum Implementation					█	█	█	█	█	█		
Rain garden/catchment installation								█	█	█		
Curriculum Outreach to Statewide Schools	█	█	█	█	█	█	█	█	█	█	█	█
Curriculum Feedback								█	█	█		
Preparing Curriculum for Publishing										█	█	█
Quarterly/Final Reporting to WSAG				█				█				█

**List of Deliverables**

- Follow the Drop – Storm water Mobile Application
- Follow the Drop- Storm water Curriculum
- Follow the Drop – Storm water Curriculum Implementation
- (2) Teacher Trainings
- (2) Rain Garden Installations
- Reporting



**Proposed Budget**

<b>FOLLOW THE DROP: BUDGET</b>			
<b>Item</b>	<b>Quantity</b>	<b>Unit</b>	<b>Total</b>
<b>PERSONNEL</b>			
Project Director/Design Principal	1	personnel	\$ 15,000.00
Project Engineering	1	personnel	\$ 3,000.00
Program Manager	1	personnel	\$ 6,000.00
Program Coordinator	1	personnel	\$ 4,500.00
Skilled Labor (Rain garden installation)	1	lump sum	\$ 720.00
<b>Subtotal - Personnel</b>			<b>\$ 29,220.00</b>
<b>MATERIALS</b>			
Rain garden media	1	lump sum	\$ 3,000.00
Soil hauling	1	lump sum	\$ 600.00
Skid steer and operator	2	days	\$ 2,500.00
Educational sign	1	lump sum	\$ 1,500.00
Misc plumbing	1	lump sum	\$ 500.00
Misc equipment	1	lump sum	\$ 500.00
Printing	1	lump sum	\$ 500.00
<b>Subtotal - Materials</b>			<b>\$ 9,100.00</b>
<b>OTHER</b>			
Mobile App Software Development	1	lump sum	\$ 40,000.00
<b>Subtotal - Other</b>			<b>\$ 40,000.00</b>
<b>IN-KIND</b>			
Native Plants	500	plants	\$ 2,500.00
Computer Tablets	2	tablets	\$ 1,000.00
Environmental Education Leaders	2	leaders	\$ 20,000.00
REDI Graphic Designers	2	personnel	\$ 8,500.00
REDI Principal Designer	1	personnel	\$ 7,500.00
Labor to install rain garden	50	people	\$ 5,000.00
<b>Subtotal - InKind</b>			<b>\$ 44,500.00</b>
<b>CASH MATCH</b>			
HCF- Fresh Water Initiative - Mobile Application			\$ 22,000.00
<b>Subtotal - Cash Match</b>			<b>\$ 22,000.00</b>
<b>Subtotal (Personnel, Materials, Other)</b>			<b>\$ 78,320.00</b>
Indirect Costs (10%)			\$ 5,632.00
Subtotal (less Cash Match)			\$ 61,952.00
<b>TOTAL Request from WSAG17</b>			<b>\$ 61,952.00</b>
<b>TOTAL PROJECT BUDGET</b>			<b>\$ 128,452.00</b>



## **D. EXCEPTIONS**

In accordance with Section 3.8 of the REQUEST FOR PROPOSALS NO. WSAG17, REDI would like to seek an exception to Section 6.21 INTELLECTUAL PROPERTY RIGHTS. In creating the coding for the “Follow the Drop” app, proprietary intellectual property regarding data analysis will be used (the “IP”). REDI believes that there exists the potential for direct competitors to utilize this IP to REDI’s economic detriment. Therefore, REDI requests an exception to Section 6.21 and requests that the language be amended as follows:

"6.21 INTELLECTUAL PROPERTY RIGHTS. REDI shall retain all right and title to the Intellectual Property created and/or used hereunder. REDI shall grant the State an unlimited, irrevocable, worldwide, perpetual, royalty free, non-exclusive license to use the Intellectual Property incorporated in the work product developed hereunder. This license shall not be transferable and the State shall not license the work to non-state agency third parties, nor disclose nor transfer any proprietary intellectual property within the work product to any third parties for any purposes, without REDI’s written consent, which shall not be unreasonably withheld. Furthermore, nothing in this Agreement shall grant the State any interest, right, title, or license to any future modifications or versions of the Intellectual Property developed by or for REDI.”

TRANSMITTAL and OFFER LETTER RFP WSAGI7

Name of Organization: Kupu  
Point of Contact: Paahana Kincaid, Environmental Education Leadership, Program Manager  
Phone: 808-735-1221 ext 1008  
Email: Paahana.kincaid@kupuhawaii.org

Water Security Advisory Group  
Department of Land and Natural Resources, Commission on Water Resource Management  
Punchbowl Street, Room 227  
Honolulu, Hawaii 96813

The undersigned has carefully read and understands the terms and conditions specified in RFP WSAG17, the Special Provisions attached hereto, and hereby submits the following offer to perform the work specified herein, all in accordance with the true intent and meaning thereof. The undersigned further understands and agrees that by submitting this offer, 1) he/she is declaring his/her offer is not in violation of Chapter 84, Hawaii Revised Statutes, concerning prohibited State contracts, and 2) he/she is certifying that the price submitted was independently arrived at without collusion.

A list of secured and required permits necessary to implement the project are hereto attached.

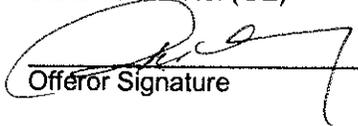
Proposal Title:

WSAG17: Follow the Drop - Storm Water Curriculum, Mobile App, and Rain Garden Installation

Total Amount of Proposal: \$ 128,452.00

If awarded, the contract with the State would be made with the following entity (please use the exact legal name as registered with the Dept. of Commerce and Consumer Affairs):

Kupu  
\_\_\_\_\_  
Legal name  
  
677 Ala Moana Blvd, Suite 1200, Honolulu, HI 96813  
\_\_\_\_\_  
Address (Contract and Billing Address must be the same)

State Tax ID No. (GE) \_\_\_\_\_ Federal Tax ID No. \_\_\_\_\_  
  
Offeror Signature \_\_\_\_\_ Date 4/20/17  
John Leong \_\_\_\_\_ Chief Executive Officer  
Print Name \_\_\_\_\_ Title

OFFER FORM OF-1
2017 IMPLEMENTATION OF WATER SECURITY PROJECTS AND PROGRAMS
STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES
RFP-WSAG17

Procurement Officer
Department of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii 96813

Dear Procurement Officer:

The undersigned has carefully read and understands the terms and conditions specified in the Specifications and Special Provisions; and hereby submits the following offer to perform the work specified herein, all in accordance with the true intent and meaning thereof. The undersigned further understands and agrees that by submitting this offer, 1) he/she is declaring his/her offer is not in violation of Chapter 84, Hawaii Revised Statutes, concerning prohibited State contracts, and 2) he/she is certifying that the price(s) submitted was (were) independently arrived at without collusion.

Offeror is: [ ] Sole Proprietor [ ] Partnership [ ] \*Corporation [ ] Joint Venture
[ X ] Other Non-Profit Organization

\*State of incorporation: \_\_\_\_\_

Hawaii General Excise Tax License I.D. No. [REDACTED]

Federal I.D. No. [REDACTED]

Payment address (other than street address below): (Same as Below)
City, State, Zip Code: \_\_\_\_\_

Business address (street address): 677 Ala Moana Blvd, Suite 1200
City, State, Zip Code: Honolulu, HI 96813

Respectfully submitted:
Date: April 20, 2017

(x) [Signature]
Authorized (Original) Signature

Telephone No.: (808) 735-1221(x1008)

John Leong, Chief Executive Officer
Name and Title (Please Type or Print)

Fax No.: (808) 356-3265

E-mail Address:
john.leong@kupuhawaii.org

\*\* Kupu
Exact Legal Name of Company (Offeror)

\*\*If Offeror is a "dba" or a "division" of a corporation, furnish the exact legal name of the corporation under which the awarded contract will be executed.

OFFER FORM OF-2

Total contract cost for accomplishing the development and delivery of the services.

\$ 128,452.00

**Note: Pricing shall include labor, materials, supplies, all applicable taxes, and any other costs incurred to provide the specified services.**

I, Kupu (Offeror), certify that at time of award the 1:1 matching fund requirement will be met for WSAG17: Follow the Drop- Storm water Curriculum, Mobile Application & Rain Garden Installation (project). The total amount of matching funds will be \$ 66,500.00 (\$22,000.00 cash-match + \$44,500.00 in-kind match)

 4/20/17  
Offeror Signature Date

John Leong, Chief Executive Officer  
Print Name Title

## Attachment E

## WSAG17- Proposal Budget

GRAND TOTAL (including match) \$ 128,452.00Subtotal for labor \$ 70,220.00Subtotal for materials \$ 12,600.00Subtotal for other actions \$ 45,632.00

Please round amounts to the nearest dollar.

Budget Category	Proposed Grant Budget (Request from WSAG)	Matching Cash	Matching In-kind	Total Budget
Salary and wages	\$ 29,220.00	\$ -	\$ 41,000.00	\$ 70,220.00
Materials and supplies	\$ 9,100.00	\$ -	\$ 3,500.00	\$ 12,600.00
Other - Mobile Application Software Development	\$ 18,000.00	\$ 22,000.00	\$ -	\$ 40,000.00
Other -indirect costs 10% of grant budget	\$ 5,632.00	\$ -	\$ -	\$ 5,632.00
<b>Total Cost</b>	\$ 61,952.00	\$ 22,000.00	\$ 44,500.00	\$ 128,452.00

The targeted percentage for indirect costs should not exceed 10% of total costs requested. If there are different indirect costs for different budget categories, please create different spreadsheets for each indirect cost rate.

## Compensation and Payment Schedule

#	Deliverable/Task/Activity	Grant Amount (\$)	Matching Cash (\$)	Matching In-kind (\$)	Total Amount (\$)
1	(September 1, 2017 - At start of contract) Mobilization of Salary and Wages - Initiate 1st teacher training and stormwater curriculum development and 50% indirect costs	\$17,426.00	\$ -	\$ 41,000.00	\$ 58,426.00
1	(September 1, 2017 - At start of contract) Mobilization of mobile application development software development	\$18,000.00	\$22,000.00	\$ -	\$ 40,000.00
2	(December 2016) Completion of Mobile Application, Stormwater Curriculum. Initiate 2nd Teacher Training and Curriculum Support, Project Wrap Up and 50% indirect costs	\$17,426.00	\$ -	\$ -	\$ 17,426.00
2	(December 2016) Initiate procurement of rain garden materials and installation	\$9,100.00	\$ -	\$ 3,500.00	\$ 12,600.00

**ATTACHMENT H: QUALIFICATIONS**

## Kupu Board of Trustees



**John Neff**  
President  
President, Hawaii Region  
Penhall Co.



**Kathleen Thurston**  
Member at Large  
Owner & President  
Thurston Pacific, Inc.



**Julianna Rapu Leong**  
Secretary  
Co-Founder  
Kupu



**Bradley Totherow**  
Treasurer  
Vice President  
Cadinha & Co., LLC



**Kaulana Park**  
Vice President  
Senior Project Manager  
Rider Levett Bucknall



**Michael Wilson**  
Member at Large  
Supreme Court Justice  
State of Hawaii



**David Matsuura**  
Member at Large  
Owner  
Orchid Isle Nursery



**Kim Gennaula**  
Member at Large  
Executive Director of  
Advancement  
'Iolani School

## Kupu Executive Leadership Team



**John Leong**  
Chief Executive Officer



**Luella Costales**  
Director of Development



**Matthew Bauer**  
Chief Operating Officer



**Nate Gyotoku**  
Director of Sustainability Initiatives



**Janice Kim, CPA**  
Chief Financial Officer



**Gina Carroll**  
Director of Environmental Leadership  
Development Initiatives



**Katrina Ogata**  
Director of Impact



**Bettina Mok**  
Director of Team-Based Initiative

### **Paahana Kincaid**

Environmental Education Leadership Program Manager

Paahana has been with Kupu since 2011. She has been managing the Environmental Education Leadership Program since 2014, where her main goal is to bring environmental education to Hawai'i's K-12 students and training Kupu's Environmental Education Leaders. She has seen the program grow from its pilot program until today, 4 years later. She has built and maintained professional partnerships within the Department of Education, charter schools, and private schools. Each year she trains and mentors a group of young adults to implement environmental education through the Environmental Education Leadership Program. These Kupu Environmental Education Leaders work on projects across Oahu teaching youth in K-12 about the importance of our natural resources and ways we can restore and protect them. She works alongside the Environmental Education Leaders in leadership development, curriculum development, and project coordination. She has a passion for infusing leadership skills and drawing that out of each individual that comes through the program.

### **Sydney Tureaud**

Environmental Education Leadership Program Coordinator

Sydney started off as a Kupu Environmental Education Leader in 2013, and served as for two years.

She was then hired as a full-time Coordinator, where she spends her time guiding our program participants in meaningful environmental projects. She has paved the way for the Environmental Education Leadership Program, by stewarding Hawai'i's youth and bringing meaning to what it means to live in Hawai'i and preserve this place we call home. Sydney has spent a significant amount of time writing curriculum and delivering lessons geared around the environment and sustainability. She has a knack for getting kids involved in outdoor projects by making learning fun. She adds a tremendous amount of skill to this program and to this project.



ROTH  
ECOLOGICAL

DESIGN INTERNATIONAL, LLC

NATURAL SYSTEM TECHNOLOGIES

# STATEMENT OF QUALIFICATIONS

9 N. Pauahi St. Suite 302  
Honolulu, HI 96817  
808-737-1512 (ph)  
[info@rothecologicaldesign.com](mailto:info@rothecologicaldesign.com)  
[www.rothecological.com](http://www.rothecological.com)

# STATEMENT OF QUALIFICATIONS

Primary Contact:

Lauren C. Roth Venu, Founder and President  
lauren@rothecological.com

Firm Type & Year Established:

Woman-Owned Small Business,  
Limited Liability Company (2006)

Teaming Partners:

Biohabitats Inc.  
www.biohabitats.com  
John Todd Ecological Design  
www.toddecological.com  
Laulea Engineering  
www.lauleallc.com

Awards:

Region 9 EPA Award, Design Team Member,  
Restorer on Punawai,  
Hualalai Resort, Kona, HI.

References:

Glenn Yokotake, KYA Design Group,  
gyokotake@kyadg.com, 808-330-6228

Josh Stanbro, Hawaii Community Foundation,  
jstanbro@hcf-hawaii.org, 808-566-5541

Roger Harris, Director of Government Affairs,  
Palamaui Inc., rharris@dtnehawaii.net,  
(808) 987-5182

John Ida, President/Partner, Urban Works Inc.,  
JIda@uwarchitects.com, (808) 597-1155



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# EXECUTIVE SUMMARY

***Roth Ecological Design Int.'s (REDI) mission is to (re)connect developments to sustainable water management practices that biomimic the site's natural hydrology, enhance resiliency and are regenerative by design.***

To do so, REDI serves as an integrative planning, design and design-build-operate consulting firm that provides comprehensive, systems-based water strategies and educational and ecological experiences for new or existing development projects. Our services include: Strategic water planning, climate resiliency and land use planning to maximize ecological features and build hydrological integrity; stormwater modeling; comprehensive water development (Net-Zero Water); Low Impact Development (LID)/Green Infrastructure; natural systems onsite wastewater treatment; water reuse plans; ecological water features; habitat creation and soils regeneration. For existing facilities and sites, REDI also performs water audits to determine the most cost-effective solutions for minimizing their water footprints by maximizing water conservation and pollution prevention that also provides return on investment and/or enhances educational and ecological value.

Specifically for educational and institutional developments, REDI also can provide educational services including lesson plan development and professional training, including use of our *Follow the Drop* mobile application, that provides experiential opportunities while undergoing a water audit or implementing green infrastructure practices. In addition REDI can assist in the development of water policies and programs to governments, regulators and businesses striving to increase their water portfolios and build water security.

We strive for “one water” using innovative strategies and green infrastructure designs to build water resiliency. Our goal is to lessen the water and ecological footprints of developments by moving sites towards a Net-Zero Water model, while meeting the triple bottom line. Systems and technologies REDI and its partners design and implement include:



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## Wastewater Treatment for Reuse

- Best-in-Class Wastewater Treatment Systems
- Constructed wetlands for Secondary Wastewater Treatment
- Eco-Machines (Tank-based wetland wastewater treatment)
- Greywater & Reuse Systems
- Compost Toilets
- Irrigation Planning & Water Reuse Development

## Stormwater (Low Impact Development)

- Bioretention
- Bioswales
- Rain gardens
- Surface flow Wetlands
- Gravel wetlands
- Rain Water Catchment
- Green roofs

## Lakes, Ponds, and Water Features

- Stormwater collection/storage ponds
- Floating wetland technologies (wetland treatment systems for open waterways)
- Integrated aquaculture systems/aquaponics

## Ecological Landscape Design

- Land Use Planning
- Stream/Wetland Restoration
- Erosion Control
- Soils Development
- Agroforestry
- Integrated Agriculture

## Educational

- *Follow the Drop* mobile app for site water audits
- Facilities Training
- Lesson Plan Development
- Educational signs
- Project-based education experiences
- Capacity Building



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# STRATEGY, TECHNOLOGY & DESIGN

## *Wastewater Treatment/Constructed Wetlands*



Wastewater is just water being wasted. REDI deploys wastewater treatment systems that are considered best-in-class to meet water quality standards for onsite reuse. REDI also can provide services to include natural systems technologies (constructed wetlands) to meet secondary or tertiary treatment standards. The constructed wetland technologies are recognized by the U.S. Environmental Protection Agency as being an ideal solution to wastewater treatment due to their low energy needs, natural appearance, and lack of odors. Treated effluent is suitable for water reuse applications.

## *Greywater*



Greywater is a type of wastewater that essentially encompasses all types of wastewater except those that come from industrial uses, toilets, and kitchen sinks. REDI provides its clients opportunities to capture and treat this resource onsite for reuse to replace potable water demands.

## *Recycled water*



Recycled water is the product of secondary or tertiary treated wastewater. The use of recycled water is a sustainable practice to maximize efficient use of water resources. REDI provides recycled water planning, design and permitting for its clients.

## *Stormwater/Low Impact Development*



Stormwater runoff often contains a variety of harmful pollutants such as heavy metals, fertilizers, herbicides, paint, fuel, oil, along with inorganic and organic debris and dust. REDI deploys various Low Impact Development (LID) strategies for developments to manage stormwater onsite to meet pre-development site conditions.

## *Water Features*



Wetland technologies can serve as landscaped, living filters for commercial water features, natural swimming pools or other ecological waterways and canals to maintain high water quality, build habitat and/or meet aesthetic standards.

## *Net-Zero Water*



Net Zero Water = Balancing a development's annual water demand through efficient use, capture, and reuse of water resources. REDI undergoes comprehensive water planning and design for its clients to meet this rigorous challenge. Net-Zero Water is a prerequisite for any building seeking the prestigious Living Building Challenge.

# SELECTED PROJECTS



## University of West Hawaii Oahu Campus, Kapolei, Hawaii

In collaboration with KYA Design Group and Perkins and Will, REDI is the lead nonpotable water infrastructure design consultant for the new University of Hawaii West Oahu Campus Administration and Allied Health Building. REDI designed an onsite greywater reclamation system, rainwater catchment and air conditioning condensate recovery for landscape water reuse. In addition (five) bioretention gardens were designed to manage the parking lot and building roof stormwater. As part of the water conservation strategies, REDI developed a conceptual soil restoration plan, since the building site is on former plantation agricultural lands, where much of the topsoil has been lost. In addition to the design REDI is providing UH with cost-benefit analysis iterations of projected savings for (re)using the onsite nonpotable water resources and is providing the campus outreach and educational opportunities. The project is seeking LEED gold status.



## Kamehameha Schools Site Water Assessments, Island-wide, Hawaii.

REDI underwent site water assessments for (4) Priority One properties owned by Kamehameha Schools (KS). These sites included: Kawaiha'o Plaza; KS Kapalama Campus; KS Maui Campus; and KS Hawaii Campus. Using the *Follow the Drop* app, REDI's team trained a group of KS interns who participated in the data collection for the site water audits. The data collection included using REDI's *Follow the Drop* app to identify and record opportunities for water conservation, stormwater catchment or recharge, and reuse. Water data was analyzed by undergoing a baseline annual water balance for each unique site to identify the greatest opportunities for cost-savings and use of onsite water resources. Summary maps were then created for each site identifying the recommended practices. Importantly the assessment also included a climate change preparedness analysis for each site to serve as an added decision tool when prioritizing the potential water infrastructure improvement projects.



## University of West Hawaii Campus, Kona, Hawaii

REDI led the design of incorporating an onsite wastewater treatment system using constructed wetland technology and recirculating sand filter technologies to treat 100% of the wastewater onsite to be reused in a native landscape. In addition REDI led the landscape design team for the nonpotable landscape design, which also incorporated Low Impact Development for storm water management. The project is seeking LEED platinum status.

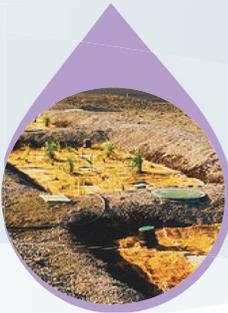
## Kahalu'u Mai Kai Redevelopment: Cultural Education Center, Kahalu'u, Hawaii.



REDI served as the lead green infrastructure and Net-Zero Water consultant for the design of integrative water resource management strategies for the 28 acre Kamehameha Schools' redevelopment project, *Kahalu'u Makai*, a highly significant cultural, anthropological, ecological and educational site. The goals for the project included a restorative approach and one that demonstrates sustainability. REDI led the design of the Low Impact Development best management practices for the site including bioretention gardens and rainwater catchment controls. In addition REDI designed onsite greywater reuse and onsite wastewater (blackwater) treatment and reuse using constructed wetland technologies. REDI provided design services from Master Planning through Construction Documentation including providing cost analysis, Basis of Design reports for the Environmental Assessment and permitting for the proposed systems with the State of Hawaii Department of Health and County of Hawaii Public Works Building Division.

REDI led the design of the Low Impact Development best management practices for the site including bioretention gardens and rainwater catchment controls. In addition REDI designed onsite greywater reuse and onsite wastewater (blackwater) treatment and reuse using constructed wetland technologies. REDI provided design services from Master Planning through Construction Documentation including providing cost analysis, Basis of Design reports for the Environmental Assessment and permitting for the proposed systems with the State of Hawaii Department of Health and County of Hawaii Public Works Building Division.

## Kona Kaiser Medical Office Building, Kailua-Kona, Hawaii.



REDI led the design of an innovative onsite wastewater treatment system using several different constructed wetland technologies targeted to remove additional nutrients before being 100% reused on site. REDI also performed procurement of the systems' materials, onsite construction management as well as the operation and maintenance (O & M) contract. The

O & M package included educational training opportunities for Kaiser's staff to learn more about the technology and how it works. The project is seeking LEED gold status.

## Four Seasons, Hualalai Resort, Kailua- Kona, Hawaii.



In partnership with Ocean Arks International and Partners in Development, REDI provided design consulting services for the floating wetland filters for the 5th Hole, 3-acre water feature at the prestigious Hualalai Resort. The water feature was being installed as part of the expansion of the resort's golf course. Instead of a flow-through design to prevent algal blooms that would have pumped over one million gallons per day of brackish water through the water feature and

have a considerable life cycle energy cost, REDI and the design team created an insitu circulation system that vertically moves water through engineered floating islands to improve water quality and reduce algal blooms. The filtration was so successful, that later native fish, shrimp and oysters were added into the system and are regularly harvested for the resort restaurants. The payback period for the project was less than two years and it was awarded a Regional Environmental Protection Agency award for its saavy design.

### **Ernie Els Golf Course, Hoakalei, Ewa Beach, Oahu**



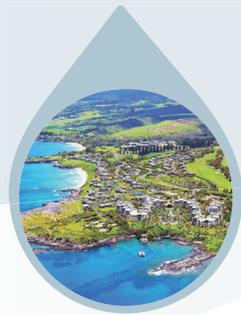
REDI led the design-build project of incorporating constructed wetlands into Pond #13 on the Ernie Els golf course to reduce algal blooms caused by high nutrients in the groundwater and from runoff. The constructed wetlands provide ongoing treatment, aesthetic value and serve as habitat to native Hawaii fauna.

### **Honolulu International Airport, Honolulu, Hawaii.**



REDI underwent the design of a series wetland filters for the three historic ponds located within the Honolulu International Airport. The systems were designed to lower operations costs for State.

### **Kapalua Resorts, Kapalua, Maui, Hawaii.**



REDI underwent a feasibility study analyzing the costs and return on investment for Kapalua Resorts to implement aquaculture systems within their stormwater ponds at the resort while managing water quality with a floating wetland treatment system. The project entailed evaluating water flows through the ponds and types and density of aquaculture that would prove beneficial for the resort. In addition an onsite natural systems

wastewater treatment system for the clubhouse as well as individual, sustainable onsite wastewater systems for the mauka cabins were conceptually evaluated for the Resort.

### **Kukaniloko Water Infrastructure and Agricultural Planning Wahiawa, Oahu, Hawaii.**



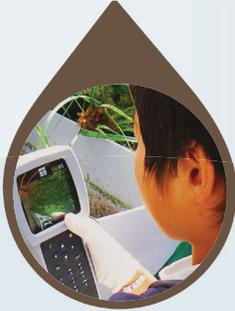
REDI provided water infrastructure strategies for the 511 acres of the Office of Hawaiian Affairs's (OHA) agricultural site surrounding the Kukaniloko birthing stones. REDI underwent a hydrological analysis of the property, stimulating various rain events and runoff scenarios based on land cover types such and soil health. Following the modeling, stormwater ponds were strategically placed on a site plan based on current elevation information to store rainwater to be used for irrigation. In addition other water sources were analyzed for their feasibility including off-site R-1 water supplies, Wahiawa Reservoir, and an onsite well. REDI is also to providing soil restoration and agricultural planning services for the agricultural lands.



### Mayapur Development, Mayapur, India

Mayapur India is the spiritual center of the Harry Krishna religion and is a rapidly developing rural area next to the Ganges River in Bangalore. Recognizing the need to better manage sanitation, REDI was invited to the property to assess local resources and capabilities to install a low-tech secondary wastewater treatment system using constructed wetlands for a series of new

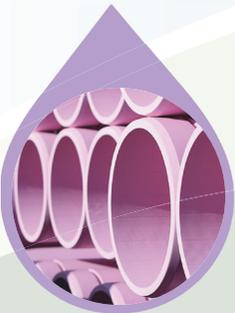
apartment complexes designed to house approximately 100 residents. As part of the scope of work, REDI identified local materials and skilled trades such that the system could be constructed by local people with identifiable resources.



### Green Machine The Hawaii Nature Center, Makiki Oahu, Hawaii

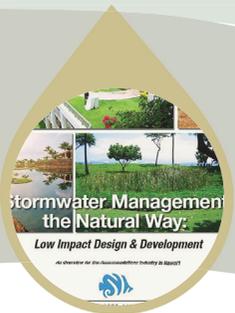
The Green Machine (formally known as the Pilot Living Machine) is a tank-based constructed wetland wastewater treatment facility located in the Makiki Valley State Recreational area in Honolulu, Hawai'i. It recycles wastewater from the Hawai'i Nature Center for irrigation on site in nearby fields. Constructed wetland technology uses the biology of Native Hawaiian wet-

land plants and bacteria to purify water. REDI works with Partners in Development to provide educational opportunities at the Green Machine for learners of all ages to learn about natural treatment systems and bioremediation.



### State of Hawaii Department of Health Wastewater Branch.

REDI was contracted by the Hawaii Community Foundation to assist the State of Hawaii Department of Health to update the state's Water Reuse Guidelines, with the goal of making the document more "user-friendly" and incentivizing the reuse of reclaimed water.



### Low Impact Development (LID) Guide for the West Maui Hotel and Hospitality Industry.

REDI is the co-author to the Low Impact Development (LID) Guide for the Hawaii Hotel Industry published by the CORAL Alliance, to support the development and permitting of green water infrastructure practices. The overall goal was to provide an easy to follow educational framework for the industry to implement sustainable strategies for managing stormwater onsite that protects coastal water quality.



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### **Windward Mall Bioretention Systems Kaneohe, Oahu Hawaii**

In partnership with Hui o Ko'olaupoko, REDI led the design of retrofitting three existing landscape sites around Windward Mall into three bioretention systems (rain gardens) to capture, treat and recharge stormwater from sections of the Mall's parking lots.



### **Kalepolepo Beach Park & NOAA Whale Sanctuary Kihei, Maui, Hawaii**

In partnership with the Water Institute for Sustainability Education, REDI and its team designed-built a shower treatment garden for the Kalepolepo Maui County Beach Park showers. The project also included the design of a series of rain gardens for managing stormwater coming from the Maui NOAA Whale Sanctuary building roof and parking lot. The system was design such that the treated greywater from the showers is used for irrigating the rain

garden during non-rainy periods. REDI also provided educational outreach to NOAA and the community members.



### **Kapolei Elementary School, Kapolei, Oahu, Hawaii.**

REDI provided a Water Reuse Plan for the new Kapolei II Elementary School. The Water Reuse Plan would allow the campus to use up to 40,000 gpd of R-1 reclaimed water supplied by the Honolulu Board of Water Supply.



### **Kilauea Lighthouse Village Kilauea, Kauai, Hawaii**

REDI underwent an onsite wastewater treatment feasibility study for Hunt Development Group's new Kilauea Lighthouse Village, a mixed use commercial development located in the center of Kilauea town on the north shore of Kauai with an estimated volume of approximately 30,000 gallons per day. REDI and its teaming partner Biohabitats evaluated onsite wastewater packaged treatment systems along with natural systems technologies and included both capital and life-cycle cost comparisons.



### **Namale Resort and Spa, Savusavu, Fiji**

REDI provided wastewater consulting services for the exclusive Namale Resort. The resort was expanding to build the Wasawasa Conference Centre and REDI introduced natural systems wastewater treatment (and reuse) options that would protect the near shore water quality and demonstrate sustainability. In addition REDI provided some guidance on solid waste management and composting opportunities.



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## Hoku Nui Development, Makawao, Maui

As part of the site planning team for Hoku Nui Maui, a mixed 258-acre agricultural, residential and commercial development, REDI initiated hydrological studies and water management strategies that helped guide land use choices and facility placement based on the ecological and hydrological capacity of the site. Using a hydrological model, stormwater is being designed to be conveyed and treated through Low Impact Development best management practices and stored in series of ponds on the property for irrigation use. In addition, REDI is guiding the site design toward a Net-Zero Water goal by meeting the various building and site water demands by strategically managing wastewater onsite using constructed wetland technologies for 100% reuse and harvesting rainwater from the buildings. REDI provided Master Planning services including Basis of Design reports for the 201H application and Environmental Assessment.



## Ma'alaea Banyons Condominium Ma'alaea, Maui, Hawaii

REDI underwent a wastewater treatment and reuse feasibility study for the 78 unit condominium complex. REDI evaluated multiple technologies for their feasibility for treating the wastewater onsite, including both a capital and life cycle cost benefit analysis comparing MBR, MBBR and natural systems technologies. In addition a water reuse plan and cost benefit analysis was provided.



## Waipa Watershed Waipa, Kauai

REDI provided an agricultural-watershed plan for the Waipa Foundation that incorporated ecological technologies to manage the water within their property from mauka to makai. In addition products such as local mushrooms and aquaculture were analyzed for their feasibility as economic byproducts.



## Maui County Haiku Fire Station Haiku, Maui, Hawaii

In collaboration with Architects Hawaii Ltd and REDI served as the lead designer for design of a constructed wetland system to serve as a secondary treatment system for the proposed LEED platinum fire station. The system was engineered to meet Hawaii Department of Health standards for onsite reuse in a native plant garden.



## Modular Household Water & Wastewater Treatment Components Port au Prince, Haiti

REDI worked with Polehouses.com to develop comprehensive water and sanitation systems for a housing project as part of the rebuild of Port-au-Prince following the 2010 earthquake. The goals were to use local materials and have the ability to manufacture the systems locally to support building the local economy. Water and sanitation systems included rainwater harvesting, composting toilets, and the development of greywater banana-mulch circles.

## KEY PERSONNEL

### Lauren C. Roth Venu: Founding Principal and President

Lauren Roth Venu is passionate about developing strategic, innovative solutions to build water resiliency. She is the Founding Principal and President of Roth Ecological Design Int. LLC and is also the Co-Founder of the education-based nonprofit the Water Institute for Sustainability Education (WISE). Lauren's educational background includes B.A. in Environmental Science with a specialty in Water from the University of Colorado at Boulder; a Master of Science in Oceanography from the University of Hawai'i at Manoa; a graduate of the Proper.net Leadership Program from the United Nations University / East-West Center; and is a fellow of the 2015 Water Leadership Institute (Water Environment Federation).



Lauren is a frequent lecturer and published author of a variety of topics on innovative water management, ecological design and green infrastructure. She also serves as a leader on numerous professional committees including serving in an advisory role for the Hawaii State Water Conservation Plan Committee (2011-2013); member of the Honolulu City and County Sustainable Building Task Force of which she chaired the Water and Wastewater Sub-Committee (2010-2011); the State of Hawaii Department of Health Water Reuse Guidelines Advisory Committee (2013-present) and via the Hawaii Chapter U.S. Green Building Council she leads the (green) plumbing codes investigation for the Green Codes Investigative Committee for the Hawaii State Building Code Council (2013-present). She also volunteers her time as a (Co)-Project Manager for the Hawaii Engineers Without Borders Chapter and serves as President of the Board of Directors for the Water Institute for Sustainability Education (WISE) and as well as a Board of Directors member for 'Ahahui Malama I Ka Lokahi. Some of Lauren's accolades include: a Region 9 Environmental Protection Agency awarded project (2005); being named one of the "Top Forty Under Forty Business Leaders" by Pacific Business News (2014); and named by Pacific Edge Magazine (2015) as an "Emerging Leader in Design."



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## Hunter Heavilin: Systems Planner

Hunter was raised as a kama'aina in the Hawaiian Islands. He has held a strong connection with the natural world since a young age. His relationship with the environment led to his studies in tropical forest ecosystems, agroforestry management and the completion of the Permaculture Design Course in 2007 with Steve Read of L'Universite Populaire de Permaculture.



Hunter holds a Master of Urban Planning degree from the University of Hawaii at Manoa. He is a planner, agricultural specialist and an educator of Permaculture design practices. He has taught all ages with a focus on sustainability oriented youth programs and Permaculture related adult workshops. Hunter has taught with the Kokua Hawaii Foundation's AINA In Schools school garden program and also with their 3R's Program focusing on solid waste management. He also co-founded the local Permablitz Hawaii program which is a community-based program aimed for residences across the islands to spread the installation of sustainable food gardens in reciprocal volunteer support model. He is a leader in the urban agricultural movement and has designed for projects ranging from the Institute for Human Services urban farm project to homesteads and urban gardens around the islands. He has also worked internationally in Peruvian Andes, Vanuatu, and Haiti teaching permaculture principles. Hunter also hosts a regular, weekly radio program where he brings in experts in the field of sustainability to discuss pertinent issues.

## Amy Cregar: Environmental Analyst

Amy specializes in multinational environmental policy and science with special focus areas in sustainable agriculture economics and industry. She has a back-ground in urban planning and remediation, which is complemented by internationally focused environmental conflict mediation. She has done extensive research on the subjects of environmental resources economics, societal metabolisms, systems dynamics, life-cycle management and distributed infrastructure.

A graduate of Erasmus Mundus' prestigious MESPOM program, she has studied in Argentina, Greece, Hungary, Spain, Sweden and the United States and has carried out fieldwork in Denmark and Slovakia. Amy earned a Masters in Environmental Science, Policy & Management from Lund University

in Sweden. She has also completed graduate level studies at University of Manchester, University of the Aegean, and Central European University. Additionally she earned a Bachelor's of Science in Urban Studies focusing on Bioremediation from University of Cincinnati's D.A.A.P., a Masters of Culinary Art from Instituto Gastronomia de Mause Sebest, and has earned a certificate on Environmental Conflict Management from ICTA at Universitat Autònoma de Barcelona. She has studied with and been deeply inspired by Joan Martinez-Alier, Allan Johansson and Erik Syngedouw.

Amy is passionate about harmonizing the intersection of industry and human societies with the ecosystems in which they exist. She advocates for solutions that are holistic, contextually relevant and sustaining. Amy is a published author on the subjects of distributed economics, industrial symbiosis and the special ecological case represented by islands. Amy currently supports REDI in project management, planning, field data collection and analysis.



## Elena Lekhter: CAD Manager

Elena Lekhter specializes in graphic and AutoCAD design. Elena earned her degree in Architecture in her native country, Russia, and has over eight years of work experience in the field of architecture and design, including collaboration with international architects for the design of luxury resorts, residential homes and clothing boutiques. Some of her accolades include a first place award for her thesis in “The 19th International Exhibition of Best Graduation Projects in Architecture and Design;” and 2nd place award in “Competition of Best Elite Houses.” Later she was accepted to the University of Hawaii at Manoa to pursue her PhD in architecture where she participated in the design and reconstruction of “Building 37” on campus, which was to revitalize an old IT lab into an “innovation center” on UH’s campus.

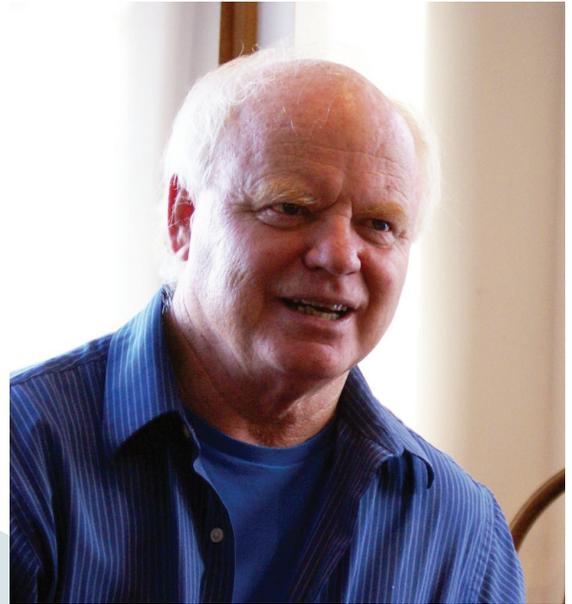


Elena has always been inspired by the outdoors. While in Russia she would volunteer her time to reforest planting native trees and numerous other ecological conservation projects. Her interest grew in water resource management when she took part in the design of integrating a community recreational park alongside a major water reservoir in the territory of Voronezh. She continues to enjoy and preserve the ecologies she is a part of and also continues to take part in volunteer community activities while furthering her design inspirations from the beauty of nature.

## TEAMING PARTNERS

Dr. John Todd

Dr. Todd has been a pioneer in the field of ecological design and engineering for nearly five decades and serves as a Senior Planner and Designer for REDI. Dr. Todd has degrees in agriculture, parasitology and tropical medicine from McGill University, Montreal, and a doctorate in fisheries and ethology from the University of Michigan. He is professor emeritus and distinguished lecturer at University of Vermont's Rubenstein School and a fellow of the Gund Institute for Ecological Economics at UVM. He is also the founder and president of Ocean Arks International and John Todd Ecological Design and co-founder of New Alchemy Institute, a research center that has done pioneering investigation into organic agriculture, aquaculture and bioshelters. He has been an assistant scientist at Woods Hole Oceanographic Institute and assistant professor at San Diego State University.



His numerous honors include the 2008 Buckminster Fuller Award for the best idea/concept to help save the planet/humanity; the Environmental Protection Agency's Chico Mendes Award and Environment Merit Award; a lifetime achievement award from the New York Open Center; Global Visionary Award from the City of Chicago; and many others.

He is also co-editor of "Solutions Journal"; a fellow of the Lindisfarne Association; a member the Society of Ecological Restoration and the Ecological Society of America; and serves on the advisory board of Ecological Engineering, the Journal of Ecotechnology. His patented Eco-Machine™ was exhibited by Smithsonian Institution's Design Triennial at the Cooper-Hewitt Museum of Design in New York City. In 2007 he was named one of top 100 visionaries of the 20th century by "Resurgence & Ecologist" magazine. He also received an E.P.A. Award for his restorer technology on Lake Punawai, Four Seasons Resort, Hualai, Hawaii, for the promotion of innovative ideas, addressing environmental problems and its ability to be widely replicated. His work was recognized in the "Genius Issue" of Esquire and he was profiled as one of top 35 inventors in "Inventing Modern America" by David Brown.



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## Erin English P.E.: Chemical Engineer

Erin English, PE, is a REDI project engineer with Biohabi-tats. Erin designs and manages waste and storm water treatment and reuse projects. With a degree in Chemical Engineering and three years spent at the non-profit eco-logical design firm, Ocean Arks International, Erin has a strong process and design background that she applies to natural systems. Alongside REDI's staff she works closely with clients, architects, landscape architects, engineers and the drafting staff in an integrated team environment.



## Wesley Wong: Civil Engineer

Wesley Wong serves as a civil engineer for REDI. He is the Co-Founder of Laulea Engineering, LLC a Hawaii-based business established in Hawaii in 2013. His primary focus is to serve clients and complying agencies with professional civil engineering services with a personal goal of dedication to environmental preservation and sustainability for Hawaii's local communities. Wesley's experience extends through various civil engineering projects throughout Hawaii, but with emphasis on wastewater engineering and compliance and water quality projects. Current projects include new wastewater systems design and existing wastewater systems upgrades for large commercial/residential buildings, land developments, and residential home owners. Wesley also served as a project engineer for Hawaii's Engineer Without Borders project in Mae Wan, Thailand.





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**ATTACHMENT I: FOLLOW THE DROP BROCHURE**



## HOKULANI Rain Garden

## what are RAIN GARDENS?

Rain gardens are vegetated, landscaped features that are designed to both treat and infiltrate storm water onsite. They are typically designed to accept stormwater from rooftops, parking lots, sidewalks and other hard surfaces to capture, treat and recharge storm water locally, preventing pollution from impacting downstream ecosystems in the watershed.

**LOW IMPACT DEVELOPMENT: RAIN GARDEN FOR STORMWATER MANAGEMENT**

### COMMUNITY PARTNERS

## ALA WAI Watershed

## what are WATERSHEDS?

Watersheds are an area of land that water flows across and through until ultimately reaching the ocean and through until Elementry School sits within the Ala Wai Watershed and its rain garden recharges up to 70,000 gallons of stormwater annually!

### Mean Monthly Rainfall (in)

Rainfall Atlas of Hawaii 2011, University of Hawaii  
 Map: 21.287° N, 157.812° W  
 Station: Kaimuki Pumping

Month	Mean Monthly Rainfall (in)
Jan	~1.5
Feb	~1.5
Mar	~1.5
Apr	~1.5
May	~1.5
Jun	~1.5
Jul	~1.5
Aug	~1.5
Sep	~1.5
Oct	~1.5
Nov	~1.5
Dec	~1.5

Mean Annual Rainfall: 50.04 (in)

# WSAG17: *Follow the Drop*: Stormwater Curriculum, Mobile Application and Rain Garden Installation



In 2016, the Hawai'i Community Foundation published *A Blueprint for Hawai'i's Water Future* that provides the following goals to be achieved by 2030 to safeguard Hawai'i's future water security:

- Conservation – Increase water efficiency by 8%
- Reuse – Double the volume of recycled water use
- Recharge: Increase stormwater recharge within key watersheds with a goal of 30 million gallons per day of increased groundwater

The overarching goal behind the *Follow the Drop* project is to bridge the Freshwater Initiative goals into the classroom to begin to unite and lay the foundation of knowledge for Hawai'i's youth to develop critical thinking skills and solution-based opportunities to meet water security goals. Although it is envisioned that the *Follow the Drop* project will eventually include all three of the Freshwater Initiative goals, Recharge was selected as the first focal point for the project development.

## **Follow the Drop – Stormwater Curriculum**

The *Follow the Drop* - Stormwater curriculum uses the school campus as a mini-watershed. Where does the water come from? Where does the water go? What is stormwater? How might this impact the watershed? Where are the opportunities to close-the-loop and recharge or capture stormwater onsite? Students will learn about Hawai'i's Freshwater Initiative and how to identify (grey) stormwater infrastructure features and identify those that could become "opportunities" to implement green infrastructure best management systems (such as rain gardens and rain catchment) to capture or recharge the stormwater onsite.

## **Follow the Drop - Mobile Application**

As part of the funding request, it is proposed to further develop Roth Ecological Design Intl's *Follow the Drop* mobile application (app) so that it can be used as a data collection and analysis - decision tool to support the *Follow the Drop*- Stormwater curriculum. The *Follow the Drop* app would allow the learners to identify and collect "opportunity" data points around campus to capture or recharge stormwater. All of the data points would include photo(s), summarized notes and data, and have a GPS reference so that the data could be exported and stored onto a map. For each data point, the collector could select the "drainage area" tool in the app and connect to Google Earth Pro to measure the drainage area, from the roof or parking lot for example, that is draining to the opportunity identified. This area would be recorded in the app and used as part of the imbedded data analysis. The user would then click on the "rainfall" link and using the GPS coordinates the rainfall for that area will be automatically calculated (for example, by incorporating the Hawai'i Rainfall Atlas or NOAA rainfall data tools). Following both measuring the drainage area and collecting the rainfall data, the app user could then press "calculate" to see how much stormwater volume is generated at that location. Multiple data points could be collected and analyzed in this way and then compared. The app's "compare" button would compare for example stormwater volumes between the data points. This would output into a bar graph. Next the user could input which type and size of a green infrastructure best management practice (rain garden, rain catchment, etc.) they would want to implement and the bar graph would show estimated stormwater runoff reduction. The imbedded data analysis in the app, would allow for not only data points to be collected and congregated into a single map for the campus to identify future recharge projects, but also be used as a decision-making tool to identify and prioritize these potential projects, offering real-world critical-thinking skills.

The screenshot shows the 'Follow the Drop Stormwater Capture/Recharge' app interface. At the top, it displays the collector's name 'Lauren', the time and date '4:55 PM, 6/5/17', and the feature type 'Open Downspout'. Below this is a photo of a downspout. The form includes fields for 'Take GPS Point\*' (Lat: 21.311649, Longt.: -157.861331), 'Surrounding area', 'Bare Soil', 'Google Earth' (Connect to Google Earth), 'Rainfall Data' (View / Enter Rainfall Data), 'Stormwater Runoff' (Calculate), 'L.I.D. Practice' (Enter), and 'Stormwater Reduction' (Calculate). At the bottom, there are three buttons: 'Save Record', 'View Map', and 'Calculate All Saved Records'.



## Rain Garden Implementation

After all the data points have been collected, analyzed and mapped using the *Follow the Drop* app, as part of the curriculum, the faculty and students will identify the best location for implementing a rain garden to recharge stormwater at this location. It is envisioned that materials and equipment to build the rain garden be covered by the requested funding, however an in-kind match would be provided by involving the students and the community in implementing the rain garden. It is proposed that the funding also cover the development of curriculum for the rain garden such that the rain garden would have continued use for project-based learning opportunities after installation.



## Impact

The partnerships for the project enable the *Follow the Drop* - Stormwater project to have a far-reaching stretch statewide throughout Hawai'i's schools and beyond using the alliances and programs established via PVS's Worldwide Voyage educational program and Promise to Pae'Āina o Hawai'i commitments. Moreover, following the success of the *Follow the Drop* - Stormwater program, the other Freshwater Initiative goals of Conservation and Reuse, could be added to the program to further the education and importantly enable the community to help meet the water security goals for Hawai'i by 2030.

Partners: Kupu (P.I.), The Nature Conservancy, Promise to Pae 'Aina, Polynesian Voyaging Society, Roth Ecological Design Intl. LLC, NOAA-OCM.

