KA MĀLA LANI: RE-PLANNING SCHOOL GROUNDS FOR GROWING PONO

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I dedicate this work to Blanche Pope Elementary School. Mahalo!
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Mahalo ke Akua i nā mea apau.

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A BIG MAHALO!
ABSTRACT

This Research Document presents Ka Māla Lani, Blanche Pope Elementary School’s garden, as a safe place of aloha (love) for students to learn about gardening and cultural values. Ka Māla Lani is the place where students who struggle in passive academic methods can feel validated and successful, using active hands-on approaches, which are often lacking during school hours. It is a Pu'uhonua, a place of refuge and healing, where their troubles are left outside, and students can focus on themselves and on living pono (in righteousness). That is why Ka Māla Lani is called “the Pono garden”.

The school garden Ka Māla Lani was instrumental in fostering hope and guiding the community towards a pono way, inspiring students, teachers and other community members to step back and re-evaluate the way things are done. This Doctorate project is an example of the influence of Ka Māla Lani in people’s lives.

The goal of this Doctorate research is to develop a site specific participatory design method and a site plan for Blanche Pope Elementary School in Waimānalo, O‘ahu, Hawai‘i. Instead of retrofitting buildings, this research took the landscape as the framework to remediate environmental issues associated to Blanche Pope Elementary School, as well as managing the resources available on site. There is vast literature on the planning, implementation, and use of school grounds, including many valuable publications focusing specifically on Hawai‘i’s unique and diverse environmental and social conditions. The proposed site plan incorporates participatory design strategies and design solutions that maximize the experience, efficiency, and self-sustainability of Ka Māla Lani. The concept of “growing pono” guided the development of the proposals in this manuscript. The design proposals incorporate the process of shelter (hale), embracing (storm water management and trellis garden by cafeteria), self-sufficiency (rain water harvesting), and healing (stormwater management). These solutions could be used not only by architects, but also by landscape architects, educators, and other community leaders interested in renovating or establishing comprehensive schoolyards, adapting the concept of pono (righteousness) to their unique environmental and cultural conditions and needs.
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PREFACE

This Doctor of Architecture Project emerged out of my practical experience at the Blanche Pope Elementary School, in Waimānalo, on the Island of Oʻahu in Hawaiʻi. Here, I was fortunate to learn and teach at Ka Māla Lani, their school garden. This garden was created as part of the Growing Pono School Projects\(^1\), a pioneer effort that has facilitated the implementation of gardens and other extra-curricular activities in Hawaii’s public schools. My efforts began as a volunteer, in 2010, under Kumu Sara Kaʻimipono Banks, Kumu Laurie Kahiapo, and Kumu Ilima Ho-Lastimosa. It all started when my good friend Leon Watson introduced me to Kumu Laurie, because Kumu Laurie wanted to design a garden with native plants at Blanche Pope, and Leon knew that I was studying native plants for my Master’s thesis in Tropical Plants and Soil Sciences at the University of Hawaiʻi at Mānoa, College of Tropical Agriculture and Human Resources (CTAHR). This was in June of 2010.

During my first visit to Ka Māla Lani, Kumu Laurie asked me to help harvesting a cassava plant that was growing in the garden. She was not sure how to harvest it. The cassava was planted by a group of Brazilians from a church in the North Shore, and it was growing there for a while. I pulled the plant and its roots, which were huge, for both of us surprise! Kumu Laurie was stoked and immediately asked me if I would like to come and help more in the garden! From that moment, I connected, and what an irony: cassava is a plant native from Brazil, the staple food of the native people of Brazil, which is also my heritage from my grandfather from my mother’s side. Cassava, or *mandioca* as we call it in Brazil, has its own moʻolelo, similar to kalo in Hawaiʻi. That episode created a bond between me, Kumu Laurie, and the garden, and the people at Ka Māla Lani. That encounter gave me hope and pride of being Brazilian, because a local kupuna gave me respect for who I am, for my ethnicity, and because I brought something pono to their place. From that moment, I didn’t look at myself as a haole anymore, but as a Brazilian, with a lot to learn, and a lot to offer, and capable of being pono and

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\(^1\) University of Hawaii at Manoa Center on Disabilities Studies, "Growing Pono Schools."
to help the people of Hawai‘i on their jorney of growing pono. I saw value in myself, and it was awesome!

Following the cassava episode, I start to volunteer in some garden classes, without any big commitment. As I started to advance in my Doctor of Architecture program, I chose to study green roofs as the topic of my Doctorate Project, and became very busy studying architectural systems and greenroof’s thermodynamics. I became pale because I was not in the sun anymore, and I gradually disconnected from Ka Māla Lani, to a point that I was not happy with the situation anymore. Since Kumu Laurie was always so loving, I went to Blanche Pope to talk with her. This was 2012 and I was tired of so many all-nighters to keep up with my studios, assignments, teaching assistant and graduate research assistant work, because all this efforts were not bringing me any joy anymore, and I was losing hope.

As I waited for Kumu Laurie in the bus pick-up area at Blanche Pope, a student from previous year’s garden club came to me and asked: “Uncle Alberto, are you coming to garden with us again?”. I didn’t give him much attention, and just said, “Yes, yes”, in a “whatever” tone. He ran to the cafeteria yelling to the rest of the school “yes! Uncle Alberto is coming back! We will garden again! Yes! Yes! Uncle Alberto is coming back!!! Cheeehoooo!!!” That boy’s name is Ha‘aheo, and he changed my entire life, and I am so thankful for that! When I heard him screaming like that, so happy for my return, I felt so much love as I had never felt before. I started to cry, partly of shame, because I had abandoned something so precious to chase diamonds in the dark. I realized what I was supposed to do: change my research topic and make it somehow connected to Ka Māla Lani, so that I would be able to come to Blanche Pope, because it would then be part of my Doctorate of Architecture! I asked Kumu Laurie permission to do so, and she was so happy for my interest that asked herself for approval from the Principal. Once the Principal gave me permission to use Blanche Pope as part of my Doctorate Project, I immediately talked with the School of Architecture Graduate Division about my desire to change my research topic, and they fortunately supported my decision.

From that point, Kumu Ilima recruited me to help planning and running the garden club summer program, and opened many doors to participate of community activities in Waimānalo,
which also changed my purpose in life. My involvement with Blanche Pope and other Waimānalo community groups, such as Hui Mālama o ke Kai and University of Hawaii Waimānalo Research Station, revealed the importance of the garden concept in preparing the children of Waimānalo to appreciate and mālama (care for) Waimānalo in a pono (right and just) way. My relationship with the garden continued for over four years, and I eventually became responsible for maintaining the garden, and co-planning and teaching the garden classes together with Kumu Laurie and other staff. This gave me the opportunity to teach the 2nd, 3rd and 4th grades.

This involvement showed me how deeply the people of Blanche Pope, especially the children, are connected to Waimānalo: the land, the sea, the music, the flora, the fauna, and especially, the community. Together, all of this made sense to me of what it meant to be Waimānalo! Mahalo!
GOALS OF THIS DOCTORATE RESEARCH PROJECT

The goal of this Doctorate project is to develop a site specific participatory design method and an comprehensive site plan for Blanche Pope Elementary School in Waimānalo, O‘ahu, Hawai‘i. It will incorporate design solutions that maximize the educational value, experience, efficiency, and self-sustainability of Ka Māla Lani, the school garden at Blanche Pope Elementary School. There is a vast literature on the implementation and use of school gardens, including some valuable publications focusing on diverse Hawai‘i's environment and social conditions\(^2\). Most of the references emphasize the importance of the involvement of the school community (including students) during the design process\(^4\)\(^5\)\(^6\)\(^7\)\(^8\)\(^9\)\(^10\)\(^11\)\(^12\)\(^13\), suggesting the use of participatory design. In this research, the understanding of pono is central to both participation and expansion of the ideas from the garden to the rest of the school campus, and vital to understanding how the design is derived. The design and implementation processes developed through this research will be also conceived around Blanche Pope Elementary School’s vision: to grow pono.

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\(^5\) Carroll, *Growing an Educational Garden at Your School: A Study of the Hawai‘i experience*.


1. INTRODUCTION

1.1. Geographical Location and Description.

This Doctorate Project is specific to its site at Blanche Pope Elementary School, on Hawaiian Homestead lands in Waimānalo, Oʻahu, Hawaiʻi. Waimānalo is a country town on the Windward (East) side of Oʻahu, the most populated of the Hawaiian Islands (Figures 1 and 2).

Figure 1. Location of Waimānalo and Blanche Pope in reference to Oʻahu.
Blanche Pope was named after *Della* Blanche Romick Pope\(^{14}\), wife of Willis Thomas Pope, former Superintendent of Public Instruction for the Territory of Hawaii from 1910-1913. Mrs. Pope was a pioneer in building the public school system in Hawaii.

The School’s vision (figure 3) is “*E Kūlia 1 Ka Pono Loa - Strive for Excellence*”. Blanche Pope Elementary is a culturally responsive school that provides students with a strong foundation for future academic and life endeavors. Students are respectful, cooperative, and active participants in a student-centered curriculum that integrates technology, collaboration, and problem-solving"\(^{15}\).

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\(^{15}\) "School Vision,” https://sites.google.com/site/bpespueo/general-information/school-vision.
The school core values are\textsuperscript{16}:

1. Through perseverance and hard work all students develop the confidence to succeed.
2. Our students are problem-solvers and critical thinkers.
3. We are a collaborative community of learners who make a difference through care and concern for all.

\begin{center}
\textbf{Believe - Achieve - Succeed!}
\end{center}

\textit{When we believe, we will achieve, we will succeed!}

\textbf{Figure 3.} Blanche Pope’s mascot and vision. Source: Blanche Pope Website.

\textsuperscript{16} Ibid.
The mascot of Blanche Pope Elementary school is the pueo, a native Hawaiian owl. Not by coincidence, the pueo is mentioned in traditional moʻolelo\textsuperscript{17} (explained further in this manuscript). The school’s oli (chant) mentions Muliwaiʻōlena, a stream also present in Waimānalo’s moʻolelo\textsuperscript{18}, currently channelized by the Army Corps of Engineers. There are historical accounts of sweet potatoes growing in Kaupō, on the dry side of Waimānalo\textsuperscript{19}, close to Blanche Pope, and taro fields existed along the stream, as well as managed agro-forest systems.\textsuperscript{20} Later, the land around the stream was used for planting sugar cane and current approaches to diversified agriculture\textsuperscript{21}. These activities revealed long standing traditions and continued support of Waimānalo’s agricultural roots.

The Community of Waimānalo is representative of many semi-rural areas in the State and has a larger percentage of Native Hawaiians than most communities. It also faces a series of social and economic challenges.

In the school year 2012/2013, there were 234 students enrolled at Blanche Pope Elementary School\textsuperscript{22}. Most of the students identified themselves as Hawaiian ethnicity (86\%) (Figure 4a). Although the data showed the option “Part-Hawaiian”, no student chose it, even though most of the students are part Hawaiian. This choice reveals the Hawaiian identity of Blanche Pope’s students and the importance to have a culturally sensitive environment. Almost 89\% of the students receive free or reduced-cost lunch (201 out of 234). In order to qualify for free lunch, students’ families must have incomes at or below 130 percent of the poverty level, and between 130 percent and 185 percent of the poverty level are eligible for reduced-price

\begin{itemize}
  \item Nathaniel B. Emerson, \textit{Pele and Hiʻiaka} (Honolulu, HI: ‘Ai Pōhaku Press, 1915).
  \item Ibid., 252.
  \item Ibid., 243
\end{itemize}
meals\textsuperscript{23}. Since 89\% of the students qualify for free or reduced cost lunch, it can be assumed that many of these students are near the poverty level.

There were twenty three students in Special Education programs during the school year 2012/2013\textsuperscript{24}, these individuals could potentially benefit from an outdoors learning experience to foster positive attitudes towards school and school personnel. There were 5 students with limited English proficiency. Sixty eight percent of the Kindergartners attended preschool\textsuperscript{25}.

The school staff is composed of 16 teachers, with an average of 13 years of teaching experience each, plus 3 administrators, and one counselor. Each teacher teaches an average of 19.2 students; however, during the school year of 2013/2013, the 4\textsuperscript{th} grade teacher was responsible for 40 students (personal observation).

The average daily attendance for the school year 2012/2013 was 91.5\%, lower than the state standard (95\%). The average daily absence rate was 15.3, when the state standard was 9. In the same school year, there were 4 suspensions, 3 of them of class B (Disorderly conduct, trespassing), and 1 of class C (Class cutting, insubordination, smoking).

Based on the report, students from Blanche Pope had above state average scores for Math and Reading, however, very low science scores\textsuperscript{26}. There are several garden based classes designed to meet the science common core standards curriculum\textsuperscript{27}.

\textsuperscript{24} System Evaluation and Reporting Section, "Blanche Pope Elementary School."
\textsuperscript{25} Ruth A. Willson, "Integrating outdoor/environmental education into the special education curriculum," \textit{INTERVENTION IN SCHOOL AND CLINIC} 29, no. 3 (1994).
\textsuperscript{26} System Evaluation and Reporting Section, "Blanche Pope Elementary School."
\textsuperscript{27} Jaffe and Appel, \textit{The Growing Classroom: Garden Based Science}. 
The percentage of high school graduates in Waimānalo (92.8%)\textsuperscript{29} is slightly higher than the State (90.4%)\textsuperscript{30}; however, the percentage of population with a bachelor’s degree or higher in Waimānalo (11.7%)\textsuperscript{31} is almost three times lower than the State average (30%)\textsuperscript{32}. There is consistent evidence that parents’ education predicts children’s educational outcomes\textsuperscript{33}, and the

\textbf{Figure 4.} Blanche Pope’s students’ ethnic background. Source: Hawaii DoE\textsuperscript{28}.

\textsuperscript{28} System Evaluation and Reporting Section, "Blanche Pope Elementary School."
\textsuperscript{30} “DP02 Selected Social Characteristics in the United States,” in 2012 American Community Survey (U.S. Census Bureau, 2012).
\textsuperscript{31} “DP02 Selected Social Characteristics in the United States - Waimanalo CDP.”
\textsuperscript{32} “DP02 Selected Social Characteristics in the United States.”
low percentage of the population holding a bachelor’s degree or higher could predict the potential education outcomes of children from Waimānalo.

Despite its strong community, Waimānalo faces many challenges. The rate of households with single parents with their own children under 18 years old in Waimānalo (16% of family households)\(^ {34}\) is more than twice as high as the State of Hawaii\(^ {35}\) rate (7.1%). The US average of grandparents who are responsible for their grandchildren under the age of 18 is 27.7%, while in Waimānalo, it is 22.7%, lower than the national average. Considering that there are more single parents in Waimānalo than the national average, and less grandparents responsible for their own grandchildren, it can be deduced that the children of Waimānalo receive less parental support than the national average, which can increase the risk of delinquency, aggressive behaviors, and somatic complaints, as well as externalizing and internalizing problems\(^ {36}\). Carefully planned afterschool programming and care could be provided at Blanche Pope to reduce the time that children are unsupervised and reduce the risk for inattention and problem behaviors\(^ {37}\), while parent involvement in early school could result in long-term educational success\(^ {38}\).

Partly in response to this need, two key projects were created at Blanche Pope to offer after school and family oriented programs, such as The Growing Pono Schools Project\(^ {39}\), and Nā Pono No Nā ‘Ohana\(^ {40}\).

\(^{34}\) Bureau, "DP02 Selected Social Characteristics in the United States - Waimanalo CDP,"
\(^{35}\) "DP02 Selected Social Characteristics in the United States."
\(^{37}\) Ibid.
\(^{39}\) Center on Disabilities Studies, "Growing Pono Schools".
2. Ka Māla Lani


The Growing Pono Schools Project implemented and currently manages Blanche Pope’s school garden, called Ka Māla Lani. The name Ka Māla Lani was chosen by students, and translates from Hawaiian to English as “The Heavenly Garden”. Kumu Laurie Kahiapo described the beginning of the school garden as follows:

“Back in 2007, Blanche Pope was facing serious problems with students’ behavior. Alu Like Inc. (Alu Like) [a non-profit service organization that has assisted Native Hawaiians in their efforts to achieve social and economic self-sufficiency since 197541] was called in to help with the situation. During the Alu Like visit to the school, the teachers had a difficult time keeping the students’ attention, and one student left the classroom, while swearing. One of Alu Like staff followed the student outside and found him crying in the stairs. The Alu Like staff member asked what was going on, and the student started to share his personal problems. At that point, the teachers realized that many of the students were coming to school with heavy hearts, and emotional issues. Their lives were filled with family problems, broken homes, abuse, and insecurity. The teachers asked the students what they would like to do, and they asked for a school garden.”

The school garden started out when students formed the Garden Club, under the guidance of Kumu Laurie, and they initially planted taro in plastic drums cut in half (figure 5). Right from the beginning, the garden has had a very solid principle: it is a pono garden. Pono is a Hawaiian concept that can be translated as righteous, good, positive, and appropriate. Mr. Kauila Clark defined pono in the movie, Life in these Islands42:

42 Don Mapes, Life in these islands: A Way of Life and Hope, (Honolulu: Kalo Productions, LLC, 2009).
What is Pono?

To live and to be in righteousness, correctness;

Respecting all things around us;

Understand the purpose of all things;

Understand our purpose;

Coming in honor and respect, rather than control and domain.

Figure 5. Students planting taro in plastic drums at Blanche Pope Elementary School, circa 2007. Photo courtesy of Laurie Kahiapo.

The school garden program is thus actually very comprehensive in its concept and practices. It addresses topics such as life cycles, food production, composting, environmental consciousness, anti-bullying, respect, life goals, and others, from a growing pono point of view. It has naturally evolved over the years and expanded greatly. Over two hundred students have gone through the program so far.

After the initial efforts of growing taro in plastic drums, more local community members have gotten involved and helped to expand the garden (figures 6 and 7).
Figure 6. Blanche Pope community members volunteering to start the garden at its current location, circa 2008. Photo courtesy of Laurie Kahiapo.
Figure 7. Taro planted in the new garden, circa 2008. Photo courtesy of Laurie Kahiapo.
2.2. Expansion and programming

Today, the garden is comprised of a fenced area of approximately sixty feet by eighty feet and includes eleven raised beds planted with vegetables, one dryland taro patch (māla kalo), sweet potatoes grown in tires, fruit trees, and a compost pile. There is an automated irrigation system, a tool shed, and an entrance gate made out of bamboo where students chant “E ho mai” before entering the garden. An overall planting design was drawn in 2012 to help visualize what could be done in the garden (figure 8).

The after school Garden Club used to meet under a big monkeypod tree, sitting on mats. About the year 2012, some classes started to come to the garden during school hours, as part of the Hawaiian, Social, and Science Studies class, which linked the garden activities to the Common Core Standards that teachers are required to meet in the classroom. The garden was used weekly by eighty students during the 2013/2014 school year (2nd, 3rd and 4th grades), and the after school program, with approximately twelve students, (most of them in the 4th grade).

The growth of this program demonstrated the need for additional gathering spaces, and the creation of more environments appropriate for the Hawaiian Common Core curriculum and the use of the school garden program. For example, program instructors noticed a need for an improved gathering and teaching space to make the transition between the classroom and the garden. Fortunately, Nā Pono No Nā 'Ohana built a tent for themselves that was shared with the garden classes (figure 9). However, sometimes the tent cannot be used, or needs maintenance. (figure 10). In those instances, the garden class had to meet in the shade of buildings or trees, or out in the sun. So the garden club must have its own sheltered space like a traditional Hawaiian hale.

Figure 8. Garden design made in 2012, including older, and student inspired newer garden elements. Drawing by Alberto Ricordi.
Figure 9. Tent built by Nā Pono No Nā ‘Ohana, shared with the garden classes.
The school garden program at Blanche Pope developed a unique protocol for the transition of students from the classroom to the garden. In the first years of the garden program, the classes usually started with short lessons (e.g. on the concepts of life cycle, etc), inside the classroom, and moved into the garden. After Nā Pono No Nā 'Ohana built their covered structure, the classes started to gather outside the classroom. However, the garden instructors realized that needed a transition between the gathering space and the garden, to help the students to calm down, focus, and listen to the instructions. This is essential as it was difficult to engender the respect for the principles of the pono garden. Inspired by Hoa ‘āina o Makaha⁴⁴, the garden

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staff created a wooden sign with the “E hō mai” modified from the original chant by Edith Kanaka'ole. (figure 11)

Figure 11. Students chanting a modified version of “E hō mai” before entering the garden.

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45 Kanakaole, "E hō mai ".

16
All students oli before entering the garden.

\[
E \ hō \ mai \ (i) \ ka \ ‘i\ke \ mai \ luna \ mai \ ē \\
‘O \ nā \ mea \ huna \ no\’eau \ o \ nā \ ‘āina \ ē \\
E \ hō \ mai, \ e \ hō \ mai, \ e \ hō \ mai \ ē \ (a)
\]

Which translates as:

*Give forth knowledge from above*
*Every little bit of wisdom contained in the land*
*Give forth, give forth, oh give forth*

The term “mele” from the original chant by Edith Kanaka'oli was replaced by ‘āina to emphasize the land as the source of knowledge as the students work in the garden. As a response, the garden instructors (kumu) answer with the chant:

\[
E \ komo \ mai \ e \ nā \ keiki \ i \ ka \ māla \ lani \ ē \\
E \ mālama \ i \ ka \ ‘āina \ e \ mālama \ pono \ ē \\
E \ komo \ mai, \ e \ komo \ mai, \ e \ komo \ mai \ ē
\]

Which translates as:

*Come in oh children in the Heavenly garden*
*Take care of the land, take good care of it*
*Come in, come in, come in*

Once the instructors finished the response chant, the students are grouped in teams and receive their tasks for the day. Some teams have leaders. At the end of class, some teams with leaders reported the work done by the group and they evaluated the leaders. It is an exercise in leadership, management and responsibility. The instructors provided directions on the type of tools and safety gear to use that included gloves and boots stored in the garden shed.
2.3. Special programming and maintenance needs

There is an opportunity to organize the tools in the storage shed so there is additional interior storage space. By completing this task, it will help with keeping the tools and materials organized so that the short time spent in the garden is efficient. Currently, all different hand tools are grouped in a bucket and the gloves are grouped in another bucket. There are several hooks to hang large tools (i.e. shovels and rake), and two shelves to hold miscellaneous materials and supplies (i.e. pens, labels, strings, hammer, seeds). The wheelbarrow stays locked to a dead plumeria trunk, and was found around the school several times. The garden has received donations of pots, potting media, seeds, table, chairs, and many other useful supplies. However, many of them are piled on the floor because there is no room for it. It would improve the efficiency of their time in the garden, which is very short, help keep tracking of tools and materials, keep things clear, pono.

The students are responsible for most of the work in the garden. The only job done exclusively by adults is weed-whacking and driving, for safety reasons. Students are responsible for building garden beds and patches, planting, mulching, hand watering, weeding, and harvesting. During breaks, tests, weather changes, and other occasions when the students do not come to the garden for a long period of time, the school garden staff is responsible for maintaining the garden, often with volunteer help.

The students take home the produced harvested from the garden. During 2013-2014 school year, every student took home a bag of produce at least one time. After working in the garden, some students enjoyed eating fresh vegetables and fruits. Some were cooked by the instructors at home and brought back the next day for students to taste. This included sweet potatoes and chicken lu‘au (figures 12 and 13). The students also learned traditional Hawaiian ways of preparing food, such as making pa‘i‘ai from taro harvested at the end of the school year, along with visiting community practitioners (figure 14).
Figure 12. Students from Blanche Pope Elementary School 2\textsuperscript{nd} and 3\textsuperscript{rd} grade eating greens grown in the school garden with homemade dressing.
Figure 13. Chicken lū'au made from taro leaves grown in the garden and harvested by students.
Figure 14. Uncle Kaneala Salsedo and his hui taught the students from the garden club how to ku'i kalo.
2.4. Incorporating Modern Techniques into Traditional Hawaiian Agriculture

The garden is based both on traditional and on modern horticultural techniques and best management practices. These techniques come from an understanding of both traditional Hawaiian and modern horticultural practices. In order to expose the students to traditional systems, there is a dryland taro patch in the school garden (māla kalo), and the students go on field trips to local farmer’s lo‘i (wetland taro farms, figure 15). Students also go on field trips to the Cooperative Extension Service demonstration areas. Besides learning traditional values and how to grow food at the school, the garden thus offers students opportunities to gain insights into science and large-scale farming. As part of the program, students visit Dr. Theodore Radovich’s Sustainable and Organic Farming projects at the University of Hawai‘i (UH) Waimānalo Research Station, where they learn about agricultural and soil science, organic agriculture and aquaponics (figure 16, 17 and 18). Dr. Radovich and his graduate students also come to the school to teach kids about crops, nutrition, and make recommendations.

Figure 15. Students from the garden club weeding the lo‘i at Kapalai Farm’s in Maunawili.
Figure 16. Dr. Radovich with Blanche Pope students catching tilapia in an aquaponics system at UH Waimānalo Research Station.
Figure 17. Dr. Radovich teaching students how to properly clean tilapia grown in aquaponics systems.
Figure 18. Different sweet potatoes grown at the UH Waimānalo Research Station, offered to students during field trip to experience the different tastes and learn about the different nutritional properties linked to food colors.
2.5. The Garden as a Puʻuhonua, a place of refuge,

As it was created to be, the garden at Blanche Pope, Ka Māla Lani, is more than a horticultural experiment, it is a safe place of aloha for students to come to learn about gardening and values. It is the place where students who struggle in academics and with emotional issues, can feel validated and be successful. The garden is a place for students to learn about key science curriculum, practical food production, and team work. Within their own cultural framework, they practice respect for each other, aloha kekahi i kekahi. The garden is above all, a place to learn about caring and respect for the land: he aliʻi ka ʻāina, he kaua ke kanaka (the land is a chief, man is its servant). From the moment students, children or adults, oli (chant), E hō mai and enter the garden, the intent is that all their hurts, such as family and relationship problems, professional and academic frustrations, social pressures, can be left behind. In this way, it is like the traditional Hawaiian Puʻuhonua, a place of refuge, where troubles are left outside. Then, the students can focus on themselves and on doing something pono, something fruitful, in peace. That is why Ka Māla Lani is called “the Pono garden”.

26
3. LITERATURE REVIEW

3.1. Schoolyards for Education

The concept of a school garden is not new. Gardens used as educational tools have been documented since the eighteenth century in Europe\(^{46}\). Various prominent philosophers have emphasized experiential education and hands on learning as the foundation of education, from Rousseau (1712-1771) to Friedrich Froebel (1782-1852). As a practical and vocational mandate, public schools have long been involved in horticulture. An Austrian law in 1869 required a garden in every rural school, and by 1898, there were 18,000 school gardens in Austria and Hungary, and by 1905 over 100,000 school gardens in Europe\(^{47}\). The first documented school garden in USA was created in 1891 at the George Putnam School in Roxbury, Massachusetts, and the first American books about school gardens date back to the early 1900’s\(^{48,49}\). These books discuss the importance of school gardens for development of teamwork skills and to offer hands-on experience, as well as emphasizing the importance of local agriculture in food production. Figure 19 depicts a school garden in Massachusetts, circa 1913.

Bucklin-Sporer and Pringle\(^{50}\) summarized how Daniel Desmond, James Grieshop and Aarti Subramaniam\(^{51}\) identified three periods of interest in school gardens in the USA: 1900-1930, was a time of Progressive reforms and war mobilization; 1960-1970, was the emergence of the counter-cultural and environmental movements; and 1990-2000 a period of renewed interest in education reform and environmental education. Bucklin-Sporer and Pringle suggests a fourth peak is occurring in the 2010’s as a consequence of the attention to climate change, efforts to

\(^{48}\) Dora Williams, *Gardens and Their Meaning* (Boston: Ginn and Company, 1911).
\(^{50}\) Bucklin-Sporer and Pringle, *How to Grow a School Garden: A Complete Guide for Parents and Teachers*.
\(^{51}\) Desmond, Grieshop, and Subramaniam, "Revisiting garden-based learning in basic education".
reconnect children to the natural world, and heightened awareness of sustainability issues, and green practices\textsuperscript{52}.

\textsuperscript{52} Bucklin-Sporer and Pringle, \textit{How to Grow a School Garden: A Complete Guide for Parents and Teachers}. 
Figure 19. A school garden in June (1913)\textsuperscript{53}.

Although many schools have started and developed their schools gardens mainly through trial and error, such as in the beginning phases of the school garden at Blanche Pope, there is a long history of the concept of school gardens\textsuperscript{54}. There is an extensive literature on design, community organization, and the use of school gardens. Before addressing the “how-to” in the design and implementation of a school garden, it is important to define “why” a school should have a school garden.

3.2. Outdoor Education and its Relationship with Traditional Hawaiian Education

School gardens are a form of outdoor education. There are endless studies and publications about the topic of outdoor education, justifying how important it can be in the formation of children. Education is a complex field, with endless sources of information about it. However, one well known ‘ōlelo no‘eau explains very well why outdoor education is as important as traditional educational methods inside a classroom:

‘A‘ohe pau ka ‘ike I ka hālau ho‘okāhi.\textsuperscript{55} 

“All knowledge is not taught in the same school.”

(One can learn from many sources.)

The Doctor of Architecture Francine Mikiala Park Palama explored the traditional Hawaiian education and tied it with architecture education as a theme of her Doctorate Project\textsuperscript{56}. Her literature review and conclusions clearly define the importance of outdoor education for the development and learning process of children from a Hawaiian perspective. The findings in her thesis deserve attention, considering the nature of this project – re-planning the schoolyard of an

\textsuperscript{53} Meier, School and Home Gardens.
\textsuperscript{54} Bucklin-Sporer and Pringle, How to Grow a School Garden: A Complete Guide for Parents and Teachers.
\textsuperscript{56} Francine Mikiala Park Palama, "Hawaiian Architecture: Developing Responsible Stewards of Our Land" (Doctorate, University of Hawaii, 2012).
Elementary School within a Hawaiian Homestead community – and will be summarized for future reference during the design process.

The study of Hawaiian Language (ʻōlelo Hawai‘i) helps to understand the dynamics of traditional Hawaiian education as a transfer of knowledge, where knowledge is sacred and should be taken seriously, because knowledge gives power to those who possess it.

In ʻōlelo Hawai‘i, the verb aʻo is used both for “teach” and “learn”. The directional marker differentiate one from another. Aʻo mai means to learn (mai is a used to indicate that the action is towards the speaker), while aʻo aku means to teach (aku is a directional used to indicate that the action is away from the speaker)\(^{57}\). Aʻo also appears in another Hawaiian word related to education: manaʻo (knowledge, thought, understanding, perspective or point of view, theory, suggestion, idea, want). Perhaps, the word manaʻo comes from the concept that once one learns, the knowledge becomes part of his mana (power, spirit). The more one learn (aʻo mai), the more powerful he or she becomes, because other people will respect and consider his manaʻo.

Fracine Palama mentions two of the three “B`s” taught to Blanche Pope Elementary School’s students as a way to Become who they want:

“...receiving and giving knowledge is acknowledged by Hawaiians who support the idea that connecting and belonging which are primary actions in a traditional Hawaiian reciprocity society. By building these relationships, a person learns and becomes the master whereby knowledge and skills are subsequently used and shared with others. For instance, a chief’s knowledge and skills gave him a sense of independence and power. The chief shared his ability to help his people become better stewards of the land by implementing proper management of the resources to ensure adequate provisions for his people. In turn, a good chief was honored and respected but a chief who was careless and reckless either faced death or was replaced”\(^{58}\).


\(^{58}\) Palama, “Hawaiian Architecture: Developing Responsible Stewards of Our Land.”
Therefore, being aʻo an action of transferring knowledge, one needs to master the knowledge before being able to move forward and passing it on. This concept contradicts the current education system where children are grouped by age, and allowed to move on to the following grades before fully learning the content. The current educational system in Hawaiʻi's public schools forces students to follow an institutional timing, instead of walking in their own pace, not for benefit of the student, but to ensure the success of good testing evaluation systems, tied to more complex political interests that are out of the scope of this Doctoral project.

In traditional Hawaiian education, education was “practical, skill oriented, socially useful, and in tune with reality; environmentally aware, conserver cognizant, heavily influenced by learning by doing”60. Outdoor learning spaces expands the opportunities for active learning by doing, and students are more exposed to the environment and more in tune with reality.

**Nānā ka maka; hoʻolohē ka pepeiao; paʻa kou waha.**

*Observe with the eyes; listen with the ears; shut the mouth.*

*(Thus one learns).*61

*If a child observed what was being taught, he would learn; by listening, the child would commit things taught to memory; and by practicing, the child would master the skill.*62

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60 Marion Kelly, Some Thoughts on Education in Hawaiian Society. In: To Teach the Children Historical Aspects of Education in Hawaiʻi (Honolulu, HI: College of Education. University of Hawaii and Bernice Pauahi Bishop Museum, 1982). In: Palama, “Hawaiian Architecture: Developing Responsible Stewards of Our Land.”
Traditional education of a child was based on each child’s particular strengths and performance observed by the kūpuna\textsuperscript{63}. Outdoor learning spaces with active participation of students enhance the chances of expressing interests and abilities, because children are not confined in a classroom limited by the space and capacity of reach that a desk, a chair, a pencil and a worksheet allow. Outdoor learning spaces are actually designed to encourage creative expression, social interaction, leadership roles (which not necessary implies that every children should manifest characteristics of a leader), and other behaviors that helps teachers, parents and guardians to identify the children’s interests and strengths. More important than that, it allow the child to discover their talents and to manifest them in the educational environment, as part of a society, without the pressures that a classroom imposes.

Outdoor learning spaces complement traditional indoor learning environments (classroom) with a common goal: “E Kūlia I Ka Pono Loa - Strive for Excellence”\textsuperscript{64}.

3.3. Why every school should have a school garden

Schoolyards are the environment and location where young students spend a great deal of time. Along with the facilities and built environment, the school grounds also the context for education and formation of intellect and character. When schoolyards are incorporated in the curriculum and are actively used by the school’s community, students understand the connection between them and the physical and cultural environment, and this helps promote awareness and active participation, developing a sense of ownership and land stewardship\textsuperscript{65}.

Schoolyards are meant for education – and many schools take advantage of their grounds for education beyond the classroom setting. In addition to recess and sports, many schools have implemented outdoor learning options.

The use of the school yard space could have an impact on the local community as well. It is a strategic location for innovation, where ideas and practices can be presented for potential

\textsuperscript{63} Ibid.
\textsuperscript{64} School, "School Vision".
\textsuperscript{65} Danks, Asphalt to Ecosystems.
adoption in the greater community. School gardens provide a defined space with informed stakeholders (students and adults), and therefore make it easier to extend out to the community.\textsuperscript{66}

### 3.4. School Garden Policies, food security and nutrition and health

There is a vast literature that supports school gardens as an appropriate environment for young students and adults to learn about nutrition, agriculture and food security, to allow them to produce their own food.\textsuperscript{67,68,69,70,71,72,73,74,75,76,77}

The development of Best Agricultural Practices in school gardens (Hawaii Department of Agriculture), and protocols for inclusion of produce from school gardens in lunch menus (Department of Health and Department of Education) will allow school gardens be part of the strategies to address food security and healthy diet goals in the state. In the context of the State of Hawai‘i, several House Bills have been introduced in the Hawai‘i legislature for promotion of school gardens. House Bill HB1243, introduced in 2014, enacts the establishment of a school garden task force to:

1. examine the feasibility of establishing school garden in public school, and specifically public charter schools, to grow food for consumption as part of each school’s lunch program; and

\[\text{\textsuperscript{66}}\text{Ibid.}\]
\[\text{\textsuperscript{67}}\text{Williams, Gardens and Their Meaning.}\]
\[\text{\textsuperscript{68}}\text{Gerlock, Subedi, and Cocquio, Through the Eyes of Children: Walking and Learning with Children.}\]
\[\text{\textsuperscript{69}}\text{Meier, School and Home Gardens.}\]
\[\text{\textsuperscript{70}}\text{Williams and Brown, Learning Gardens and Sustainability Education: Bringing Life to Schools and Schools to Life.}\]
\[\text{\textsuperscript{71}}\text{Danks, Asphalt to Ecosystems.}\]
\[\text{\textsuperscript{72}}\text{Bucklin-Sporer and Pringle, How to Grow a School Garden: A Complete Guide for Parents and Teachers.}\]
\[\text{\textsuperscript{73}}\text{Grant and Littlejohn, Greening School Grounds: Creating Habitats for Learning.}\]
\[\text{\textsuperscript{74}}\text{Food and Agriculture Organization of the United Nations, Setting up and running a school garden: a manual for teachers, parents and communities.}\]
\[\text{\textsuperscript{75}}\text{Fanton and Immig, Seed to Seed: Food Gardens in Schools.}\]
\[\text{\textsuperscript{76}}\text{Carroll, Growing an Educational Garden at Your School: A Study of the Hawai‘i experience.}\]
\[\text{\textsuperscript{77}}\text{Kōkua Hawai‘i Foundation, “ʻĀINA In Schools: Kōkua Hawai‘i Foundation,” http://kokuahawaiifoundation.org/aina.}\]
(2) Determine a process by which food grown in a school garden is inspected and certified as safe for consumption.

The HB 1571, introduced in 2014, supports agricultural education and increase community access to the benefits of gardening by:

(1) Authorizing the Department of Education to develop programs that provide incentives to establish school gardens; and

(2) Expanding the Hawaii Community Development Authority’s authorization to develop incentive programs for urban gardening to include programs in communities and schools, in addition to programs in state housing projects, seeks a feasibility study.

The Hawai‘i Office of Planning has implemented action plans to address the demands mentioned above. School gardens and agricultural education at early education levels are both aligned with the Hawaii revised Statutes §226-1, “to provide for wise use of Hawaii’s resources and to guide the future development of the State”. The Hawai‘i Office of Planning “Increased Food Security and Food Self-Sufficiency Strategy” identifies food security as one of the concerns in coastal zones, and supports school gardens as part of an effort to connect people with farms and farming, with and suggests an action plan to “Develop a Coordinated Pathway of Agricultural Training at Elementary, Secondary and Post-Secondary School Levels”. The State of Hawai‘i Office of Planning “Increased Food Security and Food Self-Sufficiency Strategy”, recognizes that the Department of Agriculture could support this goal by developing food safety standards for school gardens, which would allow food grown in school gardens to be used in school cafeterias (estimated $200,000 allocated for this program in the fiscal year 2012-2015).

The House Bill 564 of February 15, 2013, had the purpose and intent to “establish a task force within the Department of Agriculture to examine the feasibility of establishing school gardens and creating a Hawaii-grown fresh fruit and vegetable program and to advise the Department of Agriculture in the creation and implementation of the farm-to-school program.” The legislature committees received testimony in support of this measure from the Hawaii Academy of Arts and Science, Kohala Center, Hawaii Association of Independent Schools, Kauai School Garden Network, Hui o Malama Aina, Hawaii Farm Bureau federation, Hawaii
Organic Farming Association, and two individuals. The legislature committees received comments from the Department of Agriculture. The House bill states that the legislature committees found that a statewide agricultural strategic plan for a farm-to-school program would improve student engagement in agriculture and food sustainability. After discussion, however, the (legislature) committees concluded that a working group is needed to evaluate how locally-grown produce can be utilized by all state agencies, not just the Department of Education.

The State of Hawai‘i House of Representatives, Twenty-Seventh Legislature, 2013, House Bill No. 478 H.D.2, mandates that “all schools may grow food in school gardens for consumption in their school meals programs; provided that food products used in a school meals program shall be inspected and certified as safe by the department of agriculture”. The House Bill also “allows nonprofit organizations to establish and administer fresh food distribution services.” The Department of Education “shall not be liable to any person for any sickness or contamination that results from the use of fresh foods from the school garden, except when the sickness or contamination is caused by a condition resulting from the department’s failure to comply with sanitation and hygiene standards established by the department for school lunch programs…..” The same bill mandates that “there is appropriate out of the general revenues of the State of Hawaii the sum of $ [ blank ] or so much thereof as may be necessary for the fiscal year of 2013-2014 and the same sum or so much thereof as may be necessary for fiscal year 2014-2015 for the establishment and support of school gardens and the use of food grown in such gardens in school meals programs”.

As the legislature pushes for laws to deal with the recognized public issues of nutrition, agriculture and food security, they will need to seek ways to implement the school gardens to cafeteria programs by 2050. The discussion and ideas presented in this document could support schools in their efforts to meet this mandate, and the example of Blanche Pope could be relevant to any implementation of this law.
3.5. Environmental Sustainability and Stewardship:

Every school is located in a particular climate and physical region, and is part of a watershed and an ecosystem, with many systems within it: water, energy, fauna, and flora. These broader systems can be demonstrated in a school garden and many activities can demonstrate how human activity influences these systems. Under the concept of Ecological yards, activities that follow “green strategies” such as the creation of wildlife habitat, on-site water treatment, energy conservation and production, food production, and/or waste use/reduction/processing, can be incorporated in the schoolyard design.

School gardens can be a way of incorporating these macro-concepts and serve as a spring board to the whole school campus. These concepts are able to be implemented through a school garden, with practical participation by the students and others. This gives all potential stakeholders an opportunity to introduce these environmental principles in the curriculum, enriching students’ education and providing a better connection between classroom learning and real life applications, as well as a sense of participation and responsibility. Another benefit is that when the stakeholders participate in these activities at their own school, it creates awareness and pride, enhancing the role of the school as an educational leader in the community.

Ecological schoolyards provide an opportunity to enrich the students’ “learning” and “playing” experiences. They provide opportunities for activities and experiences beyond organized sports and free play, and traditional standard playground usage. Some of the areas where the students educational options are expanded include: habitat and ecological ideas like learning from seasonal plants and animals that might be part of the wildlife of the location, how to participate in school maintenance routines (such as composting, grounds keeping, greening), and the outdoor education component in the garden can also use the campus for art lessons and community activities.

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79 Danks, Asphalt to Ecosystems.
80 Ibid.
3.6. Educational value

Traditional schoolyards are not generally designed with the idea of using the outdoor spaces as an environment for education. In addition, most of the examples of the garden, and curriculum design in the USA and Europe were developed in a four season Temperate or Sub Arctic climate regime. In Hawai‘i the tropical climate allows for year round use of the outdoors as an educational space. Design of school yards in Hawai‘i must recognize this distinction, and embrace this expanded opportunity.

A well designed outdoor learning space becomes a functional site for the application of the school curriculum. The design requires landscape architectural planning of land use and space designation and design options for specific uses. Several efforts currently use the outdoors to meet specific educational common core standards. One example is the LifeLab, a 501(c)(3) non-profit organization that “teaches people to care for themselves, each other, and the world through farm and garden based programs” (from www.lifelab.org/about/ website April 15 2014).

The LifeLab developed the Growing Classroom, an award-winning resource book for educators containing 480 pages of science, math, and language arts activities that teachers can undertake with students in the school garden. These activities are aligned with California Science Content Standards. Topics include soil, plants, cycles, ecology, weather, nutrition, and food systems. Additional topics include team-building and sensory exploration activities, organic gardening skills, and information on how to create and sustain a successful school garden program. Currently the LifeLab has developed lessons that connect the Growing Classroom with the new Common Core Math and Language Arts standards and Next Generation Science Standards (NGSS) being rolled out in schools in locations throughout the USA. It is a great example of a resource that can help show educators how to teach in the outdoors and meet the required curriculum.
There are school garden programs in Hawai‘i that have developed the same kind of material. For example, the ‘Āina in Schools project\textsuperscript{81} has lessons adapted to Hawai‘i’s environmental and cultural context and which also address the common core standards. They include detailed lesson plans with academic components tied to garden activities which meet our specific standards.

These two projects (LifeLab and ‘Āina in Schools) are great potential examples of how an outdoor space could be used by teachers to achieve curriculum standards. However, without adequate site planning, even the best curriculums cannot work. The schools and teachers need a suitable space to apply these lessons. The role of a landscape architect is beneficial in the process as the outdoor space must be evaluated for such physical parameters as soils, and drainage. The garden needs to be planned and designed functionally, so it can actually grow and potentially flourish. A well designed garden, and even more so, a well designed school campus that incorporates ecological and horticultural purposes, also expands and facilitates teaching, especially if it is designed in a way that provides resources, and efficiently facilitates the lesson plans for the teachers.

3.7. School yards play value and healthy behavior patterns

Children need outdoor spaces for relaxation, healthy play and recreation. In most schools their space is treated as neutral, or ignored as a learning environment (except maybe in the case of organized sport). In many cases students are discouraged from seeing the school campus as a living environment. They are not permitted on the lawns and the plants are arranged in formalized landscape units. Danks (2010) compares traditional schoolyards, dominated by asphalt, concrete and lawn, with ecological or green schoolyards, with more variety of plant types, materials, and variations in circulation and spaces. Danks (2010) also mentions research from several authors:

\textsuperscript{81} Foundation, "ʻĀINA In Schools: Kōkua Hawaiʻi Foundation".

- schoolyard “nature play” (play in the green area?) areas encourage collaborative and cooperative play (which is important for team and community building, and respect among them – against bullying), while reducing aggression that often occurs in traditional competitive play)

School gardens fulfill the same roles. One of the observations of this research was that at Blanche Pope the value of the behavioral modification component was the main motivator for the implementation of the school garden. The curriculum value was realized later. With time, the principles of pono and mālama ʻāina (land stewardship) taught in the garden were manifested beyond the garden limits. The expansion of the principles of pono out of the garden found practical ways to be applied to the rest of the property. It influenced the planning for the rest of the site. This transformation of space opened the eyes of the school body to identify the issues and seek ways of solving them in a pono way. For example muddy pathways were improved with paving blocks installed by students during garden time and a collection of differing varieties of taro were planted in a frequently flooded area. This realization transformed the way the campus was conceived.

In Hawaiʻi the climate is tropical and many of the designs for the gardens and the concepts of a garden in the school are derived from another climate and cultural context. Perhaps the biggest lesson from the Blanche Pope experience is that there exists a possibility to return the educational experience of the children to the original educational context, the natural world. The lesson is not that we must design a garden for the school, but that the school is set in a garden.
3.8. Building Community through Participation - Laulima

Green schoolyards are a result of community collaborations: school’s principal, faculty, staff, students and families. Neighbors, local businesses, government agencies, and non-profit organizations may also be involved. Participatory design usually leads to strong ecological schoolyards because this process, itself, is important for “building community” and transforming stakeholders into stewards of the grounds (Danks, 2010, page 3). From Danks (2010):

Danks states, “Often the participatory design process is used to craft a schoolyard master plan that acts as a flexible, “living document” to guide the project’s gradual implementation over a period of many years. The master plan communicates the general project goals and infrastructure placement, while allowing the specific elements in the plan to grow and change as they are implemented one project at a time, each semester. This design philosophy enables the content of the green schoolyard to keep pace with the ever-changing needs of the school community, so that it remains an important part of the school’s identity as individual teachers, parents, and students come and go”.

The provided materials to the stakeholders with the background materials. The participatory design process will occur in the implementation phase. This is not a negation of the value of the process, but was a function of the limitations of the academic approach. At this phase it includes a design charrette and further input specifically from the custodial staff. And new teachers.

Danks approaches the issue from the perspective of a landscape architect. The “‘ecological schoolyards’ movement seeks to teach the principles of ecology through the design of the schoolyard landscape and to reconnect children with the natural systems in their local communities. Ecological schoolyards allow classes to meet outside, enriching traditional lessons in every discipline with hands-on learning resources and living systems that students can observe and interact with on an ongoing basis.”

She also ties this approach to other similar movements in education and design. “This decentralized movement and design philosophy, is also called “green schoolyards” or
“sustainable schoolyards,” follow the idea that the school campus should reflect the environmental principles taught at the school. It gives students the opportunity to learn about their own impact in the environment, gives a chance to make a change in the neighborhood (which can facilitate the arise of leaders and the understanding of community work), and to have a positive relationship with the environment, while most of the environmental messages taught to the students are negative (Danks, 2010, page 1).

She also elaborates on how this approach can reinforce the curriculum and any state standards that may apply. “The hands-on experiences in the schoolyard help students to better understand what is taught in the classroom, bridging the divide between theory and practice (Danks, 2010, page 1).

Danks further emphasizes how the schools and any changes in their ecological or sustainability practices can potentially spread beyond the schoolyard. “Many communities that build ecological schoolyards understand the importance of local self-reliance and sustainable development. The school grounds can be used as a model for what is envisioned in the surrounding community, including energy conservation and renewable energy systems, storm water and wastewater management, locally sourced materials, treat “waste a reusable resource, and engage children in projects that follow local agricultural traditions” (Danks, 2010, page 2).

These are values important to Hawai‘i, given the geographical isolation, current dependency on external energy, and concerns over food security and maintaining the production of a local food supply.

3.9. School gardens teach business and teamwork skills:

School gardens further serve as excellent educational tools, especially for students who end up involved in agriculture. Gardening is a valuable learning experience for others who will be involved in other occupations not related to agriculture, or start their own business, since school gardens also demonstrate responsibility, team work and leadership. In addition, the Food and Agriculture Organization of the United Nations (2005) mentions how many schools use their gardens to generate income for the school. This is a great resource to run programs not included in the school budget, such as after school and other community programs.
3.10. Description of the Typical School Campus in Hawai‘i

Public schools in Hawai‘i generally follow a fairly standardized lay out and architecture. In Hawai‘i, the classroom administration and service buildings are typically reinforced concrete box buildings without hallways, often with a protective overhang above walkways used for access and circulation. Covered walk ways often connect separate buildings in case of rain or to provide canopy for shade. Green areas are generally low maintenance fields which provide multiple use recreation options, or lawns or open spaces and landscaping units. Trees are often avoided because of maintenance. Species with fruits and seed pods are discouraged because of liability and messiness. Playground structures because of liability factors have become as standardized as possible. Usually they are controlled spaces made out of plastic with rubberized ground protection. The school campus is viewed as being sited on a piece of property not in a natural context.

In the case of a school campus, security needs for the protection of the students results in extensive fencing, line of sight considerations, crowd management and flow, and other security measures. These primary needs are often seen to be in conflict with landscaping or outdoor use possibilities. Elimination of potential liabilities is a major concern. For further discussion of school design options and standards, and related issues, see:

The outdoors is not generally recognized as potential teaching space. This indoor/outdoor polemic is also inherent in the term “outdoor education”. Indoor education is synonymous with “regular” formal education practices, outdoor spaces are nonformal spaces.

One of the consequences of the typical management of the school yard is that it becomes overly managed, and an ecologically sterile space. This is problematic because the school yard is part of the natural environment and situated in both an ecological and community context. In highly urban areas this connection is completely severed.

Realization of this lost connection and restoring it is one of the main challenges and gaps in the standards of public school designs in Hawai‘i. The author of this study became familiar with innovative school campus design solutions as part of his practical experience in a prominent landscape office in Hawai‘i. These solutions are noteworthy, but largely limited to schools that
had abundant resources to invest in their campuses. Some of them are mentioned as case studies later in this document.

3.10.1. Contextual Limitations for Public DOE Schools: Institutional Factors

The Hawai‘i Department of Education (DOE) manages 286 schools and institutions in Hawai‘i, with an enrollment of 183,251 students\textsuperscript{82}. Design limitations for the DOE schools in Hawai‘i are both institutional and physical. Public schools are part of a state wide single administrative entity. The DOE schools do not have the same resources or policy options as the private schools.

Private schools are autonomous and control their property as well as the decisions and budgets for use of their property. Public schools are common property spaces. The individual DOE schools have limited institutional control, and cannot set policy. Potential decision makers suffer from a complex responsibility hierarchy, and indirect management of their sites. No clear vision for who can initiate or must approve any changes in the land uses or curriculum exists. Campus based innovation is not necessarily understood or encouraged. This is one reason that the school gardens (or restoration of natural areas for ecological goals) are often seen as extracurricular activities.

Teachers use these community managed, garden spaces on their campus for teaching, but are not necessarily responsible for them. The custodians and landscape specialists are also bound by their time limits, job descriptions and training. In the case of Blanche Pope for example, the maintenance of the fields and lawns is done by DOE employees who arrive on campus with their grass cutting machines, and then leave, having a real impact, but no real connection to the property.

Budgets for the DOE are set as a whole, and money allotted to individual schools is limited. Improvements to the outdoor spaces are seen as landscaping and low priority, when contrasted with more pressing physical maintenance needs (security lighting, roof repair, painting, air conditioning, ADA compliance etc.). The administrators and staff are part of a fluid

\textsuperscript{82} Hawai‘i Department of Education 2013 Superintendent’s 24\textsuperscript{th} Annual Report. June 2014.
DOE bureaucracy. The constant change of personnel, administration, teachers, and ground maintenance positions, makes it hard to set long term goals or to do effective planning. Priorities, interests, and commitment levels often change and result in a discontinuity of purpose and practice.

The DOE should adapt to sustainable development practices, and adopt standards that reflect ecological school yard principles. Ecological schoolyards require a new mind set. Adjustments will have to be made in the way DOE conceives their role. School yard modification as proposed in this document require a considerable amount of time and dedication for their implementation, management and maintenance. They require trained and attentive grounds keeping. They may be more suitable for a paid position, especially because of the level of commitment that it requires. Also, they do not fit within the current DOE maintenance system, where a tractor is dropped off in the school, mow the grass, and move on to the next school.

Any of these considerations can result in resistance to the long term development of a comprehensive program as discussed in this proposal, rather than scattered short term projects.

3.10.2. Contextual Limitations for Public DOE Schools: Design Factors

A school campus may be situated in many different built environments. Some campuses are located in totally urban environments, while others are in rural areas. In all cases the school is maintained as a quasi-public, controlled space. They are disconnected in varying degrees from their ecological and community contexts.

One landscape Architect who addresses this issue is Sharon Gamson Danks. The ideas in her book *Asphalt to Ecosystems, Design ideas for Schoolyard Transformation* attempt to show how a concern for creating outdoor learning environments will make it possible for schools to create ecological understanding and reconnect to nature and the human well-being. Well designed school yards can “promote children’s health the construction of positive social environments, landscapes to connect with nature, the cultivation of healthy fresh food for student consumption, and the provision of spaces that facilitates a diversity of play are all options.” This project helps to illustrate how the school garden works as a transformative element in Hawai‘i.
Emphasizing the problematic disconnect between the academic setting and the natural world, she further explains how this disconnect could be remediated by effective design:

”Standard school yards do not work as ecological corridors nor serve as propagation and nesting spaces. As a consequence, they do not offer any educational value to the students who could instead be learning about ecology, biology, arts in the school grounds. Conventional schoolyards do not offer good examples of integration with the community or resources management – they are indifferent to the surroundings, they do not attempt to be self-sufficient in any resource (there are architectural or landscape architectural strategies to be self-sufficient in water, energy, food, compost, and there are examples of schools that do that). They are basically “shut” outside school hours.

Reassessing the land use and possible needs in the school yard have both ecological and landscape design ramifications. Danks elucidates the roles of schools in their communities through the concept of an “ecological school yard”.

An ecological schoolyard is the opposite of standard sterile school yards. They are dynamic and alive. She illustrates this concept as follows: (Danks 2010):

“Ecological schoolyards however, are place based, so each one is unique and memorable. The trees and vegetation on green school grounds provide a variety of microclimates that make them more comfortable and inviting than ordinary schoolyard environments. They balance ball game areas and play structures with features that encourage imaginative play and self-expression, so children have many activities to choose from at recess. Their varied grounds are also ideally suited for lessons across the curriculum.”

For a school to transform from ordinary school grounds to an ecological schoolyard, there are several topics to be considered. Danks (2010) lists 12 topics: environmental sustainability; variety; educational value; play value and behavior patterns; health; appearance; community stewardship as the new primary maintenance level; sustained fundraising; curriculum integration and use of the resources on site; meeting needs of physical education classes; liability and safety; and, vandalism and crime prevention.
3.11. Scale as an Design Factor

Blanche Pope Elementary School has a large campus, therefore the issue of campus space is not a major limiting factor for potential projects, as it may be in other sites. Nor are there any topographical or environmental hazards to consider. What is important is to identify what the priority needs are. Any proposal should consider the availability of both human and economic resources, for appropriate planning implementation and maintenance of any project. The scale of schoolyard projects vary depending on the level of support, funding, and space. The capability of a group to manage the project as well as the complexity and physical extent of the projects, are all important factors to consider.

However, projects can be successful from an education perspective whether they are small or large (Danks, 2010, page 2). Danks defines small scale gardens as follows:

Small green schoolyard projects are typically used as teaching tools to demonstrate how particular ecological systems function and to make learning a hands-on process. Many schools hope that ideas introduced at this small scale will stay relevant for students as they get older, inspire them, and find their way into their worldview as adults. Small scale, demonstration level projects may include vegetable gardens in raised beds, small ponds with solar powered pump systems, container gardens with butterfly and bird habitat plantings, rain barrels and garden composting bins, or small design features made from green materials.

In Hawai‘i, one of most common small scale efforts for school campuses are school gardens. Blanche Pope Elementary School’s garden has some aspects of the small scale schoolyard as described by Danks and others. such as: vegetable gardens in raised beds, a garden composting bin made out of pallets, and a gate made out of bamboo (a small design feature made from “green materials”). Many creative designs are possible. For further discussion of both school and other types of gardens see:
Danks (page 2) also describe large scale projects:

“Some schools work at the same environmental concepts at a much larger scale. They, too, hope that students will gain a deep understanding of the topics they are presenting – but their dual mission is to also improve the school’s environmental impact in some way. These larger projects might include the following: a large edible garden program that supplies a daily salad bar for the school cafeteria; a renewable energy system that powers the whole school; a large, onsite forest or meadow ecosystem planted by the students; a storm water pond system that cleans and retains all of the runoff from school grounds; a black water treatment marsh that processes wastewater from the school’s toilet system; and entire school buildings and landscape features made from green building materials.”

Blanche Pope Elementary School has the potential to incorporate large scale projects. Examples are an expanded edible garden program which could supply the cafeteria and storm water management, and additional facilities such as outdoor educational spaces. One clear consideration of any is whether the proposals are realistic within the physical and institutional parameters of the case study site. For example, any proposal must be appropriate in scale.

3.12. Stakeholder Benefits

Teachers benefit from green schoolyards as well, with more teaching resources and reporting increased job satisfaction when using green schoolyards (Janet E. Dyment, Gaining the ground: The Power and Potential of School Ground Greening in the Toronto District School Board. Toronto, Ontario, Canada: Evergreen, 2005, pp 24-25). The community around the schoolyard also benefits from such a project. The schoolyard brings community members together and strengthens neighborhood relationships, which, in turn, provides an improved support network for the school.

Community involvement and their contributions to stewardship of school gardens also relieves schools’ staff of some of the maintenance burden (Danks, page 2). For example, at Blanche Pope Elementary School, the Nā Pono no nā ‘Ohana and the Growing Pono Schools projects not only help maintain the school grounds, but also provide staff and funding.
Additionally, the Growing Ecological Schoolyard Movement and any proposed adaptations of its precepts addresses many of the concerns found in modern day society in Hawai‘i:

- Diet – Child obesity
- Schools can be “green patches” in urban growth
- “Sustainability topics “ (more related to energy) are becoming part of school’s curriculum
- Water issues

Why School yards are important?


- Mapping the grounds and the garden site
- Raising awareness of the ecosystem
- Planning improvements in the school gardens

The (FAO 2005) and many others use a planning approach which emphasizes participatory design. Determination of the stakeholders and their involvement is seen as a way to get maximum input and ideas, as well an equity issue, and will help to facilitate adoption of the design, and ultimately the success of the project. In the case of school community with both adults and youth, employees and volunteers and potential involvement of the surrounding community their involvement in the planning process is an important learning experience in itself.

Empowering youth is recognized as a singular goal.

“The first step is to get students to sketch-map the entire school grounds. Young kids can draw impressions and more illustrative maps, while older students can do more measurements,
(which could be part of a math class). Good maps, illustrations and pictures may help to get attention and prepare appeals, talks, explanations, and grant applications. They can be used as a form of communication between the garden team and parents, community leaders, school administration, authorities and sources of funding. These documents can guide discussions and cost estimates. Also, pictures of before and after projects are important to boost morale and can be used a “proof” of action.”

According to (FAO 2005) The food garden site is ideally: on level ground, away from main traffic routes, visible from classrooms (and near to them if possible), and easily seen by visitors. The current school garden at Blanche Pope (Ka Māla Lani) follows all those recommendations.

FAO recommends that after selecting the site for the garden, the next step is to draw a map describing the garden site. This is a schematic that shows layout of the garden and a planting plan. Similar to the grounds map, it should include any buildings, vegetation, animals, roads, circulation, etc. Cardinal directions should be included, and a scale.
4. DESIGNING SCHOOLYARDS

Danks\textsuperscript{83} defines that “successful, long-lasting, ecological schoolyard programs start with Community Building and a Master plan”. The most effective way is to create a comprehensive, participatory planning process including all the potential stakeholders to produce a master plan drawing demonstrating the school’s community’s consensus about the schoolyard future.

The FAO recommends students to create a master plan, called “grounds map”\textsuperscript{84}. By allowing the students to develop the master plan, they are in essence creating their own educational materials. “The grounds map, at a macro scale, should show all the main features of the grounds – school buildings, facilities, vegetation, pathways, circulation, parking, rubbish pits and bins, water supply, power line (FAO 2005). Everything should be labeled by the students, and they should choose which maps to show to visitors.” Adult and professional assistance should be recommended as well.

The participation of the community throughout the planning process is very important for stewardship. Participants of the planning process are more likely to volunteer in development and maintenance of the master plan, while projects without the involvement of the community generally require paid external staff\textsuperscript{15}.

The master plan should be an ongoing project, presenting the big idea for the future of the schoolyard, yet living some openness for the details of each part of the project. Staff, community, students and curriculum change over time; so do their needs and the school needs.

The school community in general should be included in the process: students, parents, school staff, community, neighbors, are all schoolyard stakeholders. Those groups are also the most familiar with the site, its history and its seasons. The school principal is vital for the success of the project, setting the tone for progress of the project.

\textsuperscript{83} Danks, 2010, page 13.
\textsuperscript{84} Food and Agriculture Organization of the United Nations, \textit{Setting up and running a school garden: a manual for teachers, parents and communities}.
It is also recommended to invite school district officials to participate in the planning, to gain support for the project success. They may ensure that the project is within the district regulations, as well as witness the community engagement, which is important especially when there is need of external resources and permits to approve designs outside the traditional approaches.

4.1. Participatory Schoolyard Design

Many excellent examples exist on how to include participatory design for both planning the school yards and also for school gardens. The approaches for a successful schoolyard design process vary, as much as the communities vary. However, a common goal is to have as many people participating in the design process as possible. This stimulates creative ideas and keeps the community involved.

Among the many step by step approaches, perhaps the clearest is put forth by Danks. However not all of these suggestions are appropriate in Hawai‘i because of cultural and site specific distinctions. The following is my synthesis and adaptation of several generic design processes and my own experience. This is specific for Blanche Pope situation, but could be replicated for other schools in Hawai‘i and the Pacific, with adjustments as necessary.

85 Ibid.
86 Carroll, Growing an Educational Garden at Your School: A Study of the Hawai‘i experience.
87 Grant and Littlejohn, Greening School Grounds: Creating Habitats for Learning.
88 Fanton and Immig, Seed to Seed: Food Gardens in Schools.
90 Danks, Asphalt to Ecosystems.
STEP 1: Forming a Schoolyard Committee

The schoolyard committee is like the pouhana, or main post that supports a hale. As the ‘olelo no’eau says:

Ka pouhana.

The main post.

(The person [in this case the committee] on whom the others depend for leadership, guidance, and help – the mainstay of the family or group.)

The main goal is to form a long term, diversified schoolyard committee that shares a common vision and passion: of “growing pono”. This committee will orchestrate long term plans for the school that, once implemented, will have community and island wide effects. The committee will invariably change over the time as the project advances, both in composition as well as in function, but the main principle should remain the same: pono. These different phases will be described below.

This committee is formed by stakeholders of all levels: principals, administrative personal, teachers, custodians, students, parents, and other community members. Members from outside of the school may also participate in this committee, bringing their knowledge and expertise, such as: members of school garden programs from other districts, designers, students, volunteers, grantors and foundations, etc. A wide age range is highly recommended, especially in Hawai‘i, given its cultural context and inclusive emphasis on elders as a source of knowledge. A multigenerational committee adds wider perspectives through the dynamic of the kupuna-keiki relationship, an important cultural value that will be also reflected in the community.

Well-formed and dependable committees have more opportunities for access to resources, both human and material, by fostering a good reputation among the school and the community. Committee members should commit to dedicate a minimum of twelve consecutive months (one year cycle) of reliable participation. This minimum level of commitment is very

important and ensures continuity and accountability. Given the tightly woven island communities as found in Hawai‘i, individuals interested in participating, but unable to meet the level of commitment described above, can still be encouraged to help in specific schoolyard planning and implementation activities such as design charrettes and community work days, or to do their own short term projects under orientation of the committee.

In the first steps of the implementation of the expanded concept of an ecological schoolyard program as proposed here for Hawai‘i, the committee members are entirely responsible for the initial planning: schedule meetings; recruit consultants, members, volunteers and other help; prepare presentation materials and agendas; seek funding and report its use; communicate with the school and the community. The committee will be responsible for organizing workshops and design charrettes, development of a master plan, and oversees other committees responsible for the implementation of individual projects, which will be explained further.

The committee should maintain a very good relationship with the principal of the school, teachers and custodians, since their support is essential for the success of the project, from the approval of ideas to the support for projects implementation and maintenance.

The presence of committee members on site is very important, especially during school hours, to continuously evaluate the real school needs and the progress of ongoing projects. Funding might be necessary to hire professional designers such as landscape architects and school garden coordinators, which will be very important during the design phase and project implementation. See appendix for sources of funding.

Ideally, in the long run, the schoolyard committee should include a part time position for management of small scale projects and a full time position in large scale projects, especially when it involves co-teaching the students in the school, since education is the main goal of comprehensive use of schoolyards. Part of the job description of these positions should include active participation in the maintenance of the projects, such as planting, weeding, pruning trees, hardscape maintenance, etc. The custodians at existing schools in the process of implementing schoolyards need to be trained to assist in the maintenance routines due to the newly installed
projects. These projects will likely change the maintenance level that was required before the implementation of projects designed to utilize the schoolyards in a less passive manner. The adoption of new projects from the part of the school should be facilitated as the school sees the committee actively working on the grounds.
STEP 2: Research

‘A’ohe ‘ulu e loa’a i ka pōkole o ka lou.92

No breadfruit can be reached when the picking stick is too short.

(There is no success without preparation.)

Research is a good educational tool and helps to understand the school from the perspective of the students and the community in general. Defining the appropriate sense of place requires that the physical context and cultural history of the location be told with respect, and in as complete a manner as possible. While it may seem odd or anecdotal to the outsider, telling the stories and honoring the ancestral connection to the land is more than necessary and required step for a successful effort.

Incorporating the history and the traditions of the site therefore is an important element during the design process, especially in an institutional project, and more so in a school. An important set of readily available site specific references are archeological monitoring reports and other site specific compilations such as the book, Sites of O’ahu. Resonating themes can be integrated in the design with the objective of manifesting local identity. The committee members can use their local knowledge and also learn to do basic site research and planning at a more developed level.

Most of the information for a physical site analysis can be found online. Professionals such as landscape architects and planners can facilitate effectively at this stage as they often have access to GIS databases and other sources as well as technical training with information on

92 Ibid.
soils\textsuperscript{93}, flood maps\textsuperscript{94}, precipitation\textsuperscript{95}, topography, and access to technical research blueprints. The Honolulu Land Information System\textsuperscript{96} (HoLIS) offers all these information online, free of cost.

In geographically isolated regions such as Hawai‘i, the inclusion of case-studies or ideas from other regions is recommended as they expose the committee to possibilities beyond what have been done in the local area. Although sources from off island, or the mainland, are less familiar or comfortable, they should nevertheless be considered.

\begin{itemize}
  \item \textsuperscript{95} Western Regional Climate Center WRCC, "US COOP Station Map," http://www.wrcc.dri.edu/coopmap/.
  \item \textsuperscript{96} Department of Planning and Permitting DPP, "Honolulu Land Information System (HoLIS)," http://gis.hicentral.com/.
\end{itemize}
STEP 3: Design workshops

These workshops are basically a traditional landscape architectural design charrette, followed by focused committee formation. The role of a professional facilitator and landscape architecture is very important here as they are trained in these processes and can avoid common problems that arise in this process. Additional workshops/meetings occur to draw plans for the grounds, incorporating the ideas from previous steps. Similar meeting can be done with students, and another with teachers, with representatives from each grade level. Any ideas should be considered, presented and discussed, the pros and cons.

_He lehu hou kēia, ke ola nei no ka ‘i‘o._

_This is a fresh cowry; the flesh is still alive._

(A warning that a new idea or plan may turn out badly. When the animal in a shell dies, a stench results.)

An example of a constraint uncovered at this point is that projects may be overly ambitious. When design limitations are overlooked, mostly due to excitement, unawareness of previous cases in similar conditions, quality standards, or blatant ignorance to apparent issues, then it is not uncommon to see potentially beneficial projects falling apart even before its conception. For instance, the custodians would likely not be able to maintain additional projects on top of their existing responsibilities. Thus, the participants of the design charrette or workshop should have a clear understanding of future maintenance needs, especially during times when the school is not in session, as well as for the long run. Another issue is that community volunteer roles or hired labor may be required for these projects, as well as training of existing personnel. A landscape architect can provide technical support during this phase which will greatly increase the efficiency of the design process.

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STEP 4: Master Planning

Hili hewa ka mana’o ke ‘ole ke kākākūkā.\textsuperscript{98}

Ideas run wild without discussion.

(Discussion brings ideas together into a plan)

Based on the drawings and ideas from the workshops, the committee or project organizer/designer needs to compile and distill the overall themes brought up by the stakeholders. They also need to have a clear understanding of the vision or potential solutions to problems, educational applications, or landscape project potential for each area of the school. The ideas should ideally be combined to generate a master plan. Any preliminary plans would be presented and discussed with the community, taking into consideration the need to use both the elements and the overall concept. The master must be flexible enough to incorporate alternatives during the master planning process and any project concepts or designs. It also needs to be constantly re-evaluated. The plan is not a static document but needs to guide the overall process especially as the projects reach completion and new demands of circumstances arise.

\textsuperscript{98} Ibid.
STEP 5: Implementation planning

Implementation planning depends on a complex set of factors. Any master planning needs to be broken down into phases. The master plan must be phased to manage costs, maximize community’s participation and allow time to let each step be completed creatively and thoughtfully. Once the general master plan is developed, each individual project should be evaluated based on its priority, scale, purpose and objectives, and cost. Once all projects are evaluated with the same criteria, the committee can choose which project should be implemented first, and a phasing plan can be developed. After approval by the committee and authorities, such as the school principal, it is time to plan each master plan component’s implementation.

STEP 6: Individual project development and the regulatory system

Once the first individual project is chosen and its relationship to the master plan is understood as a dynamic addition, the individual project needs to be fully planned and developed for implementation. Phases for projects need to be developed with timelines setting goals and outcomes. Some projects may be designed as they are built, especially isolated small scale projects that do not involve liability and do not compromise the functionality of other projects. However, complex projects, such as those involving construction, buildings, and utilities, involves liability and approval from regulatory organs such as the Department of Planning and Permitting and the Fire Department. Besides plans submitted for permitting, regulatory organs may require letters from licensed professionals certifying access to fire hydrant, roads for fire trucks access, building code compliance, and ADA compliance. These requirements can be waived or re-considered when well justified, therefore, they should not stop the progress of project designs. Instead, these situations are good learning opportunities and should be always documented as precedents for future projects. Examples of such plans are: as design development and construction document preparation, especially when involving civil engineering or health codes.
The input from recognized professionals and practitioners, such as landscape architects, within areas of expertise corresponding to each individual project, is extremely valuable. Their input will enhance the quality of the work and avoid costly mistakes and misunderstandings.

**STEP 7: Construction and implementation of individual projects**

Some projects can be done by volunteers. With students and volunteers, other considerations are also important. Numerous factors are required such as recruitment of volunteers, gathering materials etc. These range from physical limitations of the participants, to their ability with tools and need for the experience necessary to complete tasks successfully. Liability may be the biggest overall concern. Safety is the most important consideration.

**STEP 8: Evaluation**

Once the first project is finished, it is time to re-visit the master plan and choose the next project, (and potentially modify the master plan). Any participants should apply whatever lessons and knowledge was obtained (from both success and failures) to the next project.
5. DARCH DELIVERABLES

At Blanche Pope Elementary School, the school garden (a small scale project currently used once a week by 80 students as part of the social and language subjects) started with three paid positions: one project administrator, and two instructors. They were responsible for starting the project from scratch, get community involvement thought volunteers and community work days, planning and implementing the school garden, and developing the curriculum based on the teachers needs to fulfill the common core standards.

The literature consulted during this research is consistent on the importance of the input from the school community (including students) during the design process\textsuperscript{99,100,101,102,103,104,105,106,107,108,109}. The author of this document has received feedback and opinions from the school community for four years; therefore, opinions, needs and site observations collected over the years will be considered for the proposal of a site plan and design solutions that will integrate the existing architecture and landscape conditions of the school, with the ultimate goal of maximizing the educational value, experience, efficiency, and self-sustainability of Ka Māla Lani, Blanche Pope’s school garden, as well as the extended school-grounds as a whole, keeping a principle in mind: GROWING PONO.

The deliverables from this DArch (research, site analysis and design solutions) should fulfill the Doctor of Architecture degree requirements of the University of Hawai‘i at Mānoa Graduate Division and UHM School of Architecture. At the same time, this DArch should be

\textsuperscript{99} Danks, \textit{Asphalt to Ecosystems}.
\textsuperscript{100} Carroll, \textit{Growing an Educational Garden at Your School: A Study of the Hawai‘i experience}.
\textsuperscript{101} Fanton and Immig, \textit{Seed to Seed: Food Gardens in Schools}.
\textsuperscript{102} Food and Agriculture Organization of the United Nations, \textit{Setting up and running a school garden: a manual for teachers, parents and communities}.
\textsuperscript{103} Grant and Littlejohn, \textit{Greening School Grounds: Creating Habitats for Learning}.
\textsuperscript{104} Bucklin-Sporer and Pringle, \textit{How to Grow a School Garden: A Complete Guide for Parents and Teachers}.
\textsuperscript{105} Jaffe and Appel, \textit{The Growing Classroom: Garden Based Science}.
\textsuperscript{106} Cohen and Fisher, \textit{The book of gardening projects for kids: 101 ways to get kids outside, dirty, and having fun}.
\textsuperscript{107} Broda, \textit{Moving the classroom outdoors: Schoolyard-Enhanced Learning in Action}.
\textsuperscript{108} Williams and Brown, \textit{Learning Gardens and Sustainability Education: Bringing Life to Schools and Schools to Life}.
\textsuperscript{109} Gerlock, Subedi, and Cocquio, \textit{Through the Eyes of Children: Walking and Learning with Children}.
delivered in a format that is appropriate for use by the School Community, bridging the scholar to the general public. The text and graphics should benefit the existing efforts for improvements for the campus and student’s growth, and should keep in mind the potential use in community meetings, charrettes, and work as support material for fundraising for implementation of designs. Looking at a larger scale, it should also work as a reference for other communities interested in (re)planning their schools.
6. BLANCHE POPE SITE ANALYSIS

6.1. Regulatory context

The school property is within the Coastal Zone Management Program (CZM), approved by the National Oceanic and Atmospheric Administration (NOAA) in 1978 and currently led by the Hawai‘i Office of Planning.110 “The coastal management program is a network of authorities and partnerships collectively implementing the objectives and policies of Hawai‘i’s Coastal Zone Management Statutes (Chapter 205A, HRS). The entire state of Hawai‘i falls within Hawaii’s coastal zone boundary”.

The objective of the Coastal Zone Management Program is to “provide for the effective management, beneficial use, protection, and development of the coastal zone” (See L. 1977, c 188, § 1. for more information). Part of the Program includes the Hawai‘i Coastal Nonpoint Pollution Control Program, which follows a watershed approach of polluted runoff control and stormwater management.111

Another program of the Coastal Zone Management Program is the Community-Based Resource Management.112 As described on the Hawai‘i Office of Planning website, “the goal of this project is to refine and institutionalize an integrated planning approach for the Hawai‘i CZM Program to move the State towards the vision portrayed in the Ocean Resources Management Plan. The vision is natural and cultural resource management that is grounded by the place, the culture, and the community.”

6.2. Physical Geography

Blanche Pope Elementary School site is bounded by the Ko'olau Range and the ocean. Precipitation and temperature data has been documented since 1969 in a station close to Blanche Pope113 (figure 20). The climate is coastal sub-tropical, with maximum temperatures of 85°F during summer and minimum of 65 during winter (table 1). The average precipitation is 42.56 inches per year, primarily during the rainy season, from December to March (table 2). Tradewinds occur almost year round, and influence the local geography with windward orographic uplifting, providing consistent precipitation. The winds occasionally change during the winter to Kona winds. The wind speed varies from 5 mpg (sea breezes) to 50 mph during winter, but on average it stays around 15-20 mph.

Figure 20. Location of weather station (WAIMĀNALO EXP FARM COOP ID: 519523) closet to Blanche Pope Elementary School, marked by the red dashed lines. Source: Google Maps, Western Regional Climate Center

113 Western Regional Climate Center, "WAIMANALO EXP FM 795.1, HAWAII (519523)," http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?hi9523.
Table 1. Historic climate data for Waimānalo. WAIMĀNALO EXP FM 795.1, HAWAII (519523) Period of Record: 9/1/1969 to 3/31/2013 Percent of possible observations for period of record.

Max. Temp.: 95.3% Min. Temp.: 95.1% Precipitation: 99.3%. Source: Western Regional Climate Center

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Table 2. Historic precipitation data for Waimānalo. Station:(519523) WAIMĀNALO EXP FM 795.1 From Year=1969 To Year=2012.

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Table 2. (Contibuation)

Table updated on Oct 31, 2012
For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons

Winter = Dec., Jan., and Feb.
Spring = Mar., Apr., and May
Summer = Jun., Jul., and Aug.
Fall = Sep., Oct., and Nov.
6.1.1. Soils and Drainage:

Most of the soil at Blanche Pope is Haleiwa Silty Clay, 0-2% slope (HeA), with areas of Kawaihapai Clay Loam, 0-2% slope (KIA) in the northwest and north, and an area of Jaucas sand (JaC) in the east corner (Figure 21).

Figure 21. Blanche Pope Elementary School Property and its soils. The dashed red line indicates the school boundary. The orange lines indicate where the soil changes. The two blue areas indicate where water ponding occurs during the rainy season.

The water ponds in both HeA, KIA and JaC soils (market by blue squares in figure 7). The capacity of the most limiting layer to transmit water in these soils is referred as moderately

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114 Natural Resources Conservation Service, "Web Soil Survey".
high to high (0.60 to 1.98 in/hr) for HeA\textsuperscript{115}, moderately high to high (0.60 to 6.00 in/hr) for KIA\textsuperscript{116} and high to very high (6.00 to 19.98 in/hr) for JaC soils\textsuperscript{117}.

Although the Hale’iwa series are described as a well-drained soil, archeological monitoring\textsuperscript{118} at Blanche Pope with stratigraphic sequences close to the areas with recurring ponding revealed strataums with fill soil ranging from 75 to 90 cm deep (approximately 2.5 and 3 feet, respectively). Also, grading and high traffic has compacted the soil on some parts of the property, which affects the water infiltration rate. The disturbance of the soil might be the main reason which causes ponding in the project area.

\textsuperscript{115} Web Soil Survey, "Map Unit Description: Haleiwa silty clay, 0 to 2 percent slopes---Island of Oahu, Hawaii," (Natural Cooperative Soil Survey, Natural Resources Conservation Office, United States Department of Agriculture).

\textsuperscript{116} "Map Unit Description: Kawaihapai clay loam, 0 to 2 percent slopes---Island of Oahu, Hawaii," (Natural Cooperative Soil Survey, Natural Resources Conservation Office, United States Department of Agriculture).

\textsuperscript{117} "Map Unit Description: Jaucas sand, 0 to 15 percent slopes---Island of Oahu, Hawaii," (Natural Cooperative Soil Survey, Natural Resources Conservation Office, United States Department of Agriculture).

Figure 22. Photo of the north leech field excavation, view to the west. Source: Cultural Surveys Hawai‘i.
6.3. Traditional and Historical Background of Waimānalo

In order to start to understand Waimānalo you must see the location from the perspective of the Hawaiians. Defining the appropriate sense of place requires that the cultural history of the location be told with respect and in as complete a manner as possible. While it may seem odd or anecdotal to the outsider, telling the stories and honoring the ancestral connection to the land is more than necessary and required step. This assures my own sense of pono in my approach and practices in design.

There are several documents registering the history and traditions of Waimānalo. As discussed before, students identify strongly with their Hawaiian heritage (figure 4). Most of the Blanche Pope students chose Hawaiian as their ethnicity over part-Hawaiian, revealing their cultural identity, which makes sense since Blanche Pope is situated within the Waimānalo Hawaiian Homestead. Cultural and site sensitive designs therefore must consider not only the physical environment, but also the cultural and social contexts of the site.

Incorporating the history and the traditions of the site therefore is an important element during the design process, especially in an institutional project, and more so in a school. Resonanting themes can be integrated in the design with the objective of manifesting local identity.

The following literature review summarizes the existing documents regarding to mythological and traditional accounts of Waimānalo, its agricultural and residential history, and military presence. Most of this information was obtained from Cultural Surveys Hawai‘i\textsuperscript{119} archeological reports and the book Sites of O‘ahu\textsuperscript{120}. The text was kept as close as possible to these references.

\begin{footnotesize}
\textsuperscript{119} Cultural Surveys Hawai‘i, http://www.culturalsurveys.com/
\textsuperscript{120} Sterling and Summers, Sites of O‘ahu
\end{footnotesize}
6.3.1. Mythological and Traditional Accounts

Traditional accounts present some generally recurring themes about Waimānalo, including: the scarcity of water, except for small springs and Waimānalo Stream; the abundance of food crops along Waimānalo Stream; the broad reef and good fishing resources in the ocean fronting Waimānalo; and the somewhat isolated nature of Waimānalo, especially in terms of land routes, but with a sandy beach frontage allowing easy access by sea. An example of the mythological references to Waimānalo, occurs in the Pele and Hiʻiaka epic. During her travels to locations throughout the Hawaiian Islands, Hiʻiaka arrived on Oʻahu at Makapuʻu, in southeastern Waimānalo Ahupuaʻa:

“As they [Hiʻiaka and her companion Malei] traveled on, Makapuʻu and its neighbor hills passed out of sight. Arriving at Ka-ala-pueo, they caught view of the desolate hill Pōhaku-loa, faint, famished, forlorn…” It [southeastern Waimānalo] is indeed a barren land. Fish is the only food it produces. Our vegetables come from Waimānalo. When the people of that district bring down bundles of food we barter for it our fish.”

This episode depicts a strong sense of community, where people share their goods for common wellbeing. This idea is important in a garden, where people share their “gifts”, since each individual has different strengths – some are strong and can carry soils and compost, pull out weed cloth and take it to the dumpster; unload and carry mulch; dig. Others are more able to perform small tasks such as transplanting, painting, making signs, etc. However, the shared work makes the work complete, as the different parts of the body makes it a whole.

Another theme associated with Hiʻiaka’s traverse of Waimānalo is her interactions with the local beauty ʻĀpuakea. Fornander relates: “At Kapua in Koʻolau Muliwaiʻōlena and her daughter ʻĀpuakea were killed because the latter compared herself to Hiʻiaka in beauty.” A more

121 Emerson, Pele and Hiʻiaka.

comprehensive account is given in a rendition of the story of Hi‘iakai-ka-poli-o-Pele in the Hawaiian language newspaper Kā Leo o Ka Lāhui:

They traveled past Kuhui (Kukui?) and Pahonu where the people shouted at the beauty of Hi‘iaka. The news reached the ears of ‘Āpuakea and she said to her mother, Muliwai‘ōlena, “Oh, Muliwai‘ōlena, go and take a look at the women whose beauty the people are shouting about and see if they are as beautiful as I am.” Muliwai‘ōlena came out and looked. Never had she seen anything on O‘ahu to equal the beauty of these women. Turning to ‘Āpuakea she said, “Daughter, your beauty does not compare with their great beauty. You are like the soles of their feet.” Hearing this the expression on ‘Āpuakea’s face changed and she fainted away.

Hi‘iaka overheard the words of the woman to her daughter and she uttered this chant:

O ‘Āpuakea-nui, you beautiful woman, Comparisons have been made of your charms, You are beautiful, beautiful indeed.

Muliwai‘ōlena then called out to Hi‘iaka and her friend, “Come in, eat and drink and when you are full then continue on your long journey.” But the travelers did not accept as they did not like the embarrassing comparison that had been made between themselves and the young girl, ‘Āpuakea.

As the travelers went off Muliwai‘ōlena suddenly fell dead. Shortly afterwards ‘Āpuakea died...[Ka Leo o Ka Lāhui March 14, 15 1893, cited in Sterling and Summers 1978:248-249]

This account could be incorporated through design to remind students about their individual beauty, and the risks of comparisons, which may lead to bullying. For example, students could be asked to vote for the most beautiful flower of a garden. After choosing their favorite, students could be asked to defend their choice, saying why their flower is the most beautiful, and share their opinions. It is likely that there will be different opinions. Then, this account of ‘Āpuakea and Muliwai‘ōlena could be told to them. Just like the flowers, each of the students are beautiful indeed, and there is no need to compare themselves to others.
Another account tells that that coastal area of central Waimānalo, makai of UH Research Station, near the Gymnasium, was named ‘Āpukea, or Fair ‘Āpua, for the maiden “whose skin was very fair and whose behavior was so loveable that the people named the place for her and for her fair skin”\(^\text{123}\). The ancient village of Kapu‘a, the setting of the ‘Āpukea story, was also said to have been the location of the legendary Muliwaiʻōlena stream\(^\text{124}\):

When Kauholokahiki, sister of Kānehunamoku, came ashore from Uluka‘a she landed at Ulupau in Mokapu. There she built a shrine on which to lay her offerings, and there she was found by some women who went to gather sea weeds on the shore and made friends with her. The native women admired the beauty of the stranger who was covered only by a skirt of green pahapaha sea weeds. One of the women removed her own body covering and draped it around the hips of the stranger and invited her to her home. Her beauty glowed like a light in the house and many people came with gifts of tapas, skirts, dogs, hogs and poi. One day the chief Ilauhoe took Kauholokahiki, the stranger, to be his wife. She was so beautiful that even the palms of her hands were lovely. When the chief Ilauhoe married her, the chief wanted her to go bathing with him but she answered, “I am kapu and can bathe in no other water unless you go yourself and fetch my bathing water from Muliwaiʻōlena.” The husband said, “It may be in Kahiki and is too far. We do not know where this water is.” She replied, “If you love me, O Chief, go yourself for my bathing water that I mentioned. It is in Waimānalo, at Kāpua, a village belonging to the chief Lupe. It is the stream with the yellow water that runs quietly. That is the one.” The chief ran at once with a container and in no time he dipped up the water and returned. It was indeed yellowish color and that was the first time that it was known that this was Muliwaiʻōlena. It is there to this day...

Blanche Pope Elementary School’s oli (chant) mentions the Muliwaiʻōlena. Unfortunately, the stream was concreted. ‘Olena (turmeric) is a very important plant in Hawaiian

\(^{123}\) Sterling and Summers, Sites of O‘ahu.
\(^{124}\) Ibid.
herbal medicine (laʻau lapaʻau), and it could be a reason for the request to take a bath with water from that stream. This is a good story to tell the students before entering a laʻau lapaʻau garden, or before teaching them about ‘ōlena and other medicinal plants.

An additional locality of coastal Waimānalo mentioned in the Hiʻiaka story is Pāhonu. Pāhonu is very close to Blanche Pope.

There was once a chief who was so fond of turtle meat that he ordered a sea wall built to keep captured turtles from escaping. Every turtle caught by a fisherman was put into this enclosure. No one else was allowed to partake of turtle meat under penalty of death. No one dared to eat turtle as long as the old chief lived.

In the mid-valley area of Waimānalo, mauka of Muliwaiʻōlena and makai of the UH Research Station, was a low hill known as Puʻu o Molokaʻi:

Long ago a Molokaʻi man came here and went to live on a low hill not far from Muliwai-ʻōlena. The reason for his coming from Molokaʻi to Oʻahu was forgotten long ago but others followed and dwelt with him. This hill was called Puʻu o Molokaʻi or Molokaiʻs-hill. The newcomers made their homes on the hill itself and kept very much to themselves. When a boy married one of the girls of Waimānalo, he had to leave his own people to dwell with his wife’s. If a girl married a Waimānalo man she too left her own people. Gradually the Molokai people were absorbed by those of Waimānalo.

The above history is a good example to teach about mixed ethnicities and vegetables breeding.

There are also traditional accounts of two springs in Waimānalo Valley:

The one called Kupuna kane is away up in the mountains. The spring called Kupunawahine is a spring way down on the level land. The strange, strange thing about these

126 Sterling and Summers, Sites of O‘ahu.
127 Ibid.
128 Ibid.
ponds was that on calm, sunny days they begin to cry out to each other. Their voices were soft and sounded very much like a woman mourning her husband. On days that were overcast with clouds in the sky, then the water of the mountain spring changed. The water of the mountain spring came warm and when you drank the water in the lowland spring it was cool, according to their legend.

6.3.2. Early Historic Period

Waimānalo was a frequent point of arrival to and departure from Oʻahu in late pre-contact and early post-contact times, as in the following account of the loss of Oʻahu sovereignty:

When King Kahekili of Maui heard of the death of the priest, Kaopulupulu, by Kahahana (a chief appointed by Kahekili to govern Oʻahu), he sent some of his men thither by canoe, who landed at Waimānalo, Koʻolau, where as spies, they learned from the people respecting Kaopulupulu and his death, with that of his son; therefore they returned and told the King the truth of these reports, at which the affection of Kahekili welled up for the dead priest, and he condemned the King he had established. Coming with an army from Maui, he landed at Waikiki
without meeting Kahahana, and took back the government of O‘ahu under his own kingship. The chiefs and people of O‘ahu all joined under Kahekili for Kahahana had been a chief of wrong-doing…129

This episode is a good example of the importance of Leadership, and can be told to illustrate that a wrong-doing leader doesn’t last long. Also, loyalty and respect of superiors/kupuna; it seems like King Kahekili liked the priest Kaopulupulu, and by killing the priest, the chief Kahahana displeased the King Kahekili.

Samuel Kamakau, in 1875, related: “The ahupua‘a of Waimānalo, including the fish pond at Maunalua and the traveling uhu of Makapu‘u belonged to Maui-mua (First Maui)”130

During Kamehameha’s conquest of O‘ahu, part of his fleet landed near Makapu‘u and then joined with Kamehameha’s other forces, finally conquering O‘ahu. Prior to the invasion, Kamehameha sent a messenger to Kahekili:

Ki-kane, Kamehameha’s messenger to Kahekili, threw down two maika stones, a black one and a white one. Ka-hekili said when he saw these stones, “This stone (the white) brings life through farming and fishing, rearing men, and providing them with food; this other stone (the black) brings war.” Let the reader ponder the meaning of this answer. Kahekili asked, “Is Kamehameha coming to O‘ahu to fight?” “Yes,” answered Ki-hane. “What harbor will he choose?” “It was Kiko‘o’s counsel to make Waimānalo the harbor and battle site. “It is too low there to cast sling stones to reach the heights. It is good only for food and fish. If stones are thrown from above nothing can save the battlefield…”131

130 Sterling and Summers, Sites of O‘ahu.
After Kamehameha’s conquest of O‘ahu and his division of the island among his chiefs, Waimānalo was apparently retained as Kamehameha’s personal property. This seems to be the case as, in 1845, when Kamehameha III, Kauikeaouli, who had “inherited” the land as a son of Kamehameha I, claimed the ahupua‘a of Waimānalo “to be the private lands of his Majesty Kamehameha III, to have and to hold to himself, his heirs and successors, forever; and said lands shall be regulated and disposed of according to his Royal will and pleasure, subject only to the rights of tenants”.

Two early foreign visitors, both missionaries, visited Waimānalo. In 1828, Levi Chamberlain commented on Waimānalo as being a “considerable settlement.” While there, Chamberlain stayed in a native house, which he described as “a miserable place for the abode of human beings and presented a motley group of children and women, dogs, hogs and fowls.” Chamberlain also noted “though there are a good many inhabitants in the settlement, yet but very few seemed to give any attention to instruction.” In 1838, Edwin Hall wrote:

“We could not however, but notice, that most of the inhabitants on the eastern end of the island were much more degraded, and exhibited far less evidence of improvement than any we saw on other parts of the island; a fact calling for our sympathy and pity, and for our endeavors to enlighten and elevate them”.

6.3.3. Land Commission Award Documentation

In 1845, the Board of Commissioners to Quiet Land Titles, also called the Land Commission, was established “for the investigation and final ascertainment or rejection of all claims of private individuals, whether natives or foreigners, to any landed property.” This led to the Māhele, the division of lands between the king of Hawai‘i, the Ali‘i (chiefs), and the

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132 Commissioner of Public Lands, “Indice of Awards made by the Board of Commissions to Quiet Land Titles in the Hawaiian Islands,” (Honolulu, HI: Territorial Office Building, 1929).
134 Edwin O. Hall, ”Notes on a Tour Around O‘ahu,” Hawaiian Spectator 2, no. 1 (1839).
common people, which introduced the concept of private property into the Hawaiian society. In 1848, Kamehameha III divided the land into four categories: certain lands to be reserved for himself and the royal house were known as Crown Lands; lands set aside to generate revenue for the government were known as Government Lands; lands claimed by ali‘i and their konohiki (supervisors) were called Konohiki Lands; and habitation and agricultural plots claimed by the common people were called kuleana\textsuperscript{136}. Ralph Kuykendall notes the concept of private land ownership was a radical departure from the local traditional land tenure system: The old feudal arrangement of joint and undivided ownership had given place to the system of individual custodial tenures, and aliens had been admitted to the enjoyment of the same rights as Hawaiian subjects in the ownership and use of land.\textsuperscript{137}

The ahupua‘a of Waimānalo was awarded to Victoria Kamāmalu, subject to the kuleana claims of the commoners. She received the third largest share of lands among the Ali‘i nui (high chiefs) of the Kingdom of Hawai‘i, including 47 ahupua‘a-sized parcels in addition to Waimānalo. Approximately 113 kuleana land claims were awarded in Waimānalo. Nearly all of these Land Commission Awards (LCA) were located along Waimānalo Stream, or its upper tributaries, in the northwestern portion of the ahupua‘a. While the Hawaiian population of Waimānalo was likely much larger and more dispersed in pre-contact times, it nevertheless appears that the traditional Hawaiian population of Waimānalo was always clustered along Waimānalo Stream and its upper tributaries, focused on wetland taro and sweet potato cultivation. Additional kuleana LCAs, primarily consisting of house lots, were scattered along the coastal areas of central and southeastern Waimānalo, likely focused on the procurement of marine resources. No kuleana LCAs were located in the vicinity of the current project area.\textsuperscript{138}

\textsuperscript{136} Ibid.
\textsuperscript{138} Runyon et al., "Final Archeological Monitoring Report for the Blanche Pope Elementary School, Hawai‘i Inter-Island DOE Cesspool Project, Waimanalo Ahupua‘a, Ko‘olauapoko District, O‘ahu Island TMK:[1] 4-1-031:040,041."
Land Commission Award data indicated that it was common for *kuleana* awards to have a parcel along the coast, as well as a parcel in the upland area. The following account describes the traditional utilization of both land and sea:

A spring called Wai-kupanaha was pointed out to us, (in valley mauka of Mill), surrounded by tall taro plants, banana trees and fragrant white gingers. According to Mr. Alona, the Wai-kupanaha on the west side of Mr. Castle’s place was a lele, or a part of this kuleana, so both were given the same name. The upland piece was for taro growing and the piece near the sea was for fishing. The former owners of Wai-kupanaha went inland to raise taro and then to their land by the shore to fish. Both places had water but today only the upland Wai-kupanaha has water.¹³⁹

### 6.3.4. Ranching in Waimānalo

In 1828, Englishman Thomas Cummins arrived in Hawai‘i. Soon after, he married the High Chiefess Kaumakaokane, a relative of Kamehameha I, who provided Cummins with

¹³⁹ Sterling and Summers, *Sites of O‘ahu*. 80
connections to the throne. Cummins received a Royal Patent to an estate of crown lands in Waimānalo in 1842, and in 1850, Kamehameha III leased 6,970 acres of land in Waimānalo to Cummins for a period of 50 years at $350.00 per annum\(^{140}\). Thomas Cummins and his son John A. Cummins then proceeded to turn Waimānalo into a large cattle and horse ranch. The Cummins Estate, known as “Mauna Rose,” became famous for its lavish parties, commonly hosting the Kamehameha’s, King Kalākaua, Queen Liliʻuokalani, and American, British, and Russian naval officers visiting Oʻahu\(^{141}\).

Cummins constructed a landing at Waimānalo Bay, as access to Waimānalo prior to the construction of the Nuʻuanu Pali road was primarily by sea\(^{142}\). A railroad line was also constructed to connect the landing to the Cummins Estate:

Kamehameha V often visited the [Cummins’] plantation. When he grew too heavy to make the trip over the Pali on horseback, he is said to have acquired a small steamboat to transport him around the southern tip of Oʻahu to Waimānalo. A railroad track was laid to carry the rotund monarch from the landing to the Cummins home\(^{143}\).

In general, the introduction of livestock to Hawaiʻi had an exceedingly negative impact on the natural environment and contributed to the demise of traditional Hawaiian life.

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\(^{143}\) Mifflin Thomas, *Schooner from Windward: Two Centuries of Hawaiian Interisland Shipping* (Honolulu, HI: University of Hawaiʻi Press, 1983).
The relationship between cattle and the natural environment of Hawai‘i has been described by William A. Bryan:

Since the coming of the whites there have been many causes that have been at work bringing about a change in the natural conditions. Chief among the disturbing elements, however, have been the cattle. As early as 1815 they were recognized as a serious menace to the native forests. Roaming at will through the forests they and other animals, as goats and pigs, have done untold damage, and brought about conditions that have been most serious in many places.

The following account describing Waimānalo circa 1847 illustrates the damage to the natural landscape caused by the development of the Cummins Ranch:

At that time, it seemed that the valley was filled with breadfruit, mountain apples, kukui and coconut trees. There were taro patches, with banks covered with ti and wauke plants. Grass houses occupied the dry lands, a hundred of them here and sweet potatoes and sugar cane were much grown. It was a great help toward their livelihood...The whole ahupua‘a of Waimānalo was leased to white men except the native kuleanas and because the cattle wandered over them, they were compelled to build fences for protection. The taro patches that were neatly built in the time when chiefs ruled over the people and the land, were broken up. The sugar cane, ti and wauke plants were destroyed. The big trees that grew in those days, died because the roots could not get moisture. The valley became a place for animals.

The Cummins family eventually began to buy up the kuleana of the native farmers, gaining some 200 acres in fee. By the early 1870s, Chinese rice farmers were using some of these lands under agreement with John A. Cummins.

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145 Sterling and Summers, *Sites of O‘ahu*.  
82
In 1876, the Hawaiian Kingdom entered into a Reciprocity Treaty with the United States. This allowed the growing Hawaiian sugar industry a free market and the potential for great profits.

One of the Chinese rice farmers, Tai Lee, began sugar cultivation on Cummins’ Waimānalo lands. Eventually Tai Lee and other Chinese farmers cultivated up to 1,200 acres of cane in Waimānalo.\textsuperscript{146}

John A. Cummins saw the potential of sugar production at Waimānalo. He organized the Waimānalo Sugar Company and began construction of a sugar mill in 1880. In 1890, J. A. Cummins renegotiated his father’s original lease on the Waimānalo lands for an additional 30 years, and sublet the lands to the Waimānalo Sugar Company. The Waimānalo Sugar Company

\footnotesize{\textsuperscript{146} Silva, ”Final Report on Historical Documentary Research, Waimānalo in: Archaeological Reconnaissance of Proposed Additional Marine Corps Training Areas Bellows Air Force Station O’ahu, Hawai‘i.”}
continued to buy sugar from the Chinese farmers until circa 1900, when the plantation began to do most of its own cultivation.

During this time, sugar and most other goods were transported between Honolulu and Waimānalo by steamer, via the Waimānalo Landing. The Cummins Estate was still renowned for its extravagant hospitality. Lavish weeklong *luaus* were given for Hawaiian royalty. In 1883, King Kalākaua visited Waimānalo for John Cummins’ birthday celebration:

After landing from the SS *Waimānalo*, a train of six cars was waiting to convey the party to Waimānalo proper. The spectacle was a magnificent one. The wharf was lined with evergreens; the locomotive and cars were ornamented with flags and banners, the Royal cars being commodiously fitted up with sofa, arm chairs and a canopy. When it was reported “All Aboard,” away we went, booming along thru’ the cane fields, towards the mill. On arrival at Mr. Cummins’ house, hundreds of natives flocked to welcome His Majesty. A noticeable feature was the respectful manner in which the Chinese laborers uncovered their heads as the train went by them in the cane fields\(^{147}\).

The Waimānalo Sugar Company continued to grow, with increasing lands being put under cultivation. As the plantation grew, former ranch lands were converted to cane fields. New irrigation ditches and railroad lines were constructed, and improvements were made to the mill and Waimānalo Landing. A 1916 map of Waimānalo, compiled from surveys in 1880 and 1884, shows the extent of plantation development in Waimānalo, including portions of the current project area. The map also shows Waimānalo Landing, the plantation railroad connecting the landing to the mill, and the coastal government road in the area *makai* of the current project area. Also shown on the 1916 map area the coastal settlement and the Pāhonu fishpond east of the current project area.

In 1885, W.G. Irwin & Company (which later merged with C. Brewer & Company) became agents for the Waimānalo Sugar Company, with John Cummins remaining manager. John Cummins died in 1913 and his estate sold the remaining fee simple lands and the unexpired

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\(^{147}\) Conde and Best, *Sugar Trains: Narrow Gauge Rails of Hawai‘i*. 84
lease of Waimānalo lands to the Waimānalo Sugar Company. A 1922 map of the Waimānalo Sugar Company’s fields (Figure 23) shows the extent of plantation development in the early 1920s, near the currently location of Blanche Pope Elementary School. The plantation cane fields stretch across the floor of Waimānalo Valley to the base of the Koʻolau Range. Much of the project area, with the exception of the most mauka lands and gulch areas, is indicated to have been cultivated in cane.

Access to fresh water was a continuous problem for most sugar companies, including the Waimānalo Sugar Company. Irrigation for the Waimānalo cane lands was developed from three sources: springs and water tunnels in neighboring Maunawili Valley; Kāwainui Swamp in Kailua; and a swampy area near the mouth of Waimānalo Stream, known as the Waimānalo Lagoon148. Water from these sources was transported to the Waimānalo cane lands via the Kailua Ditch, Maunawili Ditch, and the Pump Ditch, respectively (Figure 24). Portions of the Pump Ditch, also known as the Tai-Lee Ditch, were originally constructed during the Chinese sugar cane growing period of 1876-1900, and later modified by the Waimānalo Sugar Company.

Carol Wilcox149 summarizes the company’s irrigation system:

Kailua Ditch, the earliest of Waimānalo Sugar’s three ditches, diverted water from upper Kailua springs in the Waimānalo basin and emptied into the Waimānalo Reservoir. A second ditch, built in 1924, had its source in the Kāwainui Swamp. Two pumps lifted water from that swamp and took it to the head of a 10,000-foot system of small tunnels, mostly through stone or hard earth, into a reservoir. This ditch cost $220,000.

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149 Carol Wilcox, Sugar Water, Hawaii’s Plantation Ditches (Honolulu. HI: University of Hawai‘i Press, 1996).
Figure 23. 1916 Map of Waimānalo, Walter E. Wall Surveyor, showing the location of sugar plantations.

The ditch most associated with the Waimānalo Sugar Company is the Maunawili Ditch. Its source is high-level tunnels, springs, and streams in Maunawili and Waimānalo Valley. The dirt- and cement-lined ditch includes about twenty flumes, many measuring no more than a foot and a half each way, before it crosses through the ‘Olomana Tunnel to Waimānalo. During dry seasons this ditch delivered less than 2 mgd [million gallons per day]. Waimānalo Sugar eventually had 99 percent of its sugar under irrigation – and nearly 25 percent of that came from surface water sources.
Figure 24. Irrigation ditches in relation to project area.
The Maunawili Ditch, Kailua Ditch, and Pump Ditch transported irrigation water across Waimānalo Valley, generally from northwest to southeast, along high-, mid-, and low-level elevation contours. A 1938 U.S. Geological Survey topographic map (Figure 9) shows the three ditch systems, along with additional plantation infrastructure associated with the Waimānalo Sugar Company throughout Waimānalo Valley. The high-level Maunawili Ditch is shown crossing through the mauka portion of the current project area, and continuing to the west beyond the project area. The mid-level Kailua Ditch is shown to cross through the central portion of the current project area. Two plantation reservoirs are also indicated in the makai portion of the project area.

Reconstruction of the Waimānalo Sugar Company’s irrigation system was undertaken in the 1930s, under the management of George Bennett:

During the last five years Mr. Bennett has rebuilt all the old flumes which bring the Maunawili water to the fields using redwood, good for 15 years or more; concreted the open ditches; and has replaced the old wooden pipes with concrete siphons.150

The rebuilding of the water system was part of a general modernization of the plantation. Other facets of modernization included mechanized land clearing and the opening of the Nu‘uuanu Pali Road and the Koko Head to Waimānalo Road. The mechanized land preparation enabled more land to be cleared in a shorter amount of time, and the paved roads to Honolulu ended the need to ship sugar products to the Honolulu Plantation Refinery by steamer.

The Waimānalo Sugar Company continued operations into the 1940s. However, facing rising operational costs and diminishing returns, the Waimānalo Sugar Company ceased operations in 1947. Following the closure of the Waimānalo Sugar Company, the plantation’s water license and irrigation ditch system reverted to the Territory of Hawai‘i. Wilcox151 noted of the Maunawili Ditch System:

150 Conde and Best, Sugar Trains: Narrow Gauge Rails of Hawai‘i.
151 Wilcox, Sugar Water, Hawaii’s Plantation Ditches.
Visually, this was a gem of a system up until recent times. Although small, it had all the components of a typical ditch system: flumes, ditches, tunnel. Its particular charm was its redwood flumes, which were in remarkably good condition in 1984.

These have since been abandoned in favor of PVC pipe.

### 6.3.6. Diversified Agriculture in Waimānalo

The Waimānalo Sugar Company sold its fee-simple land holdings and the remaining years of its lease of government-owned lands to the Waimānalo Agricultural Development Company\(^{152}\). The Waimānalo Agricultural Development Company then sub-let one to twenty-acre farm lots and up to 150-acre pastoral lots to individual farmers in Waimānalo Valley for diversified agriculture. Following the expiration of the agricultural leases in 1953, the Territorial Government began selling approximately 9-acre agricultural parcels in the central valley, known as the Waimānalo Farm Lots subdivision. Seven chicken farms, one dairy, one piggery, and

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\(^{152}\) Bartholomew and Associates, "A General Plan for Waimanalo Valley, Island of Oahu, Territory of Hawaii."
papaya and flower farms were established in the Farm Lots area\textsuperscript{153}. Portions of the former plantation irrigation system, with some modifications, continued to be used to provide water to the Farm Lots.

Circa 1950, the University of Hawai‘i established an approximately 30-acre agricultural research farm, known as the Waimānalo Agricultural Experiment Station, in the central valley. Research conducted at the experiment station provided local farmers with scientific knowledge about crops and agricultural practices to improve agricultural production in Hawai‘i. The Waimānalo Agricultural Experiment Station was later expanded to approximately 130 acres.

In 1967, the L.W. Campos Ranch relocated from Kailua to Waimānalo, establishing an approximately 200-acre dairy farm mauka of the UH Experimental Station (Bureau of Conveyances). Campos Ranch was purchased by Foremost Dairies in 1969, which expanded by acquiring an additional approximately 140 acres for pasture. It was during this period that the dairy employee housing was erected in the northwest corner of the current project area (discussed in the “Built Environment” section, above). In 1984, the dairy sub-leased an approximately 21-acre parcel, consisting of the makai parcel of the current project area, to Universal Synergetics (Unisyn). Unisyn was established to research and develop a commercial anaerobic digestion technology for manure and organic waste conversion into agricultural products or other farm products. Unisyn developed a full-scale facility and began converting biomass such as trees, grasses, agricultural wastes, animal manures, ocean plants, garbage, and other wet organic wastes into renewable resources, such as soil amendments, irrigation water, heat, steam, electricity, or liquid or gas fuels for transportation (e.g. ethanol)\textsuperscript{154}.

In 1997, the dairy was acquired by Meadow Gold Dairies, which ceased operations circa 2002.

\textsuperscript{153} Ibid.
The Waimānalo Military Reservation, including approximately 1,500 acres along the northern, coastal portion of Waimānalo, was established in 1917. Limited development and little activity occurred on the military reservation through the 1920s. In 1933, Waimānalo Military Reservation was renamed Bellows Field. Bellows Field then consisted of an infantry and artillery training area, also including a runway for the Air Corps. With the onset of World War II, accelerated development occurred at Bellows Field, which became a permanent military post in 1941.

Following World War II, activity at Bellows Field declined, with much of the area only being used for military recreational purposes and as an emergency landing field. Bellows Field was subsequently renamed Bellows Air Force Base, and later, Bellows Air Force Station. In 1956, an Air Force communications facility was constructed, with extensive antennae installations. Bellows Air Force Station continues to be used for military training and recreational purposes.
6.3.8. Residential Development in Waimānalo

The primary residential area in Waimānalo in the early 1900s was located in the vicinity of the Waimānalo Sugar Company’s sugar mill. Waimānalo Village was established as housing for plantation workers and their families (Figure 25). In 1925, the first large-scale sale of Waimānalo lands to the public occurred with the establishment of the Waimānalo Beach Lots subdivision. The subdivision, located just south of the Waimānalo Military Reservation, included 266 lots on 90 acres of land. A 1938 U.S. Geological Survey map (Figure 26) shows the road grid of the Waimānalo Beach Lots subdivision, with a few homes constructed. Also shown on the map is Kalaniana’ole Highway, which opened in 1924 and greatly improved transportation to Waimānalo.

Figure 25. Map of Waimānalo showing Waimānalo Village.

Additional residential development occurred in the coastal portion of central Waimānalo with the establishment of Waimānalo Homestead by the Hawaiian Homes Commission in 1925. Qualified homesteaders, with 50% or more Hawaiian blood, were awarded residential lots located inland of Kalanianaʻole Highway, in the vicinity of Waimānalo. In modern times, additional residential development has occurred in the Waimānalo Village, Waimānalo Beach Lots, and Waimānalo Hawaiian Homelands subdivisions.
Figure 26. Map showing Waimānalo Beach Lots, in relation to the project area (marked in red).
6.4. Available Construction Documents

The administration of Blanche Pope Elementary School provided access to the facilities archives. Among many documents and contracts, there were construction documents containing topography, building footprints, sections, elevations, building materials, and other information relevant to proceed with the design.

All blueprints were scanned for future reference (figure 27). Some of the blueprints dated back to 1973 and require some restoration work before scanning. Sheets that were falling apart were put together with tape, sometimes mounted over a new sheet of brown paper.
Figure 27. Construction document sets for construction of Blanche Pope Elementary School Building A, dated from 1973 (above), and whole school renovation sheet set from 2007 (below).

7. COMPREHENSIVE SCHOOL YARD DESIGN

As mentioned before, the participatory design is very important for a comprehensive planning and implementation of functional and productive schoolyards. Unfortunately, the scope of this academic project, its timeframe, and Human Subjects regulations make unpractical to conduct the full step-by-step sequence developed in this research. However, the active participation of the researcher with the community for the past four years gives a good idea of what are the issues and needs of the school that could be addressed through schoolyard design. In the future, the plans and projects proposed in this research could be used by Blanche Pope Elementary School as support material for community meetings, charrettes, fundraising, and implementation of proposed projects. Looking at a larger scale, it should also work as a reference for other communities interested in (re)planning their schools.
8. SITE PLAN

The goals of situating a school in its physical and cultural environment and reconnecting to its natural environment is a multi-layered problem. Encouraging the continuance of local traditions and restoring the connection to the land as a means of maintaining culture is another complex dimension.

This section documents and proposes a general plan to meet the macro level site needs incorporating the items discussed in the first section of this document. It also contains representative mechanisms and design options for creating and eventually implementing specific micro level individual projects.

The existing school garden, Ka Māla Lani, has had a real and profound role established over the years. The garden principles were the driving force for the potential transformation of the entire campus, and are the generative force for the expanded site plan. This plan proposes changes within an already existing dynamic. It acknowledges the existing modifications as the basis for future proposals.

Throughout the years certain issues related to the school site had been brought up. This problem identification was used as the basis for a practical approach to site planning.

It was observed that the school would benefit from the following improvements.

Planning (figure 28):

- Use the school garden and other outdoor spaces to help meet the Common Core Standards of Education;
- A dedicated shelter for garden activities and gathering;
- Solve drainage and other storm water issues;
- Improve the school’s circulation as a whole, especially the transition from the classrooms to the school garden;
- Provide outdoor seating space.
- Enhance the school’s capacity to supply its own food;
- Improve the school landscape to provide a better sense of place;
- Provide aesthetic and functional alternatives to current fenced areas.
- Provide an area for calming down the students and options for behavioral improvement. (horticultural therapy).

At the same time, design solutions should keep in mind:

- The nature, purpose and functional ability of the place as an Elementary School;
- The unique cultural context: Hawaiian Homestead;
- The climate: Dry summers, wet winters;
- The proximity to the ocean,
- The channelized stream (Storm water drainage issues);
- Limited budget reserved for construction and maintenance;
Figure 28. Areas of Blanche Pope Elementary School that could be improved.
8.1. Analysis of Site Issues

Before proving any specific design solution it is necessary to analyze the site issues in a holistic approach. Then each issue can be approached to maximize the efficiency of the design solutions in a harmonious manner. This also minimizes potential conflicts and ensures that the proposed design solutions are compatible and functional.

8.1.1. Sheltered Gathering Space

One of the problems that currently limit the use of the school garden as an outdoor learning environment is the lack of a designated space for gathering before going to the rain garden. The school garden programs would be benefited of a dedicated gathering space. As mentioned before, the school garden program uses a tent that belongs to the program Na ‘Ohana o na Pono (figures 5 and 6). However, this tent is not always available, and the classes have to look for alternative spaces, shaded by surrounding buildings or trees. The location of this new gathering space, which will be referred as “Hale” in this document, should also facilitate the circulation to and from the garden, to avoid mixing with other activities happening in the surroundings (figure 29).
Figure 29. Circulation analysis.
8.1.2. Water Issues

Another important element of the site plan is to consider the resources available on site, and those who are required but supplied from external sources. Water is one of the most important resources required for a successful school garden. There are several ways of reducing water consumption, such as water efficient crops, agricultural practices that preserve water such as mulching, and efficient use of irrigation. Another approach is to use water that is currently available on site, such as rain water. The school has a total of approximately 42,500 SF of roof area (figure 30), all connected to downspouts that dispense an average of 1,129,800 gallons of water per year, mostly concentrated between September and March (winter season). This period is within the school year with only three weeks of school break, therefore, there is a big potential to use rainwater for irrigation and water storage. If all downspouts 90% of the roof rainfall could stored and used to replace irrigation (considering 10% loss), and all water is used for irrigation, this catchment process would result in $5,604 in savings per year, considering the estimated 2016 rate of $4.96 per 1,000 gallons of water forecasted at the Honolulu Board of Water Supply website.

Blanche Pope has drainage problems around all buildings and the parking lot. Most of the downspouts dispense water directly in the ground next to the building foundations, and deterioration of the foundation. This also can result in puddles and ponding in the lawns, stagnating water, and mud along the walkways (figures 31, 32, 33, 34, 35, 36 and 37).
Figure 30. Blanche Pope Elementary School roof area.

BLANCHE POPE ELEMENTARY SCHOOL

IMPERVIOUS SURFACES AND RUNOFF CALCULATOR

<table>
<thead>
<tr>
<th>Month</th>
<th>Runoff (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAN</td>
<td>6.48</td>
</tr>
<tr>
<td>FEB</td>
<td>4.53</td>
</tr>
<tr>
<td>MAR</td>
<td>4.25</td>
</tr>
<tr>
<td>APR</td>
<td>3.16</td>
</tr>
<tr>
<td>MAY</td>
<td>2.75</td>
</tr>
<tr>
<td>JUN</td>
<td>1.34</td>
</tr>
<tr>
<td>JUL</td>
<td>1.57</td>
</tr>
<tr>
<td>AUG</td>
<td>1.54</td>
</tr>
<tr>
<td>SEP</td>
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</tr>
<tr>
<td>OCT</td>
<td>3.38</td>
</tr>
<tr>
<td>NOV</td>
<td>5.90</td>
</tr>
<tr>
<td>DEC</td>
<td>5.78</td>
</tr>
</tbody>
</table>

TOTAL 42.56 IN/YEAR

ROOF 42,590 SF

WATER ON ROOF:
1,129,873 GALLONS/YEAR

@$4.96 / 1,000 GALLONS

= $5,604 / YEAR IN WATER SAVINGS
Figure 31. Behind Library building.
Figure 32. Behind Building B
Figure 33. Along Building A.
Figure 34. In front of the library building.
Figure 35. Behind Library
Figure 36. Runoff from buildings and parking lot.
Figure 37. Storm water runoff drained to storm drain, to the cemented stream, and ocean.
8.1.3. Circulation and seating spaces

The cafeteria and the library at Blanche Pope Elementary School are used for several school and community events, such as graduation ceremonies, weekly church gatherings, fundraising events, and film showings. Besides the bus stop, which is covered, there is no other space for seating outside of the buildings in the entire campus. The lawn area between the library and the cafeteria could serve as a seating space, providing seating and shade for users of the school (figure 38). An intervention in this space could also help solving the drainage problems in this area where water ponds during the rainy season.

Figure 38. Covered walkway with wood rails attached to the columns to prevent people from walking on the lawn, with the bus stop and parking lot in the background.
8.1.4. School Boundaries

Currently the school boundary is determined entirely by fences (figure 39), which are not aesthetically pleasant and imposes a feeling of a “cage”. This “cage” feeling could be alleviated without reducing safety or security by the creation of edges that soften the metal fence and work as visual screens, providing privacy to surrounding residents. Besides the visual and privacy benefits, this edge could also function ecologically, providing habitat for fauna and flora, as well as serve the community with edible and other useful plants, which could also add educational value to the school landscape.

Figure 39. Existing fences separate the main recess area of the school from surrounding residences.
Taking all these issues into consideration, it is possible to develop a site plan that identifies each individual project area and integrate them in a systematic way.
8.2. Proposed Site Plan

Ka Māla Lani, the school garden, is the heart of this project. It has served the purpose of hosting garden classes, and teachers and personal from the school garden program have collaborated to use the garden to meet the common core standards. All issues presented above, even if not directly related to the garden, need attention and could be solved through design, keeping the garden principles in mind to bring the school together as a whole towards “growing pono”. A proposed site plan is presented in figure 40.
BLANCHE POPE ELEMENTARY SCHOOL
SUGGESTED WORKS

1. KA MALA LANI - SCHOOL GARDEN
2. HALE + IMU + SINKS
3. WATER CATCH + TRELILICES + 'UALA TERRACES
4. NATIVE SCHOOL FOREST
5. RAIN GARDEN
6. EDIBLE TREES BELT
7. SCHOOL FRONTAGE
8. WALKWAY FROM BACK GATE
9. BIOSWALE
9. Design Solutions

9.1. Project 1: Hale (shelter)

As described above, one of the main problems for the garden classes is the lack of a dedicated gathering space. The existing tent shared with the program Na Pono no Na ‘Ohana could be used as a reference. This proposed hale should be of a size similar to the existing tent, which measures 20’ by 30’, since the current tent works very well for garden-related activities. It should provide shade and visual connection to the garden. It is important to design this gathering space with open walls, to ensure that people do not misuse it as a space for other activities that would put at risk the safety and integrity of the school and its users, or as a permanent dwelling. All these important considerations could be achieved through a traditional Hawaiian hale building because its architectural characteristics allow to keep all sides open at eye level, since it does not require bearing walls.

Besides the architectural properties described above, a traditional Hale is appropriate for its educational, cultural, community building, and regulatory aspects.

The traditional Hawaiian hale provided shelter from the sun, rain, and cold, and functioned as storage space for crafts and clothing\textsuperscript{156}. Architecturally the hale has been considered a traditional building type. It was often considered to be a relic of the past. However the reality is that the knowledge of how to build a hale has been passed down to this generation. In reality the Hawaiian hale is still alive, and new hales have been erected by individuals, communities and institutions interested in its uses and/or cultural values. The hale builder Francis “Uncle Palani” Senenci from Hana, Maui, recently led the construction of several hales\textsuperscript{157}, including a hale overlooking wetland taro terraces (lo‘i) at the University of Hawai‘i Lyon Arboretum (figures 41 and 42).

\textsuperscript{156} Palama, "Hawaiian Architecture: Developing Responsible Stewards of Our Land."
\textsuperscript{157} Francine Palama, Email, Feb 10 2015.
Figure 41. Uncle Palani building a Hale at Lyon Arboretum with the Arboretum staff. This hale was built using locally harvested wood and lashing, ancient Hawaiian techniques\textsuperscript{158}.

The hale at the University of Hawai‘i Lyon Arboretum is an example of a contemporary hale using traditional ancient techniques. On the other hand, there are also contemporary buildings inspired in ancient hale design and construction technique, however, using modern materials and construction techniques, such as the Hale wa‘a (canoe hale) at the Hale‘iwa Elementary School (figures 42 and 43), and the Bernice Pauahi Bishop Memorial Chapel and adjacent buildings in the Kamehameha School Kapalama campus (Figures 44 and 45).
Figure 43. Hale wa'a (canoe hale) at the Haleʻiwa Elementary School, built using modern materials and techniques.
Figure 44. Hale wa'a (canoe hale) at the Hale‘iwa Elementary School (interior view).
Figure 45. Enclosed hales with lanai, Bernice Pauahi Bishop Memorial Chapel in the Kamehameha School Kapalama campus.
9.1.1. Hale Location

The recommended location for the new hale is presented in figure 46. The entry to the hale is oriented directly facing the garden. It is flanked by two existing Kukui nut trees. It is strategically located so that the group meeting inside the hale can maintain visual contact and relate to the garden. The sides are open and the connection is assured with the school, and the Koʻolau Range. This location is visible from the parking lot, and along an existing pathway which will keep it safer. A ‘imu pit is included in the design, located on the southeast side of the hale, sheltered from wind and highly visible. The ‘imu is necessary for preparation of traditional Hawaiian food. As the hale, the ‘imu is a group activity that requires community engagement, as shown in figure 47 during a hoʻike organized by Hui Mālama o Ke Kai in 2014.
Figure 46. Hale location in relationship to the school garden, Building B and other design proposals.
Figure 47. Hui Mālama o Ke Kai staff and volunteers preparing a ‘imu.

9.1.2. The Hale design process as an educational tool

A design inspired on traditional Hawaiian hale is culturally sound, and will inspire the students to connect them to their culture, since most of the students consider themselves Hawaiian, reinforcing their sense of place, pride, and identity. The structural system of a traditional Hawaiian hale is illustrated in Figure 48. David(a) Malo, was one of the first.

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160 Palama, "Hawaiian Architecture: Developing Responsible Stewards of Our Land."
Hawaiian historians to document Hawaiian history, mo‘olelo and traditions in written form in Hawaiian, (translated to English by Dr. N. B. Emerson in 1898)\(^\text{161}\).

Figure 48. The hale structural system\textsuperscript{162} and lashing techniques\textsuperscript{163}.

\textsuperscript{162} Malo, Hawaiian Antiquities.
\textsuperscript{163} Herbert Kane, Ancient Hawai'i/Words and Images (Capt. Cook, HI: Kawainui Press, 1997). In: Palama, "Hawaiian Architecture: Developing Responsible Stewards of Our Land."
The hale construction process is shown in pictures 49, 50 and 51. After gathering all materials, the frames are built and laid on the ground near the construction site. The first frame, composed of a post (Pou-hana), rafters (o’a) and spandrels (ilio or kalapau), is lifted using one of the strongbacks or diagonal braces (holo) that will be used later for climbing the hale for thatching. The second frame is lifted and connected to the first frame using the diagonal braces (holo). The remaining frames are also lifted and connected through cross members. Once all frames are erect and connected, the lateral stone wall is built over the footings.

This building sequence can be easily illustrated using digital 3D modeling software such as Rhino and Sketchup. The digital model files can be made available to the students for educational purposes.

Figure 49. 3d rendering illustrating the first steps of hale construction.
**Figure 50.** Lifting and connecting the frames.

**Figure 51.** Finished hale.
Once all frames are lifted and connected through cross members, the pole used to lift them can be removed. The strongbacks are then added, the lashing is reinforced, the ridge pole is added. The lateral poles (pou kaha) are secured with a rock wall.

9.1.3. Hale building as community building – Hui Mālama o Ke Kai Case Study

On March 21st, 2015, Hui Mālama o Ke Kai (Hui Mālama) broke ground for the building of their new Hale waʻa (figure 52). Hui Mālama is an after-school youth development program with several family oriented activities, such as the hale waʻa building. Hui mālama’s mission is to cultivate pride and leadership by living Hawaiian values (figure 53)164.

Figure 52. Hui Mālama o Ke Kai staff and volunteers breaking ground for their hale wa’a. Photo courtesy of Hui Mālama o Ke Kai.

Figure 53. Hui Mālama o Ke Kai’s mission. Source: Hui Mālama o Ke Kai Website\textsuperscript{165}.

The author participated in previous workshops offered by Hui Mālama o Ke Kāi, such as papa he’e nalu (traditional Hawaiian surfboard made out of wood) and pōhaku ku‘i ‘ai (poi pounder) workshops. As a result of a casual encounter, the author was fortunate to be invited by

\textsuperscript{165} Ibid.
one of Hui Mālama’s directors to participate in this community work day and was authorized to document the process, witnessing in first person the benefits of this group activity.

I wanted to document the hale building community day with pictures. However, as I arrived in the project site, Kumu Earl Kawa‘a promptly called me from the top of the log pile and asked to stop taking pictures and start helping to carry the logs, making very clear that everyone should actively participate in this community work day (figure 54). I am glad he did so!

![Kumu Earl Kawa‘a leads the construction of Hui Mālama o Ke Kai’s hale wa‘a, telling the author to stop taking picture and help carring the logs.](image)

**Figure 54.** Kumu Earl Kawa‘a leads the construction of Hui Mālama o Ke Kai’s hale wa‘a, telling the author to stop taking picture and help carring the logs.

Before building the actual hale wa‘a, Hui Mālama built a staging hale to dry leaves for thatching and to work on the ‘ōhi‘a logs (*Metrosideros polymorpha*) to be used as structural members of the hale wa‘a. Besides the practical use of the staging hale, it also served as a training before building the actual hale wa‘a. The ‘ōhi‘a logs, reserved for construction of the hale wa‘a, were brought from Hawai‘i Island and unloaded using a fork lift (figure 55). Once
unloaded, the logs were categorized by thickness and transported to the storage areas, where they were piled off the ground, passing the logs hand by hand, instead of carrying it (figure 56, 57 and 58). The staging hale was built with haole koa (figure 59), found on site.

The project site was blessed by kūpuna from Hui Mālama o Ke Kai before start building (figure 60). After the blessing, every participant of the community day had a change to help digging the first hole, and the hui took a group picture (figure 52).

The construction start with digging the holes for the posts. The holes were opened using a bobcat offered by community members, and finished by hand (figure 61 and 62). From this stage, community members of all ages and sexes were able to work together, thus providing an environment for intergenerational activity, which is very important in Hawaiian culture. Once the holes were dug, a flat base rock was put at the bottom of the hole, 2 feet deep, and the haole koa posts were put on top of the base rock (figure 63). The hole was backfilled with native soil and compacted with an o‘o or with another haole koa log.

The middle posts were cut about 11 feet long, adjusted to 9 feet above ground once put in place. The lateral posts were cut 9 feet long and adjusted to be 7 feet above ground (figure 64). Instead of digging or feeling the holes to make the holes exactly 2 feet deep, the posts were cut to adjust them to the desired height. Once all posts were in place, the ridge poles, made out of existing metal pipes found on site, were tied down on top of the posts (figure 65). A notch was made with a saw to facilitate lashing, and Kumu Kawa’a taught how to do the lashing (figure 66 and 67). Once the ridge poles and rafters were tied down (figure 68), a tarp was fixed to the structure using bungee cords, and an additional member was added to the sides of the hale to hold the tarp down and to add extra sun and rain protection (figure 69). After pau, all participants were served with refreshments, which were also available during the whole day (figure 70).

The involvement of the community during this building process was remarkable for promoting family, community, and professional values, bonding ties, and for exercising traditional Hawaiian building techniques, proper handling of building equipment, and team work.
Figure 55. Unloading ‘ōhi’a logs.
Figure 56. Hui Mālama o Ke Kai staff and volunteers working as a team to transport the ‘ōhi‘a logs for further use in their hale wa‘a. Photo courtesy of Hui Mālama o Ke Kai.
Figure 57. The larger ʻōhiʻa logs, about 6” diameter, were piled off the soil on top of used tires, to keep the logs dry.
Figure 58. The thinner ‘ōhi’a logs, about 4” diameter, were piled off the soil on top of palets available on site.
Figure 59. Haole koa (*Leucaena leucocephala*) cut on site to build the staging hale.
Figure 60. Hui Mālama o Ke Kai kūpuna breaking ground during blessing ceremony.
Figure 61. The intergenerational aspect of community work was observed during Hui Mālama o Ke Kai hale wa‘a work day. Photo courtesy of Hui Mālama o Ke Kai.
Figure 62. Community members donated a Bobcat and a trained operator to help digging the holes for the structural posts.
Figure 63. Haole koa posts were buried 2’ below grade and backfilled with native soil, compacted with a o’o (digging stick) or other haole koa logs.
Figure 64. Once all posts were put in place, existing pipes available on site (from old metal tents) were used as ridge poles.
Figure 65. Notch made using a saw to tie down the ridge poles.
Figure 66. Kumu Earl Kawa‘a lashing the ridge poles to the posts, while part of the hui strat to dig the foundation holes for the actual hale wa‘a.
Figure 67. Kumu Earl Kawa’a teaching lashing techniques. Photo courtesy of Hui Mālama o Ke Kai.
Figure 68. Once all ridge poles were in place, the rafters were tied to the posts using lashing techniques.
Figure 69. A additional member was added to tie the tarp down for extra sun and rain protection.
Figure 70. Hui Mālama o Ke Kai’s staging hale near completion. Refreshments were served for all involved in the community day.
9.1.4. Indigenous Hawaiian Hale Building Regulations

Although the current building regulations would not allow the use of hales built exclusively according to ancient Hawaiian techniques for use as a residence, the construction of hales under 500 sf for education purposes, and as agricultural buildings under 1000 sf, are currently exempt from building permit requirements “on commercial farms and ranches located outside the urban district” in the State of Hawai‘i. It is worth investigating if this exemption would apply to the project area, since it would reduce or at least eliminate the costs associated with building permitting and stamps from licensed professionals, and speeds up the construction process since it bypass the bureaucratic processes. From the State of Hawai‘i S.B. NO. 586, effective July 1st, 2013:

“Provides, under certain circumstances, an exemption from building code and permit requirements for nonresidential buildings or structures, including indigenous Hawaiian hale, on commercial farms and ranches located outside the urban district. Effective July 1, 2013. (SB586 HD1)”

The S.B. 586 exempt from any certificate of occupancy requirements: …

(a) Agricultural buildings, structures, or appurtenances thereto, which are not used as dwelling or lodging units, may be exempted from existing building permit and building code requirements where they are no more than [1,000] one thousand square feet in floor area[;]

(b)(10) […] Nonresidential indigenous Hawaiian hale that do not exceed five hundred square feet in size, have no kitchen or bathroom, and are used for traditional agricultural activities or education;

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166 Agricultural and aquacultural buildings and structures; no building permit required, 46-88, 586.
167 Ibid.
The revised Ordinances of the City and County of Honolulu (ROH)\textsuperscript{168} has a chapter dedicated to “Indigenous Hawaiian Architecture”, with maximum allowable size, sprinkler requirements, recommended wood species, etc. This recommendations should be considering during the design process. The ROH\textsuperscript{169} recommends four different hale styles. The Hale wa’a is the most appropriate for this project (figures 71 and 72).

\begin{figure}
\centering
\includegraphics[width=\textwidth]{hale_styles.png}
\caption{Hale styles recommended by the ROH.}
\end{figure}

\begin{itemize}
\item \textit{Hale Halawai}: Open End Style
\item \textit{Hale Ku’ai}: Shed Style
\item \textit{Hale Wa’a}
\item \textit{Hale Noa}
\end{itemize}


\textsuperscript{169} Ibid.
Figure 71. Hale waʻa example, framing schematic, and foundation detail drawing. Source: Revised Ordinances of the City and County of Honolulu\textsuperscript{170}.

\textsuperscript{170} Ibid.
Figure 72. Revised Ordinances of the City and County of Honolulu for Hale wa’a construction\textsuperscript{171}.

\textsuperscript{171} Ibid.
9.1.5. Design for Healing: The Hale as symbol of identity and culture

The Hale should be the first project because it is very symbolic, as an iconic indigenous Hawaiian building type. It reconnects students to their ancestral and cultural roots. Even students and community members that are not necessarily Hawaiian by blood will have the opportunity to belong to a Hawaiian tradition, because they will share and believe in a principle that will guide the construction process: to be pono. By behaving as such, they become part of the community, and the Hale will help to create pono bonds, to re-inforce their identity and strengthen the community as brothers and sisters, overcoming their differences.

Besides all the positive effects described above, the Hale can literally “house” the planning of the next projects, with Ka Māla Lani, the pono garden, at sight of vision, to always remind the community of the roots of this project: to grow pono.

The Hale can be also used by other programs and communities, bringing more positive projects into Blanche Pope, which will strengthen the community as a whole.
9.2. Project 2: Rainwater catchment / harvesting

Given the extensive roof area of existing buildings and the proximity of these buildings to the school garden and other areas that could potentially become productive, rainwater harvesting is a strategy to be considered. The school has a total of approximately 42,500 SF of roof area (figure 28), all connected to downspouts that dispense an average of 1,129,800 gallons of water per year, mostly concentrated between September and March. This period is within the school year with only three weeks of school break, therefore, there is a big potential to use rainwater for irrigation and water storage.

All buildings at Blanche Pope Elementary School are equipped with downspouts, channeling the runoff from roofs to the ground next to the buildings, which is not recommended since it can affect the foundation of buildings, and creates mud. These issues could be addressed with rainwater harvesting through cisterns and storm water planters, both recommended as a Low Impact Development (LID) storm water management practice\textsuperscript{172} (figure 73).

There are schools in O’ahu already adopting rainwater harvesting strategies, such as at Punahou School and Nanakuli Boys and Girls Club NFL Youth Neighborhood. It is interesting that these two projects have two different approaches, adapted to two distinct climates, and a contrasting scope of available budgets.

9.2.1. Case Study: Punahou School Omidyar K-1 Neighborhood – Honolulu, HI

The rainwater harvesting system at Punahou is part of the stormwater management system in the K-1 Omidyar Neighborhood site, designed by PBR Hawai‘i and Associates Inc. Water is collected in water cisterns and stored for use in the school garden. The cisterns have an overflow pipe that drains into the existing storm water bioswale, therefore maximizing the water infiltration to reduce water runoff (figures 74, 75 and 76). A windmill produces energy to pump water from the cistern to the raised beds. The manual water pump adds to the play environment

as the water flows down over the rocks, as a waterfall (figure 77). There are lots of educational opportunity in this system.

Figure 73. Rainwater harvesting as part of the storm water management system in residential and institutional settings.
Figure 74. Rain water cistern at Punahou School, Honolulu.
Figure 75. Rainwater harvesting system integrated in the school landscape, near the garden beds.
Figure 76. In this system at Punahou School, the rainwater is harvested and stored in the cistern and flows into a bioswale.
Figure 77. In this system at Punahou School, the rainwater is harvested and stored in the cistern.
9.2.2. Case Study: Nanakuli Boys and Girls Club NFL Youth Neighborhood

The Nanakuli Boys and Girls Club NFL Youth Neighborhood project has a different approach, and was designed by Ki Concepts LLC. There is only one large cistern, instead of several small cisterns distributed throughout the landscape (figure 78, 79, 80 and 81), probably because of the different scale of this project, which is smaller than Punahou. The water gauge in this cistern is well designed for youth observation and serves as an educational tool, since the youth can keep track of the water level as they use the water, which also encourage to save water. Also, the cistern is connected to an ‘auwai system that supply water to taro patches (figures 82, 83, 84 and 85), as in traditional Hawaiian lo‘i kalo.

Figure 78. Rainwater cistern at NFL Nanakuli. Source: ASLA Hawai‘i website.

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173 Palama, "Hawaiian Architecture: Developing Responsible Stewards of Our Land."
Figure 79. Pipe support detail. Drawing courtesy of Ki Concepts.
Figure 80. Rainwater storage elevation detail. Drawing courtesy of Ki Concepts.

Figure 81. Rainwater storage elevation detail. Drawing courtesy of Ki Concepts.
Figure 82. Rainwater storage tank detail section and plan. Drawings courtesy of Ki Concepts.

Figure 83. Pipe support detail. Drawing courtesy of Ki Concepts.
Figure 84. Pipe and ‘auwai transition detail. Drawing courtesy of Ki Concepts.
Figure 85. 'Auwai and cascade detail sections. Drawings courtesy of Ki Concepts.
9.3.3. Proposed Water Catchment System for Blanche Pope Elementary School

A similar rain water harvesting system could be designed for Blanche Pope Elementary School. Rainwater could be captured into cisterns, used to irrigate planters, and be directed to bioswales or rain gardens to reduce runoff and improve the quality of the water leaving the school to the stream and ocean. Figure 55 shows an example of how water could be captured from the existing downspouts to take advantage of the existing architecture and minimize the amount of work and costs related to this intervention, as well as preserving the existing architecture.

Figure 86. Current conditions near the janitor area at Blanche Pope Elementary School.
Figure 87. Rendering of proposed rainwater harvesting system at Blanche Pope Elementary School (below) above a proposed stone walled raised planter. Original photo above. Location: near custodians room, Building A.
9.3.4. Water catchment as a manifestation of independence

The water-catchment system will allow custodians and students to control the water – one of the most precious resources one can have. The simple act of being able of controlling the water given for free from the heavens will bring healing from the history of control and colonization that have being imposed in Waimānalo, from the submission of O‘ahu to King Kamehameha The Great (originally from Hawai‘i Island), to the overthrown of the Hawaiian Kingdom with the imprisonment of Queen Lili‘uokalani in her own ‘Iolani Palani.

The water reservoirs will be placed above the planters, in a position of high status, since it is so precious. The position of the reservoirs will also increase their efficiency, since water should be used diligently, every drop of water will go directly to the planters.

The planters that support the terrace are built with stone walls, a traditional Hawaiian construction technique. Therefore, the Hawaiian knowledge is supporting the independence through the control of the water. Even though this might seem only symbolic, and limited since the cisterns can hold only so much, it is a seed that can be planted in the heart of silenced children and adults, empowering dreams to come true.
9.3. Project 3. Bioswales

The EPA has a good description of storm water runoff\textsuperscript{175}:

*Stormwater runoff is a major cause of water pollution in urban areas. When rain falls in undeveloped areas, the water is absorbed and filtered by soil and plants. When rain falls on our roofs, streets, and parking lots, however, the water cannot soak into the ground. In most urban areas, stormwater is drained through engineered collection systems and discharged into nearby waterbodies. The stormwater carries trash, bacteria, heavy metals, and other pollutants from the urban landscape, degrading the quality of the receiving waters. Higher flows can also cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure.*

Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water.

As explained by the Hui o Ko’olaupoko Hawai‘i Residential Rain Garden Manual\textsuperscript{176}, non-point pollution (pollution that is caused by a diffused source generated from stormwater runoff, such as rainfall, that carries pollutants into storm drains, stream and the ocean\textsuperscript{177}) can negatively impact streams and the ocean, “from pollutants including nutrients, heavy metals and sediment from sources such as fertilizers, pesticides, eroding stream banks, automobiles, roads and animal waste. These pollutants build up on impervious surfaces such as roofs, sidewalks,

\textsuperscript{175} Environmental Protection Agency EPA, "What is Green Infrastructure?," http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm.

\textsuperscript{176} Hui o Ko’olaupoko, "Hawai‘i Residential Rain Garden Manual," (Kailua, HI: Hui o Ko’olaupoko, 2013).

\textsuperscript{177} Ibid.
driveways and roads. Following rains, pollutants are washed and carried into storm drains, streams and ultimately the ocean.”

Bioswales and raingardens are types of green infrastructures that slow down and reduces the amount of storm water before it leaves the site, which help to reduce the pressure on storm water public systems. They also improve the quality of the water leaving the site through physical, biological and chemical processes\textsuperscript{178,179}, reducing the amount of non point pollution in the water.

Bioswales are…

“vegetated, mulched, or xeriscaped channels that provide treatment and retention as they move stormwater from one place to another. Vegetated swales slow, infiltrate, and filter stormwater flows. As linear features, vegetated swales are particularly suitable along streets and parking lots.”\textsuperscript{180}

The project at Punahou School features bioswales vegetated with native plants. Punahou School is a wealthy school that can afford irrigation and intensive maintenance, and the result is appealing, since the bioswale is covered with lush vegetation year round. Part of the stormwater system at Punahou School is demonstrated on figure 88. The dashed red lines show the pathway of the water, running down from the gutter through a chain and meandering through rocks surrounded by native plants. Note that a football got “stuck” in between the rocks, and that it exactly how the bioswale works: stopping pollutants at the source, instead of letting it “run-off” to water ways with the water flow. Figures 89 and 90 show detail plans and sections of bioswale at Punahou Schools, with dimensions and plant species.

\begin{footnotes}
\item \textsuperscript{178} A.P. Davis et al., "Laboratory study of biological retention for urban stormwater management.,” Water Environment Research 73, no. 2 (2001).
\item \textsuperscript{179} Dunnet and Clayden, Rain Gardens: Managing water sustainably in the garden and designed landscape.
\item \textsuperscript{180} EPA, "What is Green Infrastructure?".
\end{footnotes}
Figure 88. Bioswale at Punahou.
Figure 89. Enlargement plan of bioswale at Punahou School. Drawing courtesy of PBR HAWAII & Associates Inc.

Figure 90. Sections of bioswale designs at Punahou School. Drawings courtesy of PBR HAWAII & Associates Inc.

The NFL Nanakuli also has stormwater filtration systems that treat storm water close to the source of run-off, as it travels through the site. Instead of vegetated bioswales like at Punahou, the swales in Nanakuli use coral to treat the water (figure 91), so they are called “rockswales”. It is an creative alternative to vegetated bioswale, since it uses locally available coral instead of the stones or gravel, which is site specific and appropriate.
Figure 91. “Rockswale” at NFL Youth at Nanakuli. Sources: ASLA Hawaii website\textsuperscript{181} and drawing courtesy of Ki Concepts.

\textsuperscript{181} HAWAII, “2012 General Design: Merit Award”.

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Bioswales could be used to solve existing drainage problems at Blanche Pope Elementary School, especially around the buildings, to drain the water coming from the roof and direct it to the rain. Currently, water ponds along walkways, forming mud and spilling water in the walkways. The mud and the water ends up messing up the floor of classrooms and student’s shoes.

An example of the application of bioswales at Blanche Pope can be seen in figure 60. The grade along the concrete walkway should be raised and a gravel “maintenance strip”, added at least one foot wide, to improve drainage, reduce water that spills in the walkway, and provide a buffer between the walkway and the bioswale. The graded should get lower at the midpoint to direct the water run-off to the gravel strip leading to the storm drain. There is an opportunity to use whimsical elements that add educational value by harvesting water energy, such as water wheels, Japanese bamboo water elements, etc.

The rainy season at Blanche Pope is very short, so it would be wise to use plants adapted to dry areas, instead of trying to take advantage of the bioswale to grow wetland plants or crops. Hawai‘i Residential Rain Garden Manual has a list of suitable native species for this application.

Figure 92. Current condition at Blanche Pope Elementary School.
9.4. Project 4: Rain Garden

Rain gardens, another type of green infrastructure to manage stormwater runoff, have gained popularity on Hawai‘i. They are a depression planted with vegetation to allow water to infiltrate before leaving the site (figure 94). The Hui o Ko‘ololaupoko published the Hawai‘i Residential Rain Garden Manual\textsuperscript{182}. They help residents install rain gardens on their properties

\textsuperscript{182} Hui o Ko‘ololaupoko, "Hawai‘i Residential Rain Garden Manual."
with grant-funded materials and volunteer work. It has gained community activity and has gained recognition in the public media, and could potentially be a partner in this project.

Rain gardens must consider historic rainfall patterns, soil properties and drainage areas. The Hawai‘i Residential Rain Garden Manual provides a list of recommended native plant species and cost estimated for construction of a rain grain. As mentioned in the introduction of the residential manual, it “can easily transfer to schools or more developed urban areas to construct a rain garden”.

Figure 94. Section of a rain garden showing how the water from the roof is collected by rain gutters and transferred to the rain garden depression. Source: Hui o Koʻolaupoko Hawaiʻi Residential Rain Garden Manual.
Rain gardens are not wetlands or ponds – they should be designed to infiltrate water within 30 hours of a rain event. Therefore, a properly-designed rain garden should eliminate the potential for breeding mosquitoes, which could be a concern, especially in a school\textsuperscript{183}.

The Hui o Ko‘olaupoko Hawai‘i Residential Rain Garden Manual offers easy to follow step-by-step directions on how to design, plan and build the rain garden. The first step is site mapping. The manual recommends drawing a schematic of the property detailing all structures, vegetation, retaining walls, driveways, slopes and utilities if known (figure 95). It should include the direction and flow patterns of storm water across the property. The following should be considered when mapping out the site:

- Identify any slopes and down spouts;
- Identify areas where water might drain to outside of the property;
- Identify impervious surfaces;
- Identify areas that stay wet or pond water; and
- Identify areas where the rain garden can overflow safely (e.g.; to a storm drain).

The next step is to decide where to locate the rain gardens. The manual recommends that the rain garden be somewhere close to the source of rain water from roofs and other impervious surfaces, such as rain gutters and driveways. The figure 96 shows an example of a rain garden location. It is also important to consider the overflow of the rain garden, preferably to another area that can infiltrate the water such as lawns and other gardens, or existing storm drains.

\textsuperscript{183} Ibid.
Figure 95. Example of a schematic design showing how to map storm water flow. Source: Hui o Ko‘olaupoko Hawai‘i Residential Rain Garden Manual.
Figure 96. Selecting the site for a rain garden. Source: Hui o Ko‘olaupoko Hawai‘i Residential Rain Garden Manual.

The manual recommends not to build a rain garden on, or adjacent to slopes with more than a ten-percent (10%) gradient to reduce the risks of soil slumping or shifting, resulting in erosion or other problems. It is also important to keep a clearance between the rain garden and existing walls, buildings, sidewalks, trees, and any other element that could put at risk the safety of the rain garden or complicate the job of installing and maintaining the rain garden. The manual recommends the following guidelines when determining the rain garden’s location (figure 97):

- 4 feet from a crawl space or slab;
- 4 feet from a sidewalk/driveway;
- 10 feet from a basement;
- 10 feet from the top of a retaining/decorative wall;
- Avoid the drain field of a septic tank or cesspool;
- Avoid the dripline (edge of tree canopy) of trees or proximity to tree roots that could be damaged during digging;
- Avoid areas that stay consistently wet during the rainy season, this indicates poor draining soils; and
- Avoid soils that have drainage of less than ½ inch per hour infiltration.

**Figure 97.** Recommended rain garden clearances. Source: Hui o Koʻolaupoko Hawaiʻi Residential Rain Garden Manual.

The rain garden dimensions need to be determined by calculating the area of contributing drainage area (CDA), e.g.; size of a roof, driveway or sidewalk), rainfall and soil infiltration rates. The CDA is obtained by measuring and calculating the impervious surfaces that drain rain water.
into the rain garden. The rainfall predictions can be obtained from historical data, and the soil infiltration rates can be obtained through the methodology described below.

Because different soils have different infiltration rates, and many soils are disturbed, with fill or compacted soils, it is very important to run a water infiltration test in the location of the rain garden. As a rule of thumb, the lower the infiltration rate, the larger the rain garden because the garden will need to hold more water until it can infiltrate the soil. On the other hand, the higher the infiltration rate, the smaller the garden.

A water infiltration test requires a shovel, a ruler, and water. Dig a hole 10 to 15 inches deep in the general area of the rain garden (figure 98). Fill the hole with water and wait until it drains, and fill it again with water two more times. It is important to fill the hole with water for three times to simulate a saturated soil, condition likely to happen during the rainy season. When filled for the third time, stick a ruler in the hole in the vertical position, perpendicular to the water surface. Measure the water level and the time of the reading, and measure it again after the water is drained. Divide the distance the water dropped in inches by the time between the readings, in hours. For example, if the water level dropped 6 inches in 3 hours, the water infiltration rate is 2 inches per hour (2 in/hr). The Hui o Koolaupoko Hawai‘i Residential Rain Garden Manual recommend a minimum infiltration rate of ½ inches/hour.
The NFL Nanakuli has a raingarden basin. See figure 99 for details.
NOTE: THIS RAIN GARDEN WORK WAS INSTALLED IN PHASE 1. CORAL ROCK ALONG WALKWAY SIDE TO BE REDONE IN PHASE 2.
The design proposal for Blanche Pope should follow the Hui o Koʻolaupoko Hawaiʻi Residential Rain Garden Manual. The first step is to define the water ways, using a schematic drawing (figure 100). The storm water runoff from the parking lot area should be treated before leaving the site, since pollutants from vehicles and litter currently drains directly to the cemented stream, and from there to the ocean. There are two locations suitable for rain gardens, based on land use and topography. The locations of the two rain gardens, arranged in series, are shown in plan in figure 101. A picture of the project site is shown in figure 102. A rendering of the proposed rain garden with the school garden in the background is shown in figure 103.
Figure 100. Overall schematic showing the storm water flow at Blanche Pope Elementary School
Figure 101. Selecting the site for the rain gardens.
Figure 102. Existing conditions of the recommended site for a rain garden.
Figure 103. The proposed rain garden.

9.3.3. A vision of kuleana (responsibility) and ho‘oponopono (to correct)

The storm water treatment systems (bioswales and raingardens) evokes a sense of responsibility and restoration. Responsibility because it is our responsibility to restore the stream that gives life to Waimānalo. If we cannot restore the stream that was channilized, we can at least do the best possible to clean the water before it is released into Muliwai‘ólena, and the ocean, as a process of ho‘oponopono.
9.5. PROJECT 5. School Orchard

To wrap up the proposed site plan, it is suggested that an orchard be developed in the back of Blanche Pope Elementary School, on the mauka side of the property (figure 104). This orchard could be used as a outdoor classroom, since it produces shade, and supply the school community with fruits and other edibles, complementing the school garden, since many of Blanche Pope students come from families near the poverty level based on the lunch enrollment program\textsuperscript{184}. The proposal will recommend culturally appropriate, easily maintained edible species, such as was found in Waimānalo in the old times\textsuperscript{185}.

\textbf{Figure 104.} Orchard in the back of the school.

\textsuperscript{184} System Evaluation and Reporting Section, "Blanche Pope Elementary School."
\textsuperscript{185} Sterling and Summers, \textit{Sites of O'ahu}. 189
10. CONCLUSION

The school garden Ka Māla Lani was instrumental in fostering hope and guiding the community towards a pono way, inspiring students, teachers and other community members to step back and re-evaluate the way things have been done. This Doctorial project is an example of the influence of Ka Māla Lani in people’s life. Ka Māla Lani embraced students in a way that goes beyond the educational and nutritional benefits that are often associated with school gardens. It truly worked as a Pu‘uhonua, a place of refuge and healing. This aspects of school gardens could be more explored in public schools of Hawai‘i.

The principles developed in the school garden inspired the reconceptualization of the school campus as a whole, and guided the design process from beginning, to proposed expansion and the specific projects. In order to be functional, the school garden principles of being pono and mālama ʻāina needed to be applied beyond the school garden limits into the whole school.

Instead of retrofitting buildings, this research took the landscape as the framework to remediate environmental impacts caused by Blanche Pope Elementary School, as well as managing the resources available on site.

The DOE should adapt to sustainable development practices, and adopt standards that reflect ecological schoolyard principles. Ecological schoolyards require a new mind set. Adjustments will have to be made in the way DOE conceives their role of school grounds design and maintenance. Schoolyard modification as proposed in this document require a considerable amount of time and dedication for their implementation, management and maintenance. They require trained and attentive grounds keeping. They may be more suitable for a paid position, especially because of the level of commitment that it requires. Also, they do not fit within the current DOE maintenance system, where a tractor is dropped off in the school, mow the grass, and move on to the next school. Each individual school needs a staff exclusively dedicated for landscape maintenance. Otherwise, the landscape maintenance could be performed by a contracted company, specialized in schoolyard unique landscapes and schedules.

Without adequate site planning, even the best curriculums cannot work. The schools and teachers need a suitable space to apply these lessons. The role of a landscape architect is
beneficial in the process as the outdoor space must be evaluated for such physical parameters as soils, and drainage.

The success of any curriculum which involves a garden depends on healthy gardens and school yards. Healthy gardens and school yards depend on dedicated workers and committee members, but also professionals such as landscape architects. Working together they can plan, implement and maintain their vision. In Hawai‘i, given its cultural context, a multigenerational schoolyard committee add wider perspectives and the kupuna-keiki relationship, which will foster positive community relationships. Incorporating the history and the traditions of the site therefore is an important element during the design process, especially in an institutional project, and more so in a school. Resonating themes can be integrated in the design. A proper design process will expand the function of the design as manifesting local identity.

There is a fine line that keeps moving back and forth to which extend the designer should participate in the main activity of schools: classes. Because schoolyards should be designed not only for their ecological benefits, but more importantly, for education, it is a challenge to separate the designer (as part of the committee) from the educational setting. The disconnection between the committee and the school routine may lead to inefficient designs, creating resistance for the implementation of new projects. Also, outdoor learning environments that simply mimic a traditional classroom setting, without a roof, can become unused for reasons such as inappropriate seating and shading.

One of the most important lessons from this research is that, particularly in Hawai‘i, because of its climate and cultural conditions, the garden is not at the school, but the school is set in the garden. This garden is the whole school campus, and the classroom is part of it, not inserted on it.

As the legislature pushes for laws to deal with the recognized public issues of nutrition, agriculture and food security, they will need to seek ways to implement the school gardens in every school by the year of 2050. The discussion and ideas presented in this document could support schools in their efforts to meet this mandate, and the example of Blanche Pope could be relevant to any implementation of this law.
E hana mua a pa'a ke kahua mamua o ke a‘o ana aku ia ha‘i.\textsuperscript{186}

*Build yourself a firm foundation before teaching others.*

‘Ike ‘ia no ka loea I ke kuahu.\textsuperscript{187}

*An expert is recognized by the altar he builds.*

*(It is what one does and how well he does that shows whether he is an expert.)*

\textsuperscript{186} Pukui, ‘Ōlelo No'eau: Hawaiian Proverbs & Poetical Sayings.

\textsuperscript{187} Ibid.
11. References


Commissioner of Public Lands. "Indice of Awards Made by the Board of Commissions to Quiet Land Titles in the Hawaiian Islands." Honolulu, HI: Territorial Office Building, 1929.


DPP, Department of Planning and Permitting. "Honolulu Land Information System (Holis)." http://gis.hicentral.com/.


Palama, Francine. Email, Feb 10 2015.


———. "Map Unit Description: Jaucas Sand, 0 to 15 Percent Slopes---Island of Oahu, Hawaii." Natural Cooperative Soil Survey, Natural Resources Conservation Office, United States Department of Agriculture.

———. "Map Unit Description: Kawaihapai Clay Loam, 0 to 2 Percent Slopes---Island of Oahu, Hawaii." Natural Cooperative Soil Survey, Natural Resources Conservation Office, United States Department of Agriculture.


Western Regional Climate Center. "Waimanalo Exp Fm 795.1, Hawaii (519523)." 


WRCC, Western Regional Climate Center. "Us Coop Station Map." 
[http://www.wrcc.dri.edu/coopmap/#](http://www.wrcc.dri.edu/coopmap/#).
Appendix 1. Proposed Projects Diagrams
Rain garden – kuleana

- Traditional Muliwai’ōlena
- Holds sediments
- Cultural, aesthetic and functional
- School entrance
- Educational

School Garden

Seating Edge (TBD)

Natural Edge

Series of basins formed with rocks and plantings

Proposed Hall
Proposed Bioswale at Blanche Pope
*Healing*

- Chain attached to balcony drain
- 18” Gravel drain
- Interactive water elements
- Rock edge
- 4’ wide swale planted with non-invasive and native plants
- Concrete slab, stone path or walking board
- 18” Gravel / maintenance strip
Circulation – Embracing/shelter

Non-invasive, thornless vine (flowers, ipu, lilikoi, squash, cucumber)

Locally available (ironwood) or recycled wood
PROPOSED WATER CATCHMENT

*Independence*

- Connect to existing downspouts
- Cisterns for water storage
- Terraces built using traditional Hawaiian stone wall building
- Barrels used to start the school garden
Orchard on perimeter of School - *Garden of Eden*

- Cultural sensitive planting selection
- Food security and education
- Outdoor classroom

![Image of Orchard with various trees](image-url)