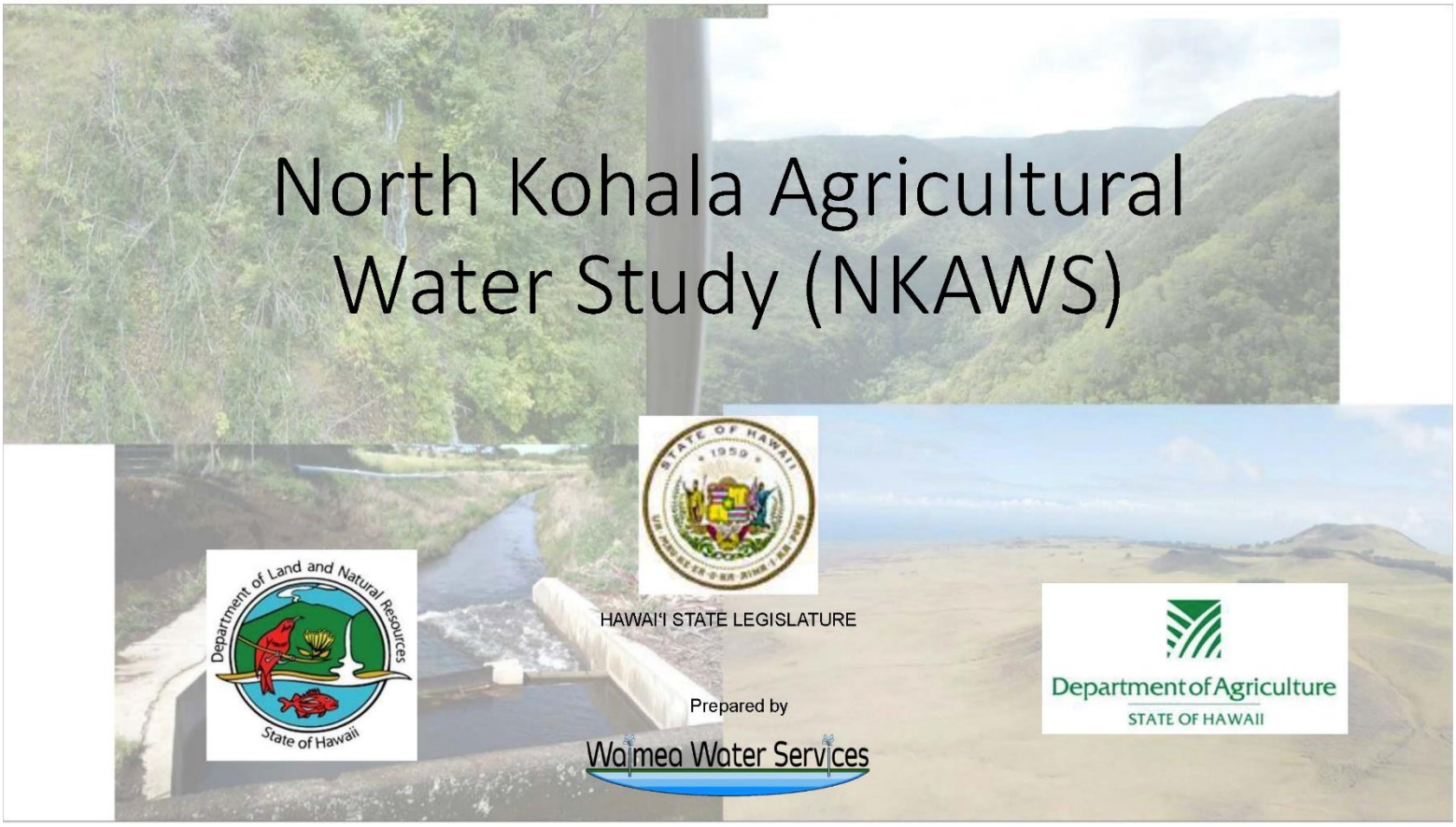
North Kohala Agricultural Water Study (NKAWS)



HAWAI'I STATE LEGISLATURE

Prepared by

Waimea Water Services

Department of Agriculture
STATE OF HAWAII

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Executive Summary:

Water has played a critical role in the population and development in North Kohala. There have been many changes and evolutions in production and water systems over the years. What has been proven repeatedly is there is enough water to support large scale agricultural production.

There is a confluence of two issues that are proving challenging to continued or new agriculture in Kohala. First is the lack of a unified, system-oriented management system and second, the plantation era facilities and equipment reaching the end of their service life.

In 1975, due to changing international pricing and production, Kohala Sugar plantation closed. Investment in water systems continued up until near the end of the plantation. This left for Kohala a water collection and delivery system, as well as other infrastructure, with decades of life left.

The lands were acquired by Chalon international that later became Surety Corp. The focus at this time was subdivision and sale of lands. In many cases, there was an assumption that the water the plantation delivered to lands would remain available for any use the new land owner chose, at little to no cost.

While certain management systems still exist – the Kohala Ditch company for example – most of the systems, subsystems and equipment were sold off as part of the land. In many cases without plans or provision to maintain or operate them as part of the larger system that had been established.

With their long lifespan, high level of maintenance prior to the closure of the plantation and their sheer size, the systems continued to function with minimal inputs and costs. Even as efficiency dropped, the systems were so oversized for the current demand the reduced flow was not a limiting factor. This allowed businesses to crop up that would normally not have access to these volumes of water at such a low cost.

Today, many of the systems are failing or have failed. The Kohala Ditch continues to function, but the distribution systems that take water from it are substantially reduced. Additionally, many of the sources that contributed to the ditch are no longer used. For the most part, the management of water in Kohala, as a system, has ceased.

Fortunately, the resources remain. While the methods of collection and transmission are degraded, functionally there is no less water in the region than when they were built. Redevelopment and reassignment are a matter of planning and organization.

The biggest challenges in Kohala are the lack of systems planning and expertise needed to rebuild, build and manage multi user/multi land owner facilities that can provide legal, sustainable and cost-effective water. This report reviews conditions and the history that brought us to this point, and offers options, solutions and planning considerations for future systems, while providing basic information to individuals new to systems planning and management.

Section 1 – Introduction

The North Kohala Agricultural Water Study (NKAWS) is an evaluation of water resources and systems in North Kohala for the purpose of providing planning tools for future agriculture. The study evaluates legal, regulatory and technical issues.

The goal of the study is to define resources, processes and procedures to allow viable agricultural endeavors of all sizes and access to water that is cost effective, economically sound and legally compliant.

North Kohala agriculture has evolved over the decades. There have been periods of growth and decline in various agricultural activities. Most recently, this brought about consolidation: first, in the irrigation systems, then in the sugar plantations themselves.

The Kohala Ditch was a major factor in the success of sugar in Kohala. Completed in 1906, the ditch delivered water to the dryer regions of Kohala – a very large undertaking. Most of the ditch's 26 miles is contained in 57 tunnels that total 16 miles. The rest is open-ditch or flumes. The net result was that productivity more than doubled.

There is a lesser known ditch that is located at the top of the mountain. It is called the Kehena Ditch, and it shares water in common with the Kohala Ditch. The major difference and benefit was that the water was collected at a much higher altitude and allowed for irrigation of lands located above the Kohala Ditch. Unfortunately, the transmission system was flawed and lost up to 80% of the water through infiltration. Due to the cost of the system and the low productivity, it was abandoned, and easements to cross private lands for transmission were surrendered.

After Kohala Sugar ceased operation in 1975 much of the land was purchased by Chalon International, which in turn became Surety Kohala. The Kohala Ditch Company was also transferred, eventually ending up with Surety Kohala, and the Kohala Ditch continued to provide water for other uses in the region.

Many smaller agricultural entities have sprung up on the rich land with available water. Even though the plantation was gone, the large transmission and irrigation systems remained. Most of these systems had a great deal of life left in them after the closure of Kohala Sugar. The Kohala Ditch Company continued to operate at a reduced capacity, maintaining the ditch system and distribution.

The Kohala Ditch Company's role after the closure of Kohala Sugar has really been that of caretaker. Without the large-scale demands, there simply was no longer funding available to do any more than keep the ditch clear and maintain basic operation. Fortunately, many of the appurtenances did not require actual input, as their lifespan was consumed. This allowed for function with minimal capital investment.

In 2006, a pair of substantial earthquakes severely damaged the ditch system. Flumes collapsed or were buried by landslides. Whole tunnels were filled with debris, and the main intake, as well

as many of the smaller ones, were damaged. Without the ditch, the agriculture that relied on the system began to suffer due to the lack of water usually supplied.

With reduced utilization and a very different economic landscape than existed when the ditch was built, the Kohala Ditch Company could not afford to make repairs. Short-term emergency solutions to provide water were put in place, but without the ditch, the existing businesses would struggle to remain economically sustainable.

Through a combination of grants, great efforts by the community, and governmental assistance, the Ditch was reactivated. This really brought clarity to the fact that agriculture in Kohala needs reliable water sources to thrive. Through the emergency, it also became evident that much of the other infrastructure was reaching the end of its service life and, there was no mechanism for repair or growth.

This brings us to the nature of this study. Kohala is at a crossroads. In order for agriculture to flourish, systems will be needed to provide water like those that were only available to large scale producers in the past. Existing infrastructure is reaching the end of its service life and will need substantial investment to continue functioning. Without effective and efficient means to overcome these issues, the agricultural value of Kohala will be dramatically impacted.

Agricultural water systems consist of four basic elements: demand, resource, transmission, and storage. The following report will review the current status and projected future needs of each element separately. We will provide flexible integration models. As businesses and agricultural production are constantly changing and evolving activities, models will need to be integrated and cost viability evaluated on a case-by-case basis.

It is important to note that historical elements included in this report are in no way complete explanations of events or methods. The cited sources provide much more in depth. They are included to demonstrate the pathway that led to successful development of water and agriculture in Kohala. While history may not hold the exact answer for the future, it does show how plans were developed and, more importantly, why.

Section 2 – Types of Agriculture

2.1 Definition of Agriculture

According to the Merriam-Webster Dictionary, agriculture is defined as:

"The science, art, or practice of cultivating the soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products." (www.merriam-webster.com, 2019).

This is a very broad definition. It needs to be broad in order to incorporate the wide range of activities that were, and are, associated with agriculture. Much of what we use in our daily lives comes from some sort of agricultural process. Food, fiber, and other consumables (oils, soaps, fertilizers, etc.) have a major impact on how we live.

Agriculture in Hawaii has also played a major role in how Hawaiian communities were formed. To fully understand the importance of agriculture in Hawaii, it is important to go back before western contact. Agriculture's evolution followed the needs generated by population growth and later interaction.

The first people to arrive in Hawaii saw an abundant, untapped resource. Starting in the easiest areas first, crops were planted and animals raised. As there was virtually no competition or disease, crops and populations flourished. There were also substantial changes to the native environment as it adjusted to the new uses and newly introduced species.

As the population reached a level where the natural stream beds and wet areas were no longer capable of sustaining growth, the first works to move water and establish new, previously uncultivated areas began. This took place slowly, as a natural progression, when resources became a limiting factor.

The culmination of this growth occurred with the large irrigated areas throughout the islands and the establishment of the dryland farm areas of Maui and on the Big Island. Some of the biggest non-irrigated croplands are in the upper areas of Kohala. So important was this field system, the king of Hawaii Island, Umi-a-Liloa, relocated his primary residence to the Kona area to be closer to it (Kirch, 2012).

Interestingly, this stands in sharp contrast to some of the input Waimea Water Services has received from residents and business people in Kohala. The common theme has been, "If it can be produced in Kohala, it can be produced easier/cheaper somewhere else." If you look at the most successful time for the field systems, it was before the advent of large-scale irrigation systems, even though the most productive time came after.

Herein lies one of the difficulties with agriculture: productivity does not always translate to success. Without the ability to deliver a product to a suitable market at a competitive price, no amount of production will fix the issue. Often, as the intensity of agriculture increases, so do the

costs. If the cost per unit increases, a situation of diminishing or negative returns can result. The use of resources then becomes difficult to justify.

This dichotomy is a clear demonstration of the challenges of forecasting water demand and land use on a large scale. There is also an additional challenge of having to compete with imported products. In many cases, it remains less expensive to raise elsewhere and import rather than grow locally. Figures 1, 2 and 3 show how different the scale and location of the land use was in these very different times.

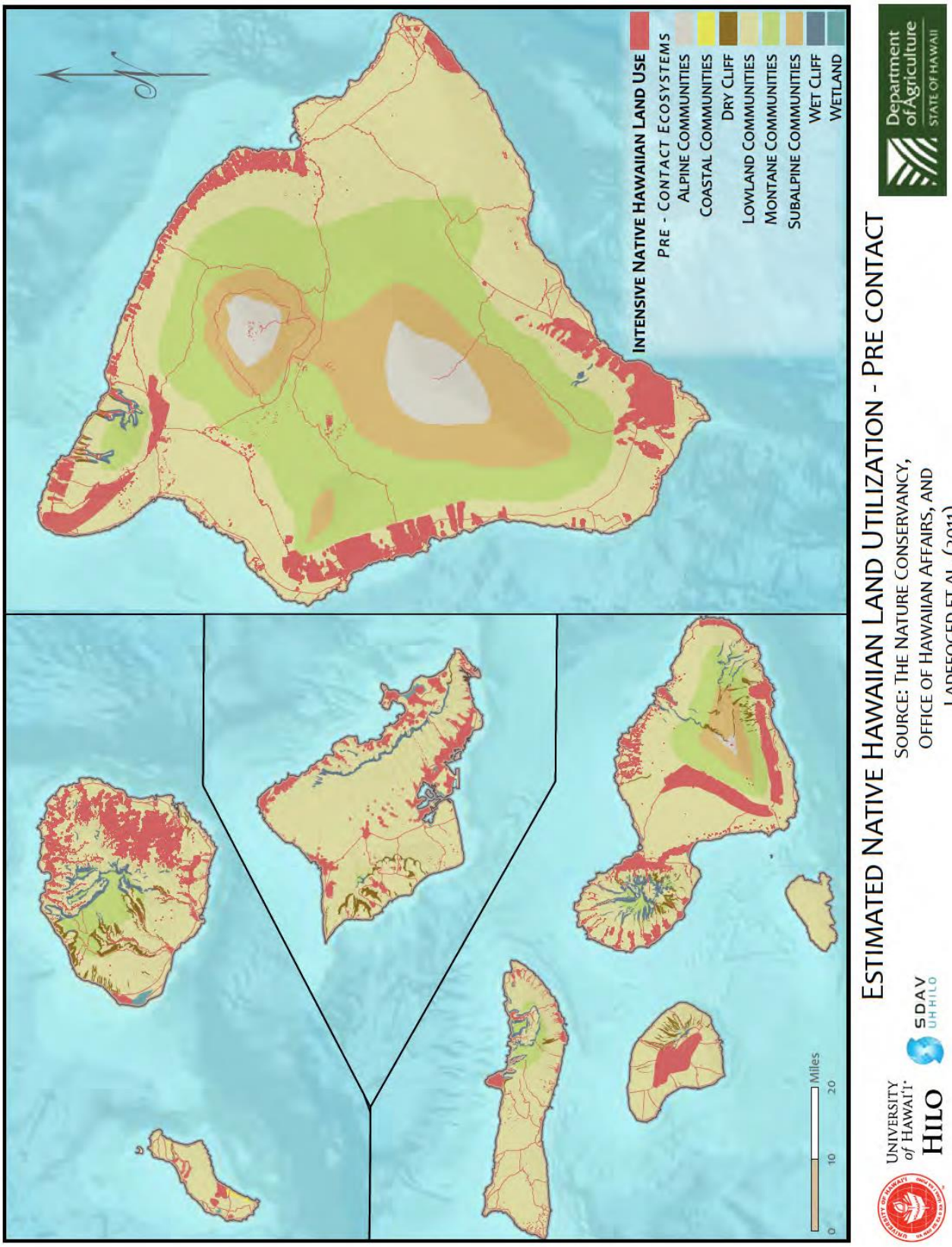
It is important to note that not all information gathered in researching this report is included. A great deal of information was gathered on the basis that details would not be shared publicly. Water systems are often points of contention, and in certain cases, such as drinking water systems, they can be potential targets for malicious mischief.

Each element is managed a bit differently, but as a rule, successful activities or management will be given as actual examples. Improvements or plans that have security concerns will be presented in a general manner, and points of contention and/or conflict will be demonstrated in model systems with no direct connection to actual people, organizations or companies.

The primary focus is to identify resources and to provide options to connect them with current and potential future uses without disrupting ongoing operations. The secondary goal is to identify potential points of contention or conflict and offer options and means of resolving them.

In many cases, historical means coupled with new technology and equipment offer much better and more cost-effective solutions than have been available in the past. These should serve as a "tool box" going forward as additional needs and resources are recognized and developed.

Figure 1



Estimated Native Hawaiian Land Utilization - Pre contact

Source: The Nature Conservancy, Office of Hawaiian Affairs, and Ladefoged et al. (2011)

Figure 2

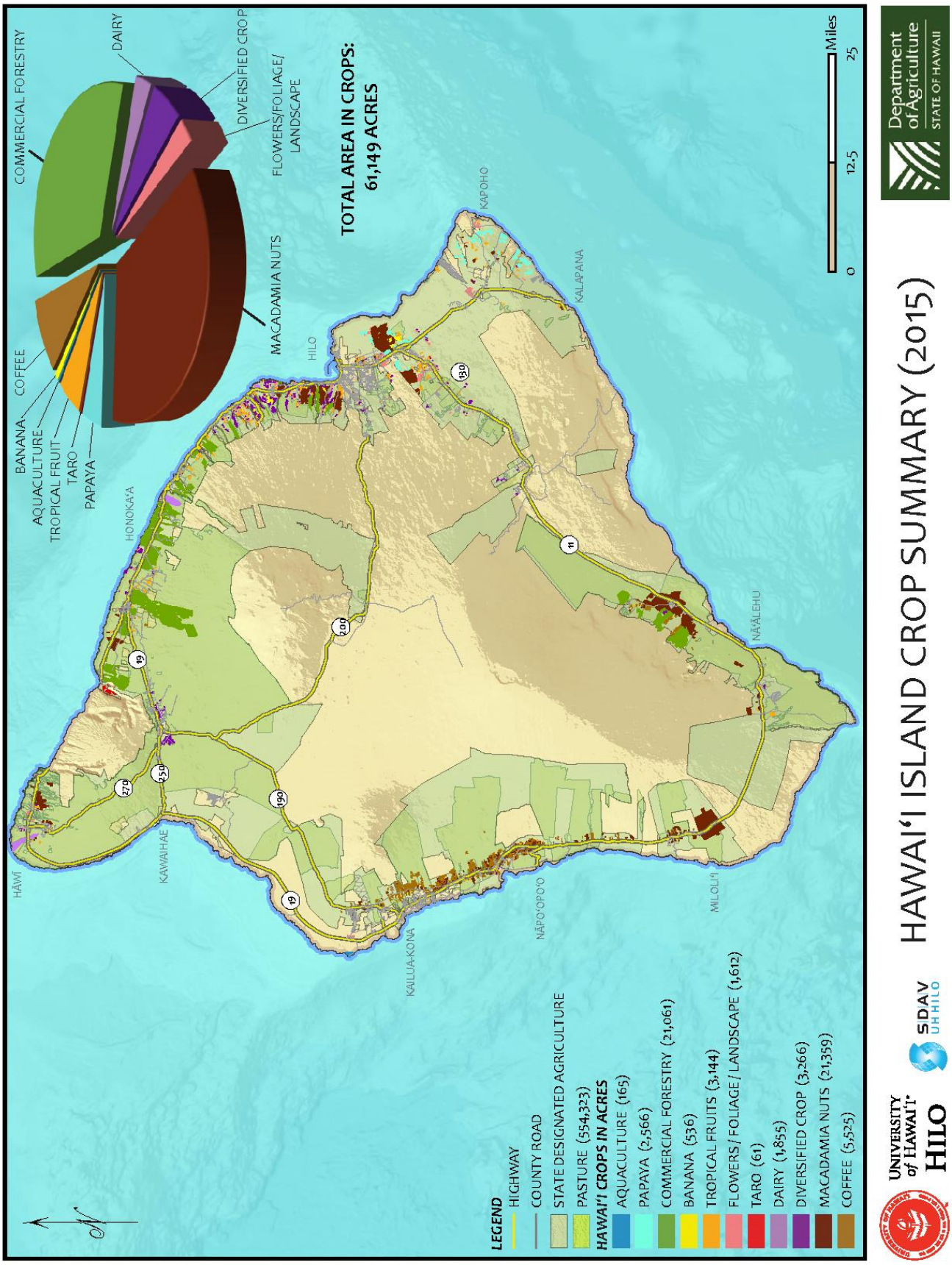
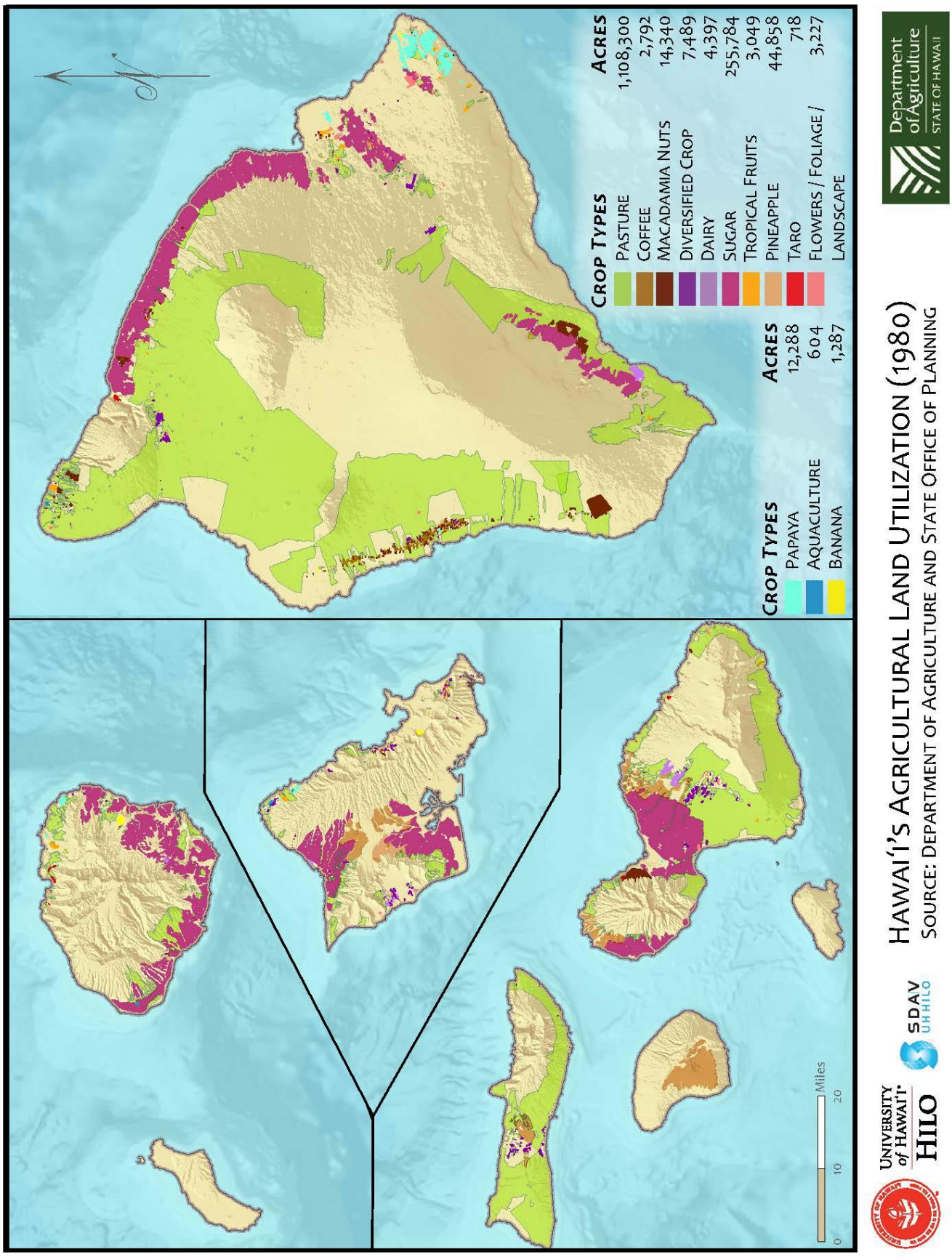

HAWAI'I ISLAND CROP SUMMARY (2015)
TOTAL AREA IN CROPS:
61,149 ACRES
COMMERCIAL FORESTRY
DAIRY
DIVERSIFIED CROP
FLOWERS/FOLIAGE/
LANDSCAPE
MACADAMIA NUTS
COFFEE
BANANA
AQUACULTURE
TROPICAL FRUIT
TARO
PAPAYA
HILO
KAPOHO
KALAPANA
HONOKA'A
KAWAIHAE
HĀWI
KAILUA-KONA
NĀPO'OPO'O
MILOLI'I
NĀ'ĀLEHU
LEGEND
HIGHWAY
COUNTY ROAD
STATE DESIGNATED AGRICULTURE
PASTURE (554,323)
HAWAI'I CROPS IN ACRES
AQUACULTURE (165)
PAPAYA (2,566)
COMMERCIAL FORESTRY (21,061)
BANANA (536)
TROPICAL FRUITS (3,144)
FLOWERS/FOLIAGE/LANDSCAPE (1,612)
TARO (61)
DAIRY (1,855)
DIVERSIFIED CROP (3,266)
MACADAMIA NUTS (21,359)
COFFEE (5,525)
0
12.5
25
Miles
Department of Agriculture
STATE OF HAWAII
UNIVERSITY of HAWAI'I HILO
SDAV UH HILO

Figure 3


Crop Types
Pasture
Coffee
Macadamia Nuts
Diversified Crop
Dairy
Sugar
Tropical Fruits
Pineapple
Taro
Flowers / Foliage / Landscape
Acres
1,108,300
2,792
14,340
7,489
4,397
255,784
3,049
44,858
718
3,227
Crop Types
Papaya
Aquaculture
Banana
Acres
12,288
604
1,287
Miles
0
10
20
Hawai'i's Agricultural Land Utilization (1980)
Source: Department of Agriculture and State Office of Planning
University of Hawai'i Hilo
SDAV UH Hilo
Department of Agriculture State of Hawaii

Hawai'i Island

ISLAND-BY-ISLAND AGRICULTURAL SUMMARIES 2015 CONT'D.

Hawai'i Island is the largest and youngest in the Hawaiian archipelago. It is the size of all the other islands put together, so it is no surprise it hosts 30% of the State's total crop area at 61,000 acres. Two-thirds are planted in macadamia nuts or commercial forestry. In addition, there are roughly 560,000 acres in pastureland, or 73% of the State's total.

NORTH KOHALA

North Kohala was once one of the most active agricultural areas on Hawai'i Island. For centuries, wetland taro was produced in the windward valley, and an extensive dryland field system stretched for miles along the mid-level slopes of Kohala's leeward coast. By the 1860s, sugar began to replace subsistence farming as the primary agricultural activity. By the early 1900s, nearly 20,000 acres were planted in sugar, partially fed by a surface irrigation system that served six sugar mills and irrigated most leeward plantation fields. Sugar production ended in 1974, and new agricultural activity has emerged sporadically over the last 40 years.

The foliage industry, led by Kohala Nursery, was the first successful post-plantation agricultural venture to develop from a series of unsuccessful efforts envisioned by the State's Kohala Task Force in the mid to late 1970's. For a time, Kohala Nursery was the biggest foliage plant exporter in the State. Rising competition and economic cycles, both locally and nationally, have seen the foliage industry grow and then recede. There are currently about 85 acres of land in North Kohala dedicated to foliage production, most of it in Honomaka'u and Kapa'au. Products include palms, potted plants, and landscape trees and shrubs.

Macadamia orchards were part of plantation diversification experiments in the 1960's. It was not until the early 1980's that commercial planting began in earnest. Today, over 1,080 un-irrigated acres are planted in macadamia trees, and the success of growers and processors fluctuates with global market conditions.

Kohala is home to Clover Leaf Dairy, which moved into a State-owned feedlot near 'Upolu Point in 1985. It operates on 840 acres and has 600 milking cows. The dairy has used Kohala Ditch water to irrigate pastureland to produce green chop, which has been used as feed to reduce the grain imports. Clover Leaf is one of only two commercial dairy operations in the State. Milk is sold to Meadow Gold Dairies and processed at its facility in Hilo.

There is a small amount of diversified crop production in North Kohala although there is significant interest within the Kohala community to strive for community food self-sufficiency. A Food Forum held in North Kohala in 2009 identified a relatively short list of five to six commercial farmers in the region, most of whom were organic vegetable growers who marketed their crops to local residents, restaurants, and to retail outlets around the Island. In addition to these commercial and private farm operations, there are several community-based efforts to educate Kohala young people in the business of farming and to promote family farming for local self-sufficiency.

There are about 150 acres of tropical fruit in the North Kohala district, most of which is sold locally or shipped to distributors on other islands.

Cattle production is the largest single agricultural land use in the district. Ponoholo, Kahuā, Kukuipahu, and Parker Ranches use much of Kohala's pastureland along with a number of smaller independent producers. The bulk of North Kohala's cattle are exported to the West Coast.

FIGURE 29

Right: Hawai'i Island crop pattern 2015

ISLAND-BY-ISLAND AGRICULTURAL SUMMARIES 2015 CONT'D.

NORTH KOHALA CONT'D.

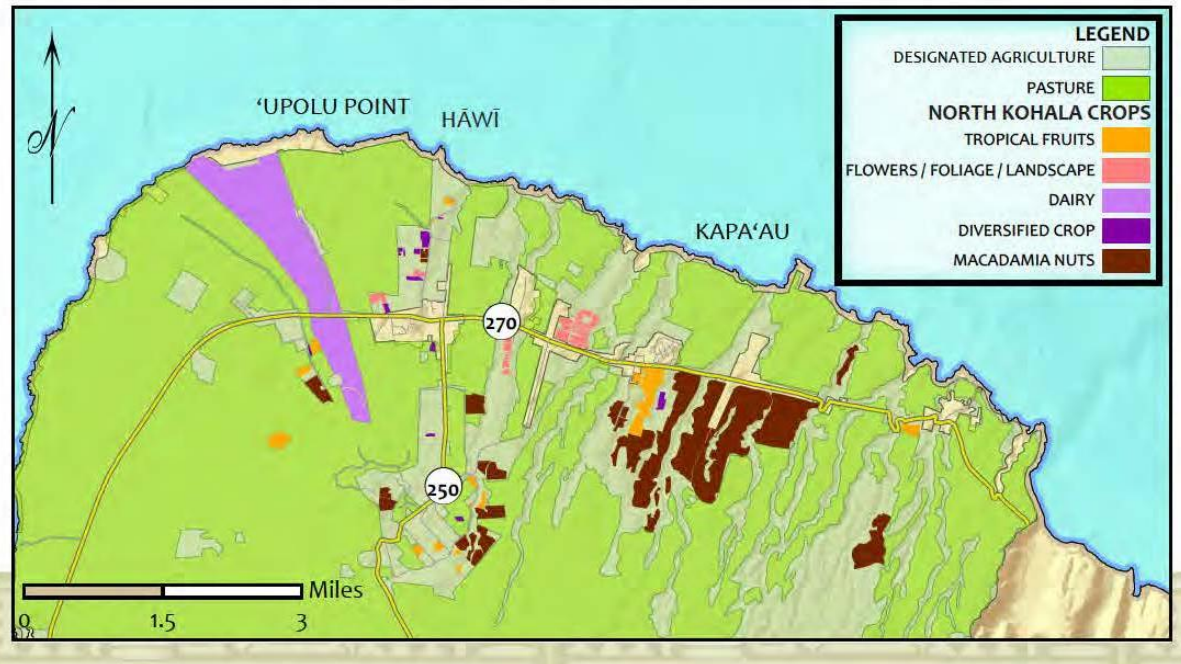
The Kohala Ditch was built in 1906 and is owned and operated by the district's largest landowner, Surety Kohala Ltd.

The ditch's principal stream intake is on land owned by KS in the remote east branch of Honokāne Valley. The Kohala Ditch is an anomaly in Hawai'i plantation irrigation systems.

It survived for nearly 40 years after the sugar industry shut down without being acquired or subsidized by the State or other government agency. As originally designed, the system had the capacity to convey an average of 30 to 40 million gallons per day (mgd) at high flow. A renovated intake in Honokāne now limits average flow to 10.0 mgd. The ditch is currently operational, but there are ongoing issues with trail access to intakes and the condition of flumes and distribution lines.

The largest income producers for the ditch are kayak float tours that use the ditch to transport visitors through the district on private flume adventures. There is also a small hydroelectric power plant near the end of the ditch, which has produced intermittent electrical power to the public utility company for several decades.

In addition to the Kohala Ditch, there are several perched water springs that provide reasonably dependable water. The privately owned Bond and Watt Tunnels in I'ole are two important resources. Together they produce approximately 1.5 mgd. Improvements are underway to replace piping and increase storage capacity so these sources can serve both domestic and agricultural uses on the 'Iole lands, now owned by The Kohala Institute.



SOUTH KOHALA

Farmland in South Kohala is concentrated around Waimea. Farm lots in Lālāmilo and Pu'ukapu account for about 500

Figure 5

2.3 Scale of Agriculture

For the purpose of this report, agricultural scale will be based on water consumption. In evaluating uses and future potential, it has become evident that three tiers exist and that each has their own opportunities and challenges. There will be some crossover between the levels, based on use, geography and demographics. The levels are fundamentally starting points to begin planning.

2.31 Large Scale Agriculture

Greater than 20,000 gallons per day will be considered large scale agriculture. In large scale agriculture, 20,000 gallons a day is not a large amount of water. Putting it in perspective, the Kohala Ditch is capable, even today, of delivering over 25 million gallons per day. At this level economies of scale and land areas begin to reach sizes that allow independent system development and operation to be practical.

There is also an opportunity for a coordinating entity to negotiate use of the larger infrastructure to enable smaller entities to be connected. While it should not be mandated that the larger operators supply water to smaller operations, there is an opportunity to build on the economy of scale as the system increases in use.

2.32 Mid-Size Agriculture

4,000 – 20,000 gallons per day will be considered mid-size agriculture. This range applies to water use, not size of operation. This is an important distinction, as some forms of agriculture – livestock for example – will need less than one hundred gallons per acre per day. Sugar cane, by comparison, was generally thought of as needing 4,000 gallons per acre per day at a minimum. In some cases, 10,000 gallons per acre per day were applied. For this reason, total system demand is a more important number then the area of an operation.

Mid-size agriculture is probably one of the most challenging sizes to service. It is large enough that it will have an impact on any water system in Kohala, but small enough to lack the economy of scale to manage a large system on its own.

There will be opportunities in some cases to build systems scaled to the needs of the operations. This is particularly possible in low areas where a shallow well could be drilled at an acceptable cost. A shallow well also reduces the lift energy required, which can effectively lower the cost of water. Other areas are fortunate enough to have springs expressing on them that could also be utilized.

In addition to having an impact on the water volume consumed, operations of this size also offer a demand that can improve the economy of scale in other systems. Even if it only increased the use of a system by 15-20%, the costs of granting access by a larger operator may well be surpassed by the smaller organization’s contribution. This effectively would lower the operating costs, and therefore the cost of water, for everyone involved.

The major issue would be the management of interaction between organizations and people. Many of the challenges are discussed in Section 7 – Sample Systems. It will be important to clearly document expectations and responsibilities between any cooperative ventures.

2.33 Small/Micro Agriculture

Small scale or micro agriculture is a category that is often overlooked. In many cases, families or extended families establish an agricultural entity by growing things they want personally, then selling the surplus. Often the production grows to the capacity of the family and land available to cultivate.

The process starts by filling a household need or desire for something personally raised or costly to purchase. The product is seen by friends and neighbors. With the current "farm to table" and "locally sourced" attention, requests for the product are made and production begins to grow.

In some cases, these products are labors of love that, while profitable, are not suited to large-scale production. These may include edible flowers, long-lived ornamental plants, as well as certain fish or animals. The very nature of these products means the only local availability will come from the micro producer.

The micro producer carries the challenge of not having the economy of scale or overall size to support a large water system. In order for these entities to flourish, a reasonably priced, reliable, and clean source of water is essential. Attaching to, and participating in, an existing private or public water system will be the only practical solution.

Small/micro farms also have another important role. Often the first experience in an agricultural business comes in the form of very small production. From there, some people will expand and grow into larger operations. As the starting point for agriculture, small farms should be seen as a place to grow farmers as well as products.

2.34 Agricultural Processing

Agricultural processing needs to be included in the agricultural water use and priorities. While not the growing portion of the process, it is a major element of production. All agriculture starts with a living item that is processed to some degree before being sold to the consumer. This can be as simple as washing and packaging or as complex as necessary for a value-added product.

Regardless of what processing takes place, there is a need for water. This will need to be determined on a case-by-case basis. The normal requirements and restrictions of the primary producer may not be applicable to a processing facility that takes care of multiple producers. It is important that any agricultural plan also allow for the resources necessary to prepare products for use or sale.

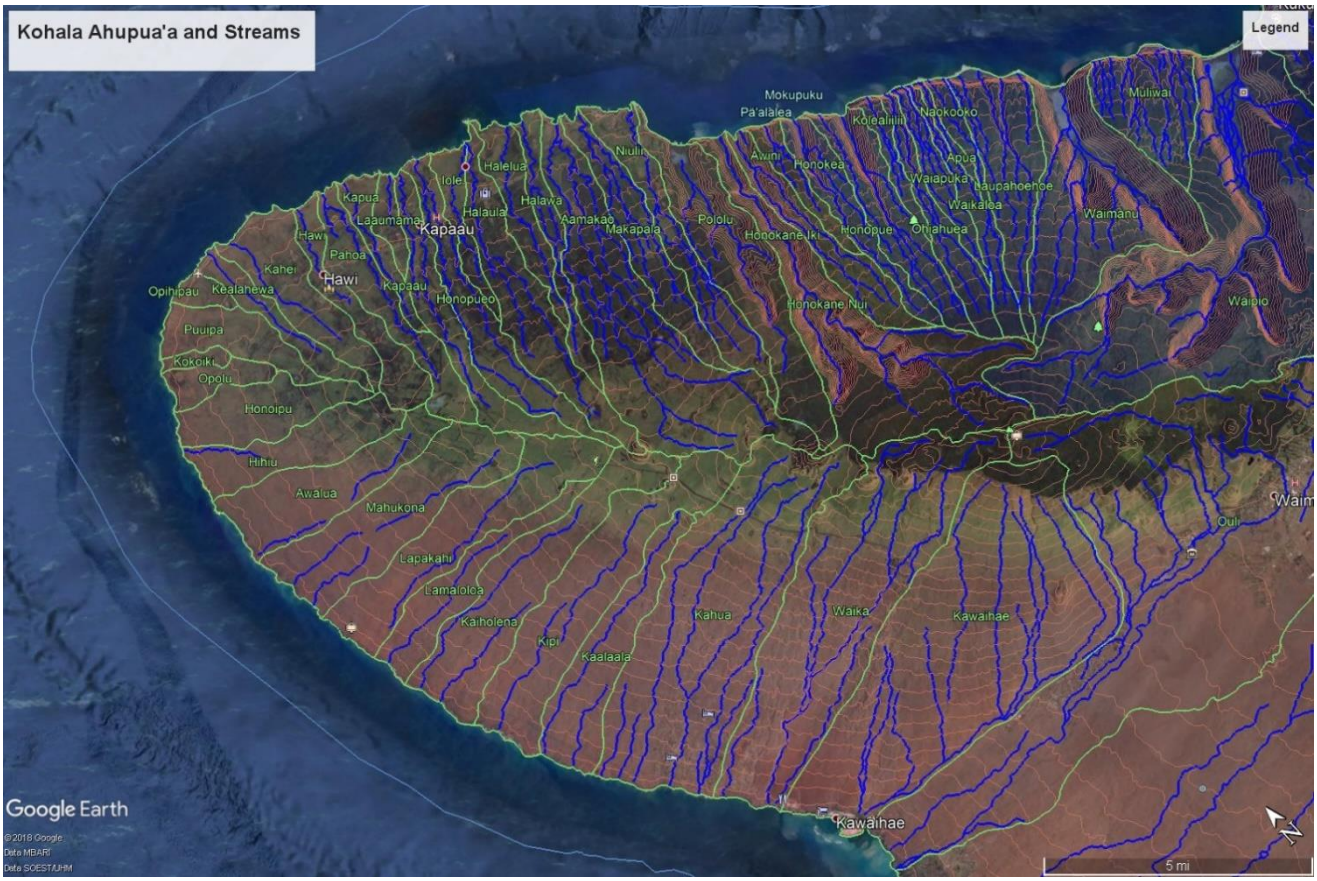
Section 3 – Resources

See attachment A for hydrological overview.

3.1 Historical Systems

The evolution of irrigation systems followed a path that was driven by a combination of need, resources available and technology. The first phase came with the arrival of Polynesians to the Hawaiian Islands. As the numbers were initially small, the easily cultivated areas along streams were occupied. As these filled up, flow channels (*auwai*) and terraces (*lo'i*) were established to enable greater production from existing resources.

Figure 6 – Kohala Ahupua'a and Streams



The second phase came with the *ahupua'a* systems. *Ahupua'a* were formed around an economic and ecological unit that essentially followed the streams. While there is a great deal to discuss about *ahupua'a*, the scope of the North Kohala Agricultural Water Study is limited to the water use and development.

The first map (Figure 6) is of the *ahupua'a* in Kohala. The streams are located almost exclusively within the boundaries of the *ahupua'a*. Diversions would be assigned and regulated

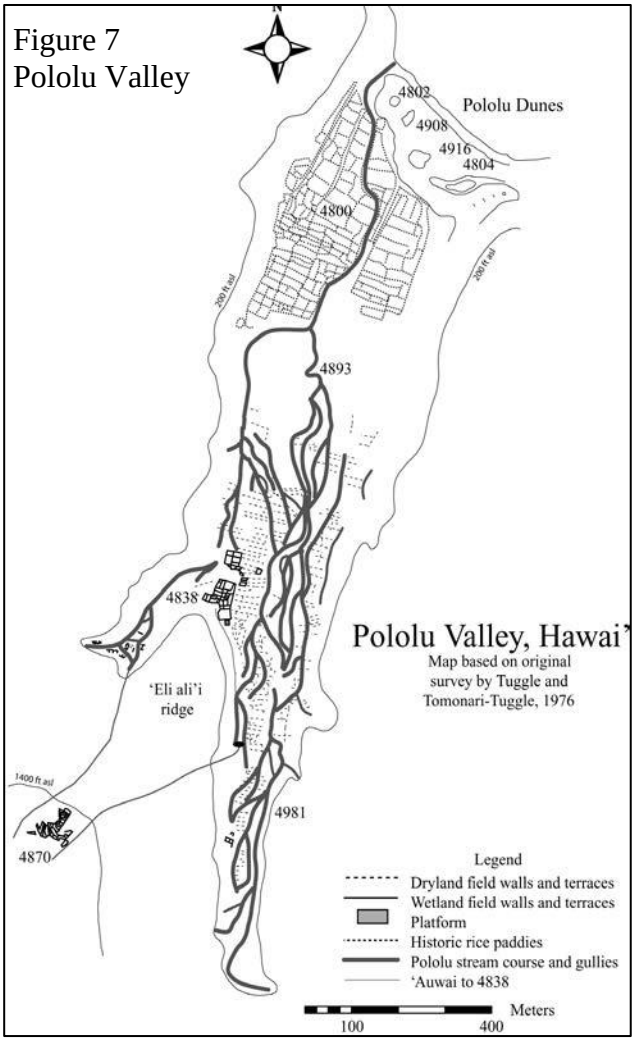


Figure 7
Pololu Valley

by the *konahiki* (a royal designee or administrator). Water use and reuse was managed with an emphasis on supporting the most successful cultivators. In this way, each water source would be centrally managed in order to maximize benefit.

Within the *ahupua'a* there were many uses for water. It is important to recognize that the water was often used more than once. Water that passed through a *lo'i* would be returned to the main water course, and then again utilized downstream.

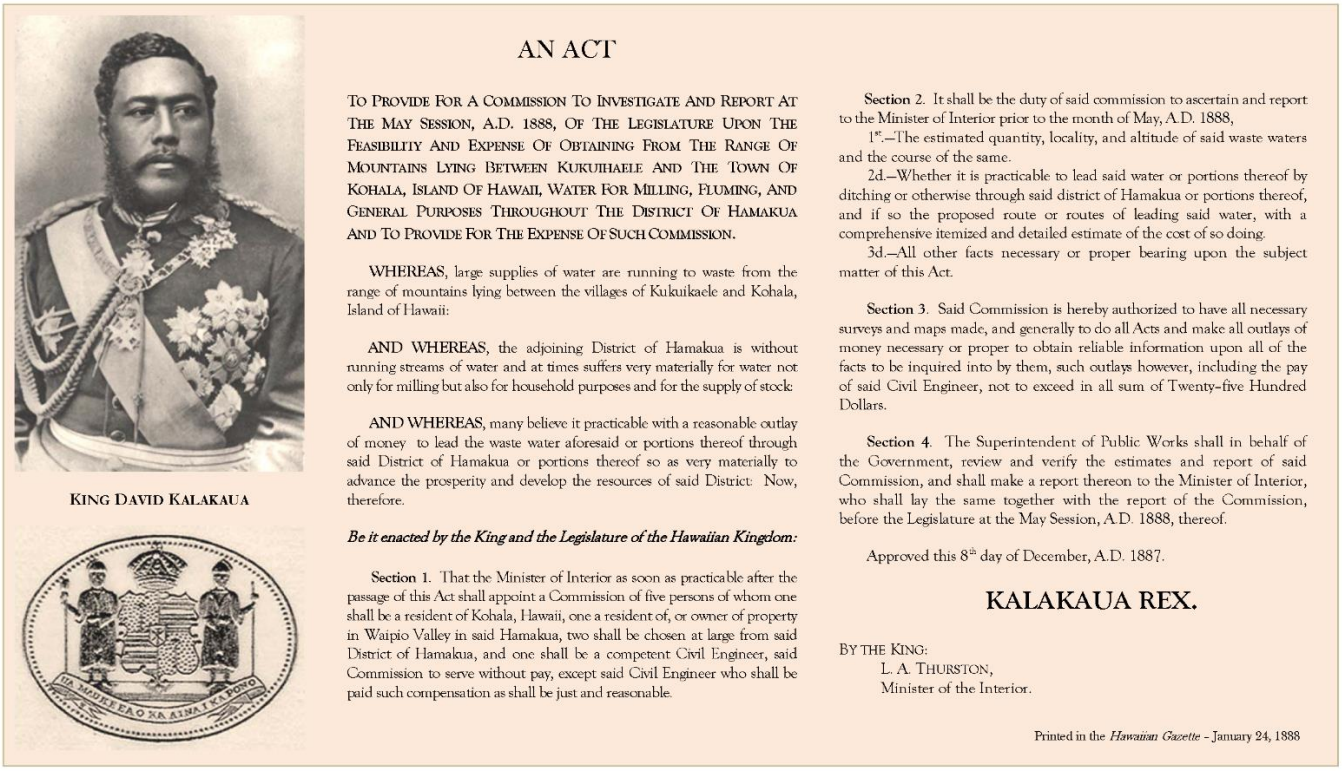
Passages of water would be orchestrated to ensure maximum use and uses. Pololu valley has been extensively studied. Figure 7 shows how intensive the system was. Hawaii's historical and archaeological development followed a natural evolution of building on the natural water ways and adding to them as needed. The water courses were constrained by terrain and land suitable for cultivation.

Virtually all earth work was done by hand prior to western contact. With this fact in mind, as the population grew and the demand for production increased, the more difficult lands to cultivate were developed. The balance between need, effort required and available labor determined the speed of development.

The water systems all followed the basic model of diverting water as it came down from the mountains and headed to the ocean. While effective, these systems suffered the effect of sourcing water in the same climate area it was being used. That meant when it was raining and there was reduced need for irrigation, there was water available. When it was dry and you needed water, it was not. Because of this, and the types of crops that would grow in the areas cultivated, much of the water was used for things like taro (*kalo*) that required flow rather than more conventional irrigation.

The major break from this model came in 1906 with the construction of the Kohala ditch. While *auwai* and other ditches, including tunnel systems, such as the Wai'apuka tunnel on the edge of Pololu, had been used for a very long time, this was the first major system that took water laterally from the very wet areas to the dryer areas of Kohala. In the case of sugar, it more than doubled production and made areas otherwise unsuitable, usable for cane production.

Figure 8 – Kalakaua Commission Approval



KING DAVID KALAKAUA

AN ACT

TO PROVIDE FOR A COMMISSION TO INVESTIGATE AND REPORT AT THE MAY SESSION, A.D. 1888, OF THE LEGISLATURE UPON THE FEASIBILITY AND EXPENSE OF OBTAINING FROM THE RANGE OF MOUNTAINS LYING BETWEEN KUKUIHAELE AND THE TOWN OF KOHALA, ISLAND OF HAWAII, WATER FOR MILLING, FLUMING, AND GENERAL PURPOSES THROUGHOUT THE DISTRICT OF HAMAKUA AND TO PROVIDE FOR THE EXPENSE OF SUCH COMMISSION.

WHEREAS, large supplies of water are running to waste from the range of mountains lying between the villages of Kukuikaele and Kohala, Island of Hawaii:

AND WHEREAS, the adjoining District of Hamakua is without running streams of water and at times suffers very materially for water not only for milling but also for household purposes and for the supply of stock:

AND WHEREAS, many believe it practicable with a reasonable outlay of money to lead the waste water aforesaid or portions thereof through said District of Hamakua or portions thereof so as very materially to advance the prosperity and develop the resources of said District: Now, therefore.

Be it enacted by the King and the Legislature of the Hawaiian Kingdom:

Section 1. That the Minister of Interior as soon as practicable after the passage of this Act shall appoint a Commission of five persons of whom one shall be a resident of Kohala, Hawaii, one a resident of, or owner of property in Waipio Valley in said Hamakua, two shall be chosen at large from said District of Hamakua, and one shall be a competent Civil Engineer, said Commission to serve without pay, except said Civil Engineer who shall be paid such compensation as shall be just and reasonable.

Section 2. It shall be the duty of said commission to ascertain and report to the Minister of Interior prior to the month of May, A.D. 1888,

1st.—The estimated quantity, locality, and altitude of said waste waters and the course of the same.

2d.—Whether it is practicable to lead said water or portions thereof by ditching or otherwise through said district of Hamakua or portions thereof, and if so the proposed route or routes of leading said water, with a comprehensive itemized and detailed estimate of the cost of so doing.

3d.—All other facts necessary or proper bearing upon the subject matter of this Act.

Section 3. Said Commission is hereby authorized to have all necessary surveys and maps made, and generally to do all Acts and make all outlays of money necessary or proper to obtain reliable information upon all of the facts to be inquired into by them, such outlays however, including the pay of said Civil Engineer, not to exceed in all sum of Twenty-five Hundred Dollars.

Section 4. The Superintendent of Public Works shall in behalf of the Government, review and verify the estimates and report of said Commission, and shall make a report thereon to the Minister of Interior, who shall lay the same together with the report of the Commission, before the Legislature at the May Session, A.D. 1888, thereof.

Approved this 8th day of December, A.D. 1887.

KALAKAUA REX.

BY THE KING:
L. A. THURSTON,
Minister of the Interior.

Printed in the *Hawaiian Gazette* - January 24, 1888

The idea of moving water from the high rainfall areas in Kohala to the dryer areas had been being explored for some time. Even early in the reign of King Kalakaua it was known that moving the water was key to increasing production in Kohala. In 1888 a formal commission was formed to study and plan for better use of the available resource.

Additional studies were commissioned as well. The "Report on the Proposed Development of the Water Resources of the Waipio and Honokane Valleys on the Island of Hawaii" dated October 15, 1902 by Arthur S. Tuttle, M. Am. Soc. C. E., done for the Bernice Pauahi Bishop Estate and the Bernice Pauahi Bishop Museum, paved the way for the Kohala and later the Kehena Ditch systems.

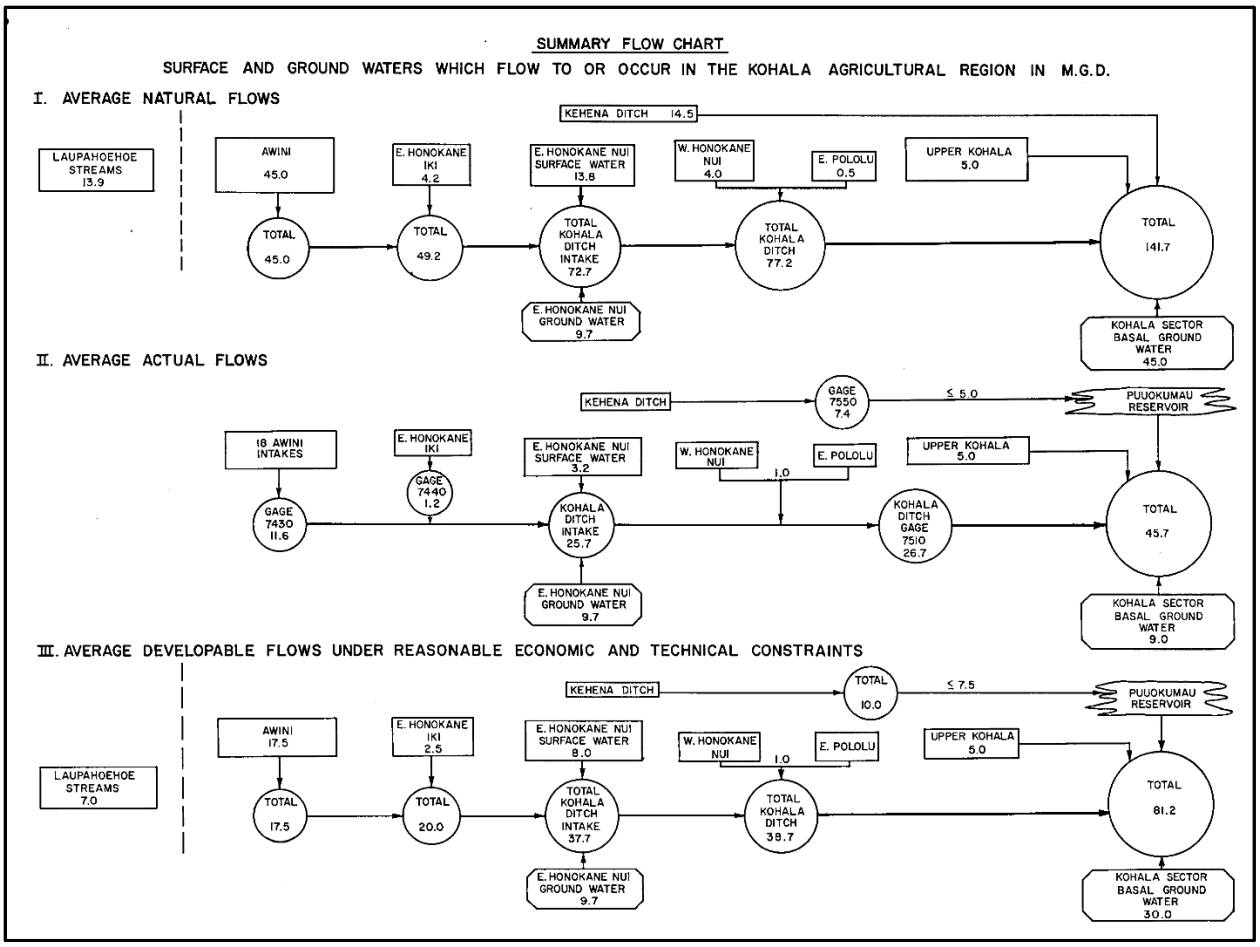
In depth reports are cited in this study. While many are available, some are more difficult to locate. Copies will be provided to the DLNR and made available on request.

3.2 Current Kohala Ditch System Intakes

When the Kohala Ditch was developed, there were many sources of water included in the flow. Multiple input points were used to maximize the water available to meet contract requirements. Figure 9 is a graph of the resources as developed.

After the 2006 earthquake, it was decided not to reactivate many of the smaller intakes. There are some amounts of water that do enter the ditch from sources other than the primary intake, especially when it is raining. Currently, the primary source of water is the Honokane intake.

Figure 9. Water Flows in Kohala Agricultural region



There is an active permit that allows up to 35 million gallons per day to be withdrawn from the stream. Currently, Kamehameha Schools, the owner of the land that the intake sits on, has limited the flow to approximately 7 million gallons per day. This is reflective of the lack of use by farming and priorities that have been allocated to cultural and natural resources.

3.3 Springs

There are well over 30 documented springs in Kohala. They range in capacity from a few gallons per minute up to several hundred per minute. They range from deep-set springs, such as the Bond tunnel, to shallower springs such as Watt or Murphy.

The last of these springs was developed in the 1970s. In many cases, this was also the last time they saw substantial maintenance. As expected, much of the supporting infrastructure is defunct and the safety of entering some of the sources is questionable.

With changes in technology and the availability of new and better equipment, there are many possibilities for reuse of these sources. Most of the shallow springs could be excavated and stabilized to provide long-term operations. Initial studies are underway, but careful plans will need to be developed on a case-by-case basis.

Most of the springs occur in the wetter regions of Kohala. This is not surprising, as a spring requires the fall of higher water to flow down and express itself at the surface. Transmission may be as short as instantaneous or may take weeks or even years to express. Time, volume, temperature and indicator minerals or bacteria can be observed to aid in determining the actual performance of a spring.

Flow through the ground greatly affects the performance and characteristics of a spring. In cases where the water flows through enough layers of ground that bacteria and nutrients are no longer present, the spring may be classified as ground water. This rating is present in at least one spring in Kohala. A ground water classification is the best to use as a source for drinking water as regulations normally only require disinfection.

Ground Water Under the Direct Influence of Surface Water (GWUDI) is an EPA classification that essentially means there is a pathway where surface water can come in contact with the source before it expresses. Most of the springs in Kohala have this classification. This means that in order to manage potential contamination that can occur with surface water, a lot more testing and processing will be needed to ensure consumer safety if used as drinking water. This is not normally a concern for agricultural uses.

GWUDI rules are the main reason the Department of Water Supply (DWS) shifted to wells as the primary drinking water source throughout the island. Several of the larger springs were used for drinking water but have since been abandoned as sources. This means the resource is available for other uses and, other than classification, offers high quality ground water without pumping costs.

What will be of more concern are the performance characteristics of the springs. As the water passes through the ground, there are many different structures that can determine how the water flows. These structures can affect speed of transmission, duration and volume of flow, as well as the characteristics of the water.

The usefulness of a spring is primarily determined based on its ability to provide adequate, suitable quality water when needed. The amount of time water takes to transit to the spring and how it flows may make the difference of a spring flowing through a dry period or drying up until it rains again.

One of the major values of the springs is most of them are substantially higher than the Kohala Ditch. While they tend to originate in the wetter regions, the increased height allows for the efficient lateral movement of water to the dryer regions. The most valuable springs are the ones nearest to the transition from the wet to dry zones, as these could be utilized with far less transmission infrastructure and related challenges.

3.4 Wells

Much has been learned about ground water in North Kohala. Even with the number of springs in the area, science and technology of the 1900’s did not suggest the presence of a significant usable aquifer. The lack of cap rock, present in the low-lying coastal areas of the other older

Hawaiian Islands to confine basal groundwater, or other less-permeable structures to contain water in the saturated zones of rock, was interpreted to mean fresh water would be of limited availability from wells.

A report provided to the Bernice Pauahi Bishop Museum and the Bernice Pauahi Bishop Estate by Arthur S. Tuttle titled "Report on the Proposed Development of the Waipio and Honokane Valleys on the Island of Hawaii" dated October 15, 1902, Section III states, "On the North Coast of Hawaii there does not seem to be any such conditions (impermeable barriers) for the storage of fresh water, and the underground supplies must be subject to the free infiltration of sea water."

It was in 1888-1889 that W. Badon-Ghyben and in 1901 that A. Herzberg worked out what is today known as the Ghyben-Herzberg Relation. USGS Circular 1312, Ground Water on Tropical Pacific Islands – Understanding a Vital Resource, page 6, has a sidebar that explains it well:

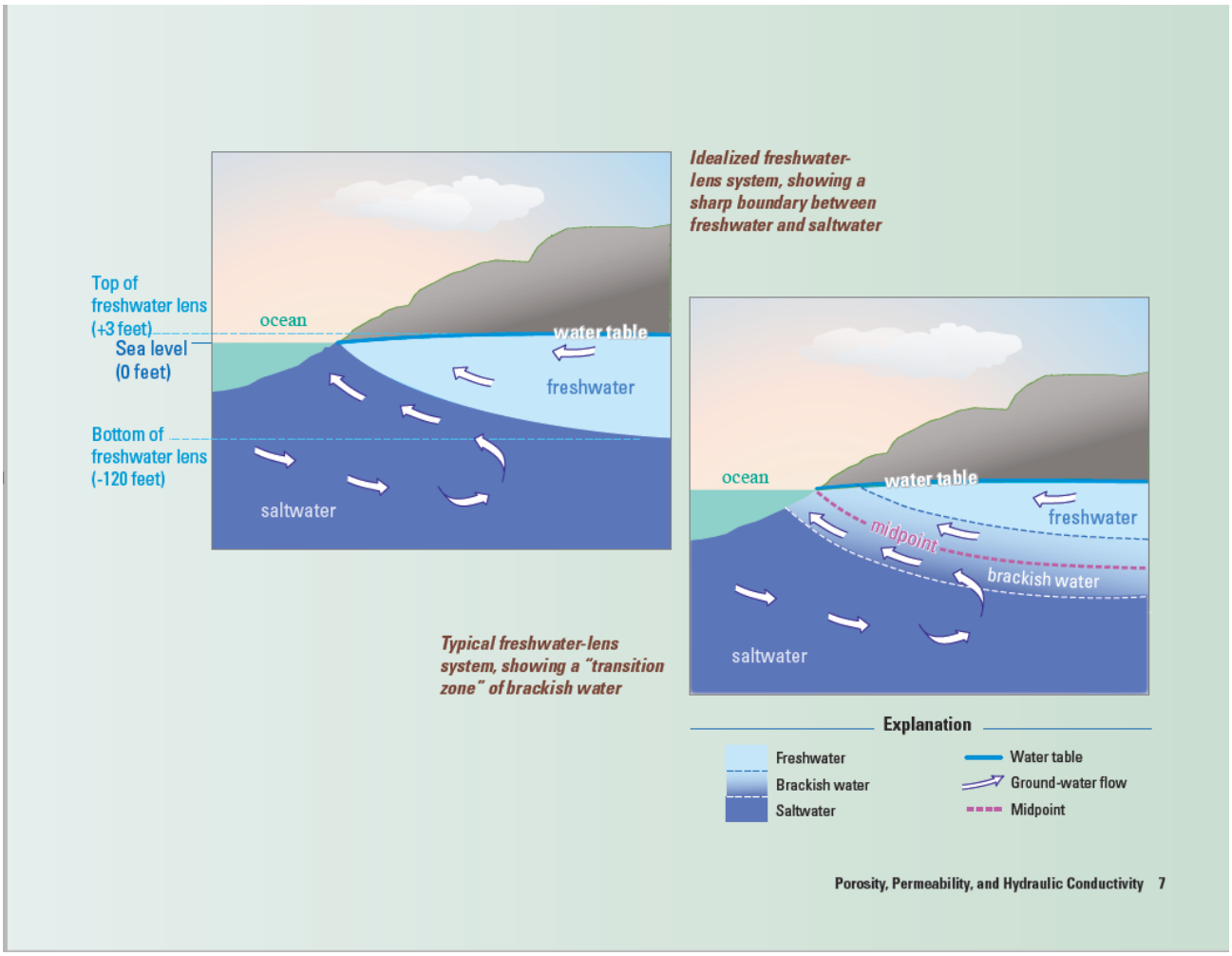
"The principle commonly used to estimate the thickness of freshwater in a freshwater-lens system is called the Ghyben-Herzberg principle. This principle was independently formalized by Captain Willem Badon Ghyben (Dutch Army) in 1889 and A. Herzberg (German) in 1901, but it was originally described in 1818 by Joseph Du Commun, an instructor at the United States Military Academy at West Point.

Because seawater is about 2.5 percent denser than freshwater, the fresh ground water in a freshwater-lens system "floats" on the underlying saltwater. However, the weight of the freshwater depresses the surface or top of the saltwater downward 40 feet for every foot the water table is above sea level. Therefore, the estimated thickness of a freshwater lens is about 40 times the elevation of the water table above sea level. For example, a freshwater lens that is elevated 3 feet above sea level will extend to a depth of 120 (3×40) feet below sea level (left image on page 7). In reality, a broad "transition zone" of brackish water commonly exists between freshwater and saltwater. In this situation, the Ghyben-Herzberg principle estimates the depth in the transition zone where the brackish water has a salinity about 50 percent of that of seawater (known as the "midpoint," right image on page 7).

Although a useful approximation, the Ghyben-Herzberg principle assumes no mixing between freshwater and saltwater and does not calculate the actual thickness of the drinkable or "potable" part of the lens, which is typically much less than the total thickness of the lens to the midpoint of the transition zone. The Ghyben-Herzberg principle also assumes that freshwater flow is predominantly horizontal. Thus, the principle does not apply in settings with complex geology or where vertical ground-water flow is significant.

The thickness of the transition zone is determined by several factors, such as the physical properties of the aquifer, flow rates, and the distribution of wells pumping ground water from the aquifer. Predicting the thickness and dynamic movement of the transition zone in response to pumping and changes in recharge is a considerable challenge. In general, a high-permeability aquifer will have a thicker transition zone than a low-permeability aquifer. In addition, ocean tides and ground-water pumping can cause vertical mixing of water, also resulting in a thicker transition zone."

Figure 10 Ghyben-Herzber Aquifer



There are currently over 50 documented wells in North Kohala. The development of deep set and submersible pumps would allow extraction from wells that would not have been practical 75 years ago. Additionally, relatively small diameter wells, in the 12-inch diameter casing range, have proven to be capable of producing over 1,000,000 gallons per day.

While larger wells are possible, there is a balance regarding the cost, demand, and required distribution as well as power requirements and impacts that needs to be considered. Having more wells closer to the actual demands removes the requirement for long transmissions lines. There is also substantially more flexibility with smaller wells to service various demands without constructing large storage facilities.

Power consumption and impact will have great effect on the size and capacity of any well or system. Energy is a major cost any time water is moved. Power consumption is a direct cost but can carry additional costs depending on how and when its used. Demand charges, rate schedules, and time of day limitations are all factors when using power from the utility. These need to be carefully considered when any large pump is included in a water system plan.

Full rate schedules may be found at:

https://www.hawaiianelectric.com/billing-and-payment/rates-and-regulations/hawaiian-electric-rates

There are also limitations with the infrastructure itself. Large electric motors, such as well pumps, have large in-rush currents when they start. The electric grid in Kohala has limitations regarding the initial draw in many areas. Electrical improvements can be very costly. Often times it is more cost effective to put in several smaller wells instead of one or two large wells.

Run time and frequency are important to sizing a well. The number of on/off cycles often determines the life of a well pump and motor. Ideally, a pump comes on, runs for a long period, then shuts off for a long period. An ideal pump day is 16 hours continuous, as this gives a reserve of 33% if needed. Multiple wells allow one well to operate for an extended period during times of low demand, maximizing the lifespan of the pump.

A sample of well prices is attached (APPENDIX B). Depth and size determine the price of the well. Pumps are a separate cost that can vary depending upon size and desired construction materials (i.e., stainless, cast iron, steel etc.).

3.5 Department of Water Supply

While not a "source" in the traditional sense, the Department of Water Supply (DWS) is an important resource for water in Kohala. The DWS distribution system is the largest source of drinking water in Kohala. It also maintains the most comprehensive distribution system. While not designed or purposed to deliver large scale agricultural water, there are needs that DWS is best suited to meet.

There are two primary roles for the DWS. The first is its primary mission of providing drinking water. This is applicable not only for the normal domestic and commercial use but is critical to agricultural production in Kohala. Regardless of the crop, there are sanitary, processing and human needs that must be met for agriculture to flourish. The challenge of preparing crops and adding value demands water.

The second role is for irrigation water for the small scale or "micro" farmer. This is an important area in agriculture of Kohala that is often neglected. A major challenge to finding farmers and ranchers is the lack of small scale, economically advantageous, opportunities in agriculture. There are many areas of Kohala where small scale agricultural water could provide opportunities for beginning and small-scale operations.

There are currently rules in place that allow for an agricultural water meter to be established that is substantially below the rates charged for domestic water. The initial rate of up to 5000 gallons per month is the same as domestic but drops dramatically once 15,000 gallons per month, or approximately 500 gallons per day, is reached.

Section 4 – Transmission

4.1 Historic Methods of Transmission

The movement of water in Kohala has been an evolutionary process. Initially, crops were grown on the edge of the natural water channels. Once the prime land was covered, attempts to move the water began. One of the earliest methods was an *ʻauwai*. An *ʻauwai* was simply a ditch. Traditional methods of digging included wooden tools such as the *ʻoʻo*. Often sources would include streams or ponds and would be dug just large enough to irrigate the desired field or *loʻi*.

Most *ʻauwai* were dug in softer soils, so loss to seepage could be substantial. Longer runs exacerbated the problem. This, coupled with the increase in maintenance requirements, encouraged farmers to keep the transmission as short as possible. Often, as seen in the example of Pololu, water was moved once, then used multiple times. From that point it could be returned to the stream or used to flood dryer areas. In either case, the goal was to get water to the land and maximize its use with the least amount of digging and maintenance.

An example of a simple *ʻauwai* is below. This system is in use today for agricultural water, namely for cattle. The flow channel appears to follow an existing, naturally occurring waterway. This would be expected with the limitation and challenges associated with digging a ditch of this length. This is a good early example of using the natural topography to establish an agricultural water system. A similar concept, albeit on a much larger scale, was used in the development of the Kehena Ditch.

Figure 11
Sample Auwai Intake

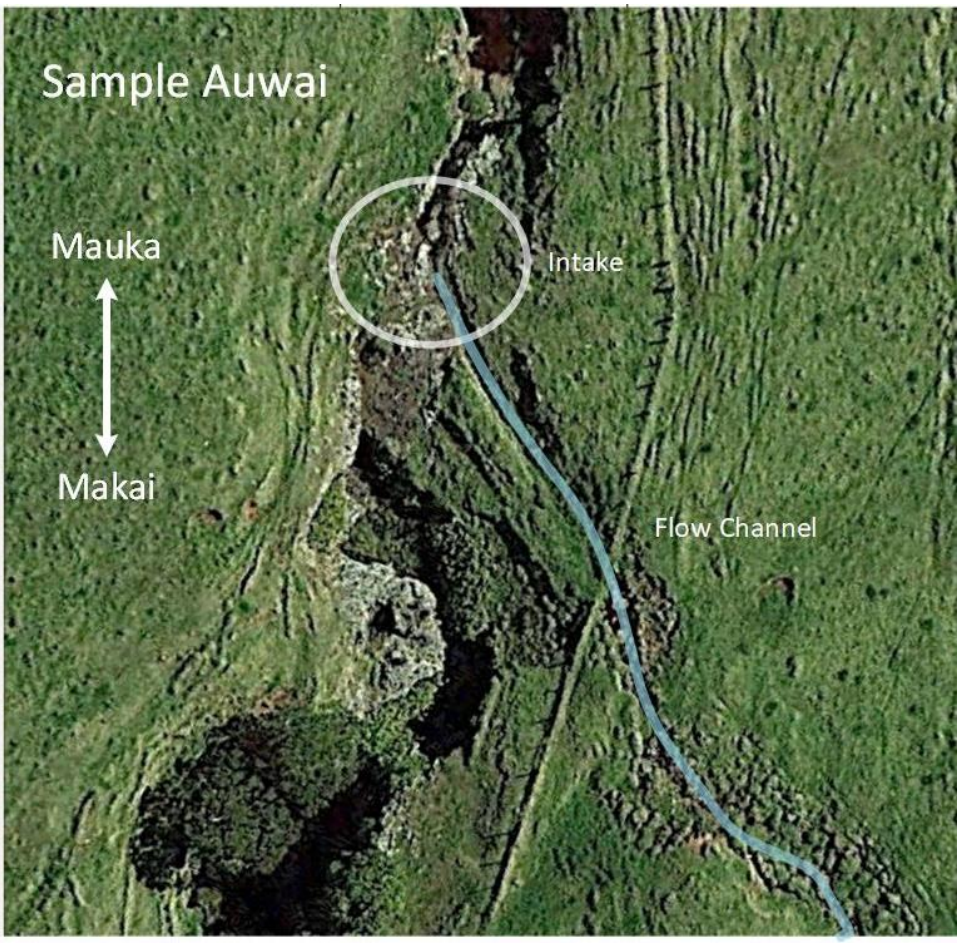
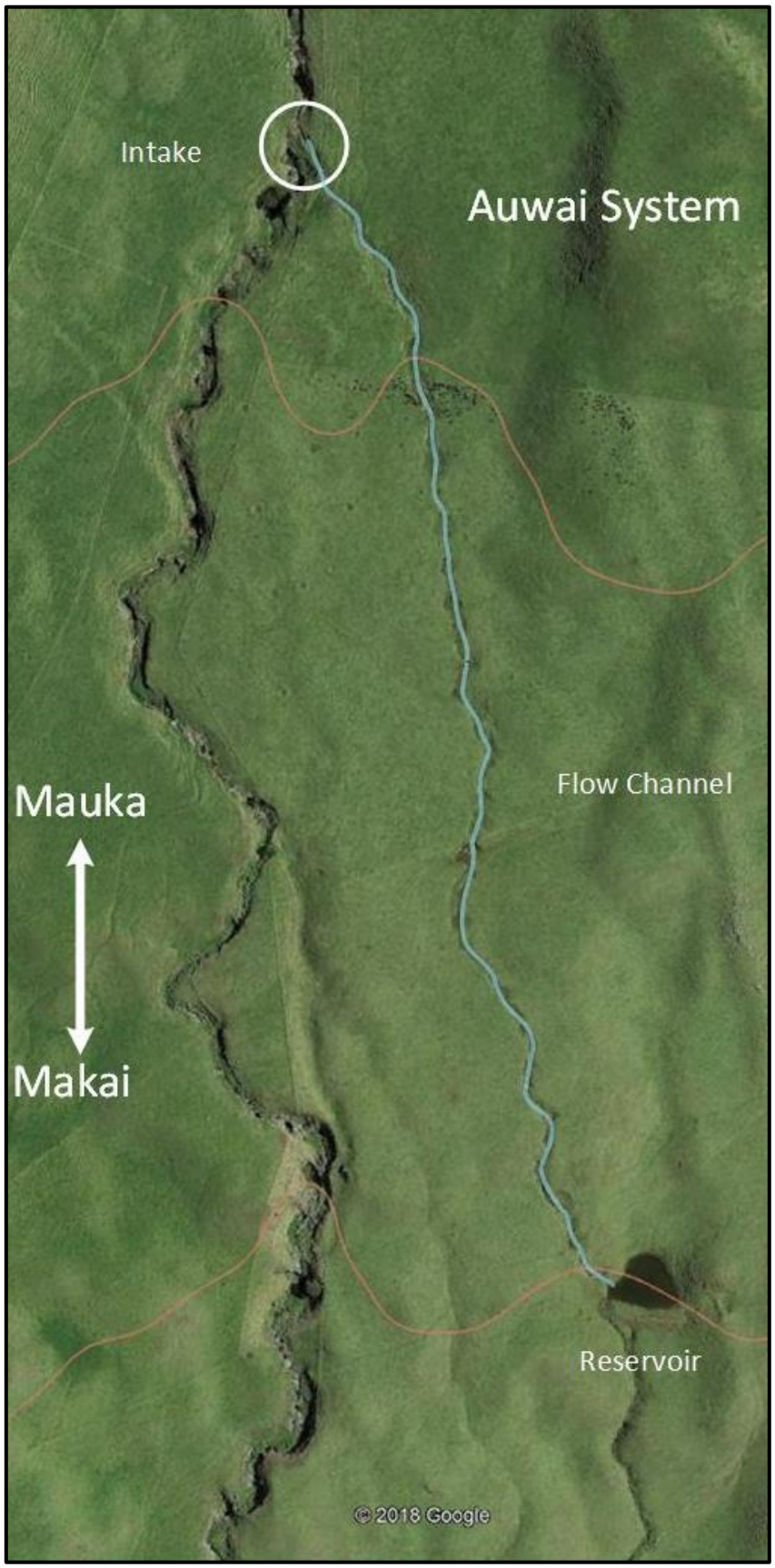


Figure 12
Sample
Auwai System



4.2 General Legal Requirements

Moving water often requires agreement, coordination and interactions between multiple entities for the duration of the project. This can be for years or decades. Historically, larger systems have gained the direct support of the government at the time. This often resulted in special laws, charters or organizations that allowed these systems to be built. The Kohala and Kehena Ditches are examples.

The current administration of Hawaii is committed to supporting agriculture and the needs of the people. One major difference is a commitment to ensure **equal** access and opportunities for everyone, not just major industries. This requires a set of rules and laws that apply to, and are fair for, everyone. Any changes or new laws should be expected to follow these concepts. By their very nature, legal scenarios that involve more parties become a bit more complex.

With smaller systems and subsystems being desired, a couple of critical elements need to be addressed: easements and liability. The following sections (4.21, 4.22, a portion of 6.1, 6.12, 6.2, 6.21 through 6.26, and Appendix C) were written by Morihara, Lau & Fong LLP. This firm was selected because of their extensive experience in water and infrastructure system legal matters. Their contributions to this study have been very helpful in ensuring planning compliance and establishing organization for long term system viability. In their own words:

*"**Morihara Lau & Fong LLP** employs some of the State's finest legal professionals with longstanding reputations for consistently achieving their clients' objectives. The firm meets its clients' objectives by combining expert legal analysis with creativity and a strategic and practical business approach. The firm represents various domestic, national, and international clients, working closely with each client to deliver high quality legal and business expertise. The firm is committed to providing each client with personal attention and excellent service and takes pride in its ability to bring flexibility, integrity, cost effectiveness, and a team-oriented approach to meet each client's needs. Collaboration with government, regional planning and development agencies, design and engineering professionals, and other consultants is a specialty of the firm. The firm's attorneys play a leadership role in every collaborative project, and work closely with other professionals to inspire and direct the project team to secure the desired outcome for its clients. The firm's primary practice areas include: Public Utilities, Telecommunications, and Energy; Land Use, Environmental, and Natural Resources; and Real Estate Development, Leasing, and Disposition.*"

4.21 Easements

As a preface before discussing the details of easements, it is very important to understand that the successful operation of the Kohala water systems **will depend upon easements being provided by land owners and obtained by agricultural water companies and applicable water system users in the least contentious manner as reasonably possible**. This is what will allow community access to water. If the applicable landowners, agricultural water users, and agricultural water companies can truly commit to going through the grant of easement process in a community-minded perspective and a collaborative manner, it will help to enable the

agricultural water companies to get up and running cost-effectively and quickly, and to therefore legally deliver water to agricultural users sooner, rather than later.

What is an easement? As described in the Hawaii State Bar Association Hawaii Conveyance Manual, 5th Edition (2010), an easement is:

> A property interest which one person has in land owned by another, entitling the holder of the interest to limited use or enjoyment of the other's land... Because an easement is an actual interest in land, an express grant of easement must be in writing.

Why are easements important with respect to the North Kohala water systems? As indicated in the introductory Section 1 of this report, agricultural water systems consist of four basic elements – demand, resource, transmission, and storage. Especially with respect to the North Kohala water systems, where the water systems' infrastructure crosses over lands owned by multiple different individuals and entities, easements are critical to the proper functioning of the transmission and storage elements.

For example, consider the multi-user complete system discussion in Section 7.3 of this report: In that example, there are multiple infrastructure components (e.g., well head, water tank, power lines, water pipelines, etc.) that are located across four properties, with each property being owned by a different Land Owner (as shown in the Section 7.3 diagram, these are Land Owners A, B, C, and D; as noted in the Coordination Point 10 discussion, D owns the land and E holds a license to farm the property). Suppose that the agricultural water company owns and operates the well head and water tank, but does not own any of these lands. Because the infrastructure owned and operated by the agricultural water company is located on land that is not owned by the agricultural water company, the company needs easements that allow it to locate, operate, access, and maintain such infrastructure on the applicable properties. In this case, the agricultural water company would need easements from Land Owner A. Also, if the local electric utility is providing electricity to power a pump or other equipment at the well head, then the electric utility needs easements that allow it to locate, operate, access, and maintain its power lines on the applicable properties. In this scenario, the electric utility would need easements from Land Owners A and B for the utility's power lines. Furthermore, notice the water pipelines, which extend down from the tank and from there, connect to the lands owned by Land Owners B, C, and D. Often, these types of water pipelines that are downstream from a tank or other storage facility are customer-owned (i.e., not owned by the agricultural water company) – whether the customer or the agricultural water company owns a pipeline will depend on the agricultural water company's rules and policies. It is worth noting that if the water pipeline is owned by the customer, then the customer must obtain any applicable easements. In this case, if Land Owner C owns the water pipeline that extends out of the tank, then Land Owner C needs an easement from Land Owner A for that pipeline.

How are easements created? Generally, easements are created by a contract called a Grant of Easement. In a Grant of Easement contract: (1) the person to whom the easement is being granted (in the example above, separate easements are being granted to the agricultural water company, the electric utility, and Land Owner C) is called the grantee, and (2) the person who owns the land on which the easement is located is called the grantor. The grantor and grantee

come to agreement regarding the terms for the easement (e.g., how long the easement will last, what the grantee will be permitted to do within the easement area, exactly where the easement area is located, etc.) and document such terms in the Grant of Easement contract, which is signed by both parties. A more detailed "checklist" of the process for obtaining or granting an easement is provided below.

The checklist below is an example of the steps needed for an agricultural water company or a customer obtaining irrigation water service (either of which own a pipeline for the purpose of receiving irrigation water) to obtain an easement for the pipeline from an individual landowner. In this example, the landowner is the grantor and the agricultural water company or the customer is the grantee.

1. **Determine whether an easement is needed.**
   - If the agricultural water company will own or operate any parts of the water system (e.g., well, tank, transmission or distribution lines, or other equipment), or if the customer will own and operate any water pipelines that will be located on lands owned by someone else, then an easement is needed.
2. **Determine where the easement should be located.**
   - Figure out where the existing water system infrastructure is or where future water system infrastructure will be located – this is the area over which an easement will be created. It may be helpful to actually walk the property to view any existing infrastructure and/or to view the agricultural water company's or customer's engineering drawings, schematics, or other plans.
3. **Determine how to document the location of the easement.**
   - It is preferable to obtain a metes and bounds description of the easement, prepared by a registered professional surveyor licensed in the State of Hawaii. (As an aside, if the property is Land Court property, the surveyor must also be found qualified by the judge of the Land Court (Rule 101.(1), Rules of the Land Court).)[1] A properly prepared metes and bounds description is the most accurate way to define the location and boundaries of an easement, which makes it easier to resolve any future questions that may arise regarding the location of the easement.
   - In selecting a surveyor, it may be helpful to visit the following websites: www.bbb.org/us/hi/category/surveys (Better Business Bureau); or www.landsurveyors.com/directory/?find=Hawaii&field=state&searching=yes&submit.x=0&submit.y=0 (Hawaii surveyors)
   - If the property is Regular System property, an alternative to obtaining a metes and bounds description is to utilize a map or drawing depicting the location of the easement on the grantor's property. However, should future questions arise regarding, for example, whether the agricultural water company's infrastructure is within or outside the bounds of the easement, it may be more difficult to resolve this type of issue with only a drawing to reference rather than a metes and bounds description.

[1] The State of Hawaii has two recording systems: the Regular system and the Land Court system. Land in Hawaii is either Regular system property, Land Court system property, or dual system property (meaning that such properties contain land in both systems). One way to determine whether a particular property is Regular, Land Court, or dual system property is to look at a deed or a title report for the property. If the deed or title report affecting the property refers to recorded documents as "Document No. XXXXXXX", "Document No. T-XXXXXX", "Certificate of Title No. X,XXX,XXX", or "Transfer Certificate of Title No. X,XXX,XXX", then the property is Land Court property. If the deed or title report affecting the property refers to recorded documents by "Liber XXXXX Page YY" or "Document No. YYYY-XXXXXX", or "Document No. A-XXXXXX", then the property is Regular system property. If the deed or title report affecting the property refers to documents using both formats, then the property is dual system property.

- In addition to obtaining an accurate description of the easement, it is important to understand where the easement will be located by, if possible, actually walking the easement area. For example, the grantor and grantee may be basing the location of the easement on a set of engineering drawings, but when they walk the property, they find that the existing infrastructure was not built per the engineering drawings, so the easement area needs to be adjusted to account for how the infrastructure was actually built in real life.

4. **Perform a title search of the land on which the easement will be located**.
   - Obtaining a title search is important to ensure that the person who will sign the Grant of Easement document as the grantor is actually the person who is authorized to do so. For example, if a piece of land has been passed down through generations and it is unclear exactly who or how many family members are currently the legal owners of the land, a title search should provide clarity on these issues.
   - In selecting a title agent to perform a title search, it may be helpful to visit the Better Business Bureau website at www.bbb.org/us/hi/category/title-agent and the title agent's website for the types of services offered by the title agents.
5. **Prepare the grant of easement document**.
   - A Grant of Easement form, instructions for how to complete the form, and samples of completed forms, are provided as Appendix C. Because the successful operation of the Kohala water systems absolutely depends on cooperation and a collaborative effort by all participants, these forms are drafted to facilitate such cooperation and collaboration. In other words, these forms are intended to be even-handed forms that do not clearly favor the grantor over the grantee or vice-versa. Notwithstanding this, you may wish to retain your own attorney to provide you with specific advice regarding any grant of easement into which you may enter.
   - If the land over which the easement will be located is Land Court property, before entering into the grant of easement, the easement area must first be surveyed by a registered, licensed surveyor qualified by the Land Court judge. The surveyor's metes and bounds description and survey map must be submitted to the Land Court, reviewed by the State Surveyor and found to be accurate, whereon, the Land Court will issue an order registering the easement area in the Land Court system. The Land Court will then record its order at the Bureau of Conveyances, which clears the way for the grant of easement document to then be filed at the Land Court.
6. **Execute (sign) the grant of easement document in the presence of a notary public.**
7. **Record the grant of easement document**.
   - To record the Grant of Easement document is to enter the document into the public records. Under Hawaii law (Hawaii Revised Statutes § 502-83) any conveyance of real estate within the State of Hawaii must be recorded in the Bureau of Conveyances (the "Bureau").
   - The State of Hawaii has two recording systems: the Regular system and the Land Court system. All documents in both systems are recorded in the Bureau, which has two separate records of documents recorded in the two systems. Documents to be recorded must be taken to the correct counter (either the Regular system counter or the Land Court counter) at the Bureau to be recorded in the proper system. Some properties are "dual system" properties, meaning that such properties contain land in both systems; grant of easement documents for such dual system properties must be recorded in both systems.
   - For a fee, a title company can coordinate the recordation process. It is preferable to have a title company handle the recordation process, since title companies are very experienced at doing so.
   - Parties may attempt to file the Grant of Easement document at the Bureau themselves. If doing so, the Parties must be sure to comply with all applicable laws, rules, regulations, and requirements. Refer to the State of Hawaii Bureau of Conveyances website (available at dlnr.hawaii.gov/boc/) for further information.
8. **Send applicable documents to the County of Hawaii Planning Department.** Although not strictly required, it is recommended that the following documents be sent to the County of Hawaii Planning

Department, with a request that the easement be shown on the appropriate tax map and that the grant of easement be noted in the tax records.

- If the property is Regular System property, send copies of the recorded Grant of Easement document, together with the metes and bounds description of the easement (if applicable) and the survey map (if applicable), or the map or drawing depicting the location of the easement.
- If the property is Land Court property, send copies of the recorded Grant of Easement document, together with copies of the Land Court order (registering the easement in the Land Court system) and the Land Court map.
- If the property is dual system property, send copies of the recorded Grant of Easement document, together with the metes and bounds description of the easement (if applicable) and the survey map (if applicable) or the map or drawing depicting the location of the easement, the Land Court order (registering the easement in the Land Court system), and the Land Court map.

Is the process outlined above applicable to all easements? No, as previously stated, the process described in the checklist above is based on a scenario of an agricultural water company on the Big Island, or a customer who owns a pipeline, being granted an easement by an individual landowner. Federal, state, and municipal agencies typically must abide by certain laws, rules, and regulations when granting easements over their lands. Likewise, companies – particularly businesses with large land holdings – often follow certain procedures for granting easements over their lands. Thus, if the easement will cross over land owned by the government or a business entity, the process, including the form of the Grant of Easement document, will likely vary from that described above.

For how long does an easement exist? Easements can be perpetual or for a specified amount of time. The Grant of Easement form attached hereto as part of Appendix C, provides both options for the term of the easement (i.e., perpetual or twenty-year term with option to renew). If an easement is for a specified period of time, the easement will cease to exist once the specified time period is over. A perpetual easement is never-ending.

However, easements can be terminated before the specified end date and even perpetual easements can be terminated. The Grant of Easement document can define certain parameters under which an easement will terminate. For example, Section 3 (Automatic Termination of Easement) of the Grant of Easement form provided in Appendix C specifies that the easement will automatically terminate if the easement is not used by the grantee (the agricultural water company) for a continuous ten-year period.

Additionally, an easement may be terminated when its holder (i.e., the grantee) releases all of its rights in the easement to the owner of the land over which the easement runs (i.e., the grantor). For example, a release may be used to terminate an easement in the following circumstance: Agricultural Water Company has an easement over Land Owner A's property. Land Owner A desires to extinguish the easement. Land Owner A requests that, in exchange for payment of a certain sum of money, Agricultural Water Company signs a Release of Easement agreement, which will be recorded in the Bureau and which will terminate the easement. If Land Owner A and Agricultural Water Company are able to reach agreement on the terms of the Release of Easement, then the easement can be terminated.

4.22 Mitigating Liabilities Related to Easements

Whenever an easement is created (i.e., the grantee has rights to use a portion of the grantor's land), questions arise as to who may be held liable if a loss or injury occurs related to the easement. Because determinations regarding liability are highly fact-specific, it is not feasible to describe here all of the various circumstances in which the grantee (holder of the easement), the grantor (the land owner), or both may be held liable for a particular loss or injury. To provide an example of how liability determinations are highly fact-specific, consider these two scenarios:

(1) Grantor intentionally digs a hole in an area of the easement where Grantee frequently walks and Grantor covers the hole with leaves so that the hole is not visible. Grantee falls into the hole, injuring himself. In this scenario, it is likely that Grantor may be held liable for Grantee's injury.

(2) Grantee digs a hole in an area of the easement where Grantee frequently walks. Grantee digs the hole in order to access Grantee's water pipeline to perform a repair. Grantee is unable to finish the repair in one day, so Grantee leaves for the day without filling the hole. Overnight, leaves blow over the hole, covering it. Grantee returns the next day to complete the repair and accidentally falls into the hole, injuring himself. In this scenario, it is unlikely that Grantor may be held liable for Grantee's injury.

In order to protect yourself from potential liabilities related to obtaining or granting an easement, it is important to purchase the appropriate types and amounts of insurance. At a minimum, whether you are the grantor (landowner) or the grantee (easement holder), you should consider purchasing personal liability insurance. If, in connection with the easement, you are sued after a person is injured or property is damaged, personal liability insurance may provide for your defense and may pay certain amounts for which you are held responsible. Whether your policy will provide coverage for a particular claim depends upon the specific wording of the policy, including the coverage amounts. Before selecting insurance types and coverage amounts, you should consult with one or more insurance agents, comparing prices and terms of coverage. Additionally, if you are a business owner, you should also consider purchasing the insurance coverages discussed in Section 6.12 (Liability and Insurance) of this report.

4.3 The Kohala Ditch

The Kohala Ditch system, composed of intakes, take-outs, flumes, ditches, tunnels and distribution pipelines, served as the primary source of irrigation water for the sugar plantations of Kohala from 1906 until the closing of Kohala Sugar Company in 1975. The demise of sugar in North Kohala removed thousands of acres of cane land from production making the continued operation of the ditch system uncertain. Over time, dozens of new agricultural operations sprouted in the fallow cane fields; however, demand for agricultural water never returned to plantation-era levels.

In 1988, Chalon International of Hawaii (later renamed Surety Kohala Corporation) purchased the land assets of Kohala Sugar Company. Included in the purchase were the portions of Kohala Ditch on the property. Surety Kohala Corp (SKC) subsidized the continued operation of the ditch system while exploring options for its newly acquired holdings. A subsequent decision to focus on the gradual disposition of land assets in Kohala meant that SKC would eventually divest of all its Kohala holdings. Even as its land divestiture program progressed, SKC continued to subsidize the operation of the aging ditch system.

The 2006 Kiholo Earthquake heavily damaged Kohala Ditch beyond the capability of SKC to repair on its own and it appeared the ditch would not be revived. However, an ad hoc committee of farmers, land owners, businesses, government agencies, and individual volunteers arose. Together they raised funds and executed the work needed to repair the ditch. Raising over $5 million and laboring through two years of difficult and often dangerous work, this community coalition exceeded expectations and succeeded in resurrecting Kohala Ditch. In 2008, plentiful, low-cost agricultural water returned to North Kohala.

The success of this community-based effort to rebuild Kohala Ditch provided "proof of concept" for a plan for the long-term disposition of the Kohala Ditch system: transfer operation and maintenance of the system out of the hands of a fading private company, and into the hands of local farmers who depend upon the reliable delivery of low-cost agricultural water for their livelihood.

SKC and other members of the earthquake repair committee conducted a meticulous planning effort to determine the best approach for moving the ditch system to user-based management. The outcome was the formation of a consumer cooperative association (CCA), created under HRS Chapter 421C, to own and operate the intakes, take-outs, ditches, flumes, and tunnels that make up Kohala Ditch. The CCA will provide non-potable agricultural water service to the CCA's members.

To simplify administration of the CCA, the membership of the CCA will be comprised of pipeline associations, not individual users. Each pipeline association will be composed of all users on each pipeline that directly taps Kohala Ditch. To be eligible to apply for membership in the CCA, a pipeline association must, at a minimum, (1) operate a pipeline that connects directly to Kohala Ditch at a CCA-approved point-of-connection, and (2) distribute agricultural water to its members only.

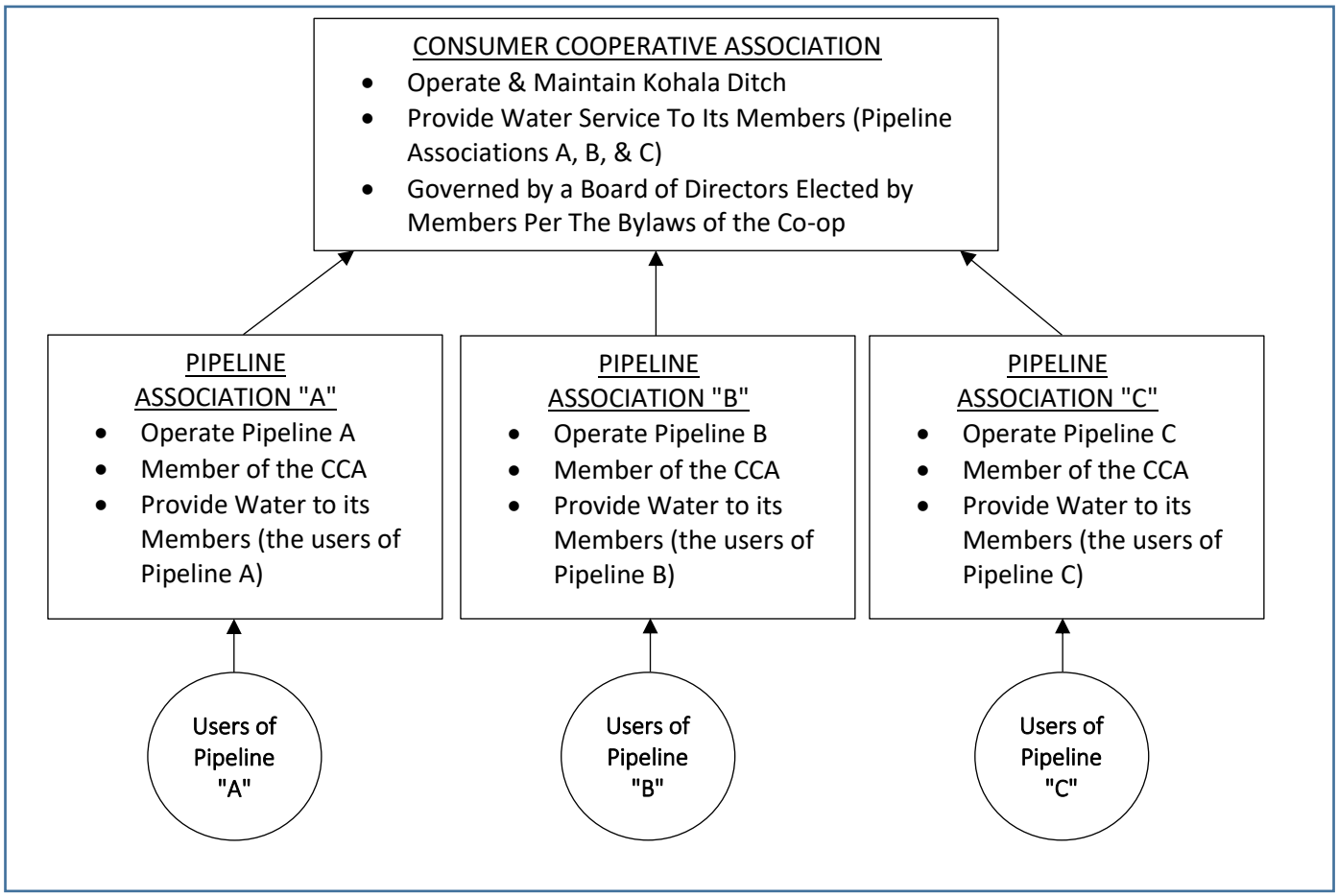
Thus, the Kohala Ditch system will be divided into manageable portions: Kohala Ditch, which will be operated by a CCA, and transmission pipelines, with each pipeline under the control of its own pipeline association. Pipeline associations will make up the membership of the CCA. Individual users will make up the membership of the pipeline associations.

In March of 2019, articles of incorporation for Kohala Ditch Co-op, Incorporated were filed. Kohala Ditch Co-op (KD Co-op), as a consumer cooperative association organized under HRS 421C, will own, operate, and maintain Kohala Ditch while providing agricultural water access to its members from Kohala Ditch. The coop's organizing board of directors has begun the job of building the administrative apparatus of the cooperative and tackling the myriad tasks needed to build an organization capable of meeting it's purpose of providing reliable, low cost, non-potable agricultural water service from Kohala Ditch to the cooperative's members. Securing access to non-potable water sources, negotiating maintenance agreements with outside contractors, negotiating the acquisition of assets from the Kohala Ditch Company, securing rights-of-ways, and bringing KD Co-op into compliance with all applicable laws, rules and regulations are just a few of the immediate tasks needing attention. Additional tasks include fleshing-out the co-op's bylaws, refining membership requirements, recruiting membership, budgeting, fund raising, drafting of agreements, writing operational and maintenance guidelines, developing relationships

with stakeholders, and public outreach and education. It is anticipated that several years of work remain to complete the transition of Kohala Ditch to the full control of KD Co-op. During this transition, existing users of Kohala Ditch agricultural water will be encouraged to join existing pipeline associations where possible. For pipelines where no single formal association currently exists, users will be encouraged to organize themselves and take responsibility for the pipelines that service them. Each pipeline association seeking membership in KD Co-op will submit an application packet demonstrating that it meets all KD Co-op membership requirements. KD Co-op's Board of Directors will make a determination on their application based on the submittal provided and the availability of water from Kohala Ditch. As a member-owned cooperative, KD Co-op limits non-potable agricultural water service to members only. Individual users will make up the membership of the pipeline associations, as depicted in Figure 13 below.

Additional information on Kohala Ditch and Kohala Ditch Co-op can be found at kohaladitchcoop.com.

Figure 13. Kohala Ditch Consumer Cooperative Association (CCA) Organizational Structure



Kohala Ditch Co-op, Incorporated (KD Co-op) has filed its Articles of Incorporation. It is now formally the consumer cooperative association that will provide agricultural water service to its members from Kohala Ditch. Its organizing Board of Directors has begun the job of building the administrative apparatus of the cooperative, which comes down to building a non-potable agricultural water company from scratch.

Critical immediate tasks include securing access to non-potable water sources, negotiating maintenance agreements with outside contractors, negotiating the acquisition of assets from the Kohala Ditch Company (an SKC subsidiary), securing rights-of-ways, and bringing KD Co-op into compliance with all applicable laws, rules and regulations. Additional tasks include fleshing-out KD Co-op's bylaws, refining membership requirements, recruiting membership, budgeting, fund raising, drafting of agreements, writing operational and maintenance guidelines, developing relationships with stakeholders, and public outreach and education. It is anticipated that several years of work remain to complete the transition of Kohala Ditch to the full control of the Co-op.

During this transition, existing users of Kohala Ditch agricultural water will be encouraged to join existing pipeline associations where possible. For pipelines where no single formal association currently exists, or for future pipelines, users will be encouraged to organize themselves into pipeline associations. Each pipeline association seeking membership in KD Co-op must submit an application packet demonstrating that it meets all KD Co-op membership eligibility requirements. KD Co-op's Board of Directors will make a determination regarding the applicant's membership status, based on the submittal provided as well as on the availability of water in Kohala Ditch. As a member-owned cooperative, KD Co-op limits non-potable agricultural water service to members only.

As stated in its Articles of Incorporation, KD Co-op's purpose is, "To provide reliable, low cost non-potable agricultural water service from Kohala Ditch to the Cooperative's members." As a self-sustaining cooperative, KD Co-op is committed to fulfilling its purpose for the long run. With the same determination, pragmatism, and hard work exhibited by Kohala Ditch agricultural water users and stakeholders in returning Kohala Ditch to service in 2008, Kohala Ditch Co-op will strive to keep the ditch in good running order so that it may continue to provide not just non-potable agricultural water but abundant possibilities for a sustainable agricultural future for the North Kohala community and the Big Island as a whole.

4.4 The Kehena Ditch

The “Interim Report on Kehena Ditch Water Study”. DLNR circular C53, dated March, 1969, available from the DLNR, does a very good job explaining the resources and potential uses of water that are carried in the Kehena Ditch. While there are data sets that need to be updated, the issues of loss and maintenance are as true today as when the document was created.
Legally speaking, the Kehena Ditch no longer exists. There was a reversion clause that was exercised on 15 July 1977. With this, the rights to cross lands for the purpose of conveying water ceased. This does not change the fact that the ditch system does still exist.

There are a large number of people and entities that need to be involved should an effort to reactivate the ditch system on a large scale be undertaken. Additionally, legal challenges have

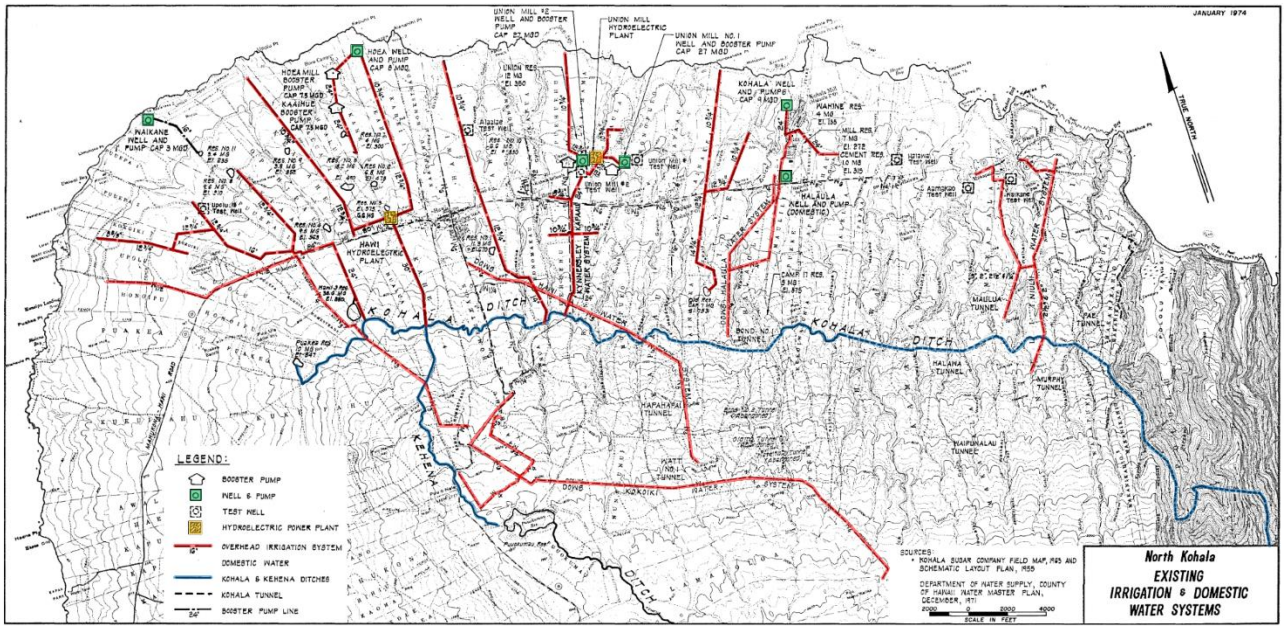
recently arisen that will need to be resolved in order to bring the system back. Initial flow studies and land owner consultations have begun.

Overall, the land owners have been positive and supportive in reactivation of the system for community use. While careful to ensure their needs are met, all of the major land owners consulted recognize the large volume of water potentially available and the importance of their role to improve access. In all cases, an operating entity will need to be selected and accepted by the land owners to ensure compliant and safe operation that minimizes disruption to ongoing agricultural ventures.

The bigger issue is the legal aspects of water diversion. The Kauai Springs case, as well as issues with A&B on Maui, have challenged the way the Hawaii Water Commission (CWRM, Commission on Water Resource Management) and the DLNR Land Board have conducted water leases and diversions. As a result, the process is in flux. Until the regulatory process is more clearly defined the plan for reactivation cannot be fully developed.

4.5 Existing Distribution Pipelines

Figure 14. Pipelines and Distribution at System Peak



Pipelines and Distribution Remaining

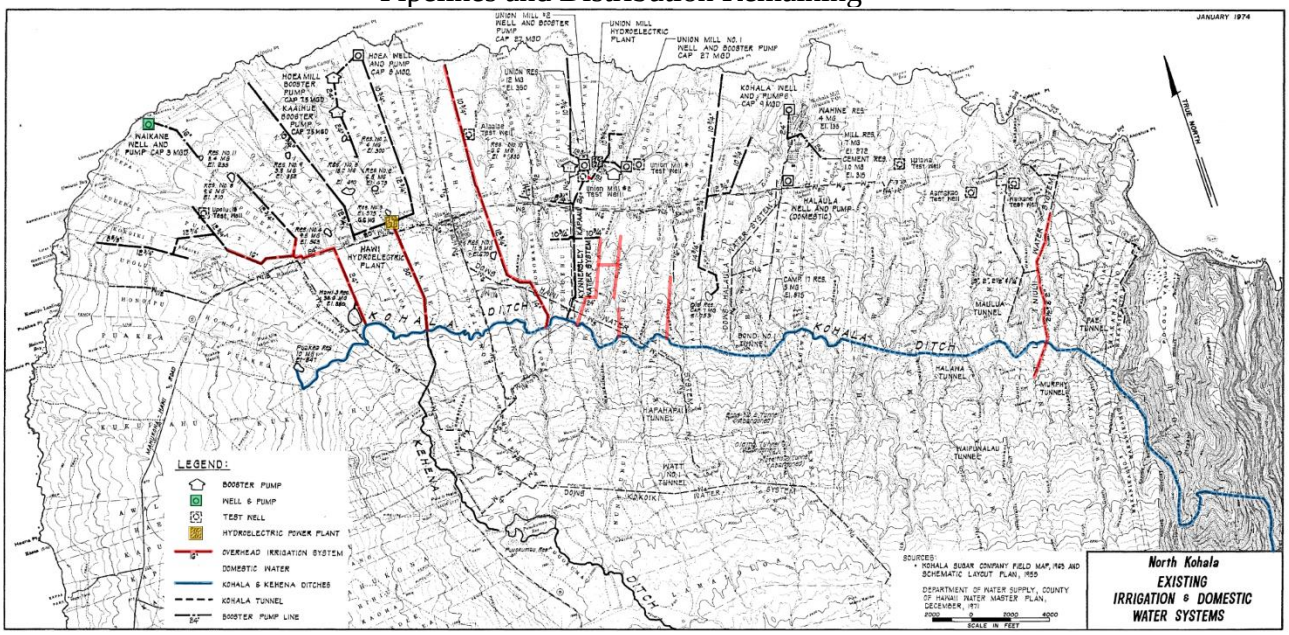


Figure 15

The two maps show how much the systems have degraded since the peak of development. The second map is not comprehensive but shows the remaining major distribution systems that could be used for irrigation. Maps are representative, full size maps available from DLNR.

Basically, there have been a few small additions but the majority of the system has been abandoned. What remains is small, fragmented and often saddled with grossly oversized equipment and facilities. The one unifying feature remains the Kohala Ditch.

4.6 Potential Demand and Pipelines

The first step in planning a water system is to determine how much water is going to be needed currently and under current plans. The second is to evaluate the plan and circumstances for potentially higher demand within the lifespan of the system. The third is to compare the options for system construction balancing cost, timing and the value in constructing to meet future increased demands.

In the case of Kohala, this has been reversed. Often businesses or enterprises have been put together based on the water available from existing facilities left behind by the plantation. In these cases, the capital cost to construct the infrastructure was not included in the business model. Often the systems are underutilized based on the lower demand of the smaller businesses.

While the harvesting of the residual value is actually a good practice, it can lead to the situation Kohala faces today. Many of the entities face a circumstance where maintenance and repair costs are rising on an old system that is far larger than they need. With the costs being relative to the size of the facilities, the situation can quickly become financially untenable. Couple this with the often-imperfect land tenure and the future access to a critical resource becomes questionable.

In order to correct the current situation and build for the future, the planning strategy needs to be brought into alignment with the first paragraph of this section; planning should first examine current and anticipated need. The first two steps need to be conducted as soon as possible with an effort to include any potential new uses. From that point resources can be brought to bear to meet the needs at a financially acceptable level.

As these systems are explored, a major recurring issue is fractionalization of the land. With the small parcels and related businesses, cooperation is needed now that was not required when the areas were under a single entity's control. Source and demand are often not on the same property and additional properties need to be crossed to connect the two. Use, storage and transmission, along with their associated elements and costs, will need to be coordinated between the entities involved to ensure a secure water system. Sample systems and associated organizational concerns are addressed in Section 7.

4.7 Highway Crossing

Highway crossings pose a unique and major challenge. Several major contracting firms were interviewed and recently completed projects were compared. Numbers were remarkably similar. A simple road crossing, assuming no major geological challenges or utility conflicts, costs between $110,000 and $175,000 and will take from 12-18 months to complete.

Water, generally speaking, is moved based on source, need, elevation and shortest routes. Roads tend to follow rainfall lines (areas of similar rainfall) and lines of commerce. This can often lead to situations where the best routes for either need may diverge. Crossings become inevitable at this point.

As with most water projects, the cost of laying underground pipe has less to do with the cost of pipe than with the cost of excavation. In the case of a road crossing the opportunity exists to build conduits rather than just pipelines. Simply stated, a very large (20" or larger) pipe would be laid in any crossing. The large pipe would serve as a conduit to put other smaller pipes through. This would allow users, with the appropriate easement, to run a pipe from a source, through the conduit, to the demand without requiring the construction of another road crossing.

While these crossings could be privately owned, the somewhat public nature of the service would be best served by a government or quasi-government organization. This organization would hold not only the conduit but approach easements to allow access to the crossing.

Section 5 – Storage

5.1 General Considerations

Water, by its nature, is heavy and energy intensive to move. Gravity is the most efficient means to power distribution. This obviously requires the source or storage to be at a higher elevation than the demand.

This can be accomplished by sourcing the water at higher elevations or pumping to high level storage. System loss becomes a critical number if pumping is utilized. The energy expense is in the lift. If the water is allowed to leak or evaporate in storage or transmission, the cost gets divided by fewer units. This can lead to the cost becoming prohibitive even on relatively short lifts.

Multiple source options and costs should be considered as well. In the event only a well is available, potential down time should be considered when planning the volume of water needing to be impounded. Minimizing down time can come in the form of keeping spare equipment on site, allowing the well to be repaired in several days. It can also be a backup source of power should the utility fail for an extended period.

5.2 Determining Volume Needed

The formula for determining the volume needed is fairly straight forward.

Max Daily Demand X Max Number of Days Before Recharge X 120% = Ideal Storage Requirement

Maximum Daily Demand is an interesting number. There are many factors that contribute to its calculation, but it all comes down to the amount of water needed for irrigation and operation plus any losses.

Losses are often the hardest to account and plan for. Losses can come in the form of evaporation from open reservoirs and overhead spraying. It is important to look at the efficiency of the delivery system to ensure the correct number.

Leaks and seepage are also major consumers of water. A faucet dripping once every second adds up to five gallons a day. This becomes over 1,800 gallons a year. While not a huge number, when dealing with a system that may need to last several months before it recharges, it can have a significant impact. In the event of a break, even something as small as a 1-inch line can be a major issue. At low pressure, a 1-inch line can lose 23,000 gallons in a day. Margins of safety are thus critical.

Transmission losses are also a major issue. The Kehena Ditch is an excellent example of transmission loss. At the upper weir, directly after collection, the system regularly produced over 40 million gallons a day on wet days. By the time the water reached the Puu O Kamau reservoir, less than 7 million gallons a day remained. When flow was lower, the water delivered would diminish or even stop. While there was a positive impact on springs lower down, the system was very inefficient.

Measuring is key to determine how much water actually reaches the point of use. Systems should have multiple meter points to help identify areas of loss. Accounted, non-correctable, losses are calculated into the total use of the system.

5.3 Reservoirs

In order to impound water in a reservoir a permit is required once it reaches a regulated status. In Hawaii, reservoirs are regulated by HRS 179D and HAR 190.1. Regulation has two primary considerations. First is the height of any dam. Second is the total volume impounded. If a dam is less than 6 feet above grade there is no limit to the volume of water that may be impounded. Likewise, if there is a total of less than 5 million gallons impounded, there is no limit on the height of the dams.

There is one additional non-regulated zone. Up to 15 million gallons may be impounded if the dam height is less than 25 feet. Dam height is measured from the top of the dam to the lowest point of fill. In the event of a filled streambed or draw it will go to the bottom of the "toe". (See Appendix D).

The process can be challenging to build a regulated dam. From a financial and time standpoint other options should be considered. There are a couple of exceptions that do make the time and effort acceptable.

The most important question is one of scale. If a very large volume of water needs to be stored, a single large structure may be the most efficient. This can apply to a single user or the supply of a group of users. The key is to spread the compliance cost over the largest volume of delivered water possible. This will help manage the financial impact on the delivered cost.

5.4 Temporary Tanks

Temporary tanks are tanks that can be placed in a location, used for a period, then removed for reuse somewhere else or some other time. There are basically two types to consider, rigid and non-rigid.

Rigid tanks hold their shape whether empty or full. There are several examples (see Appendix E). The major advantage to this type of tank is it functions just like a permanent tank. Smaller tanks need a minimal amount of ground prep and can be relocated without heavy equipment.

Non-rigid tanks (see Appendix E) tend to have shorter lifespans than ridged tanks but are extremely quick to deploy and take down. They also tend to be lighter, per volume stored, and are movable without heavy equipment.

5.5 Permanent Tanks

Unlike temporary tanks, permanent tanks are not intended to be moved for the life of the tank once installed. It is important to plan a bit more thoroughly when committing to a location.

Hydraulic consideration of elevation and flow will be set once the tank is in. Should your needs change, it may or may not be compatible.

Additionally, many of the options have different costs and lifespans. If a finite lifespan is needed it may make more financial sense to utilize a less expensive option even if it is shorter lived. As seen in Kohala, water appurtenances often outlive the operations they were built to serve.

Samples are shown in Appendix E.

Section 6 – System Operating Organization(s)

6.1 General Consideration

The construction and operation of water systems, or segments of water systems, have certain elements that dictate the type of organizations needed to run them. One of the most important starting points is that water systems tend to have substantial life spans. This is demonstrated by the fact the Kohala Sugar plantation closed in 1975, and some of the elements of its distribution system are still in use in 2019.

The long lifespan comes with substantial cost. It is not unreasonable to expect to spend $150-$250 per foot installed of large pipe. That translates to $792,000 to $1,320,000 a mile. This is a very large capital expense. Obviously, smaller pipes have lower costs, but they also carry less water. When juxtaposed against the income stream and margin of most agricultural ventures, expenditures of this nature only become cost effective over the long term.

Long term use and continuous management require organizations that are capable of handling a succession of people and organizations. With the wide variation of agricultural scope and scale that has developed in Kohala, organizing the various companies and individuals becomes much more challenging.

This brings us to the single biggest shift that has taken place in agriculture in Kohala. With the collapse of Kohala Sugar a leadership vacuum was created. The plantation, in addition to large parcels with continuous ownership, was the clearinghouse for information and capabilities. It was a large organization that had the resources to gather information, plan and execute agricultural operations as well as build and maintain the associated infrastructure.

The associated infrastructure is what has created the challenge of continued agricultural growth in Kohala. Simply stated, Kohala Sugar built such a robust water system that it has continued to operate decades after the plantation closed. This created the illusion of "free water". In reality, agriculture in Kohala has been living off the careful planning and heavy investment of an organization that closed in 1975.

From this point forward, new opportunities will require substantial investment in infrastructure. Existing facilities and appurtenances will require increasing investment to maintain and operate. In many cases repair or replacement may not even be possible as they are today. Researching the few existing distribution systems has revealed serious deficiencies in legal rights to properties they occupy or cross.

It is very important to remember, most of the water systems, as well as other infrastructure such as roads, were not transferred but abandoned by Kohala Sugar when it shut down. This means that management of condition and legal status stopped where they were. It often also means that when lands were subdivided and transferred, no consideration was given to the "systems". This is seen in large pipelines having no legal easements or leases and major roads segmented into private properties without general access.

There are two other important legal considerations worth mentioning here. The first is whether the entity will be subject to regulation by the Hawaii Public Utilities Commission ("PUC"). As a general rule, if an entity is providing utility service (such as non-potable irrigation water service) only to itself, rather than to the general public or any portion thereof, then that entity should not be subject to PUC regulation. In other words, if the persons receiving service from the entity are the same group of persons that have control over the entity (for example, if the customers and the shareholders are comprised of the same group of people), then that entity is not a public utility. (Decision and Order No. 17557, filed on February 22, 2000, in Docket No. 00-0009, in *In re Hokulia Community Services, Inc.*; and Decision and Order No. 11184, filed on July 22, 1991, in Docket No. 6939, in *In re Poipu Kai Water Reclamation Corp.*).

The second legal consideration is to ensure that any entity providing non-potable irrigation water service is in compliance with all State of Hawaii Department of Health laws, rules, and regulations governing the provision of non-potable irrigation water service. These include…

Until the legal issues are addressed, external funding will not be possible and direct investment would be difficult to justify. The long operating life of these systems require long term security of the investment.

There has also been legitimate criticism of the plantation as it monopolized lands and resources. Its ability to organize, plan and execute were solely for the benefit of the plantation. Going forward there will need to be an organization capable of system oversite but with the mission of providing access to water for other organizations and individuals. This will be further discussed in Section 9.

6.11 Lawful Land Access

One of the challenges will be the access to lands for transmission and storage. This may involve easements or right of way for transmission lines, power lines, pump locations and tanks or reservoirs. Access is not just for the system itself but will be required for maintenance, operational checks and emergencies as needed. Each system will be unique but some general system guidelines will improve the likelihood of success. For further information regarding easements in general and how to properly obtain, grant, and document an easement, refer to Section 4.21 of this report.

The key principle for success will be participants in the systems committing to provide easements, in as non-disruptive way as possible, thereby allowing access to water. As has been witnessed before with the ditch, land crossing and water access have been seen as a marketable asset. Unfortunately, there is often a lopsided supply and demand structure. The entity providing access is often the only option for the entity needing water. Without mutual benefit, "fair" becomes a matter of perspective rather than something that is calculable. Without a clear definition of value or acceptable oversight, this situation becomes a prime source of conflict and abuse.

In order to prevent these issues from taking hold, there will need to be an organization that will fill the role of overseeing the request for easements and facilities. This organization may be a

not-for-profit or a co-op but all parties should have a say in how requests are offered and the process for mediation.

An additional role for the aforementioned organization will be the coordination and facilitation for government lands and facilities. In particular, road crossings and easements needed to improve the DWS system to provide agricultural water units for small farmers will need to be addressed.

6.12 Liability and Insurance

In Section 6.2 and its subsections (§ 6.21 through 6.26) below, different types of business organizations are discussed. While business owners can limit their personal liability by choosing the appropriate type of business entity, business owners also need to think about how to protect the business's assets. Purchasing the appropriate types and amounts of business insurance is key to protecting the business owner's personal assets as well as the business's assets.

Provided below is an overview of types of insurance that a small business should consider purchasing (and in some cases, may be required by law to purchase). This list is not meant to be exhaustive – before selecting insurance types and coverage amounts, the business owner(s) should consult with one or more insurance agents, comparing prices and terms of coverage.

Type of Insurance	**Purpose**
General Liability	Protects against financial loss resulting from bodily injury, property damage, medical expenses, libel, slander, defending lawsuits, settlement bonds, or judgements
Commercial Property	Protects against loss and damage of company property due to events such as fire, smoke, wind, hail, civil disobedience, vandalism
Business Interruption	Protects against loss of income due to a disaster
Commercial Automobile	Protects against injuries and damage company employees may cause to other people or property while driving
Directors and Officers Insurance	Protects the directors and officers of the company for claims made against them while serving on the Board of Directors of the company or as an officer of the company
Worker's Compensation	Wage replacement and medical benefits for employees injured while employed, in exchange for employee relinquishing the right to sue the employer for negligence
Unemployment	Unemployment benefits for eligible workers unemployed through no fault of their own

Type of Insurance	Purpose
Disability	Benefits to employees that guaranty income if an employee cannot work due to illness or an accident.

6.13 Operational Requirements

Small water systems offer a challenge that large-scale systems do not. Namely, they lack the economy of scale to keep operators that are focused on the systems. The result is often one or two individuals in the organization using water become the operators on a part-time basis. They also become the de-facto "after hours" people. This often results in conflict within a user's group.

Another issue in small systems is the stockage of repair supplies and parts. While many of the elements are available from local hardware stores, certain specialty items are not. Filters, pumps and adaptors are commonly not immediately available. This can cause disruption to the users and negative impacts on agricultural operations.

Operations of water systems is a challenge that will be best addressed by a company that is owned either by an association or non-profit. This would allow operation cost to be set by the group and standardization of components. It would also allow for higher skilled operators to run the primary systems and consolidate the "on call" needs.

6.14 Ag Water Capacity Report

Unlike drinking water systems, agricultural systems are not highly regulated. While this allows cost saving measures to be included in the design and construction, the long-term operation and safety should be evaluated.

HAR 11-20-29.5 "Capacity demonstration and evaluation" offers a very extensive evaluation protocol for a public water system. While it is excessive for an agricultural system to conduct, it does offer some very useful guidelines that should be incorporated into the developmental plan for any system:

1. Clear system layout, mapping and description
2. Adequate water source
3. Adequate technical performance
4. Infrastructure replacement plan
5. Competent, trained operators
6. Organizational structure and management
7. Clear identification of ownership
8. Emergency plans
9. Internal policies
10. Adequate financial capacity and budget controls

6.15 Coordinating Entities

The topic of a coordinating entity is an unusual one. Hawaii has an interesting combination of water being held in public trust, private property rights and the focus of water providers being on drinking water. There is a major missing element when it comes to agriculture.

The most successful development of agricultural water was accomplished by large entities that had political support and very low population densities. The era of sugar cane cultivation that produced these entities is now long gone and the legal environment and population levels will not allow agricultural water development to occur as it did before. Additionally, no ventures of the scale needed to undertake such a project are planned or expected.

As has been previously discussed, the planning and execution of water development by the plantation was outstanding. An organization, or organizations, with vision and capabilities similar to that of the plantations, but with the goal of providing resources to other operations, as opposed to being for its own exclusive use, is critical to the development of efficient large water systems. This leaves governmental options or some sort of private entity capable of coordinating and administering water development in a collaborative way.

This type of organization will need to be independent of any operation that uses water in the area in order to avoid conflicts of interest. The challenge is going to be to look at the bigger picture and potential future uses so easements and facilities can be secured before divisions and property developments begin.

A small core organization as part of a government agency or a non-profit would be ideal with the understanding that the organization will evolve and fill needs as they arise. It may go as far as including an operations or maintenance company to facilitate transmission. This would help the economy of scale issues that are a constant challenge for small systems.

6.2 Types of Business Organizations

There are many different ways to structure and form a business or other entity in Hawaii. Section 6.2 provides a high-level overview of various entity types and certain key characteristics. The information contained in this report is intended only as a starting point in the process of forming an entity and is not a substitute for legal or tax analysis, research, or advice. Selecting an entity type is an important decision, as it will determine the form of ownership and control, the structure of the management and operation of the entity, tax treatment, and scope of liability; therefore, it is highly advisable to retain legal counsel and tax expertise to advise you in the process of forming a business entity.

To form a business in Hawaii, generally, the business owner(s), either themselves or through their attorney(s) and/or tax advisor(s), will interact with various government agencies. To form the entity itself, and for the filing of annual reports and other required documents, forms must be filed with the State of Hawaii Department of Commerce and Consumer Affairs (DCCA). The DCCA's Business Registration website (http://cca.hawaii.gov/breg/) provides information on the

various types of business entities and contains links to standard forms. The forms can be accessed, completed, and filed online.

Any business that is formed in Hawaii or that intends to transact business in Hawaii is required to obtain a Hawaii General Excise Tax (HGET) number from the State of Hawaii Department of Taxation by filing a Basic Business Application (Form BB-1). Depending on the circumstances, the business may also need to: (i) obtain a Federal Employer Identification Number (FEIN) from the Internal Revenue Service by filing an Application for Employer Identification Number (Form SS-4), and (ii) file a UC-1 form with the State of Hawaii Department of Labor and Industrial Relations.

6.21 Sole Proprietor

A sole proprietorship is not a legal entity; it is simply a person who owns and operates a business. Sole proprietorships are relatively easy to establish, since corporate formation documents (e.g., articles of incorporation, certificate of limited partnership, articles of organization, etc.) do not need to be prepared or filed. Taxation is also simple, as income and losses of the sole proprietorship are income and losses of the owner. The main drawback of a sole proprietorship is that the owner is personally liable for all of the business's debts, losses, and liabilities.

6.22 Cooperatives

In general, a cooperative is a special type of corporation that is owned and controlled by its members, who all share in the profits/benefits of the organization. One of the key reasons an irrigation company may choose to be organized as a cooperative is so that it will not be regulated by the PUC. (Refer to the discussion in Section 6.1, above.) To that end, typically, when an irrigation company is organized as a cooperative, the company provides service only to its members (who are the owners). Although it is a common belief that a cooperative is always a non-profit entity, that it is not necessarily true. For example, under Hawaii law, cooperative organizations may elect to be organized as either for-profit or non-profit corporations. (For further information regarding for-profit corporations, refer to Section 6.25 below, and for further information regarding non-profit corporations, refer to Section 6.26 below.) Hawaii law provides for Agricultural Cooperative Associations and Consumer Cooperative Associations, both of which are discussed below.

Agricultural Cooperative Association (ACA): ACAs are governed by Hawaii Revised Statutes ("HRS") Chapter 421. An ACA is a cooperative association which has the purpose of:

. . . engaging in any cooperative activity for producers of agricultural products in connection with:

> (1) Producing, assembling, marketing, buying or selling agricultural products or harvesting, preserving, drying, processing, manufacturing, blending, canning, packing, ginning, grading, storing, warehousing, handling, shipping, or utilizing the products, or manufacturing or marketing the byproducts, thereof; provided

seventy-five per cent of such agricultural products shall be of Hawaiian origin;

(2) Manufacturing, buying for or supplying to its members machinery, equipment, feed, fertilizer, fuel, seeds, and other agricultural supplies;

(3) Performing or furnishing business or educational services, on a cooperative basis, or to its members;

(4) Financing any of the above enumerated activities for its members.[2]

As used above and in the applicable laws, "agricultural products" includes floricultural, horticultural, viticultural, forestry, nut, coffee, dairy, livestock, poultry, bee, farm or plantation products, and fish and aquaculture commodities.[3] Due to the narrowly defined purpose of an ACA, only bona fide producers of "agricultural products" may be members of an ACA. Because irrigation cooperatives typically provide service only to their members, if organized as an ACA, non-members (i.e., anyone who is not a bona fide producer of agricultural products) would not be able to receive service from the ACA.

Consumer Cooperative Association (CCA). CCAs are governed by HRS Chapter 421C. A CCA is a group enterprise organized on a cooperative basis. Unlike an ACA (which, by law, has a narrowly prescribed purpose), a CCA's purpose is much more flexible – under Hawaii law, a CCA's purpose is to "transact any lawful business for its membership, the general public, or both."[4] Because a CCA's purpose is more flexible than an ACA's purpose, so too is a CCA's membership more flexible than an ACA's membership. In a CCA, the board of directors and/or the members themselves, through the CCA's governing documents, establish the eligibility requirements and the application process for becoming a member of the CCA. For practical purposes, this means that a key benefit to a CCA, as opposed to an ACA, is that membership in a CCA need not be restricted to bona fide producers of agricultural products, and therefore, a CCA may provide irrigation service to those who are not bona fide producers of agricultural products, so long as they are members of the CCA.

Although a CCA is more flexible in terms of its purpose and its membership, it is more stringent in terms of its structure. As just one example, the key principles of a CCA are:

- Each member has one vote and only one vote, except as may be altered in the articles or bylaws of a secondary cooperative by provision for voting by member organizations;

- The maximum rate at which any return is paid on share or membership capital is limited; and

[2] HRS § 421-2.

[3] HRS § 421-1.

[4] HRS § 421C-2.

- The allocation or distribution of net savings after making provision for such separate funds as may be required or specially permitted by statute, articles, or bylaws, is made to member patrons or to all patrons, in proportion to their patronage; or is allocated in a manner which benefits the general welfare of all of the members of the association.

In addition to the above, HRS Chapter 421C, which governs CCAs, includes various other parameters for the structure and governance of a CCA.

6.23 Partnerships

General Partnership. General partnerships are governed by HRS Chapter 425. As defined by law, a partnership is "an association of two or more persons to carry on as co-owners a business for profit." HRS § 425-101. Practically, this means that paper work is not technically needed to form a partnership (this is different from other legal entities, for which formation requires filing paper work with the DCCA). A general partnership is deemed to be created when two or more persons engage in activities that meet the statutory definition of a partnership. In a general partnership, each partner has unlimited personal liability for the debts and liabilities of the partnership and each partner has vicarious liability for the other partners' acts. Because of this, it is very rare for a general partnership to be the preferred organizational structure.

Limited Partnership (LP). LPs are governed by HRS Chapter 425E. An LP is managed by its general partner, thereby limiting the liability of the limited partners. The LP itself is not subject to income tax – instead its gains and losses flow through to the partners. In an LP, the general partner is personally liable for all partnership obligations. It is not unusual for the LP's general partner to be a corporation, since such structure can provide some limits on the liability of the general partner. If the LP's general partner is a corporation, it is often an S Corporation, to align the pass-through tax benefits of the partnership and the S Corporation.

6.24 Limited Liability Company (LLC)

LLCs are governed by HRS Chapter 428. Perhaps the most notable characteristic of an LLC is that all of its members are entitled to limited liability; this is different from a limited partnership, which requires that certain member(s) or manager(s) assume unlimited liability. Furthermore, the law governing LLCs is comparatively flexible regarding the structure of the entity. For example, the LLC can elect to be treated, for tax purposes, as either a general partnership (i.e., a pass-through entity) or a corporation (i.e., a non-pass-through entity). In forming an LLC, one of the first choices will be to determine whether the LLC will be "member-managed" or "manager-managed." In a member-managed LLC, all members participate in managing the LLC – this means that member management can be increasingly difficult the more members an LLC has. In a manager-managed LLC, the members select one or more managers (the managers do not have to be members, and the managers can be either persons or other business entities). Those managers are authorized to conduct the LLC's business affairs.

6.25 Corporation

C Corporation. C Corporations (sometimes referred to as regular corporations) are governed by HRS Chapter 414. A C Corporation is characterized by centralized management and limited liability for its shareholders, who are the owners. The Board of Directors, which is elected by the shareholders, is responsible for managing the corporation. For example, the Board of Directors selects the officers who will handle the day-to-day business operations. In a C Corporation structure, there is double taxation on business income: (i) first, the C Corporation itself is subject to tax on its income, (ii) then dividends (which are corporate income that is distributed to the shareholders), received by shareholders are subject to income tax.

S Corporation. The formation of an S Corporation is, like a C Corporation, governed by HRS Chapter 414; however, for tax purposes, an S Corporation makes an S election. The main difference between a C Corporation and an S Corporation is that an S Corporation's income normally is not subject to double taxation. In most respects, S Corporations are taxed like partnerships (i.e., income and deductions flow through to the shareholders and the corporation itself does not pay income taxes). Rules applicable to S Corporations limit the number and types of shareholders who are allowed to own stock in the S Corporation. For example, a corporation (unless it is a charitable organization), a partnership, most trusts, and nonresident aliens may not own stock in an S Corporation.

6.26 Non-Profit Corporation

Non-profit corporations formed in Hawaii are governed by HRS Chapter 414D. Generally, nonprofit corporations are special types of corporations that are organized to qualify for tax-exempt status under Section 501 of the Internal Revenue Code. The non-profit corporation structure is often utilized for religious organizations, charitable organizations, trade groups, and community associations. Non-profit corporations enjoy an exemption from the standard tax impositions placed on other businesses. Depending upon the specific tax-exempt qualification utilized, a non-profit corporation may be subject to a multitude of additional, ongoing filing requirements at both the state and federal level, therefore, as with the formation of any business entity, it is highly advisable to seek advice from qualified legal and tax experts.

Section 7 – Sample Systems

The sample systems bring together the aforementioned issues and requirements into complete systems. Some details, (method of irrigation, how total demand was derived, crop suitability, etc.) have been omitted for the purpose of clarity. While specifics are addressed elsewhere in this report, the focus of the sample systems is overall systems organization and management. The important challenges for compliance and long-term sustainable operations are pointed out to assist in planning considerations.

The systems described are not the only correct way to assemble and govern a water system/sub system. Many situations may require a novel approach that differs or combines concepts. While content may be directly useful, the logic pattern to defining and addressing potential issues are the most important aspects of the study cases.

Many of the challenges and critical points addressed in the models were discovered during interviews with actual users. In order to foster open communications, individuals and companies that are in conflict are not named in this report. Most important are the lessons learned from issues that have arisen and, where applicable, how they were resolved or prevented.

“Coordination points” are the aspects of a multi-user system that all users will need to agree upon in governance. These points also often result in conflict. Careful consideration of potential issues is important when planning for operation of a system that’s lifespan may exceed some or all of the owners. When applicable, a Guideline (GL) is offered. These are based on successful outcomes in similar settings.

7.1 Single User Complete System (Source to End User)

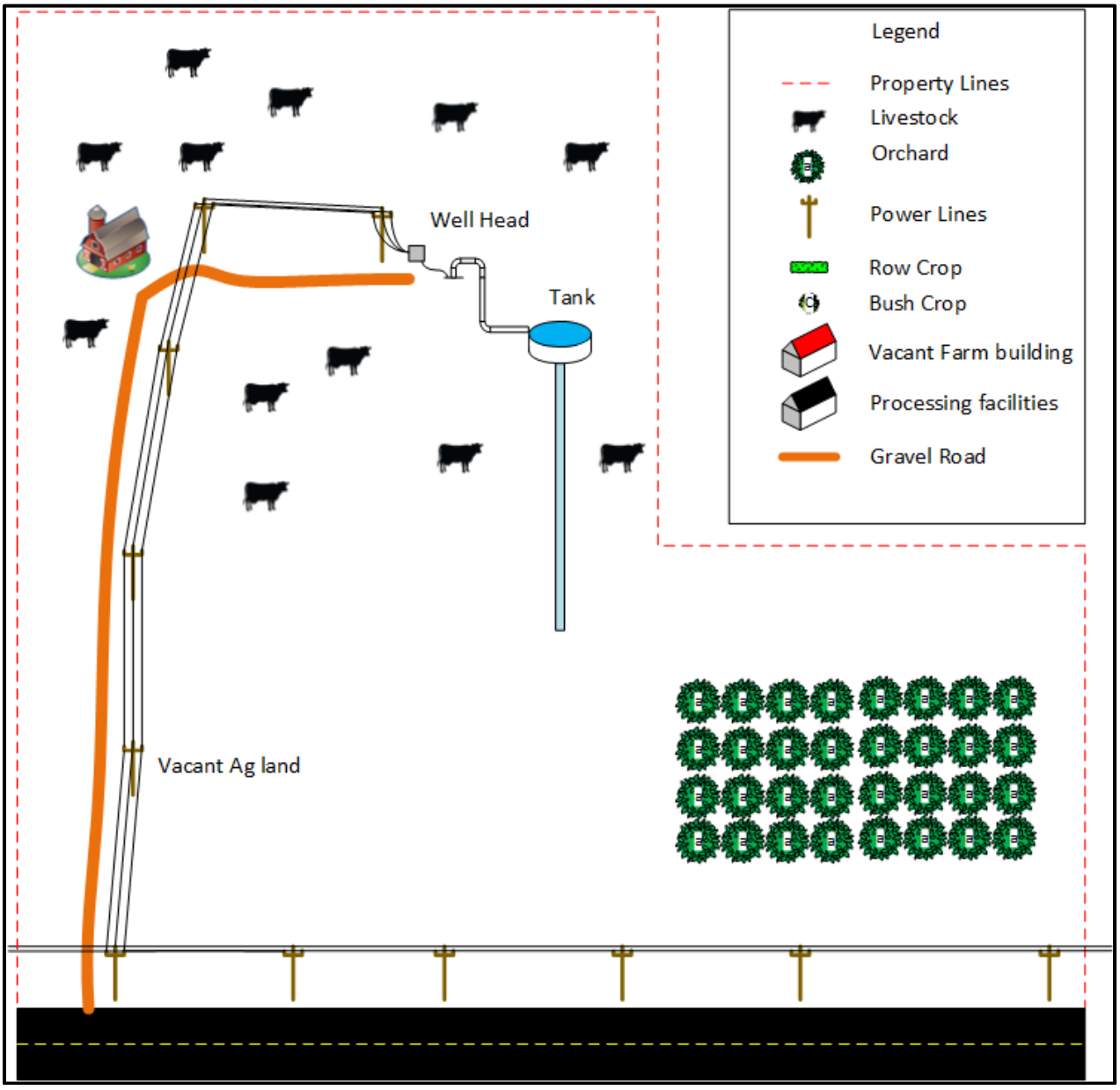


Figure 16

Operation description: The single user well system is the simplest of all systems from the point of governance. Weather, other businesses or individuals, liability, cost containment are all internal concerns. As with any single-owned system, all costs are borne by the operating entity. Total cost per 1000 gallons will be based on energy consumption and the operational costs.

Most concepts remain valid if another land owner-controlled source, such as catchment or a spring, is utilized. A well was utilized for the source in this example as it has some of the highest compliance and planning requirements.

Operationally, the system is simplified as water is available on demand only when needed. Storage can be kept to a minimum needed for operations and redundancy.

Organizational possibilities: Sole proprietor, LLC, Incorporation

Operational elements: State registered well with monthly reporting requirements. HELCO connection capable of handling pump operations. Transmission systems. Storage.

Operational Challenges: Management is simplified as the decisions will all be made by a single entity. By following BMPs and sound business practices most of the issues will be straight forward.

The only real challenge in Kohala is going to be the well itself. Pumps are not always available and power supply can be challenging at times. As crops are included in this model there will need to be an evaluation of their resilience in the event irrigation water is not available for a period. At a minimum, a well pump and motor should be kept in stock. Backup power will be necessary if the crop has a short life depending on the total available storage.

Liability Concerns: Liability Concerns are limited to water keeping in line with the scope of the study. Other liabilities for the operation are not discussed and will need to be part of the business plan.

Strictly speaking the liability of the system will be minimal. There may be impacts that will affect the business but are limited regarding outside entities. Provided all support structures and appurtenances are in compliance with code or best management practices, direct liability will be minimized.

One element that must be further discussed is the well itself. As a system that utilizes a public trust resource, its compliance is critical. This applies not only to the reporting requirements and construction, but work done at or near the well itself. A well is an excellent source of water but can also be a source of contamination for the aquifer. It also has the possibility to affect neighboring wells if the capacity is not kept within acceptable rates for the aquifer.

In both of these cases perception can become an issue as well as any real problem. Wells in the Kohala area are capable of producing a great deal of water. When large amounts are used, often the well is brought up if an issue develops in the region.

Primary Water Issues:

1. Land tenure: In relation to a water system, land tenure's main concern is longevity. Water systems are capital intensive and tend to have lifespans in excess of 20 years. Investment becomes hard to justify and harder to finance if the operator may be required to walk away before the lifespan is complete.

   Several options exist to manage the capitalized value. It can be a direct investment in the property where if the land reverts to the owner, any undepreciated value is paid back to the investor. This can be accomplished through a direct buyout or assumption of payments on any financing that was used to build the facilities.

   An immediate payback in rent reduction or is another option. Where all or a portion of the rent is taken in value of improvements. The goal being as rapid payback as practical to

normal landlord/tenant relationship can resume. Simply stated, the price of an improvement is paid back to the renter by reduced costs.

2. Well compliance: At a minimum, total volume pumped, chlorides and temperature will be required to be submitted to CWRM on a monthly basis. It is important that one party is responsible and ensures compliance. Additional issues may arise when well pump service is needed. If a different size pump is used, permits and testing may be required by CWRM.

3. Well operations: The actual operation of the well will probably be automated but there will still need to be regular checks and maintenance on the system. One party should oversee the checks and maintenance.

4. Electricity Utility: There are a couple of issues to be mindful of with the electrical utility. First, as discussed in section 3.4, there are multiple rate structures and limitations of the power system. Kohala is far from the primary generation systems and large motors may have a disproportionate impact. The operator will need to ensure compliance with any rate structure and any limitation imposed by the utility.

   Second, it is important to keep a close eye on the power itself. In the case of three-phase power, the distance, exposure and age of the transmission lines can result in fluctuation in power during weather events. It is important to monitor and ensure adequate protection is in place for the well equipment. A major surge or undervoltage situation may burn out an expensive well pump. As an "act of God" the utility is not responsible for these issues.

7.2 Multi-User Consumer System (Source Owned by Others)

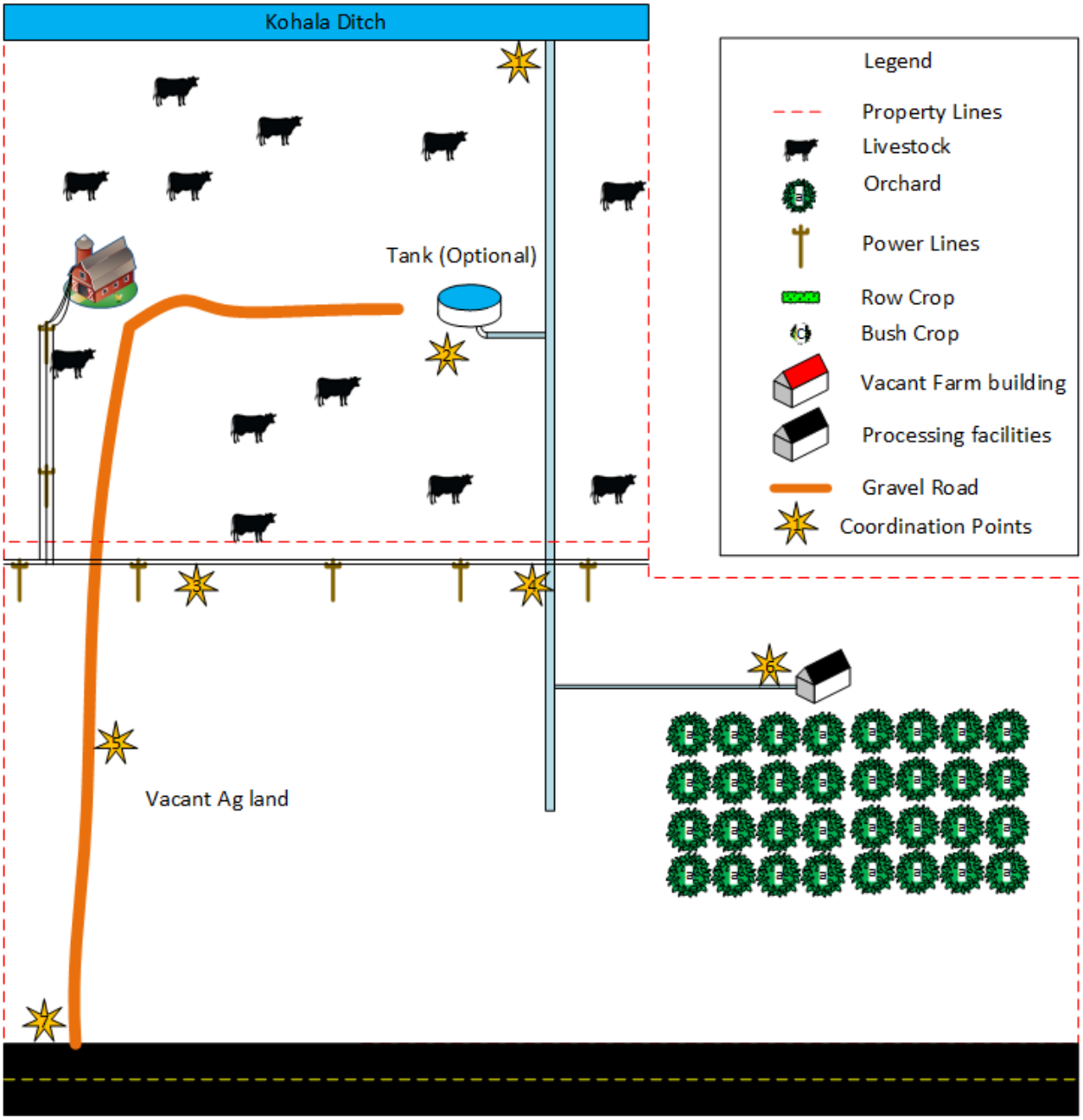


Figure 18

Operation description: The multi-user ditch system actually represents a couple of options. The source could easily be replaced by catchment or a spring. Each will have similar limitations. The Kohala Ditch is weather dependent. The same can be said about catchment systems and possibly springs. In any case where an extended dry period may render the source nonproductive, this model may fit.

A multi-user ditch system is fed from a weather dependent source. Ideally, it is gravity-fed but may include lifting to a storage point to feed higher elevation areas on the project. Each additional subsystem will require careful planning an organizational consideration.

Organizational possibilities: Sole proprietor, LLC, Incorporation, Partnership

Operational elements: The Source, Storage, Distribution, Possible Lift Pumps

Coordination points: In all interaction points there are critical agreements that must be made regarding responsibilities and rights necessary to ensure stable long-term operations.

Primary water issues:

1. Ditch access. A single point of access serves several entities, this brings up certain issues as businesses evolve.
    a. What entity is responsible for the bill? Guidelines (GL): There needs to be a single entity directly responsible to ensure water is available. This could be the largest, the most stable, the entity that borders the ditch, or any combination thereof. It needs to be capable of maintaining the safe operation of the system in the event others in the group stop participation.
    b. What entity is responsible for maintaining the access point? If it is done jointly, will one entity be responsible for the full cost if the other fails to meet its obligation? GL: Similar to the financial responsibility, access may be denied if the outflow system is not maintained. In the end, there needs to be a single organization capable of maintaining a compliant access point, even if other members cease to participate.
    c. Will cost be shared equally or based on water use?
    d. If the property owner that has the access point on it sells or goes out of business, is there an easement to allow continued access to water?
    e. What are the rights and responsibilities of the easement holder? GL: This can have many facets. One of the major issues is the impact of a pipe on property use. If an excavation or heavy earthmover work needs to be done over the pipeline, who is responsible if it is damaged or needs to be moved? Also, what happens to the pipeline at the end of the service life or if the operating entity chooses to no longer use the pipe? Removal, abandon in place or shift in control needs to be spelled out in the agreement.
2. Tank/Storage: Common storage has certain the following interactional challenges:
    a. What entity owns the tank?
    b. Who is responsible for upkeep and replacement?
    c. Are expenses shared evenly or based on percentage of water used?
    d. How is the water divided/used in times of drought?
3. Electric Lines/ Access: Electricity transmission easements are normally held by the utility. In order to keep the system as clean as possible all transmission should belong to the utility. In some cases, transmission lines are put on agricultural land after a “Master Meter”. This is

also known as the demarcation point. If the system is private it is important to ensure a solid agreement is in place to ensure access and sustainable operation if one or more parties' defaults or separates from the agreement.

4. Transition point on property line: Where a property line is crossed, an agreement is needed to ensure smooth operations. At a minimum, there should be clear markings at the transition point and a valve on the up-stream property. This will allow a clean separation if the system downstream is abandoned, ceases operation or has a leak or other problem.

5. Access Road: Access roads are often a point of contention. Many issues can arise, especially when expectations are not set. These can include, but are not limited to, times of access, who can use the road, responsibility if gates are left open, speed limits, responsibility of maintenance and appearance. All of these issues should be discussed and included in the agreement with enough flexibility to allow for unexpected situations.

6. Processing water use: Process water – water used to clean, cook or otherwise prepare an agricultural product – brings specific challenges, particularly water and solids disposal. Unlike irrigation that is a consumptive use, process water often needs to be disposed of after it has served its purpose. Irrigation, if available and appropriate, is an excellent disposal method. There are often times solids (dirt, leaves, etc.) are included in the wastewater flow and will need to have a final destination.

7. Highway access: Similar to the access road, highway access can be a major concern. Timing, who can use, and highway compliance are just a small number of issues that come up. Additionally, security and appearance need to be agreed to. This will not only involve installation of needed security, signage and aesthetic elements, but their long-term upkeep.

Operational Challenges:

1. Liability Concerns: Unlike the single user systems, multiple users and multiple properties can result in liabilities that need to be addressed.

   First, damage caused by water: Basically, this comes down to the operating agreement. Water can cause damage in many different ways. There are flow issues if a pipe or tank ruptures. As the flow and/or amount of water impounded increases so does the risk

   There are also potential damages from the way the water is delivered. Under any agreement there needs to be a clear definition of parameters the water will be delivered under. Pressure, cleanliness, timing, etc. Compliance will need to be factored in on the pricing.

   These requirements can also be waived in an agreement. To help manage cost, a less expensive, but also less stable system may be used. Often, short-term pressure losses may come from limits in pipe sizes and flows. Who uses what when is as much part of the question as how much is needed in a day. Users will be the cause of system fluctuation. This interaction with the system, and by extension other users, needs to be clear to avoid negative impacts on users of the system.

   While the actual numbers are negotiable it is imperative that an agreement that is realistic in cost and operations is developed. If ignored it is almost a guarantee of conflict between system users and operators.

Second, damage caused by the lack of water. Many agricultural ventures have a time criticalness of water. This can be for irrigation but can also be part of processing. Either use can be negatively impacted in the event water is unavailable. As with any system, failures should be expected. How they will be managed and how long repairs will take needs to be part of the discussion.

Included is a method for dealing with proximal cause. If the lower land owner has a pipe break and drains the tank while the ditch is not running, what are they responsible for? Do they have to truck water in? Can it wait until the ditch is flowing? Is there a delay? Hours, days, weeks? These will all need to be part of the risk management assessment of the system for the operator.

2. User Conflict: Very few things evoke emotion, especially from agricultural producers, like water. The consumable nature, variations of availability and quality often put water into the position of determining success or failure of an agricultural venture. It is also in a position that the impact will be very rapid. Animals will die in days without water. Crops can be damaged or destroyed without water at critical junctures. When flow stops and storage levels begin to drop, without proper planning, tensions will rise.

   There is also a major issue that comes from the fact that source, storage and transmission often do not occur on the same parcel of land or even under the same owner. When coupled with the evolutionary nature of water systems, and the tendency in agriculture to do business on a handshake, actual agreements may not always be clear. Rights and responsibilities become clouded, especially if the amount needed becomes less what is available.

   Like most conflict, the real source is unmet expectations. In order to prevent and manage conflict there are two important issues that need to be addressed:

   First is a diligent effort to seek agreement on how the system will be run. This includes what each should expect to get, what they are responsible for and what will be done in time of shortage or crisis. This may not only be times of drought or reduced resources availability, but situations that may arise from normal operations. If a pipe fails, who fixes it? Who pays for it? What if it's the result of accidental damage? If it's at night, can it wait until morning? These are just a sample of the questions that need to be explored and agreed to.

   Second is ensuring there is a means of managing disagreement. One fundamental truth is no matter how diligent, there is a very good chance that something that was not considered may arise. Many of these cases can be solved by simple communication and addressing the issue. In some cases, there may be resulting disagreement. Having a method in the agreement that will resolve issues is important. This can be accomplished through binding arbitration or mediation. There may also be a need for more than one level. It is important that all parties are comfortable using whatever is selected. This will help ensure short term grievances are resolved before they become a major conflict.

7.3 Multi-User Complete System (Source, Pipelines, storage, distribution)

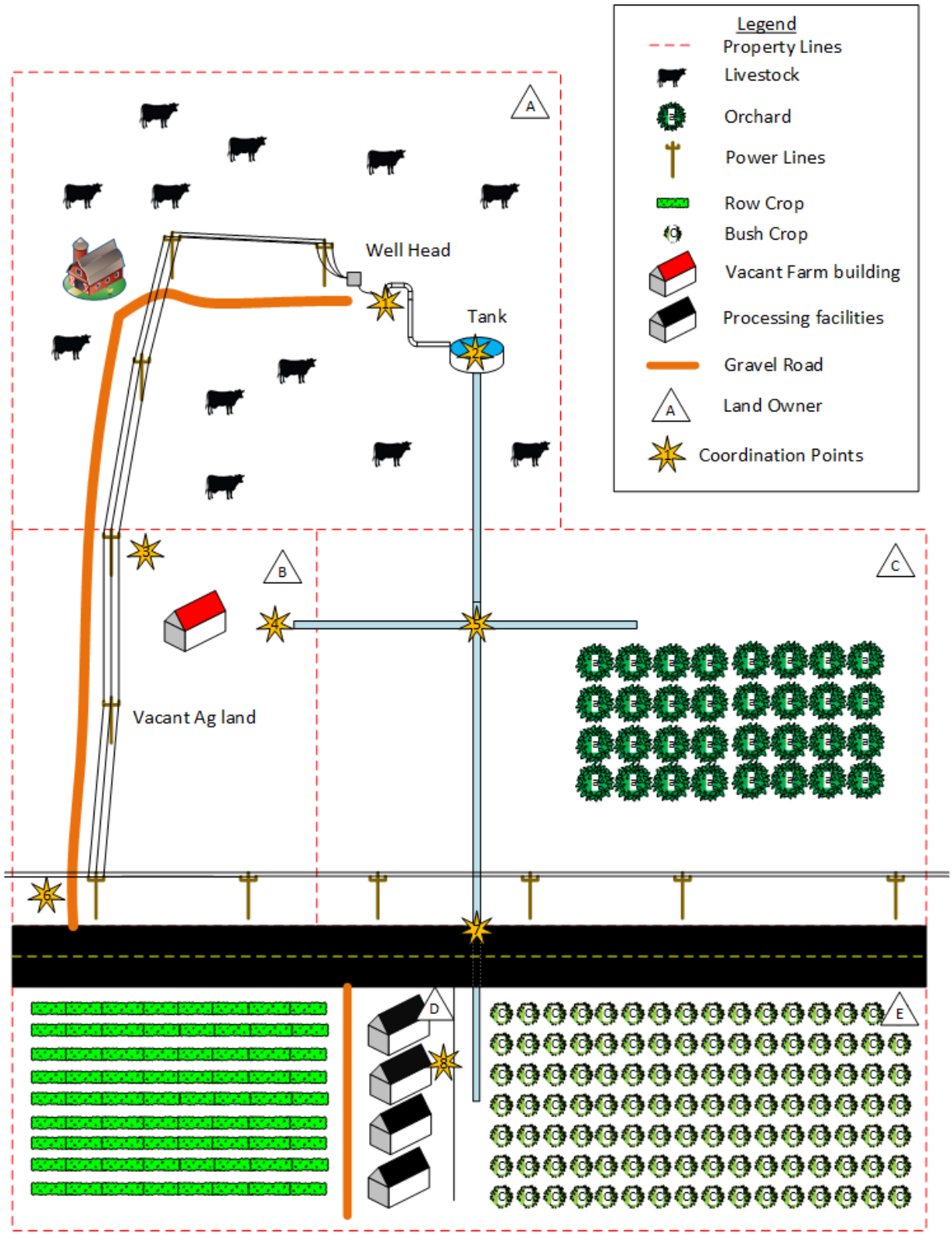


Figure 18

Operation Description: Multi-User Well System

Organizational Possibilities: Sole Proprietor, LLC, Incorporation, Partnership

Operational Elements: The Source, Storage, Distribution, Possible Lift Pumps

Coordination Points: In all interaction points there are critical agreements that must be made regarding responsibilities and rights necessary to ensure stable long-term operations.

1. Well: Unlike the well in the simple system, there is a need to plan for well operations. In most cases, demand is managed by filling a tank in order to reduce the operational cycles of a well. In the case of multiple users, coordination is important to ensure efficient use of the well. In addition to meeting demands, there is often a reduced rate if pump times are coordinated with the utility. Cycle times will need to be within the constrained time. Ideally, the daily use follows the pattern of:

    a. The heavy demand starts,

    b. The tank begins to drop,

    c. Well comes on and runs until the day's demands are met,

    d. The tank fills and then the well shuts off. Small demands are met with what is in the tank until heavy use begins again.

    This will require coordination of use and timing. For best efficiency it will be important the tank does not fill completely until the end of the cycle but must not run dry. Flow and storage will need to be managed to reach the most efficient and cost-effective level of use.

2. Tank/Storage: Common storage has certain interactional challenges.

    a. What entity owns the tank?

    b. Who is responsible for upkeep and replacement?

    c. Are expenses shared evenly or based on percentage of water used?

    d. How is the water divided/used in times of crisis? Pump failure etc.

3. Electric Lines/ Access: Electricity transmission easements are normally held by the utility. In order to keep the system as clean as possible, all transmission should belong to the utility. In some cases, transmission lines are put on agricultural land after a "Master Meter". This is also known as the demarcation point. If the system is private it is important to ensure a solid agreement is in place to ensure access and sustainable operation if one or more parties' defaults or separates from the agreement.

4. Inactive lateral: North Kohala is a model of evolving agricultural use and land ownership. It is not uncommon for systems to go inactive for periods of time or be abandoned. In a system that has multiple users, this can result in an attached relic that costs to maintain but is not in use. That same relic can also be part of the value of the land that is not in use (the land has access to water). Any agreement should address responsibilities and contain remedies for this type of situation. It can be an agreement to contribute to costs regardless of use or have a separation clause after a period of non-use. Whatever the solution, a plan should be in place

that allows for clean separation if entities no longer contribute to the operation or no longer want to be part of the system.

5. Distribution Control Point: There needs to be clear delineation on access and responsibilities anytime a control point is present. As in previous elements, management becomes critical when demand exceeds the available resources. Control points can become critical to maintaining flow in a stressed system.

   In this model there is a mix of crop types and vacant areas. Priority can be assigned based on ownership, use, contribution or need. Animals suffer and can die within a couple of days but are a low economic density in most business models. Orchard and bush crops are usually more capable of surviving dry periods but yield may suffer. Row crops are the most sensitive after animals, but many have short field lives. These would not be replanted unless water became available.

   With the differing demands, related incomes and impacts governing documents of the water system needs to set expectations for the users. This will allow for effective planning by each of the respective users and prevent conflict in times that will, by their nature, be difficult.

6. Access Road: Access roads are often a point of contention. Many issues can arise especially when expectations are not set. These can include, but are not limited to, times of access, who can use the road, responsibility if gates are left open, speed limits, responsibility of maintenance and appearance. All of these issues should be discussed and included in the agreement with enough flexibility to allow for unexpected situations.

7. Road Crossing: Road crossings pose a unique challenge to agriculture. With crossings costing in excess of $150,000 and taking over a year to install, they become a critical juncture for agricultural entities. An additional challenge exists when water comes from a different owner or system.

   A road or highway crossing is just that, a crossing. In order for it to be useful, other elements of the system must align. Easements from the source to the demand must be placed in such a manner that the crossing fits into the plan. In most cases, opposite sides of the road are different parcels of land. Even if they are owned by a single entity, easements should be established to ensure the system will survive the sale of any parcel of land that may affect the overall function.

8. Licensed or sublease tenant responsibilities: In this parcel, D is the land owner and E holds a license to farm the property. Again, with the long operational lifespan of many of these systems, there is a possibility the operations of the land may change even if ownership is maintained. The above responsibilities will still need to be met. In order to prevent missteps, the base agreement should include a clear delineation of responsibilities that shall be met by the owner regardless if they are the operator or not. The owner is then responsible for including those elements in an agreement with any operators or accept them themselves.

Operational Challenges:

1. Well compliance: At a minimum total volume pumped, chlorides and temperature will be required to be submitted to CWRM on a monthly basis. It is important that one party is responsible and ensures compliance. Additional issues may come up when well pump service is needed. If a different size pump is used, permits and testing may be required by CWRM.

2. Well operations: The actual operation of the well probably will be automated but regular checks and maintenance on the system will still be needed. One party should oversee the checks and maintenance.

3. Electricity Utility: There are a couple of issues to be mindful of with the electrical utility. First, as discussed in section 3.4, there are multiple rate structures and limitations of the power system. Kohala is far from the primary generation systems and large motors may have a disproportionate impact. The operator will need to ensure compliance with any rate structure and any limitation imposed by the utility.

   Second, it is important to keep a close eye on the power itself. In the case of three phase power, the distance, exposure and age of the transmission lines can result in fluctuation in power during weather events. It is important to monitor and ensure adequate protection is in place for the well equipment. A major surge or undervoltage situation may burn out an expensive well pump. As an "act of God" the utility is not responsible for these issues.

4. Liability Concerns: Unlike the single user systems, multiple users and multiple properties can be result in liabilities that need to be addressed.

   First, damage caused by water: Basically, this comes down to the operating agreement. Water can cause damage in many different ways. There are flow issues if a pipe or tank ruptures. As the flow and/or amount of water impounded increases so does the risk

   There are also potential damages from the way the water is delivered. Under any agreement there needs to be a clear definition of parameters under which the water will be delivered (pressure, cleanliness, timing, etc.). Compliance will need to be factored in on the pricing.

   These requirements can also be waived in an agreement. To help manage cost, a less expensive, but also less stable system may be used. Often times short term pressure losses may come from limits in pipe sizes and flows. Who uses what when is as much part of the question as how much is needed in a day. Users will be the cause of system fluctuation. This interaction with the system, and by extension other users, needs to be clear to avoid negative impacts on users of the system.

   While the actual numbers are negotiable it is imperative that an agreement that is realistic in cost and operations is developed. If ignored it is almost a guarantee of conflict between system users and operators.

   Second, damage caused by the lack of water: Many agricultural ventures are time critical for water. This can be for irrigation but can also be part of processing. Either use can be negatively impacted in the event water is unavailable. As with any system, failures should be expected. How they will be managed and how long it will take needs to be part of the discussion.

Included is a method for dealing with proximal cause. If the lower land owner has a pipe break and he drains the tank while the well is down, what are they responsible for? Do they have to truck water in? Can it wait until the well is fixed? Is there a delay? Hours, days, weeks? These will all need to be part of the risk management assessment of the system for the operator.

5. User Conflict: Very few things evoke emotion, especially from agricultural producers, like water. The consumable nature, variations of availability and quality often put water into the position of determining success or failure of an agricultural venture. It is also in a position that the impact will be very rapid. Animals will die in days without water. Crops can be damaged or destroyed without water at critical junctures. When flow stops and storage levels begin to drop, without proper planning, tensions will rise.

   There is also a major issue that comes from the fact that source, storage and transmission often do not occur on the same parcel of land or even under the same owner. When coupled with the evolutionary nature of water systems, and the tendency in agriculture to do business on a handshake, actual agreements may not always be clear. Rights and responsibilities become clouded, especially if the amount needed becomes less that what is available.

   Like most conflict, the real source is unmet expectations. In order to prevent and manage conflict there are two important issues that need to be addressed:

   - First is a diligent effort to seek agreement on how the system will be run. This includes what each should expect to get, what they are responsible for and what will be done in time of shortage or crisis. This may not only be times of drought or reduced resources availability, but situations that may arise from normal operations. If a pipe fails, who fixes it? Who pays for it? What if it's the result of accidental damage? If it's at night, can it wait until morning? These are just a sample of the questions that need to be explored and agreed to.

   - Second is ensuring there is a means of managing disagreement. One fundamental truth is no matter how diligent, there is a very good chance that something that was not considered may arise. Many of these cases can be solved by simple communication and addressing the issue. In some cases, there may be resulting disagreement. Having a method in the agreement that will resolve issues is important. This can be accomplished through binding arbitration or mediation. There may also be a need for more than one level. It is important that all parties are comfortable using whatever is selected. This will help ensure short term grievances are resolved before they become a major conflict.

Section 8 – Funding Options for Water Systems

8.1 NRCS

United States Department of Agriculture

August 30, 2017

Dear John,

Thank you very much for taking the time to come to the Waimea Field Office with your presentation on the Kohala Agricultural Water Study you are conducting. As you know from our discussion at the meeting, the Natural Resources Conservation Service and the Waimea Field Office have a long history of serving Kohala with technical and financial assistance for farmers and ranchers as they address their resource concerns. Inadequate water is a common resource concern for Hawaii farmers, ranchers, and land managers. NRCS with it's staff of engineers and conservation planners work to meet the needs of the operation in an efficient, cost effective manner.

The practices we typically use to help address Inadequate Water are: Irrigation Pipeline (430)
Irrigation Reservoir (436)
Irrigation Management System-Micro irrigation (441) Irrigation Water Management (449)
Livestock Pipeline (516)
Pond (378)
Pond Sealing and Lining-Flexible Membrane (521A) Pumping Plant (533)
Roof Run Off Structure-Gutters and Downspouts (558) Spring Development (574)
Sprinkler System (442)
Water Harvesting Catchment (636) Watering Facility (614)

More on these practices can be found at the Field Office Technical Guide, Section 4, Current Standards, https://efotg.sc.egov.usda.gov/treemenuFS.aspx.

I have included some photographs of installed practices for your reference on the following page:

Natural Resources Conservation Service Pacific Islands Area
P.O. Box 50004 Rm. 4-118
Honolulu, HI 96850-0050
808-541-2600
An Equal Opportunity Provider, Employer, & Lender
@NRCS_PIA

Watering Facility-Trough (614) with Heavy Use Area Protection-Gravel on Geotextile (561)

Water Harvesting Catchment-Elevated Roof (636)

Watering Facility- Tank

Pond-Water for Livestock (378)

NRCS provides technical and financial assistance to eligible applicants. Financial assistance comes under the Farm Bill Programs, such as the Environmental Quality Incentive Program (EQIP) or the Agricultural Management Assistance program (AMA) and are administered on an annual basis.

Please contact our office should you need further assistance or more information and please direct any producers you encounter in need of assistance to our office.

Sincerely,

STEPHANIE FICKE-BEATON
Digitally signed by STEPHANIE FICKE- BEATON
Date: 2018.08.30 13:27:52 -10'

S. Jill Ficke-Beaton
USDA Natural Resources Conservation Service Soil Conservationist
Certified Professional in Rangeland
Management # CP15-003 Waimea Field
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67-1185 Mamalahoa
Highway, Suite H148
Kamuela, Hawaii 96743
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Mobile Phone (808) 345-1771 or (808) 937-0314

Section 9 – Recommendations

9.1 Short Term (< 1 year)

9.11 Ag Water Agreement with DWS for Small Scale/Micro Agriculture

The small/micro agriculture operation and opportunities offer the quickest direct impact on agricultural activities. Small operations that are started are very fragile. Any help may make the difference between success and failure. A clear pathway to get access to water may be the factor that determines if a new venture starts or not. By fostering small operations, it becomes more likely that they will grow into larger more self-sufficient businesses.

The Department of Water (DWS) has in its rules, the ability to sell water to agriculture on a favorable rate as long as the system has capacity. The priority goes to domestic water. In Kohala there is no more capacity available. DWS is prepared to participate in an Intergovernmental Agreement (IGA) that sets aside water units for agriculture in exchange for improvements to the system. This may come in the form of a well(s), pipelines or tanks.

It is important to recognize the benefit to all of the community. While there may remain some limits on water meters for housing, this will increase the resilience of the system and support growth and productivity in a way the community has determined. The North Kohala Community Development Plan is very clear.

9.2 Visions, Goal, Values:

"The overall **GOAL** of the North Kohala Community Development Plan is:

> *To manage the future growth of the district in a manner that is consistent with the Kohala lifestyle and ideals of being a rural community with a strong cultural heritage, an agricultural base, and a small-town feel*."

An agreement that supports agricultural production while not disrupting the current limitations of high-level development is consistent with the community goals.

DWS has stated that beyond their rules, they are not prepared to administer the allocation of water units. This means that any application for ag water that has been set aside will need to be administered by an appropriate organization. The Department of Agriculture is prepared to fill this role in the short term with the expectation of passing it to another organization once established.

9.12 Establish interim organization to manage and begin coordination

Develop an RFP to solicit establishment of an interim organization. This entity may come from existing non-profit organizations, groups that will establish such an organization and/or government agency that are interested.

9.2 Mid Term (1-3 years)

9.21 Establish organization(s) to coordinate system management and development.

Non-Profit or Quasi-Governmental Organization.

As has been explained, the lack of an organizing entity to coordinate the ag water system maintenance and development has resulted in agriculture salvaging value from existing systems while not reinvesting in them. Systems and infrastructure are reaching the end of their service life with no plan or funding for replacement, effectively setting up a collapse of the major water system. While non-profit is used to describe the overseeing entity, this term includes options of quasi-governmental/NGO/Semi- Autonomous groups.

The departure of the plantations also left a structural gap in agriculture in Hawaii. Much of the planning, biosecurity, legislative interaction and execution of system plans were done by the plantations. The role of government was primarily one of oversight and regulation. While the agencies that assist with agriculture have moved into this space to a degree, gaps remain. This organization will need to help close the user, develop/manage and regulatory/oversight gaps.

The lesson learned is that an organization focused on delivering water and other supportive infrastructure, properly supported and funded, can be successful in Kohala. The only real shift would be to focus on the goal of facilitating the growth of independent, for profit, enterprises.

As was demonstrated under the plantation era, a large organization with goals that are not aligned with small producers makes small producer viability and growth very difficult. Any organizing entity would need to maintain the mutually aligned interest of growth, rather than competing or participation in the use of resources. Additionally, without the financial support of a major industrial company and the mission of public service, the organization would need to be eligible to accept and manage public funds.

Non-Profit(s) Critical Abilities:

1. Develop and manage need/use database and contacts.
2. Facilitate potential user cooperation.
3. Be qualified to accept public funds.
4. Manage an advisory board of current and potential users to ensure public input.
5. Develop and maintain a data base of material and skill resources.
6. Be able to manage support companies or entities.
7. Manage easements across public property.
8. Negotiate and manage easements for private property.
9. Develop and maintain recommended standards of formation and operation.
10. Assist in legal formation of managing entities for systems.
11. Assist in legal documentation for partnering entities, including easement creation.
12. Possible coordination or pooling for insurances and liability management.
13. Be able to assist in compliance with state water use and disposal rules.

14. Work with and provide resources to current water purveyors to improve availability to users.
15. Provide liaison between county, state and federal agencies (i.e., DOH, DOA, USDA etc.).

The DLNR will need to develop an RFP and evaluate entities for this role.

9.3 Long Term (> 3 years)

9.31 High level water system

There are two low energy options for high level water systems. First is the utilization of the highest springs, moving the water as needed. Second is the reactivation of the Kehena Ditch intakes.

The first option could be started on a small scale with a coordinating entity managing the flow and customers. From that point it could be expanded according to demand and participation. Lateral flow is possible with the relatively high elevation of some of theses sources.

The second would be a reactivation of the Kehena Ditch or parts of it. The intakes still exist and function. If agreements with the major land holders could be reached one or more pipelines could be utilized to move the water virtually anywhere in Kohala from Pololu all the way to Mahukona. This would open up the options for many of the dryer regions.

9.32 Stabilize

Once an organization, or organizations, are in place a plan and reserve will need to be established to ensure the process and evolutions can continue without running into the problems we face today. This will need to involve community input, organizational acceptance and planning as well as legislative regulatory and finical support. While too soon to finalize this role, it will be important that any plan is able to sustain the pathway to agricultural growth in Kohala.

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Section 10 Appendices

A. Resource Review

B. Well Prices / Pumping Costs

C. Easement Instructions

D. Dam Regulations

E. Sample Tanks

F. Figures and Maps

Appendix A

North Kohala Water Resources

North Kohala Agricultural Water Study

Abbreviations

AWUDP	Agricultural Water Use and Development Plan
CDP	Community Development Plans
CWRM	State of Hawaii Commission on Water Resources Management
DHHL	Department of Hawaiian Homelands
DLNR	Department of Land and Natural Resources
DOH	State Department of Health
DWS	Department of Water Supply
ET	Evapotranspiration
HDOA	State Department of Agriculture
HDOH	State Department of Health
HRS	Hawaii Revised Statutes
LUPAG	Land Use Pattern Allocation Guide
MGD/mgd	million gallons per day (water)
mg/L	milligrams per liter
P	Precipitation
R	Recharge
RO	Runoff
SWPP	State Water Projects Plan
SY	Sustainable Yield
WRPP	State Water Resource Protection Plan
WUDP	Water Use and Development Plan

Table of Contents

1 Hydrologic Setting

1.1 Physical Setting and Geologic History

North Kohala forms a peninsula on the northernmost portion of Hawai‘i Island consisting of the elongated Kohala Mountain, an extinct, post-shield stage volcano with a summit elevation of 5,605 ft, encompassing about 234 square miles, or about 40% the area of the Island of Oahu. Although boundaries of North Kohala vary, in this discussion we consider North Kohala to include all terrains that have been produced by Kohala Volcano, essentially the peninsula of North Kohala, proceeding clockwise from Mahukona around to the Honokane Valley, as the Kohala Ditch's first intake is located here. This is distinct from the study area of this report, which does not include areas away from the studied water infrastructure including the areas of Kawaihae, Mahukona, as well as Waipio.

Kohala Volcano was formed by thousands of lava flows that erupted from two main rift zones and possibly from a now-buried caldera. Shield volcanoes are generally described as passing through four stages in their life cycles: pre-shield, shield, post-shield, and rejuvenated (Clague and Sherrod 2014). Kohala Volcano, being extinct, has passed through these stages. Basaltic and andesitic lavas of the Pololu and Hawi Volcanics, respectively, erupted from two main rift zones that trend 35 degrees west and 65 degrees southeast from Kohala summit, the northwest and southeast rift zones (Wolfe and Morris 1996). The Pololu Volcanics are the older of the two series, followed by the less voluminous Hawi Volcanics. These rift zones are delineated by the crest of the Kohala Mountain, and by spatter and scoria cones (plc, plmc, hwc, hwbd, and hwd series) that dot the crest. The Hawi Volcanics are primarily lava flows composed of hawaiite and mugearite (hw) as well as trachyte from vents (hwt) (Wolfe and Morris 1996) of 120,000 to 230,000 years of age (Figure 1). The Pololu volcanics consist of basaltic (pl) and mugearite (plm) lava flows of 250,000 to 400,000 years of age, although some older lava flows in the sequence have been dated to more than 700,000 years of age. Many of the surface lava flows can be traced back to their source vents (Wolfe and Morris 1996).

The original caldera of the Kohala Volcano may have been centered near the head of Waipio Valley (Kinoshita 1965). The volcanic shield, or dome, consists primarily of permeable, thin-bedded basaltic lava flows. Numerous dikes consisting of thin, nearly vertical sheets of massive, low-permeability rock have intruded lava flows in the rift zones, but exposed dikes are only found in the deeply eroded valleys on the eastern slope of Kohala Mountain.

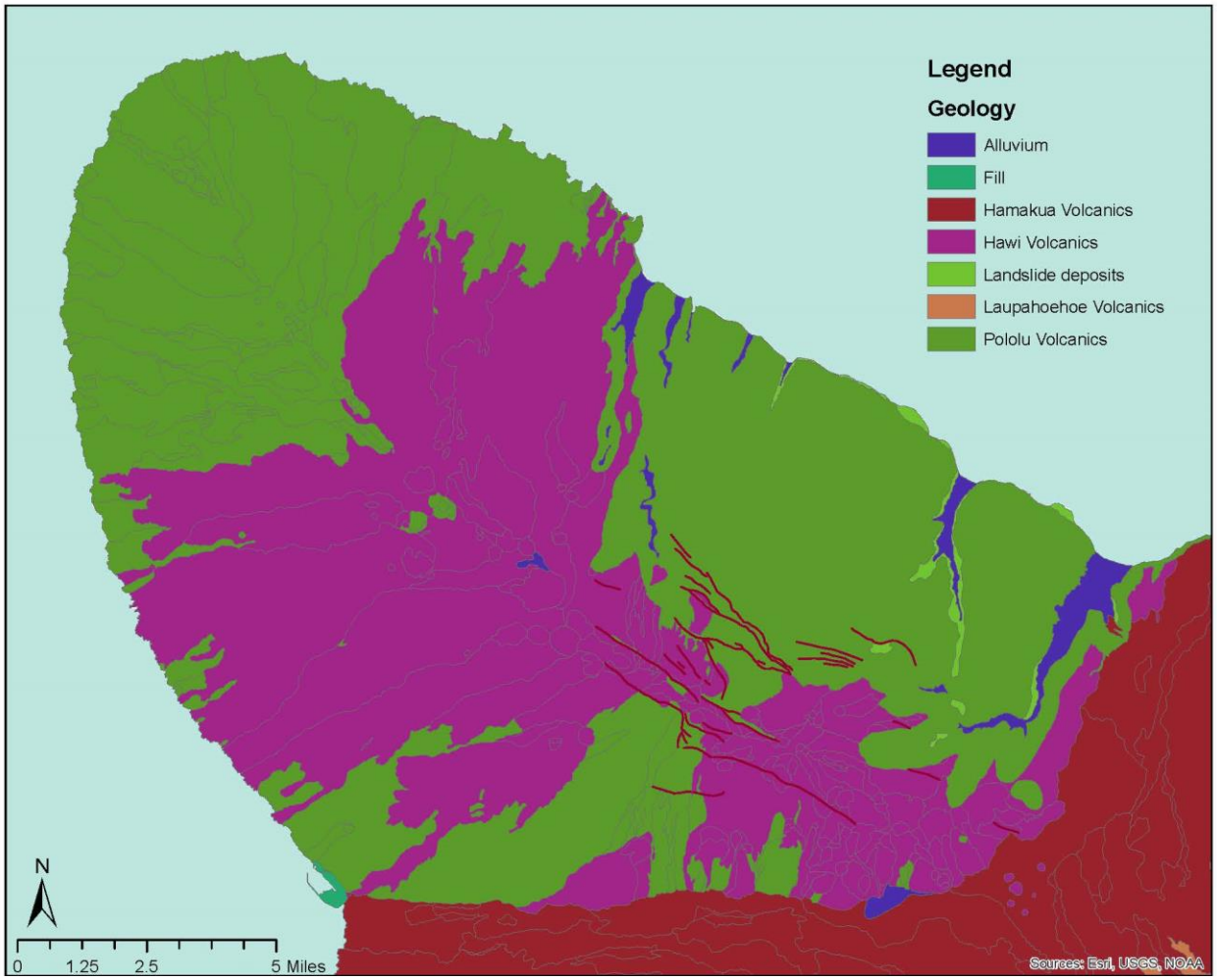
The basalts of the Pololu Volcanics weather to red-brown soils and in places weathering has been so thorough that these lava flows are almost completely decomposed down to depths of 50 to 200 feet. Soils of the younger Hawi Volcanics are generally a few inches to three feet thick, and tend to be rocky in arid locations (Stearns and Macdonald 1946).

Subsidence of Hawaiian volcanoes due to isostatic pressure on the underlying plate is specific to each island, and older, eroded volcanoes may be experiencing rebound. Hence the observed change in sea level at a specific location is due to both so-called eustatic, or global, sea level change, and isostatic sea level change due to each island's subsidence. Clague and Sherrod (2014) state that the combination of erosion and subsidence erase the visible portion of Hawaiian

volcanoes in about 15 million years. Tide gauge data for Hawaii Island show sea level rise at about 3.1 mm/year (Moore 1970, Caccamise et al. 2005).

A curious aspect of the geology of North Kohala is the indented nature of the windward coastline from Pololu Valley to Waipio Valley. A trace of the contours across the land surface of this area show that equal elevation contours have moved seaward in this area, relative to adjacent areas in North Kohala and the Hamakua District. Additionally, fault lines are apparent at the crest of the Kohala Mountains above this area (Moore et al. 1989). Taken together, these features indicate mass wasting (i.e., a landslide) at least 120,000 years before present, with the lower portion of this slide producing a debris avalanche called the Pololu Slide, resulting in the indented coastline.

Figure 1. Geologies of North Kohala



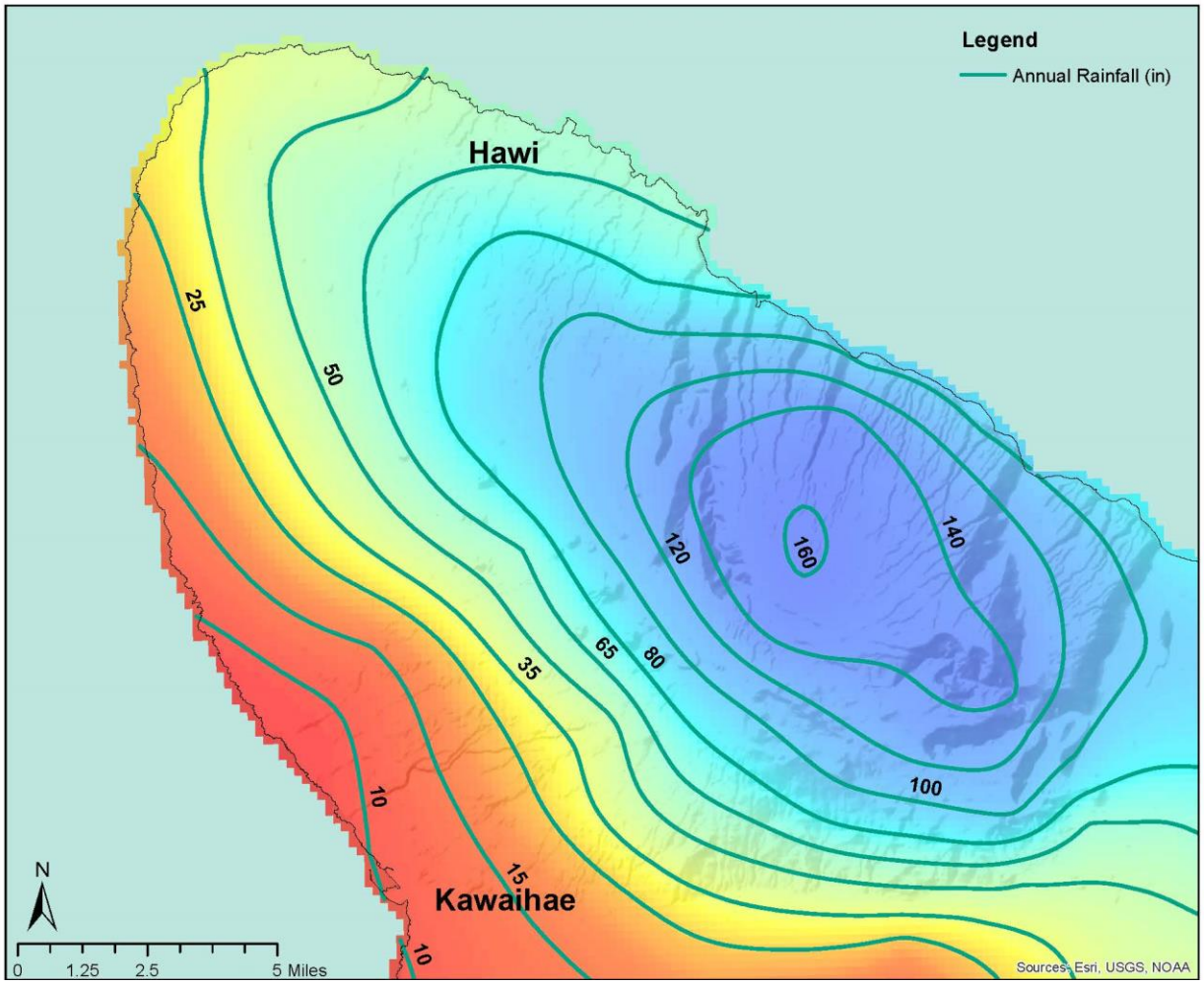
1.2 Climate and Precipitation

Rainfall in Kohala is primarily orographic, forced by the typically northeast trade winds which bring an influx of moist air from the northeast Pacific Ocean (Figure 2). Thus precipitation in Kohala is demarcated into two regions: the wet windward and dry leeward areas, with

transitional areas in between (Figure 3). Rainfall on the windward slope of Kohala, deeply cut by gulches and cathedral valleys, has a maximum of more than 160 inches/year, at around 3000 to 4000 feet of elevation. This decreases to less than 9 inches/year on the leeward coast near Kawaihae. Rainfall in windward portions of Kohala show a wet March-April period, an increase in summer months followed by a drier autumn period (Giambelluca et al. 2018). Leeward areas, however, show a more regular seasonality of precipitation, with wetter winter months and drier summer months.

Figure 2. A view of the Kohala Mountains from Waimanu Valley. The drenching trade-winds deposit copious amounts of moisture on the mountains through the process of orographic precipitation.

Figure 3. Annual Rainfall of North Kohala



1.3 The Hydrologic Cycle

The hydrologic cycle refers to the constant movement and connectedness between water in different states and locations including groundwater, ocean water, fresh water, and the atmosphere. The hydrologic cycle is largely driven by solar energy and gravity. Solar energy drives evaporation and evapotranspiration, the loss of water from soils and surface water and the transfer of water from plants to the atmosphere through transpiration. Water vapor is produced by wind, solar heating, and evapotranspiration, is transported and eventually falls as rain. Rainfall is either taken up by vegetation, it infiltrates to produce groundwater, it runs off to the ocean or streams, or evaporates (Figure 4).

The hydrologic cycle can be expressed quite simply mathematically by:

$$R = P - RO - ET$$

Where R is the recharge of groundwater due to infiltration and percolation, P is precipitation, RO is runoff and ET is evapotranspiration. As land use varies, so does recharge; urbanized areas with impermeable surfaces like roadways allow relatively little rainfall to infiltrate and recharge

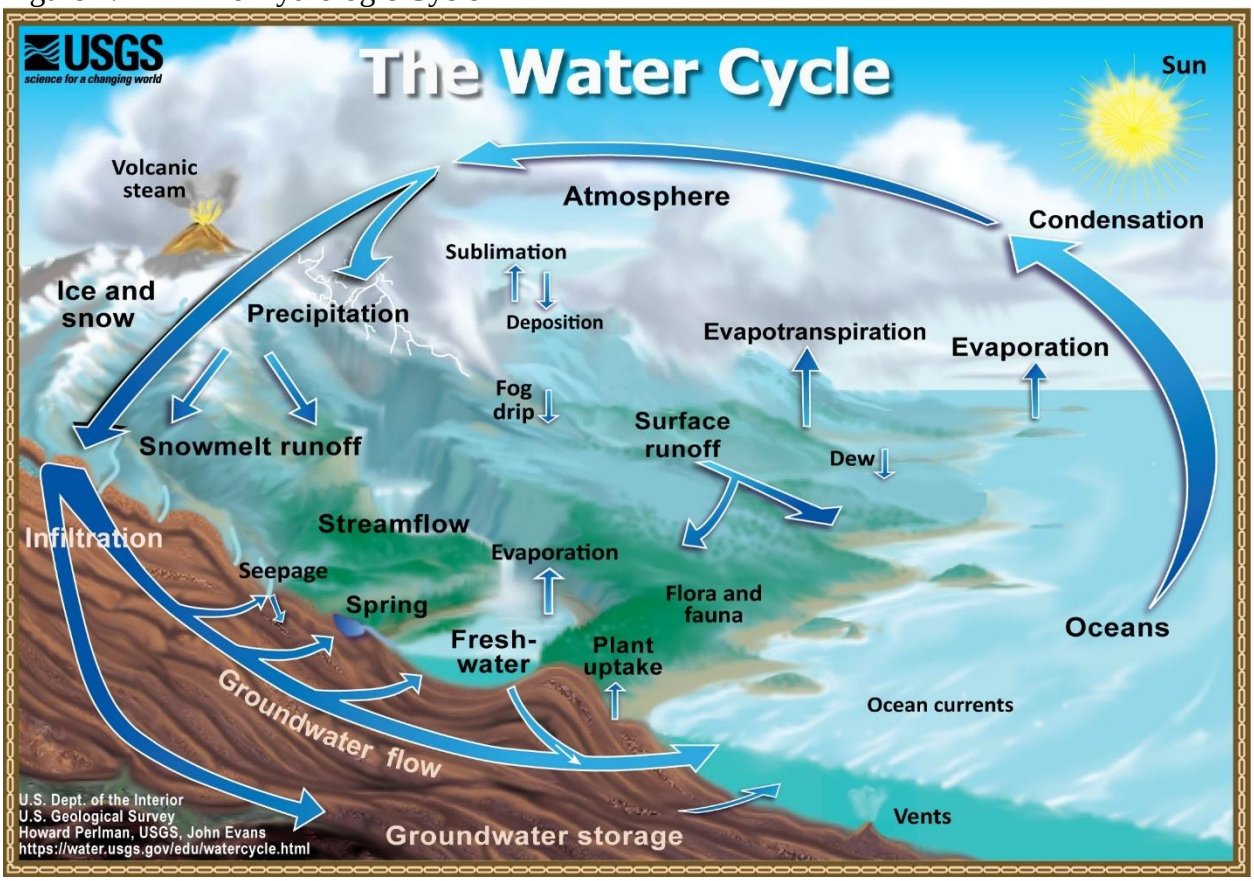
aquifers and hence increase runoff, while thick vegetation, by slowing down the rate at which rainfall flows downhill, increases recharge.

This equation represents pre-development recharge of groundwater. Post-development, with consideration of withdrawals of groundwater and surface water the change in ground water storage may be expressed by the following equation:

Change in Storage = Inflow – Outflow – Withdrawal

If withdrawal and outflow are greater than inflow, ground water depletion results.

Figure 4. The Hydrologic Cycle



1.4 Recharge and Sustainable Yield

Sustainable yield (SY) is defined as the quantity of (basal) ground water that can be extracted in one aquifer without impairing water quality or causing ecological impacts. It is further defined by Chapter 174C-3 HRS as, "…the maximum rate at which water may be withdrawn from a water source without impairing the utility or quality of the water source as determined by the commission." Sustainable yield can also be seen as a fraction of the recharge. Sustainable yields for particular aquifers are used to manage ground water resources, and were first adopted in Hawai'i by CWRM in the 1990 Water Resources Protection Plan, and refined in 1993 to consider the smaller Aquifer System approach of aquifer delineation. Calculation of sustainable yield is performed using the Robust Analytical Model (RAM), which calculates the variation of hydraulic

head in the basal aquifer over time in response to pumping stress, utilizing basal aquifer hydraulic head data. Sustainable yield is essentially an aquifers recharge multiplied by the fractional withdrawal. Conceptually, sustainable yield differs from recharge be the degree to which an aquifer is stressed by pumping and withdrawals. A more thorough description of the relationship between recharge and sustainable yield can be found in the WRPP Update, Appendix F.

The 2018 WRPP Update estimated sustainable yields for the Kohala Aquifer Sector systems of Hawi, Mahukona, and Waimanu (Table 1, CWRM 2018).

Table 1. Kohala Aquifer Sector Systems Sustainable Yields

Aquifer Sector	**Aquifer System**	**Sustainable Yield 2018 WRPP**	**Recharge Engott 2011**	**Recharge WRPP 2018**
Kohala		131 mgd		
	Hawi	11 mgd	21.09 mgd	
	Mahukona	10 mgd	38.00 mgd	
	Waimanu	110 mgd	147.0 mgd	

It should be emphasized that Sustainable Yield is not to be seen as the exploitable rate of groundwater use, that SY values are estimates, and that the estimates reflect the average daily pumpage over an entire aquifer system assuming wells are spaced optimally. Pumpage near the SY would be an unusual situation, as SY does not consider the feasibility of developing groundwater, nor whether the groundwater is potable or brackish.

Recharge is the fraction of rainfall that infiltrates soil and works its way to groundwater due to gravity. This fraction depends sensitively upon the terrain, including the slope and type of surface, ranging from zero for impermeable surfaces like pavement to higher values like 80% for dense forests. Engott (2011) estimates the total fraction of rainfall that infiltrates for Hawaii Island is 49% of mean annual rainfall, or 6,594 mgd. Estimates of recharge obviously affect calculations of sustainable yields, so much interest has gone into improving infiltration models using GIS data sets of land use, improved and more recent rainfall data, as well as improved details of the hydrologic cycle including for parameters including drip, irrigation, and evapotranspiration, not to mention additional computing power for greater spatial and temporal granularity.

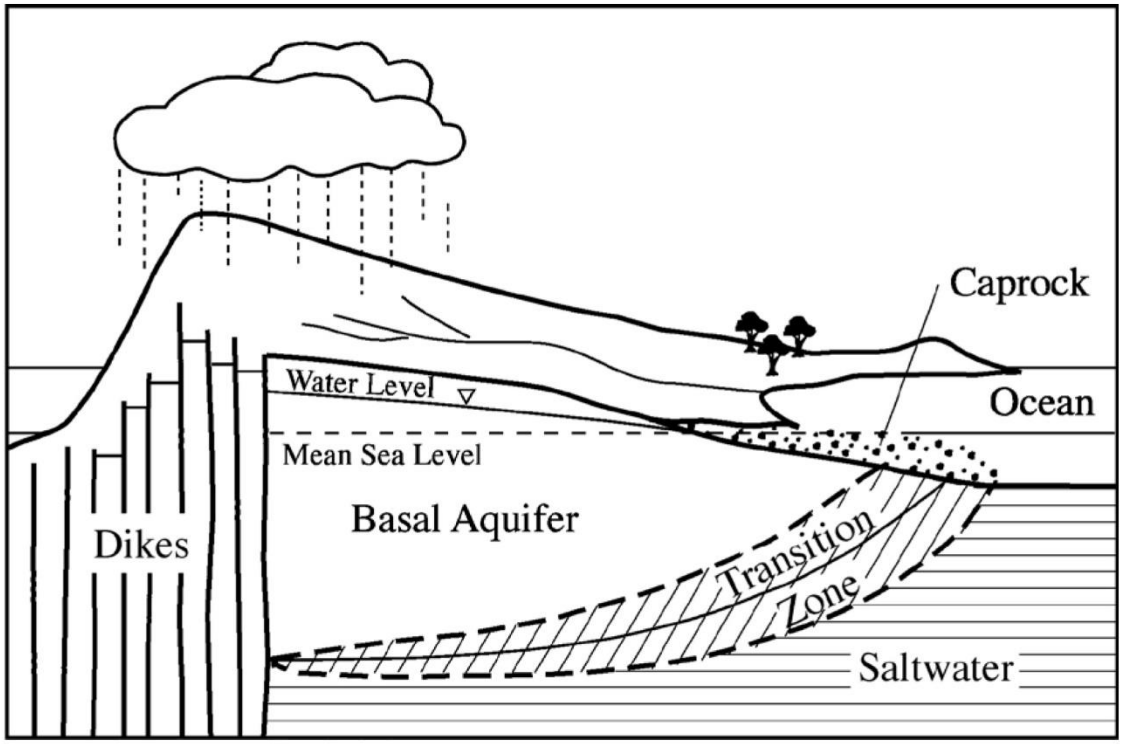
Engott (2011) found that the fraction of water inflow that becomes recharge for leeward North Kohala is uniformly less than 20%. This is also the case for the agricultural band towards the windward side of the Kohala crest, with the exception of areas of the Waimanu Aquifer System, and a small fraction of the Hawi Aquifer System, which have higher estimated recharge fractions of up 40% – 59% in areas with the highest rainfall.

1.5 Ground Water in North Kohala

Through the process of infiltration ground water is derived from rainfall, which percolates downward until it meets an aquifer, then flows downhill with the gradient of the aquifer. In most places this infiltrated ground water reaches the basal aquifer, which consists of a lens of fresh water

floating on denser, brackish groundwater beneath. Basal ground water ultimately reaches the ocean, with the timescale for this depending inversely upon the permeability of the rock, also expressed as the hydraulic conductivity, through which it flows. Generally encountered near sea level, the basal aquifer grows in thickness slowly with distance from the shoreline. Near the shoreline a zone of tidally-forced mixing exists, so basal groundwater generally becomes more brackish with proximity to the shoreline. This brackishness can be exacerbated by pumping near the shoreline, causing sea water intrusion. Due to the high permeability of Hawaiian lavas, this zone of brackishness may extend for several miles inland. This "lens" is also referred to more specifically as the Ghyben-Herzberg lens, after those hydrologists who first described this phenomenon, although it should be noted that Carl B. Andrews of the University of Hawai'i independently published an explanation of the freshwater lens in 1909 (Wentworth 1951). A general conceptual diagram of groundwater in Hawai'i is shown in Figure 5.

Figure 5. Schematic of Hawaii Groundwater



Note: Adopted from 2018 WRPP Update

On Hawai'i Island, groundwater encounters the surface where there are perennial streams, demonstrating that not everywhere is the groundwater basal. Groundwater in such areas is referred to as "high level", and is either trapped between dikes, intrusive and vertically-oriented volcanic features of low-permeability, or is found in horizontally-oriented lava layers confined by low-permeability layers. The latter, "perched" water, is usually found confined by so-called "caprock", or lower permeability sedimentary rock. On Hawai'i most high-level water is thought to be confined by dikes. Exploration of high-level groundwater is a relatively recent development. The CWRM database shows that a number of tunnels in North Kohala utilize dike-impounded water at elevations significantly above sea level.

According to Lau and Mink (2006) groundwater that accumulates in the mountains is generally of very high quality and requires no treatment for potability, with typical chloride concentrations of only 10 to 20 mg/L, 35 to 45 mg/L of silica, and less than 1 mg/L of nitrate nitrogen. Other minerals also occur naturally but at levels far below water quality standards. The picture presented of generally uninterrupted mauka-makai flow or ground and surface water is limited, and the actual behavior of water is highly site-specific and complex.

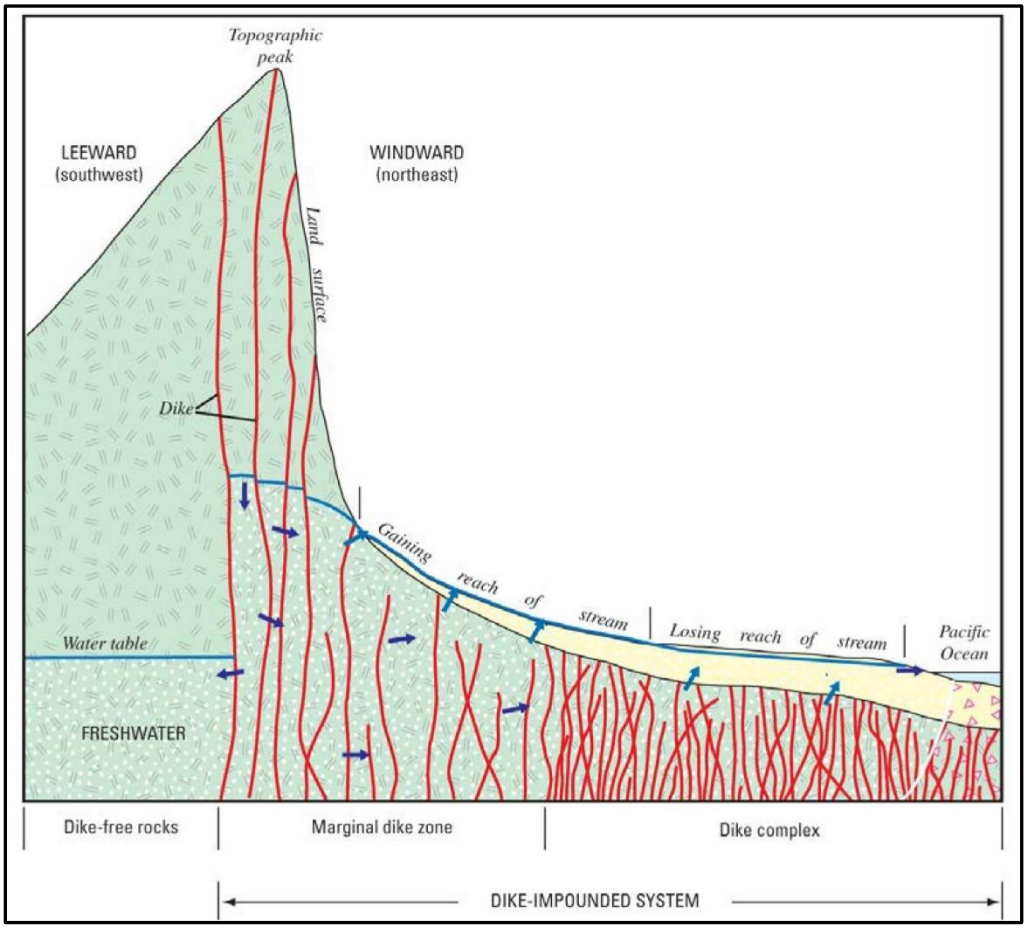
In the case of dike-impounded groundwater (Figure 6), some leakage occurs, and this water flows to down-gradient dike compartments or to the basal aquifer, although this dynamic is poorly understood. Dike-impounded water may overflow directly to a stream where the stream channel has breached dike compartments.

Perched water is also considered high-level water, and is entrained on top of lower permeability layers, including volcanic ash layers, dense volcanic rock or clayey sediments. Where perched layers encounter the ground surface, possibly because of erosion, springs often result. Perched water supplies are often developed by tunnels or diversion of springs.

So, with respect to a particular stream, a number of processes may determine stream flow in a given location along the stream. The upper portion, such as with a number of windward North Kohala streams, may encounter dike water, resulting in so-called cathedral valleys from erosion at the head of the stream. Streams may be "gaining" through groundwater leakage from high-level water along its course, such as Honokane Nui Stream. In the absence of groundwater contact streams may be "losing" streams with declining discharge, such as with Pololu Stream, which is not perennial along its entire course. Thus, in the case of Pololu and Honokane Nui Streams we see significant differences between the behavior of streams that are adjacent, illustrating the complexity inherent in these groundwater-stream systems.

The lateral movement of developed groundwater adds another level of complexity. In North Kohala a large number of tunnels were developed, the Kohala-Awini Ditch System. The Awini Ditch system, although in a state of disrepair, was constructed to collect from 18 streams including the East Branch of Waikoloa Stream, the West Branch of Honopue Stream, and the West Branch of Honokea Stream. This lateral movement represents the direct transfer of water from one aquifer system to another, where a portion of that water may infiltrate and reach ground water.

Figure 6. Representation of Dike-Impounded High-Level Groundwater



Note: Adapted from 2018 WRPP Update

1.6 Description of Aquifer Systems

Mink and Lau (1993) classified Hawai‘i Aquifers and Aquifer Systems by their type, status and geology (Figure 7). The aquifer type is either basal or high level, and unconfined, confined, or uncertain. Geology is described as flank, dike, flank/dike (indistinguishable), perched, dike/perched (indistinguishable), and sedimentary. These descriptors are coded by number as shown in Table 2.

Figure 7. Hawai‘i Island Aquifer Systems

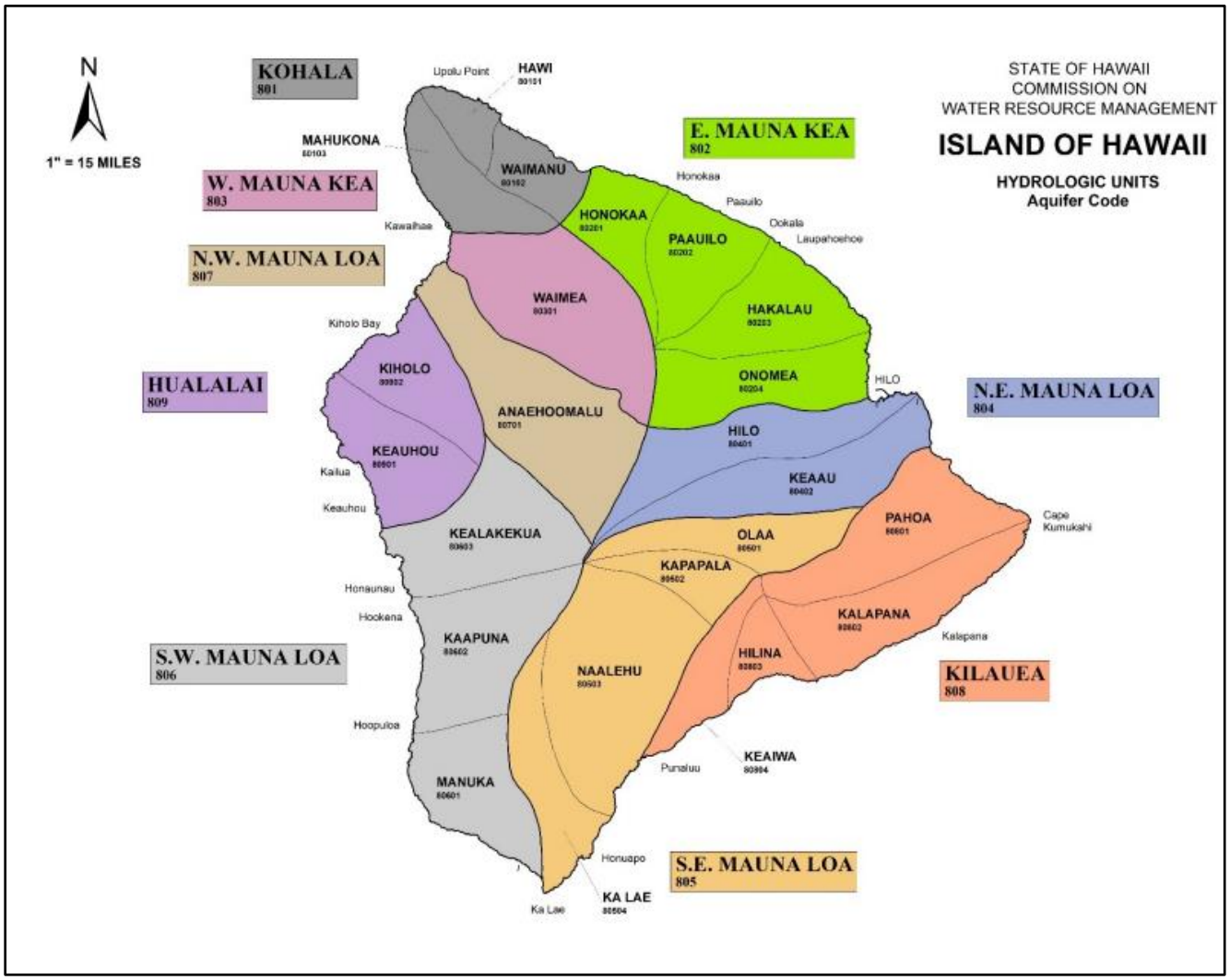


Table 2. Aquifer Type Description of Mink and Lau (1993)

No.	Type	Description
1	Basal	Fresh water in contact with seawater
2	High Level	Fresh water not in contact with seawater
1	Unconfined	Where the water table is the upper surface of the saturated aquifer
2	Confined	Aquifer is bounded by impermeable or poorly permeable formations; top of the saturated aquifer is below the surface of the groundwater.
3	Confined or Unconfined	Where the actual condition is uncertain.
1	Flank	Horizontally extensive lavas
2	Dike	Aquifers in dike compartments

3	Flank/Dike	Indistinguishable
4	Perched	Aquifer on an impermeable layer
5	Dike/Perched	Indistinguishable
6	Sedimentary	Non-Volcanic Lithology

Further, Mink and Lau described each aquifer system by status, using five different descriptors including development stage, utility, salinity, uniqueness, and vulnerability to contamination (Table 3).

Table 3. Aquifer Status Descriptors of Mink and Lau (1993)

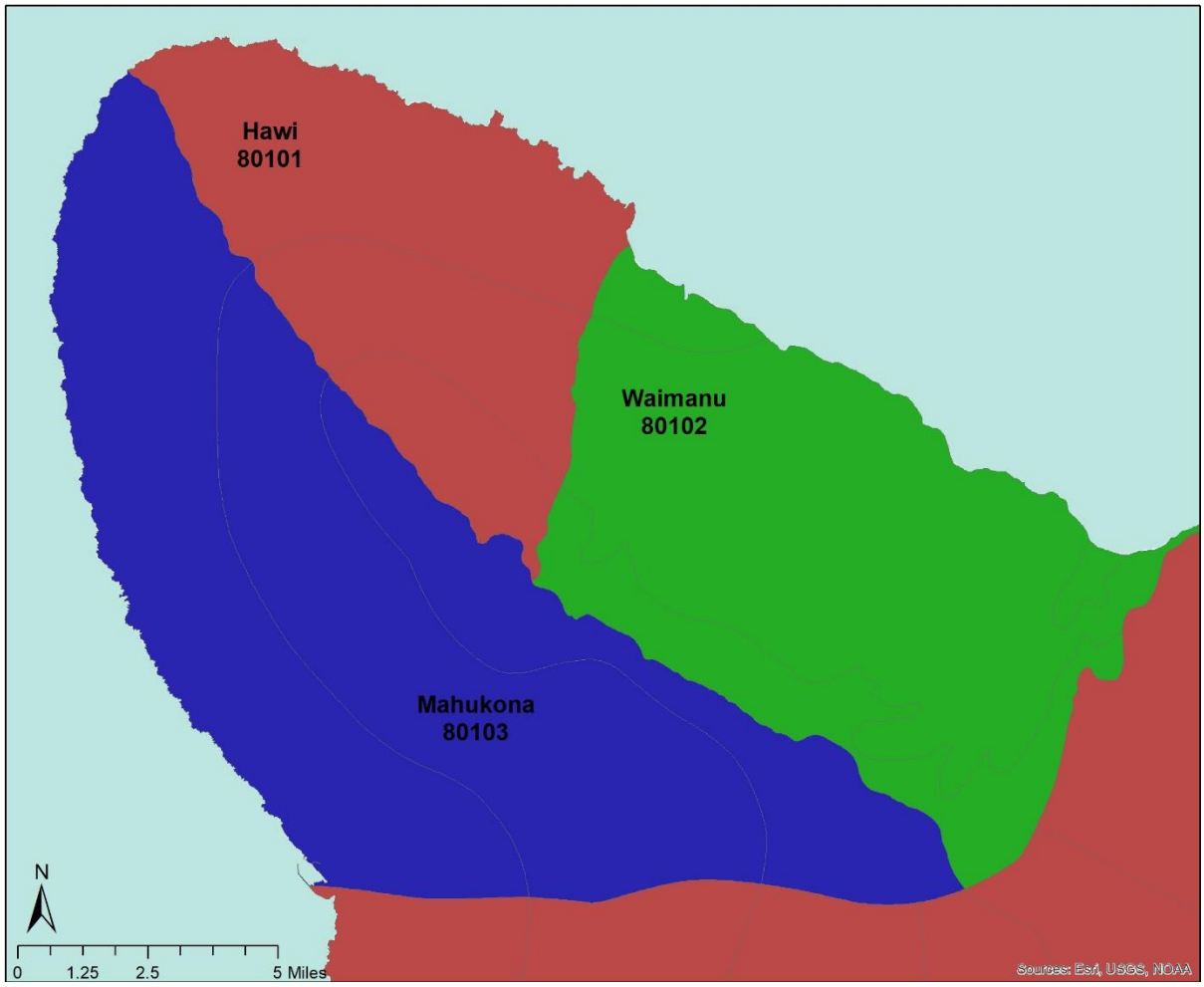
Category	**No.**	**Status Element**
Development Stage	1	Currently Used
	2	Potential Use
	3	No potential use
Utility	1	Drinking
	2	Ecologically important
	3	Neither
Salinity (mg/L Cl^-)	1	Fresh (<250)
	2	Low (250-1,000)
	3	Moderate (1,000-5,000)
	4	High (5,000-15,000)
	5	Seawater (>15,000)
Uniqueness	1	Irreplaceable
	2	Replaceable
Vulnerability to Contamination	1	High
	2	Moderate
	3	Low
	4	None

In this manner, Mink and Lau (1993) designate an aquifer type and status code for each aquifer system, and sometimes two codes as both upper level and basal aquifers are described in some locations. The purpose of this coding system is to facilitate understanding of ground water hydrology by delineating areas that are related and exhibit similar characteristics. The primary objective of the coding system is to provide standard aquifer delineations for the coordination of data, information, and resource management practices. In general, each island is divided into regions that reflect broad hydrogeological similarities while maintaining hydrographic, topographic, and historical boundaries where possible. These divisions are known as Aquifer Sector Areas. Smaller subregions are then delineated within Aquifer Sector Areas based on hydraulic continuity and related characteristics. These sub-regions are called Aquifer System Areas. In general, these units allow for optimized spreading of island-wide pumpage on an aquifer-system-area scale. It is important to recognize that Aquifer Sector Area and Aquifer System Area boundary lines were based largely on observable surface conditions (i.e.

topography, drainage basins and streams, and surface geology). Hydrogeologic features and conditions at the surface may not adequately or accurately reflect subsurface conditions that directly affect groundwater flow. Mink and Lau (1993) emphasize that the Aquifer Sector Area and Aquifer System Area boundary lines should be recognized as management lines and not as hydrologic boundaries. Communication of groundwater between Aquifer Sector Areas and between Aquifer System Areas is known to occur. There are a total of 113 Ground Water Hydrologic Units delineated across the islands of Kauai, Oahu, Molokai, Lanai and Kahoolawe.

North Kohala contains three aquifers: Mahukona, Hawi, and Waimanu (Figure 8). The Kohala Aquifer Sector includes all of Kohala Volcano, with the southern boundary formed partially by the contact between Mauna Kea lavas and Kohala Volcano lavas near Kawaihae Road, and on the other side by Lalakea Stream from Waimea to Waipio Bay. Kohala lava flows are distinguished as being of the younger, alkalic basalts of the Hawi Volcanics and the older tholeiitic basalts of the Pololu Volcanics.

Figure 8. Aquifer systems of North Kohala



1.5.1 The Hawi Aquifer System

The Hawi Aquifer System extends from Puu Pili, along the crest of the Kohala Mountains, northwest to the northern extremity of the island between Puakea Point and Upolu Point, with the eastern boundary being Polulu Valley. Thus the Haqi Aquifer system underlies areas that are densely vegetated forest, as well as agricultural areas close to the communities of Hawi and Kapaau. Mink and Lau (1993) state that where rainfall is substantial and the Hawi Volcanics overlie the Pololu Basalt, perched water occurs. Also, high-level dike water also occurs inland in the rift zone. Over a distance of 2 to 3 miles inland the Pololu Basalt contains a basal lens.

The Hawi Aquifer System of the Kohala Aquifer Sector contains a handful of distinct aquifers including basal and upper-level aquifers, as well as those distinguished by distance inland. These are described in Table 4.

The State Water Resources Protection Plan (CWRM 2018) states that the Hawi Aquifer System has a sustainable yield of 11 mgd, and notes that this aquifer system contains ground water as basal, perched, and high level, with all the reported ground water use pumped from the basal zone.

Table 4. Hawi Aquifer System Characteristics Summary

	Aquifer Code	**80101111**	**Status Code**	**11111**
Hawi Basal Aquifer	Island Code	8–Hawai‘i	Development Stage	1–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	01-Hawi	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	1–Basal	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	1–Flank		
Region	**Aquifer Code**	**80101213**	**Status Code**	**21111**
Hawi Mid-Level Aquifer	Island Code	8–Hawai‘i	Development Stage	2–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	01-Hawi	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	3–Confined or Unconfined		
Region	**Aquifer Code**	**80101214**	**Status Code**	**21111**
	Island Code	8–Hawai‘i	Development Stage	2–Potential Use

Hawi Inland Aquifer, Upper Level	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	01-Hawi	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	4–Perched		
Region	**Aquifer Code**	**80101212**	**Status Code**	**21112**
Hawi Inland Aquifer, Lower Level	Island Code	8–Hawai‘i	Development Stage	2–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	01-Hawi	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	2–Moderate
	Aquifer Type, geology	2–Dike		

1.5.2 The Waimanu Aquifer System

The Waimanu Aquifer System starts at the western divide of Pololu Valley and extends eastward to Lalakea where the Hawi Volcanics meet the Mauna Kea rocks, with the Kohala Mountain crest forming the inland boundary. This aquifer system contains deeply cut cathedral valleys including those of Pololu, Honokane Nui, Waimanu, Kawainui, Alakahi, Koa‘e, Waima, and Waipio, reflecting the terrain’s high relative age and rainfall. Perched groundwater formed by dike compartments is found toward the head of the canyons, and on the Hawi formation, with basal water in sediments and near the mouths of the major canyons. The State Water Resources Protection Plan (CWRM 2018) states that the Waimanu Aquifer System has a sustainable yield of 110 mgd, containing ground water as basal, perched, and high level, with no reported ground water use.

The Waimanu Aquifer System of the Kohala Aquifer Sector contains a handful of distinct aquifers including basal and upper-level aquifers, as well as those distinguished by distance inland. These are described in Table 5.

Table 5. Waimanu Aquifer System Subunits

	Aquifer Code	**80102111**	**Status Code**	**21111**
Waimanu Basal	Island Code	8–Hawai‘i	Development Stage	2–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking

Aquifer, Low Elevation, Northwest Portion	Aquifer System	02-Waimanu	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	1–Basal	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	1–Flank		
Region	**Aquifer Code**	**80102212**	**Status Code**	**11111**
Waimanu Upper-Level Aquifer At Lower Elevation	Island Code	8–Hawai‘i	Development Stage	1–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	02-Waimanu	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	2–Dike		
Region	**Aquifer Code**	**80102216**	**Status Code**	**11111**
Waimanu Inland Aquifer, Waipio Valley	Island Code	8–Hawai‘i	Development Stage	1–Currently Used
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	02-Waimanu	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	6–Sedimentary		
Region	**Aquifer Code**	**80102212**	**Status Code**	**21112**
Waimanu Inland Aquifer, Waipio Valley	Island Code	8–Hawai‘i	Development Stage	2–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	02-Waimanu	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	2–Moderate
	Aquifer Type, geology	2–Dike		

	Aquifer Code	**80102214**	**Status Code**	**21111**
Waimanu Basal Aquifer, Inland, High Level	Island Code	8–Hawai‘i	Development Stage	2–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	02-Waimanu	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	4–Flank		
Region	**Aquifer Code**	**80102212**	**Status Code**	**21112**
Waimanu Aquifer, Inland, High Level	Island Code	8–Hawai‘i	Development Stage	2–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	02-Waimanu	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	2–High
	Aquifer Type, geology	2–Dike		
Region	**Aquifer Code**	**80102216**	**Status Code**	**11111**
Waimanu Inland Aquifer, Upper Level	Island Code	8–Hawai‘i	Development Stage	1–Currently Used
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	02-Waimanu	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	6–Sedimentary		
Region	**Aquifer Code**	**80102212**	**Status Code**	**21112**
Waimanu Aquifer, Inland, High Level	Island Code	8–Hawai‘i	Development Stage	2–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	02-Waimanu	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable

	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	2–Moderate
	Aquifer Type, geology	2–Dike		

1.5.3 The Mahukona Aquifer System

The Mahukona Aquifer System is comprised of the leeward side of Kohala Volcano from the crest to the sea. The southern boundary follows the contact between Kohala lavas and those of Mauna Kea near Kawaihae Road. Geologically, the Hawi volcanics overly the Pololu Basalts generally inland, while this cover thins towards the ocean, where the Pololu Basalt is exposed on the northwest and south. This area is arid, with rainfall increasing from less than 10 inches to about 75 inches annually near the Kohala crest. The erosional features and stream channels in this area are all the product of transient streams. Perched groundwater is found in the Hawi Volcanics toward the mountain crest. High-level dike water occurs in the rift zone and may reach as far seaward as the 1,000-ft elevation. The basal zone, which is several miles wide, is brackish. Table 6 summarizes the Mahukona Aquifer System characteristics.

The WRPP 2018 draft revision (CWRM 2018) states that the Mahukona Aquifer System has a sustainable yield of 10 mgd, containing ground water as basal, perched, and high level. The WRPP also states that the majority reported ground water is pumped from the high level.

Table 6. Mahukona Aquifer System Characteristics

	Aquifer Code	**80103111**	**Status Code**	**11211**
Mahukona Basal Aquifer, Low Elevation	Island Code	8–Hawai‘i	Development Stage	1–Currently Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	03-Mahukona	Salinity (in mg/L Cl^-)	2–Low (250-1,000)
	Aquifer Type, hydrogeology	1–Basal	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	1–Flank		
Region	**Aquifer Code**	**80103213**	**Status Code**	**11111**
Mahukona Mid-Elevation Aquifer	Island Code	8–Hawai‘i	Development Stage	1–Currently Used
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	03-Mahukona	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable

	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	3–Confined or Unconfined		
Region	**Aquifer Code**	**80103214**	**Status Code**	**21111**
Hawi High Elevation Aquifer, Upper Level	Island Code	8–Hawai‘i	Development Stage	2–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	03-Mahukona	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	1–High
	Aquifer Type, geology	4–Perched		
Region	**Aquifer Code**	**80103212**	**Status Code**	**21112**
Hawi High Elevation Aquifer, Lower Level	Island Code	8–Hawai‘i	Development Stage	2–Potential Use
	Aquifer Sector	01-Kohala	Utility	1–Drinking
	Aquifer System	03-Mahukona	Salinity (in mg/L Cl^-)	1–Fresh (<250)
	Aquifer Type, hydrogeology	2–High Level	Uniqueness	1–Irreplaceable
	Aquifer Condition	1–Unconfined	Vulnerability to Contamination	2–Moderate
	Aquifer Type, geology	2–Dike		

1.6 Streams of North Kohala

Streams flow due to a combination of groundwater seepage, stormwater runoff, and base flow. Due to Hawaii's propensity for flash floods, Hawaiian streams are notable for their wide range of discharge, which may span several orders of magnitude. For instance, Kawainui Stream near Kamuela in South Kohala has a base flow near 0.15 cfs, a median flow of 3.0 cfs, a mean flow of 10 cfs, and a maximum recorded flow of 121 cfs.

The geography of the perennial streams in North Kohala reflects rainfall patterns, with perennial streams concentrated within the highest rainfall area of windward Kohala. Moving along the North Kohala coast counter-clockwise into the increasingly dry lee side of the Kohala Mountains, the last perennial stream encountered is Kumakua, or its tributary Waipiele, that pass between Hawi and Kapaau. The location of Kumakua Stream demonstrates that the predominantly agricultural area in North Kohala is in a transitional area between the wet

windward side and dry leeward side. The entire leeward coast of North Kohala does not contain a single perennial stream. All streams, both perennial and transient, are shown in Figure XX.

Many of the streams that drain Kohala Mountain may have perennial flow for only part of their reach, according to Presley (1999), who described Pololu Stream as intermittent, as the main channel of the stream does not gain water from ground water sources except at the wetlands near its ocean effluence.

The Hawaii Stream Assessment (HSA) evaluated Hawaii's stream resources in order to identify streams appropriate for protection (CWRM 1990b). Of the 376 perennial streams in the State of Hawai‘i, 34 are located in North Kohala (Table 7).

Table 7. North Kohala Perennial Streams

Stream	**Code**	**Quad**	**Trib**	**Cont/Int**
Aamakao	8-1-12	Hawi	N	C
Halawa	8-1-11	Hawi	N	I
Haloa	8-5-01	Kamuela	N	I
Hanaula	8-1-06	Hawi	N	I
Hapahapai	8-1-07	Hawi	N	I
Honokane Iki	8-1-17	Honokane	N	C
Honokane Nui	8-1-16	Honokane	N	C
Honokea	8-1-20	Honokane	N	C
Honopue	8-1-22	Honokane	N	C
Kailikaula	8-1-21	Honokane	N	C
Kaimu	8-1-33	Kaimu	N	C
Kalele GL	8-1-18	Honokane	N	C
Kolealiilii	8-1-23	Honokane	Y	C
Kukui	8-1-29	Honokane	N	C
Kumakua	8-1-03	Hawi	N	C
Lamimaumau	8-5-02	Kamuela	N	C
Nakooko	8-1-25	Honokane	N	C
Niulii	8-1-13	Honokane	N	C
Ohiahuea	8-1-24	Honokane	N	C
Pae	8-1-34	Honokane	N	C
Pali Akamoa	8-1-08	Hawi	N	I
Paopao	8-1-30	Honokane	N	C
Pololu	8-1-15	Honokane	Y	C
Pukoa	8-1-36	Honokane	N	C
Punalulu	8-1-32	Honokane	N	C
Unnamed	8-1-10	Hawi	N	I
Waiaalala	8-1-31	Honokane	N	C
Waiapuka	8-1-26	Honokane	Y	C
Waikaloa	8-1-27	Honokane	N	C
Waikama	8-1-14	Honokane	N	C
Waimaile	8-1-2'8	Honokane	N	C

Waimanu	8-1-35	Honokane	Y	C
Wainaia	8-1-09	Hawi	N	I
Waipahi	8-1-19	Honokane	N	C

Notes: Quad = USGS Quadrangle map, I = Intermittent, C = Continuous

The HSA identified the following streams as candidate streams for protection:

Halawa (8-1-11), for cultural significance

Pololu (8-1-15) for Cultural, Riparian and Recreational significance

Honokane Nui (8-1-16) for Cultural and Recreational significance

Of the streams in the HSA, Table X shows flow data for those streams with gages in North Kohala.

Table 8. Gaged Streams in North Kohala

NAME	CODE	GAGE #	MEDIAN (CFS)	AVERAGE (CFS)	YRS REC	DIV
East branch Honokane Nui Stream near Niulii	8-1-16	747500	21.0		63-69	Y
Honokane Iki intake to Awini Ditch near Niulii	8-1-17	744000	0.9	1.76	27-72	
Kukui Stream near Waimanu	8-1-29	742000	0.9		39-66	N
Paopao Stream near Waimanu	8-1-30	741000	1.1	3.3	39-52	N
Waiaalala Stream near Waimanu	8-1-31	740000	0.6	1.10	39-52	N
Punalulu Stream near Waimanu	8-1-32	739000	2.4	6.53	39-52	N
Kaimu Stream near Waimanu	8-1-33	738000	3.2	8.68	39-52	N
Waiilikahi Stream (Waimanu)	8-1-35	737000	4.3	10.00	39-60	N

Notes: YRS REC = Years stream gage data recorded, DIV = Diversion Present?

Stream Diversions

The Hawai‘i County WUDP lists stream diversions in the Kohala Aquifer Sector Area, as shown in Table X.

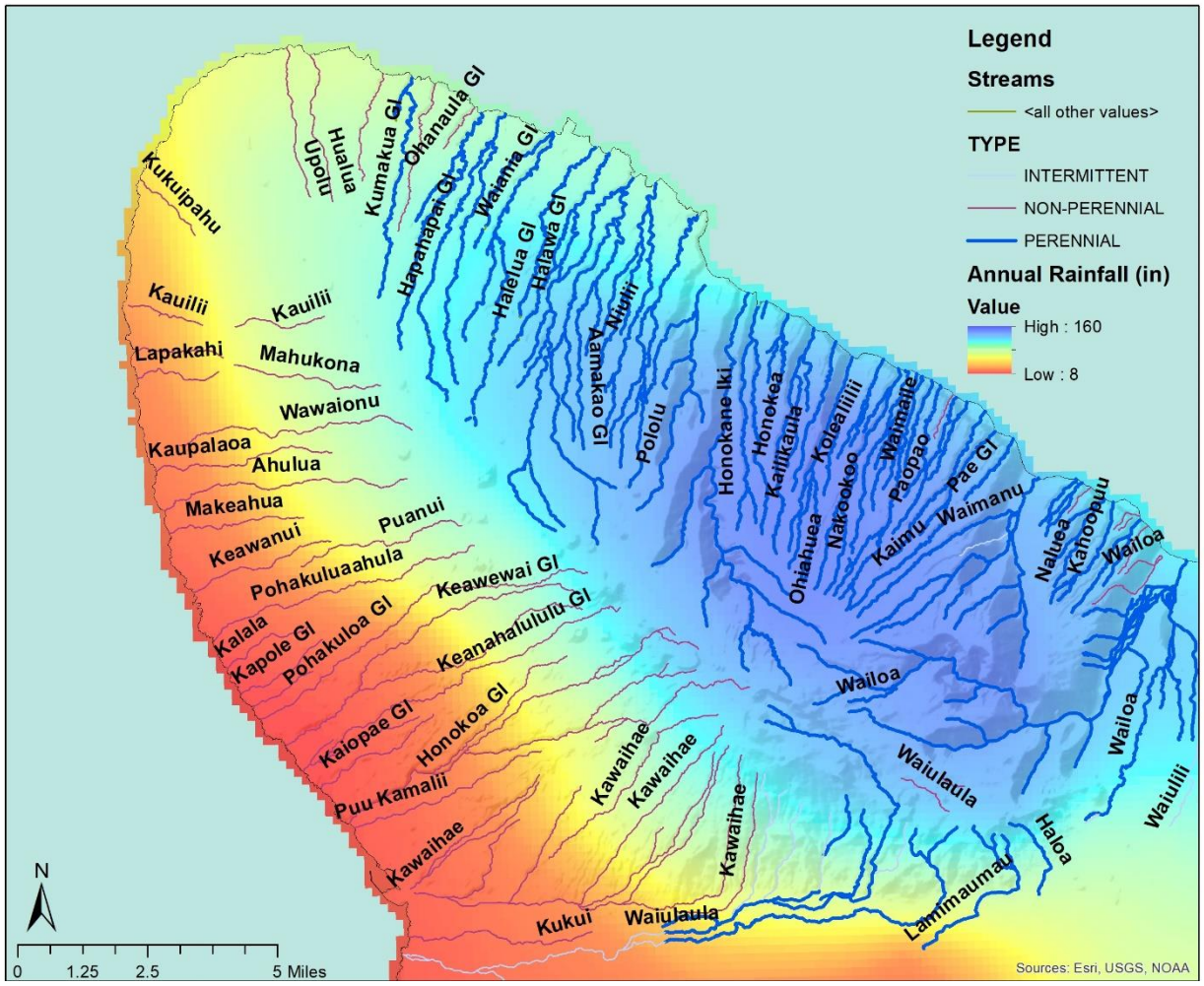
Table 9. Stream Diversions of the Kohala Aquifer Sector Area

FILE	TMK	STREAM	DESCRIPTION
Chalon Int	5-2-004:003	Puwaiole Gulch	Stream diversion, Intake #9 from Puwaiole Stream. Temporarily damaged. Declared Q of 5.849 is the total for Hawi Weir.

Chalon Int	5-2-005:001	Waipuni Gulch	Stream diversion, Intake #7 from Waipuhi Stream to Kohala Ditch. Declared Q of 5.849 is the total for Hawi Weir; Verified Q is estimated from flow velocity.
Chalon Int	5-2-005:001	Niulii	Stream diversion, Intake #5 from Niulii Stream to Kohala Ditch. Declared Q of 2.571 is the total for Niulii Weir.
Chalon Int	5-2-005:001	Waikani Gulch	Stream diversion, Intake #6 from Waikane Stream to Kohala Ditch. Declared Q of 5.849 is the total for Hawi Weir; Verified Q is estimated from flow velocity.
Chalon Int	5-2-005:001	Waikama Gulch	Stream diversion, Intake #3 - Waikama Stream to Kohala Ditch. Declared Q of 2.571 is the total for Niulii Weir.
Chalon Int	5-2-005:001	Waikama Gulch	Stream diversion, Intake #4 - Waikama Stream to Kohala Ditch. Declared Q of 2.571 is the total for Niulii Weir; Verified Q is estimated from flow velocity.
Chalon Int	5-2-006:003	Waipunalau Gulch	Stream diversion, Intake #8, Waipunalau Stream to Kohala Ditch. Declared Q of 5.849 is the total for Hawi Weir; Verified Q is estimated from flow velocity.
Chalon Int	5-3-002:001	Halawa Gulch	Stream diversion, Intake #11 from Halawa Stream. Declared Q of 5.849 is the total for Hawi Weir. Intake is damaged. No flow observed during field verification.
Chalon Int	5-3-002:001	Walaohia Gulch	Stream diversion, Intake #10 from Walaohia Stream. Declared Q of 5.849 is the total for Hawi Weir. Intake is damaged.
Chalon Int	5-3-004:001	Waiakanaua Gulch	Stream diversion, Intake #12 Waiakauaua Stream to Kohala Ditch. Declared Q of 5.849 is the total for Hawi Weir.
Chalon Int	5-3-005:006	Hapahapai Gulch	Stream diversion, Intake #14 from Hapahapai. Unused. Declared Q of 5.849 is the total for Hawi Weir.
Hamakua Sugar	4-8-003:006	Hiilawe	Stream diversion, Hiilawe Stream Intake to Lalakea System. Declared Q of 912 MG is the total for three intakes to the Lalakea System.
Hamakua Sugar	4-8-003:006	Hakalaoa	Stream diversion, Hakalaoa Stream Intake to Lalakea System. Declared Q of 912 MG is the total for three intakes to the Lalakea System.
Hamakua Sugar	4-8-003:006	Lalakea	Stream diversion, Lalakea Intake to Lalakea System. Declared Q of 912 MG is the total for three intakes to the Lalakea System.
Crane, J.	4-9-010:020	Waiola	Stream diversion, flume from Wailoa Side Stream. Declared Q of 292 MG includes both of declarant's diversions. See new entry created for diversion from waterfall. Declarations were submitted in 1990.
Crane, J.	4-9-010:020	Unnamed	Stream diversion, Unnamed waterfall (new entry). Declared Q of 292 MG includes both of declarant's diversions. See other entry for flume. Declarations were submitted in 1990.
Rathbun, C.	4-9-011:002	Wailoa	Stream diversion, main auwai from Wailoa Stream. Declared Q = 48 cubic ft per second.
Hamakua Sugar	4-9-012:001	Alakahi	Stream diversion, Alakahi Stream Intake to Lower Hamakua Ditch. Declared Q of 11,000 MG is the total for four intakes to Hamakua Ditch.
Hamakua Sugar	4-9-012:001	Kawainui	Stream diversion, Kawainui Stream Intake to Lower Hamakua Ditch. Declared Q of 11,000 MG is the total for four intakes to Hamakua Ditch.
Hamakua Sugar	4-9-012:001	Koiawe	Stream diversion, Kaiawe Stream Intake to Lower Hamakua Ditch. Declared Q of 11,000 MG is the total for four intakes to Hamakua Ditch.

Hamakua Sugar	4-9-012:001	Waiama	Stream diversion, Waima Stream Intake to Lower Hamakua Ditch. Declared Q of 11,000 MG is the total for four intakes to Hamakua Ditch.
Chalon Int	5-1-001:004	Honokane Nui East Branch	Stream diversion, Honokane Dam Main Intake. East Branch to Kohala Ditch. Declared Q of 2.571 is the total for Niulii Weir
Chalon Int	5-1-001:004	Honokane Nui West Branch	Stream diversion, Intake #2, Honokane Nui West Branch to Kohala Ditch. Declared Q of 2.571 is the total for Niulii Weir.
Chalon Int	5-1-001:019	Tributary to Pololu Stream	Stream diversion, Kohala Ditch Trail Intake #B from Unnamed. Declared Q of 2.571 is the total for Niulii Weir. Intake "A" is inactive.
Chalon Int	5-1-001:019	Waiakalae Gulch	Stream diversion, Twin Falls Intake from Waiakalae Gulch. Declared Q of 2.571 is the total for Niulii Weir.
SOH DOA	6-3-001:004	Kawainui	Stream diversion, Kawainui Intake from Kawainui Stream. Declared Q of 366.671 is the total for all 5 intakes.
SOH DOA	6-3-001:004	Unnamed	Stream diversion, Koiawe Intake from comb intake. Declared Q of 366.671 is the total for all 5 intakes.
SOH DOA	6-3-001:004	Unnamed	Stream diversion, Waima Intake from comb intake. Declared Q of 366.671 is the total for all 5 intakes.
SOH DOA	6-3-001:004	Alakahi	Stream diversion, Alakahi Intake from Alakahi Stream. Declared Q of 366.671 is the total for all 5 intakes.
SOH DOA	6-3-001:004	Kawaiki	Stream diversion, Kawaiki Intake from Kawaiki Stream. Declared Q of 366.671 is the total for all 5 intakes.
Parker Ranch	6-1-001:004	Keawewai	Stream diversion, Keawewai Supply Ditch from Keawewai Stream. Declared Q = 176,596,950,000 gallons per year.
DWS	6-3-001:001	Waikoloa	Stream diversion, pipe from Waikoloa Stream. Declared Q of 559.8 is the calculated total for 2 intakes at 1.427 MGD.
DWS	6-5-001:011	Kohakohau	Stream diversion, Kohakohau Stream Diversion. Declared Q of 559.8 is the calculated total for 2 intakes at 1.427 MGD.

Figure 9. Named Streams of North Kohala



1.7 Wells

The CWRM well database lists 60 wells in the study area, including shafts and tunnels, constructed by the following entities, with number of wells in parentheses: Kohala Sugar (40), DWS (8), and USGS (12). Of these 60 wells, 37 are tunnels, and four are shafts. All of the tunnels were constructed prior to 1940. The first well drilled on Hawaii Island drilled at Mahukona in 1881 (McCandless 1936). The four shafts, named Alaalae, Kohala, and Hoea shafts were all dug in 1900, with the Waikane Shaft dug in 1920.

It is generally very difficult to glean information from this database relating to the spatial variation of ground water characteristics (i.e., salinity, depth to groundwater) due to differences in reporting methodologies. However, one relationship reveals a clear inverse trend, that of the ground surface elevation of wells (above mean sea level) and the measured chloride concentration (Figure 11). This is to be expected as near-shore and hence lower elevation wells are expected to be more influenced by brackish water. This relationship allows the observation that wells located above 1000 feet of elevation, basal or otherwise, can be expected to have low chloride concentrations (<250 ppm).

Figure 10. Wells of North Kohala

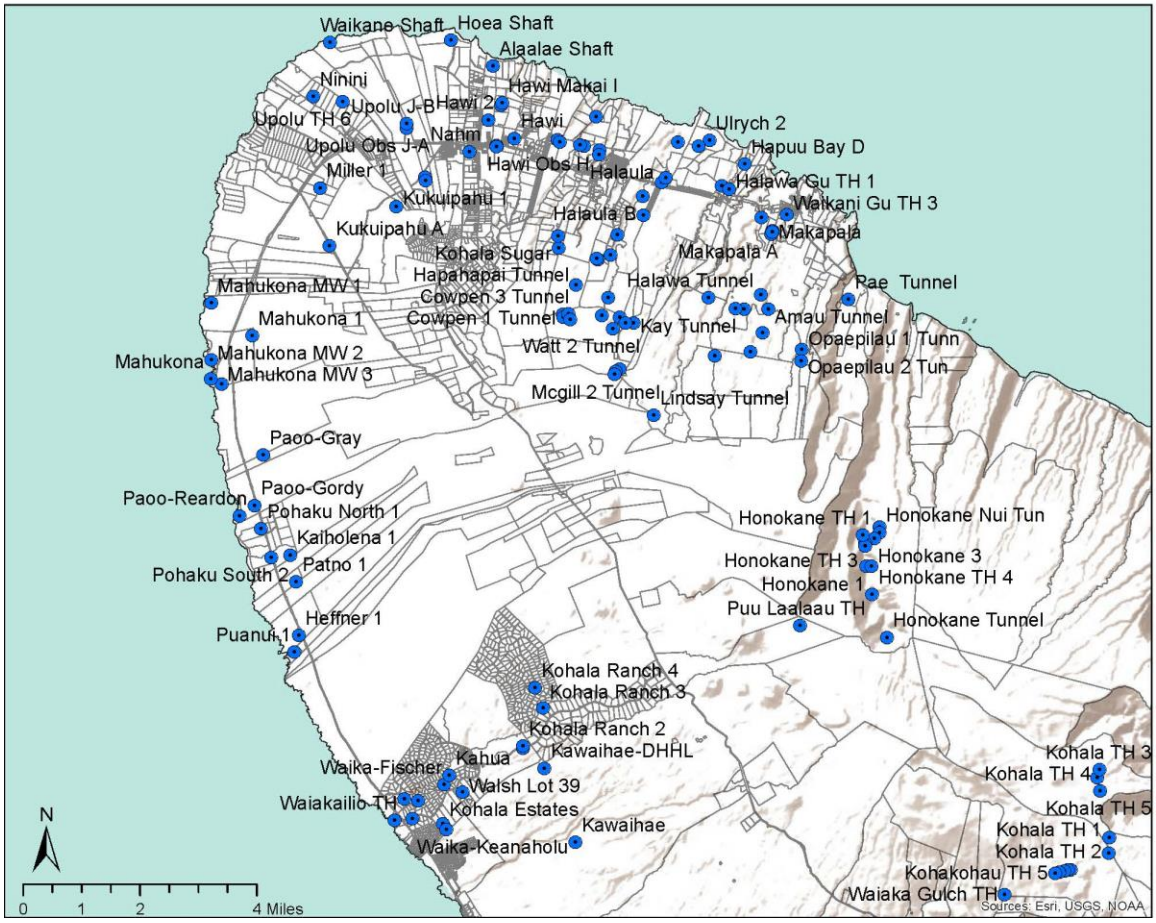
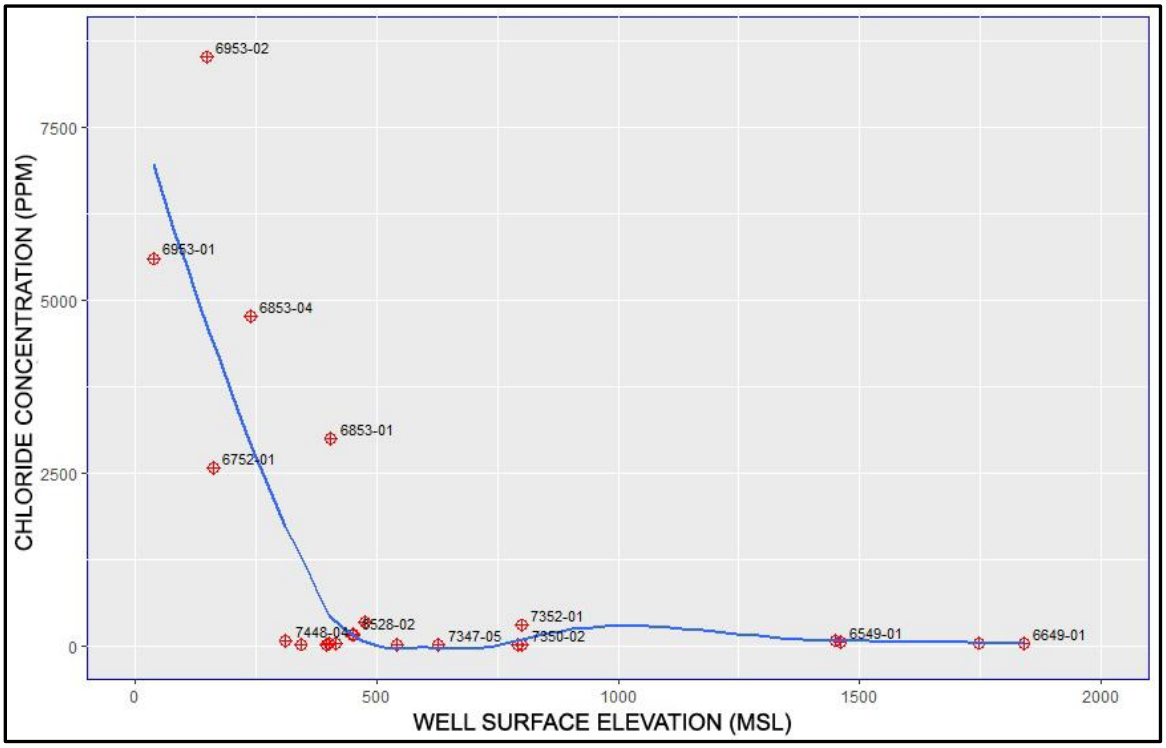


Figure 11. North Kohala Wells, Well Surface Elevation versus Chloride Concentration



Note: Trendline is a 2nd order polynomial fit.

1.8 Department of Water Supply System

The County of Hawai‘i Department of Water Supply maintains two networks in North Kohala, the system that supplies the Hawi-Kapaau area and a smaller system that supplies Makapala. Together the systems provide supply to approximately 1,700 connections. The Hawi-Kapaau System is supplied by two wells, Hawi Deep Wells A and B, and extends from Puakea Bay to Halaula. A series of tanks and pumps provides gravity head to the two feeder lines that are connected on the makai side by an 8-inch line. This latter system suffers from a lack of robustness in that capacity is limited by several factors including (1) the limited capacity of the main 8-inch distribution line; (2) the change in vertical distance over the system requires a large number of PRVs (3) the reservoirs that supply Hawi are undersized and represent a bottleneck in the system.

Formerly, the Hawi-Kapaau system made use of five tunnels including the Lindsey Tunnel, the Watt #1 Tunnel, the Hapahapai Tunnel, the Bond #1 Tunnel, and the Kohala #5 Intake. These sources are no longer connected to the system. Although these sources may be affected by the Surface Water Treatment Rule, also known as Ground Water Under Direct Influence (GWUDI) of surface water, they should be considered for development for agricultural distribution and use.

1.9 Land Use and Social Setting

Figure 12 displays land cover in North Kohala. Three urban areas are visible, the communities of Waimea/Kamuela, Kawaihae, and the several communities of far North Kohala including Hawi and Kapaau. The dry, leeward areas of North Kohala are almost completely rangelands,

with proud estates nestled against areas alongside the puu, often protected by ironwood windbreaks. To the north over the Kohala crest are the steeply sloping valleys, gulches, and canyons of the windward Kohala Coast, mostly described as forest lands, with small wetland areas in the bottom of Waipio, Waimanu and Pololu Valleys. Between the arid, leeward regions and the rainforests of the windward side are agricultural areas, presenting a band where precipitation is copious.

Figure 13 shows land cover in North Kohala with annual mean rainfall isohyets overlain. Rangelands generally are predominant in areas with less than 30 inches of rainfall annually, and the agricultural band appears to be dominant in areas with between 30 and 100 inches of rainfall annually.

In general, ranching, macadamia nut production and nursery products are the principal agricultural activities within North Kohala. The majority of land formerly in sugar cane production is now utilized for grazing purposes.

The population of North Koahala (as the Kohala ASEA) has grown significantly in the last 20 years, which can be attributed to the growth in tourism, an influx of retirees, and other entrepreneurial activities in North Kohala (County of Hawaii 2012, WUDP). Table 10 summarizes the population growth in recent decades.

Table 10. North Kohala Population

		Population				
Year	Area	North Kohala District	Halaula CDP	Hawi CDP	Kapaau CDP	Remainder
2000		6,038	495	938	1,159	3,446
2010		6,322	469	1,081	1,734	3,038
2016		6,441	632	1,315	1,935	2,559

Land use in North Kohala, as defined by the County of Hawai‘i General Plan Land Use Pattern and Allocation Guide, is summarized in Table 11.

Table 11. North Kohala General Plan LUPAG Designation

Land Use	**Acreage**	**% of Total**
High Density Urban	0	0
Medium Density Urban	795	0.5
Low Density Urban	4,596	3.2
Industrial	854	0.6
Important Agricultural Land	50,712	32.9
Extensive Agriculture	41,016	26.6
Orchard	0	0
Rural	735	0.5
Resort/Resort Node	47	0.0
Open	2,930	1.9

Conservation	49,869	32.3
Urban Expansion	2,297	1.5
University Use	0	0
Total	**154,211**	**100.0**

County of Hawai‘i Zoning designations in North Kohala are summarized in Table 12. These show that agriculture continues to be the highest and best use of most North Kohala lands.

Table 12. Acreage in North Kohala by Zoning

Zoning Class	**Acreage**	**% of Total**
Single Family Residential	1,923	1.2
Multi-Family Residential	212	0.1
Residential-Commercial Mixed Us	0	0
Resort	28	0.0
Commercial	297	0.2
Industrial	271	0.2
Industrial-Commercial Mixed	0	0
Family Agriculture	26	0.0
Residential Agriculture	124	0.1
Agriculture	99,770	64.7
Open	963	0.6
Project District	0	0
Forest Reserve	49,289	32.0
(road)	1,307	0.9
Total	154,210	100.0

Figure 12. North Kohala Land Cover

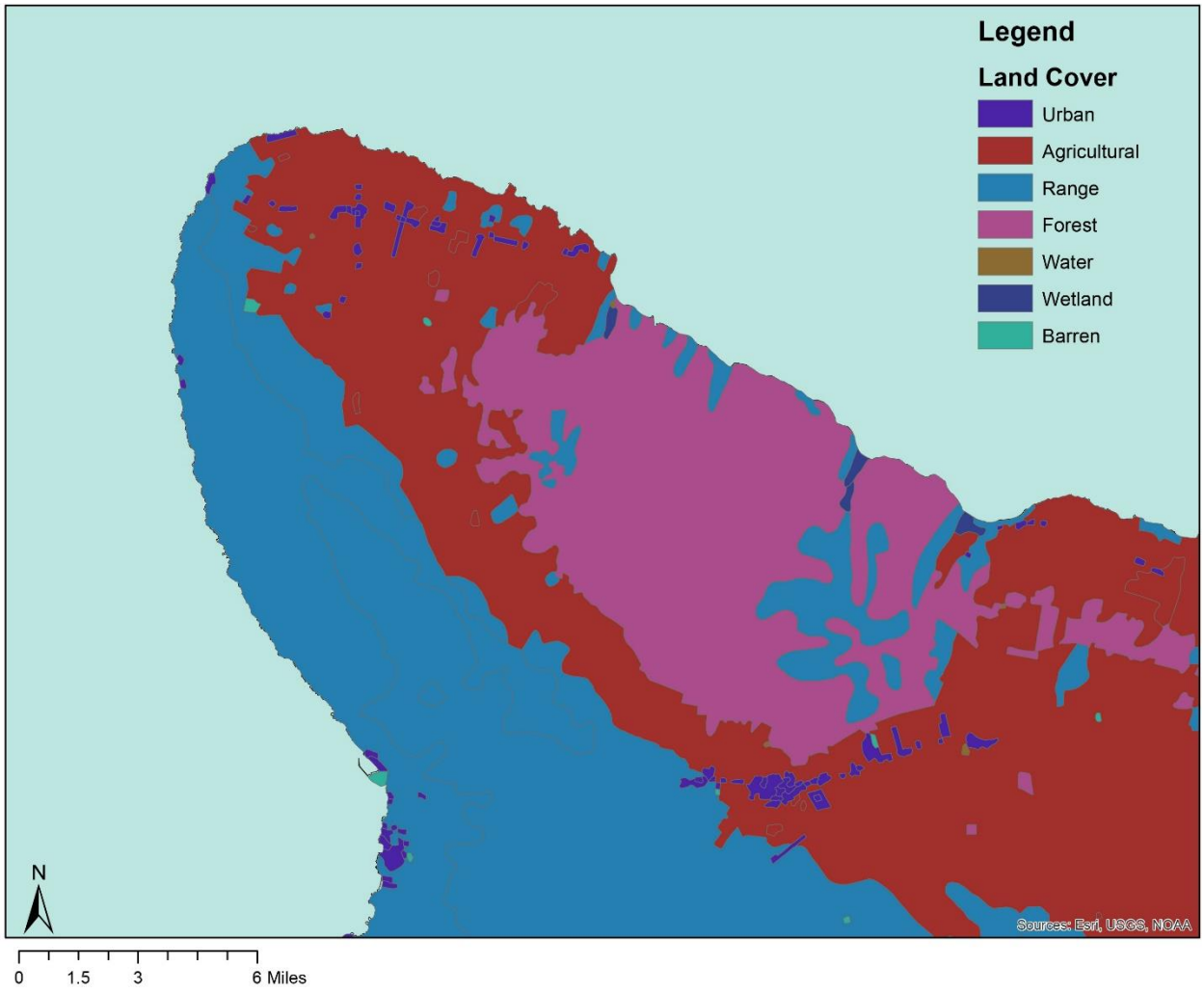
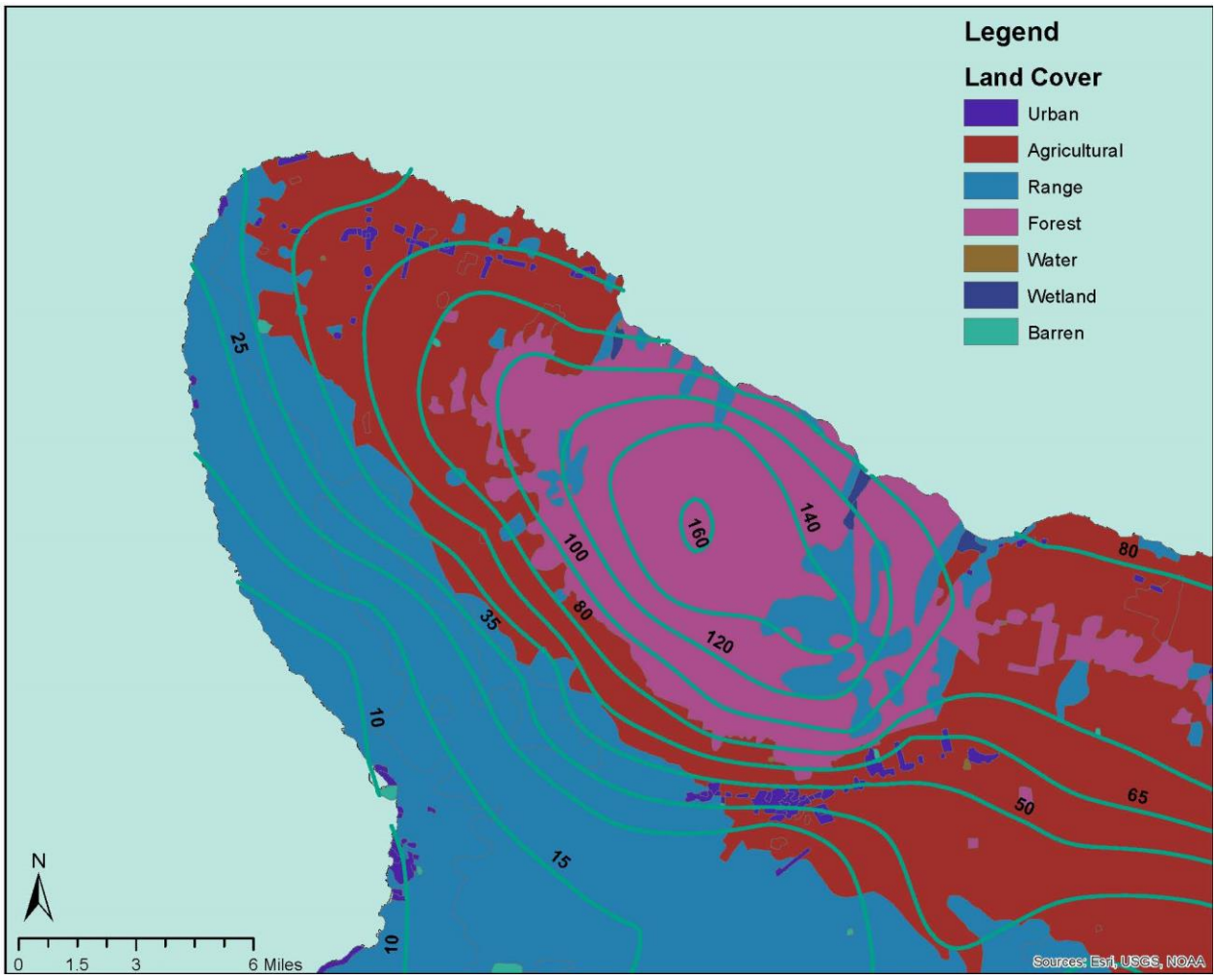


Figure 13. Land Use Cover with Rainfall Isohyets



Sources: Land use data from EROS Data Center, rainfall from Giambelluca et al. 2013.

Discussion

As previously noted, agricultural lands are generally located between the high rainfall areas of windward Kohala and the dry leeward areas. Zoning of North Kohala designates nearly 65% as agriculture. Changes in actual land use was discussed in Section 2.1 (Figures 1 – 2).

1.10 Groundwater Contamination

A release of hazardous materials, wastewater, or stormwater runoff, at or near the ground surface, such as a spill of petroleum hydrocarbons, can infiltrate and contaminate groundwater. Thus it is appropriate to evaluate the potential for ground water contamination in North Kohala. The State of Hawaii Department of Health Safe Drinking Water Branch (SDWB) maintains data on contaminated wells. As of December 10, 2018 SDWB had no data on well contamination in North Kohala (HDOH 2018).

However, a number of sites with known soil contamination are known in North Kohala including the Kohala Sugar Company Mill located at Tax Map Key (3rd) 5-5-019:025 in the vicinity of the

town of Hawi. This site is listed on the Comprehensive Environmental Response, Compensation and Liability Information System in 2009 (EPA ID No.: HIN00908796). Assessments have shown soil contamination from dioxins, metals (i.e., arsenic, lead, and mercury) and semi-volatile organic compounds (SVOCs) at or above HDOH environmental action levels (EALs). The Removal Action Work Plan for the site stated that leaching and the hazard to groundwater from the contaminants was not significant (Integral Consulting 2015).

Underwood et al. (1995) reviewed available water quality data for the Hawi aquifer. This work included water sample analysis for five of eight USGS test well sites. (A, B, E, F, and H). Three sites (A, B, and F) water samples were also collected for analysis for 18 metals and 79 organic compounds, including pesticides, volatile components of petroleum hydrocarbons and solvents. No dissolved metals or organic compounds were found at concentrations exceeding maximum contaminant levels. Toluene and Xylene were found in well A at or near the detection limit of 0.2 ppb, well below the current HDOH Tier 1 Environmental Action Levels 9.8 and 13 ppb, respectively.

The State of Hawai‘i Department of Health maintains the Underground Injection Control program to ensure that injection wells do not impact drinking water resource ground water. Groundwater used for drinking water sources is distinguished from ground water not used for drinking water by the underground injection control (UIC) line. In North Kohala the UIC generally follows the shoreline.

Water quality reports published by the DWS show no detections of exceedances of contaminants in North Kohala wells. The 2017 North Kohala System Water Quality Report showed nitrate detected at 0.45 ppm in the Hawi Well Nos. 1 & 2 and 0.34 ppm in the Makapala well. Both detections are well below the maximum contaminant level (MCL) of 10 ppm.

Thus it does not appear that North Kohala groundwater may be affected by significant groundwater contamination issues, however, well development near and downgradient from former sugar cane mills and urban areas should be avoided for an assurance of safety.

2 Water Use Law and Related Policies

2.1 The Hawai‘i Water Code

Hawaii Revised Statutes Chapter 174C State Water Code, made law in 1987, set out the structure for the management and administration of water and declared that, "…the waters of the State are held for the benefit of the citizens of the State. It is declared that the people of the State are beneficiaries and have a right to have the waters protected for their use." This statement is known as the Public Trust Doctrine.

The Code introduced the Hawaii Water Plan as the comprehensive method to address problems of supply and conservation of water. Further, the Code declared that it should be interpreted liberally to obtain maximum beneficial use for purposes including domestic uses, aquaculture, irrigation and other agricultural uses, power development, and commercial and industrial uses, however, the Code further stated that adequate provision for the protection of traditional and customary Hawaiian rights, ecological protection, scenic beauty, public recreation, public water supply, agriculture, and navigation are all in the public interest.

The State Water Code determined that its administration should lie with the Commission on Water Resource Management.

The State Water Plan shall be prepared and contain the following four parts:

(1) Water Resource Protection Plan
(2) Water Use and Development Plans for each County
(3) State Water Projects Plan
(4) Agricultural Water Use and Development Plan
(5) Water Quality Plan, prepared by the Department of Health

2.1.1 The Water Resource Protection Plan

The Water Resource Protection Plan (WRPP) was published in 2008 (CWRM 2008) and an update is in progress (CWRM 2018) The WRPP seeks to, "protect and sustain statewide ground and surface water resources, watersheds, and natural stream environments". The WRPP includes the following elements:

- General water resource management principles and policies;
- The nature and occurrence of water resources in the State;
- Hydrologic units for ground and surface waters and sustainable limits for water supply;
- Existing water uses and projected future demands;
- Programs for hydrologic data collection and analyses;
- Regulatory authorities and permitting systems; and
- Studies and programs to conserve and augment water resources.

The report notes that the State Department of Hawaiian Homelands has water reservations for the Hawi hydrologic unit of 0.148 mgd and for the Mahukona hydrologic unit of 3.014 mgd, effective September 2018.

2.1.2 County of Hawaii Water Use and Development Plan

The County of Hawai‘i Water Use and Development Plan (WUDP, County of Hawai‘i 2010) serves as a long-range guide for water resource development in Hawai‘i County. The initial County of Hawaii WUDP was adopted in 1990 and revised in 2010. Its objective is “to set forth the allocation of water to land use through the development of policies and strategies which shall guide the County in its planning, management, and development of water resources to meet projected demands.” Section 13-170-31, Hawaii Administrative Rules states that the WUDP shall include but not be limited to: (1) Status of water and related land development including an inventory of existing water uses for domestic, municipal, and industrial users, agriculture, aquaculture, hydropower development, drainage, reuse, reclamation, recharge, and resulting problems and constraints; (2) Future land uses and related water needs; and (3) Regional plans for water developments including recommended and alternative plans, costs, adequacy of plans, and relationship to the water resource protection and water quality plans.

The County of Hawai‘i WUDP evaluated water demand by district. Tables 13 - 15 show the estimated use as a percentage of sustainable yield for the three Kohala Aquifer System Areas. The methods of water use estimation used herein include a per acreage water use of 3,400 gallons per acre per day for diversified agriculture, which is an overestimate, as not all agricultural lands are in use. Therefore these use estimates should be viewed as total potential use.

Table 13. Estimated Water Use for Kohala Aquifer Sector Area

CWRM Water Use Category	Water Use (MGD)	Percent of Total without Ag	Percent of Total with Ag
Domestic	0.11.	4.9	1.8
Industrial	0.00	0.0	0.0
Irrigation	0.00	0.0	0.0
Reclaimed WW	0.00	0.0	0.0
Agriculture	4.16	0.0	64.2
Military	0.00	0.0	0.0
Municipal			
DWS System	1.53	65.8	23.6
Private Public WS	0.68	29.3	10.5
Total without Ag	2.32	100.0	
Total with Ag	6.48		100.0

Table 14. Estimated Water Use for Hawi Aquifer System Area

CWRM Water Use Category	Water Use (MGD)	Percent of Total without Ag	Percent of Total with Ag
Domestic	0.03	5.9	1.4
Industrial	0.00	0.0	0.0
Irrigation	0.00	0.0	0.0
Reclaimed WW	0.00	0.0	0.0

Agriculture	1.88	0.0	76.0
Military	0.00	0.0	0.0
Municipal			
DWS System	0.50	94.1	22.6
Private Public WS	0.00	0.00	0.0
Total without Ag	0.53	100.0	
Total with Ag	2.21		100.0

Table 15. Existing Water Use for Waimanu Aquifer System Area

CWRM Water Use Category	Water Use (MGD)	Percent of Total without Ag	Percent of Total with Ag
Domestic	0.02	20.2	5.8
Industrial	0.00	0.0	0.0
Irrigation	0.00	0.0	0.0
Reclaimed WW	0.00	0.0	0.0
Agriculture	0.24	0.0	71.1
Military	0.00	0.0	0.0
Municipal			
DWS System	0.00	79.8	23.0
Private Public WS	0.00	0.0	0.0
Total without Ag	0.10	100.0	
Total with Ag	0.34		100.0

Table 16 summarizes the current production estimated by the County of Hawai‘i WUDP, potential production (for 16- and 24-hour periods), sustainable yield (SY) and the percentage of SY for the various productions calculated. The current production was estimated by the highest 12-month moving average (MAV) calculated from actual pumpage data reported for each aquifer system/sector area. The data are based on pumpage data from January 2003 through October 2005 reported to CWRM.

Table 16. Estimates of Aquifer System Production

Aquifer Sector Area	**Aquifer System Area**	**High 12-Month MAV (MGD)**	**Potential 16-Hour Production (MGD)**	**Potential 24-Hour Production (MGD)**	**SY (MGD)**	**High 12-Month MAV SY (%)**	**Potential 16-Hour Production SY (%)**	**Potential 24-Hour Production SY (%)**
Kohala		1.44	17.66	26.49	154	0.94	11.47	17.20
	Hawi	0.65	15.23	22.844	27	2.41	56.40	84.59
	Waimanu	0.10	0.96	1.44	110	0.09	0.87	1.31
	Mahukona	0.69	1.47	2.21	17	4.06	8.67	13.00

The County of Hawai‘i WUDP states the following:

> Ground water and surface water are plentiful in the Kohala Aquifer Sector Area, and these may continue as the primary sources of water. Specifically, high-level groundwater could be developed for potable water sources, and the island's four major ditch systems could be restored to satisfy non-potable needs. Including worst-case agricultural demands, full development to the maximum densities of LUPAG and County Zoning are not sustainable within the Kohala Aquifer Sector Area and the Hawi and Mahukona Aquifer System Areas. Without agricultural water demands, the LUPAG and County Zoning scenarios are sustainable within the Kohala Aquifer Sector Area; however, LUPAG maximum density build-out cannot be sustained within the Mahukona Aquifer System Area. This can be mitigated by transfer of water between aquifer system areas, although the projected 20-year demands indicate that this will not be necessary in the near future. Potential shortages of water in adjacent aquifer sector areas can also be addressed through transfer of water from the Kohala Aquifer Sector Area, which will likely necessitate infrastructure upgrades.

2.1.3 State Water Projects Plan

The objective of the State Water Projects Plan is to, "provide a framework for planning and implementation of water development programs to meet projected water demands for State Projects." The first SWPP was completed in 2000, with the most recent revision published in 2017 (DLNR 2017), however, due to budgetary constraints, DLNR decided that only the Department of Hawaiian Home Lands (DHHL) projects would be considered for this recent update.

The 2017 SWPP updated noted that DHHL maintains the Kawaihae Water System which includes three stream diversions and a number of wells on its Kawaihae tract and states the following:

> The Kawaihae Unit #1 Water System is located within the Kohala Aquifer Sector and the Mahukona Aquifer System on the island of Hawai‘i. The water system is DOH Public Water System No. 164 and is owned by the Department of Hawaiian Home Lands and operated by Pural Water Specialty Company, who is under contract with DHHL. There are 152 service connections; however, the system will serve 195 connections when the subdivision is fully completed. The average water usage is 0.054 MGD. Water is purchased from the Kohala Ranch Water System and enters the Kawaihae Water System at a 0.1 MG concrete tank at elevation 305 feet. The water is disinfected by calcium hypochlorite tablet and pumped to an upper 0.1 MG concrete tank at elevation 636 feet using two 120-GPM booster pumps. The system facility capacity of the two pumps is 0.115 MGD. Details of the distribution system are not known. Based on the average existing water use, the maximum day demand is 0.081 MGD, and therefore, the surplus system facility capacity is 0.034 MGD.

2.1.4 Agricultural Water Use and Development Plan

The Agricultural Water Use and Development Plan (AWUDP), published by the State Department of Agriculture in 2003 (HDOA), was made part of the Hawai‘i Water plan in 1998 by means of Act 101 (HDOA 2003). Under Act 101 the Hawai‘i Department of Agriculture was authorized for the following:

- Inventory the irrigation systems of the State;
- Identify the extent of rehabilitation needed for each system;
- Subsidize the cost of repair and maintenance of the government systems;
- Establish criteria to prioritize the rehabilitation of the systems;
- Develop a 5-year plan to repair the systems; and
- Setup a long-range plan to manage the systems.

Although the AWUDP studied 13 plantation-era irrigation systems, the North Kohala irrigation systems were not discussed. Over a 20-year planning period the AWUDP proposed a set of maintenance and capital improvements necessary to maintain the viability of the 13 systems.

2.1.5 Water Quality Plan

The Water Quality Plan, prepared by the Department of Health (HDOH 2014), was first published in 1990 and was revised in 2014 and is intended to promote and implement, “the proper conservation and development of the waters of the State…the control of waters of the State for public purposes…the attainment of adequate water quality,” and “the implementation of the water resources policies expressed in the Hawaii Water Code” as stated by Chapter 174C HRS. As such, the Water Quality Plan focused on the quality of surface and ocean waters.

2.1.6 Kohala Water Resources Management and Development Plan (Phase II, 1974)

The Kohala Water Resources Management and Development Plan (“Kohala Water Plan”, Bowles et al. 1974) was commissioned due to the 1971 closing of the Kohala Sugar Company, which stimulated the State to pass Act 197 pertaining to the planning and development of North Kohala, specifying funds for planning and feasibility studies, and development of a master plan for Kohala water use and development. The plan had the following four phases:

1. Preliminary findings and conclusions.
2. A detailed evaluation of North Kohala’s water resources, a proposed irrigation system, a proposed operating organization.
3. Implementation of specific projects and activities related to the establishment of an expanding irrigation water program.
4. Operation of the water system to assist agricultural users in North Kohala, maintained by revenues from water sales.

The Kohala Water Plan stated the following capacities for North Kohala water sources in MGD:

Table 17. Kohala Water Plan North Kohala Capacities

Source(s)	Maximum (MGD)	Low (MGD)	Average (MGD)
Kohala Ditch	55-60	10	26

Kehena Ditch	10-20	0	1
Shafts	25	n/a	8
Wells	5	n/a	1

The Kohala Water Plan presented a proposed irrigation system, utilizing a building block approach, with infrastructure to be completed in five phases, developing outward from the core development. The sources of this irrigation water would be 19.5 MGD from the Kohala Ditch and 3 MGD from basal pumping.

The Kohala Water Plan made the following recommendations for Phase III:

1. Explore methods for establishment of a Water Cooperative to replace the Kohala Ditch Company following closure of Kohala Sugar in 1975.
2. Establish a means for transfer of the Kohala Ditch and appurtenances to the State, County of Cooperative.
3. Kohala Ditch: replace flumes and intakes on Awini and Kohala Section and construct horizontal drill hole at Honokane Nui
4. Secure rights to use three existing Kohala Sugar feeder lines
5. Secure rights to use Kohala Sugar's Reservoir No. 5 and the Union 1 and 2 wells, and appurtenances.
6. Construct or install wells, pumps, motors, diesel generators, transmission lines, earth reservoirs, and appurtenances for the service irrigation system.

The Kohala Water Plan further described item (1), the North Kohala Water Cooperative Council would have the following purposes:

1. The operation and maintenance of existing irrigation works.
2. The reconstruction, repair, or improvement of existing irrigation works.
3. The construction or purchase of works or parts thereof for the irrigation of lands within the operation of the district.
4. The construction, reconstruction, repair, or maintenance of a system of diverting conduits (dams, tunnels, ditches, flumes, wells, pipelines, etc.) from a natural source of water supply to the point of individual distribution primarily for irrigation purposes.
5. The execution and performance of any contract authorized by law with any department of the federal government or of the State of Hawaii or the County of Hawaii for reclamation and irrigation purposes.
6. The performance of all things necessary, within the law, to enable the Cooperative to exercise the powers granted it by act of legislation.

2.2 Other Water Use Planning Documents

2.2.1 Hawai‘i County General Plan

The General Plan for the is the document expressing the broad goals and policies for the long-range development of the Island of Hawai‘i (County of Hawai‘i 2005). The Plan was adopted in 2005 and is in the process of being revised, in part through preparation of new Community

Development Plans for each of the nine judicial district. The General Plan is organized into 13 elements with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to each judicial district. The following excerpts of the General Plan are pertinent to this study:

> 2.4 Economic
>
> 2.4.5.2 Courses of Action
>
> (a) Aid in the expansion of agriculture through the protection of important agricultural lands.
>
> (f) Support efforts to promote small business development that is consistent with the rural, agricultural, and historic character of the area.
>
> (g) Assist the communities and residents in diversifying the economic base in ways that are consistent with the rural, agricultural, and historic character of North Kohala.
>
> 11. Water
>
> 11.2.2 Policies
>
> (a) Water system improvements shall correlate with the County's desired land use development pattern.
>
> (b) All water systems shall be designed and built to Department of Water Supply standards.
>
> (c) Improve and replace inadequate systems.
>
> (d) Water sources shall be adequately protected to prevent depletion and contamination from natural and man-made occurrences or events.
>
> (e) Water system improvements should be first installed in areas that have established needs and characteristics, such as occupied dwellings, agricultural operations and other uses, or in areas adjacent to them if there is need for urban expansion.
>
> (f) A coordinated effort by County, State and private interests shall be developed to identify sources of additional water supply and be implemented to ensure the development of sufficient quantities of water for existing and future needs of high growth areas and agricultural production.
>
> (j) Cooperate with appropriate State and Federal agencies and the private sector to develop, improve and expand agricultural water systems in appropriate areas on the island.
>
> (k) Promote the use of ground water sources to meet State Department of Health water quality standards.

(n) Develop and adopt a water master plan that will consider water yield, present and future demand, alternative sources of water, guidelines and policies for the issuing of water commitments.

(o) Expand programs to provide for agricultural irrigation water.

11.2.4.5 North Kohala

11.2.4.5.1 Profile

The North Kohala District obtains water primarily from two wells and a spring.

The Hawi Wells No. 1 and 2 serve the following areas: Kaauhuhu, Hawi-Kokoiki, Kynnersley-Kapaau, and Halaula.

The average consumption for this system is 0.30 mgd. The Makapala-Keokea water system source is from the Murphy Tunnel owned by Chalon International of Hawaii. Present consumption is 0.0281 mgd.

11.2.4.5.2 Courses of Action

(a) Pursue a ground water source for the Makapala-Keokea water system.

(b) Explore further sources for future needs.

(c) Improve and replace inadequate distribution mains and storage facilities.

(d) Encourage efforts to improve the Kohala ditch system and its use for agricultural purposes.

Discussion

The General Plan states that improvement of agricultural water distribution systems is an important issue in the entire County, as well as in the district of North Kohala.

2.2.2 North Kohala Community Development Plan

The North Kohala Community Development Plan was adopted by County Council action in 2008 and is in the process of being revised (County of Hawai‘i 2008).

Portions of the North Kohala CDP that are pertinent to this study include the following:

“The key planning implications related to Kohala’s natural and cultural resources include: …Agricultural potential – Agriculture should be promoted and agricultural lands should be preserved for this use.”

Chapter 4 of the North Kohala CDP outlines programs and ideas important for action. Strategy 1.4 is entitled, “Promote and Support a Community of Diversified Agriculture” with the stated goal of, “The Kohala Community will produce 50% of the food it consumes.” Specific actions include the following:

- Re-establish Kohala's agricultural education programs, by working with the School Community Council, to generate more farmers (both K-12 and higher education)
- Secure accessible capital for new farmers, such as a local micro-loan program
- Create incentives for start-up agriculture, including implementing changes to the County's real property tax code
- Work with owners of various agricultural water transmission and distribution systems to provide subsidized agricultural water rates.

The North Kohala CDP states, as a long-term strategy (Section 4.12a), to "Support repair and maintenance of existing agricultural water transmission and distribution systems to meet agricultural needs." Further, Section 4.12a states the following:

> Overall, residents acknowledge that these systems are an important resource to their community, and are essential to keeping the future of agriculture in Kohala alive by providing low-cost, plentiful irrigation water. As such, they want the repairs completed and irrigation water again made available for agricultural users.

Finally, Appendix D of the North Kohala CDP enumerates "Courses of Action", including the following:

> Public Utilities – Water
>
> (a) Pursue a ground water source for the Makapala-Keokea water system.
> (b) Explore further sources for future needs.
> (c) Improve and replace inadequate distribution mains and storage facilities.
> (d) Encourage efforts to improve the Kohala Ditch system and its use for agricultural purposes.

Discussion

The North Kohala CDP shows clear consideration of the importance of the provision of agricultural water. This long-term strategy, involving several courses of action, partly supports the CDP's Strategy 1.4: Promote and Support a Community of Diversified Agriculture, with a stated goal of the Kohala community producing 50% of the food it consumes. The CDP emphasizes that residents desire that necessary repairs and improvements be made to the Kohala Ditch system, and other water infrastructure.

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Appendix B - Well Prices / Pumping Costs

Section Under Development

Appendix C - Easement Instructions

APPENDIX C

GRANT OF EASEMENT FORM, INSTRUCTIONS, AND SAMPLES

Included in this APPENDIX C are the following:

1. Grant of Easement form
2. Instructions explaining how to fill out the Grant of Easement form
3. Sample of a completed Grant of Easement form for a Dual System property
4. Sample of a completed Grant of Easement form for a Regular System property
5. Sample of a completed Grant of Easement form for a Land Court property.

When filling out the form, it will be helpful to keep in mind the following:

- Grantor means the owner of the land upon which the easement will be located. The owner may be an individual person, a group of people, or an entity.
- Grantee means the person, people, or entity who need the easement.
- Ownership deed means the legal document by which the current owner(s) of a property acquired ownership rights in that property.
- A certificate of title is a certificate issued by the Land Court that shows the name(s) and marital status of the property owner(s), along with other information related to the property. A certificate of title can sometimes be called an original certificate of title or a transfer certificate of title.
- There are two land systems in Hawaii, the Regular System and Land Court System. Certain properties are in both the Regular and Land Court systems. These properties are called Dual System properties. Section 4.2.1 of the Kohala Water Report describes how to determine whether the property is Regular System property, Land Court property, or Dual System property.
- There are 20 steps to fill out the Grant of Easement form. Each step is shown on the Sample Grant of Easement forms by red numbers, with arrows, and is explained in the Instructions.
- The Guidelines attached to the Instructions provide additional information to help in filling out the Grant of Easement form. The Guidelines are attached to the Instructions.
- The Instructions explain how to fill in the grant of easement form. The Kohala Water Report, at Section 4.21, describes the entire process for obtaining an easement, including what should be done before the grant of easement form is completed and how to record the completed grant of easement document.

Grant of Easement Form

LAND COURT SYSTEM | REGULAR SYSTEM

AFTER RECORDATION, RETURN BY MAIL ( ) OR PICKUP ( )

1

TYPE OF DOCUMENT:
GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION

PARTIES TO DOCUMENT:
GRANTOR: 2 _____
GRANTEE: 3 _____

TAX MAP KEY FOR PROPERTY:
4 _____, THIRD TAXATION DIVISION

5

(TOTAL PAGES: _____)

GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION

6

THIS GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION ("Agreement"), effective as of _____, _____, is made between **[**fill in Grantor's legal name**]**, whose address is **[**fill in Grantor's address**]** ("Grantor") and **[**fill in Grantee's legal name**]**, whose address is **[**fill in Grantee's address**]** ("Grantee") (each, a "Party", collectively, "Parties").

7 8 9 10

RECITALS

A. Grantor is the owner of the real property described in Exhibit A attached hereto and incorporated herein by reference ("Property").

B. **[**Choose either option 1 or option 2.**]**

[Option 1**: Grantee operates the **[**fill in name of water system**]** non-potable water system ("Water System"), which provides agricultural water service to agricultural users in the North Kohala area on the Island of Hawaii, State of Hawaii.**]**

[Option 2**: Grantee is or will receive agricultural water service in the North Kohala area on the Island of Hawaii, State of Hawaii.**]**

C. **[**Choose either option 1 or option 2.**]**

[Option 1**: Certain Water System infrastructure ("Infrastructure") that is essential to Grantee's operation of the Water System: (i) exists on the Property, or (ii) pursuant to Grantee's plans, will be constructed on the Property.**]**

[Option 2**: Certain infrastructure ("Infrastructure") that is essential to Grantee's receipt of agricultural water service: (i) exists on the Property, or (ii) pursuant to Grantee's plans, will be constructed on the Property.**]**

D. Grantee seeks to obtain, from Grantor, and Grantor agrees to convey, an easement over portion(s) of the Property as described in and/or shown on Exhibit B, attached hereto and incorporated herein by reference (collectively, "Easement Area") for the existence, construction, maintenance, and operation of the Infrastructure through the Easement Area.

E. Grantor seeks to quitclaim and dedicate any presently existing Infrastructure, as listed or depicted in Exhibit C, attached hereto and incorporated herein by reference, within the Easement Area to Grantee.

F. Accordingly, Grantor desires to provide to Grantee and Grantee desires to acquire rights sufficient for these purposes, all as more particularly set forth below.

AGREEMENT

NOW THEREFORE, for and in consideration of the sum of TEN AND NO/100 ($10.00) and other good and valuable consideration paid by Grantee to Grantor, the receipt whereof is hereby acknowledged by Grantor, and of the covenants of Parties as hereinafter contained, Grantor does hereby grant and convey unto Grantee, **[**fill in Grantee's tenancy**],** an easement over the Easement Area to use, maintain, operate, replace, repair, reconstruct, and remove any and all Infrastructure now or at any time hereafter located within the Easement Area, including those facilities, equipment,

appliances, and appurtenances necessary to convey, transmit and distribute water through the Easement Area and to properly measure and control water so conveyed, transmitted, and distributed, including the items listed or depicted in Exhibit C.

TOGETHER WITH the right to enter upon the Easement Area and the lands adjacent thereto for all purposes in connection with the rights and easements hereby granted;

AND with the right, title, and interest in the presently existing Infrastructure described in said Exhibit C;

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TO HAVE AND TO HOLD the same unto Grantee, **[**fill in Grantee's tenancy**],** and its successors and assigns.

In consideration of the rights hereby granted, the acceptance thereof and obligations hereby assumed, Grantor and Grantee hereby covenant and agree as follows:

1. **Quitclaim, Surrender, and Dedication**. Grantor hereby quitclaims and surrenders forever, and dedicates and conveys to Grantee all of its right, title and interest in and to any and all Infrastructure installed within the Easement Area for non-potable water purposes, including but not limited to the items listed or depicted in Exhibit C, said personal property is conveyed by Grantor to Grantee "AS IS", "WHERE IS", without warranty or representation, express or implied as to the condition or fitness for any purpose whatsoever, Grantee hereby affirming to Grantor that Grantee has had the opportunity to inspect and accepts the same "AS IS", "WHERE IS", together with any and all warranties or product support agreements to which Grantor may have rights applicable to such facilities, equipment, appliances and appurtenances, and all such facilities, equipment, appliances and appurtenances hereinafter shall be and remain the property of Grantee.

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2. **Term**. **[**Choose either option 1 or option 2.**]**

[Option 1**:** The rights granted in this Agreement shall be possessed and enjoyed on a perpetual basis.**]**

[Option 2**:** The term of this Agreement shall commence on the effective date of this Agreement (as first written above) and shall run for a period of twenty (20) years (the "Term"). If Grantee is not in default under this Agreement, Grantee shall, starting at five (5) years prior to the end of the Term, have the option to renew this Agreement for a further period of _____ (__) years. Any such renewal shall be upon the same terms and conditions of this Agreement. Grantee shall give prior written notice to Grantor of its intent to renew this Agreement at least four (4) years prior to the end of the Term.**]**

3. **Automatic Termination of Easement**. This Agreement shall lapse, terminate, and become automatically null and void if Grantee fails, for a continuous period of ten (10) years, to maintain, operate, replace, repair, reconstruct, or remove any Infrastructure within the Easement Area.

4. **No Interference**. Grantee will exercise its rights hereunder in such manner as to occasion only such interference with the use of the Property by the owners and occupants thereof as is reasonably necessary.

5. **Restoration**. That after any construction, repair or other work has been completed by Grantee, the surface of the ground and of any road, walkway or curb disturbed by Grantee shall be restored by Grantee to its condition existing prior to such construction, repair or other work to the extent that such restoration is reasonably possible.

6. **Indemnity**. That Grantee shall indemnify and save harmless Grantor against all loss or damage to the Property or to the property of others situated adjacent to the Easement Area, and from all liability for injury to or death of persons when such loss, damage, injury or death arises or proximately results from the negligence of Grantee, its agents or servants.

7. **Placement of Improvements Below, on Surface of, or Above Easement Area**. That Grantor shall not at any time during the term of this indenture erect or place any building foundation of any kind below the surface of the Easement Area or at any time erect or place any landscaping, building, structure or improvements of any kind, other than roads, walkways, curbs or appurtenances thereof, or stockpile any material above or on the surface of the Easement Area, unless the plans for the landscaping, building foundation, building, structure, improvements or stockpile shall be first approved in writing by Grantee and unless the same shall be so constructed or placed as not to interfere with Grantee's exercise of its rights hereunder; provided, however, that this provision shall not prohibit Grantor from constructing and maintaining roads, walkways, curbs, or appurtenances thereof within the Easement Area or from laying, constructing, operating, maintaining, repairing or removing Grantor's own pipelines, conduits or drains below the surface of the Easement Area provided that such uses do not interfere with the exercise by Grantee of the rights herein granted; provided, further, that if it becomes necessary to excavate, grade or change the existing ground conditions or Grantor's pipelines, conduits or drains within the Easement Area, the plans shall first be submitted to Grantee for its prior written approval, which approval shall not be unreasonably withheld.

8. **Condemnation**. That if at any time the premises across which the rights and easements are hereby granted, or any part thereof, shall be condemned or taken by any governmental authority, Grantee shall have the right to claim and recover from the condemning authority, but not from Grantor, such compensation as is payable for the rights and easements granted herein and for the pipelines, conduits, meters, fire hydrants, control cable, storage tanks, facilities, equipment, appliances and

appurtenances within the Easement Area owned by Grantee, all of which shall be payable to Grantee.

9. **Parties in Interest**. The covenants contained in this Agreement shall inure to the benefit of, and be binding upon, the Parties and their respective heirs, devisees, personal representatives, successors, and assigns. As such, the Property shall be held, conveyed, hypothecated, encumbered, leased, used and occupied subject to the covenants, terms and provisions set forth in this Agreement, which shall run with the Property and each portion thereof and interest therein as equitable servitudes, and shall be binding upon and inure to the benefit of the Parties and any other person and entity having any interest therein during their ownership thereof, and their respective heirs, devisees, personal representatives, successors and assigns.

10. **Attorney's Fees**. In any action arising out of this Agreement, the losing or defaulting Party shall pay to the prevailing Party reasonable attorney's fees, costs and expenses incurred in prosecuting such action.

11. **Governing Law**. This Agreement shall be governed by and construed in accordance with the laws of the State of Hawaii.

12. **Notices**. All notices and demands by one Party to another shall be made in writing and delivered by personal service or sent by registered or certified mail, return receipt requested, to the address of the appropriate Party as set forth herein and shall be deemed effective upon mailing:

If to Grantor: 19 _____

_____

_____

Attention: _____

If to Grantee: 19 _____

_____

_____

Attention: _____

Any Party may from time to time change its address for the purpose of notices to that Party by a similar notice specifying a new address, but no such change is effective until it is actually received by the Party sought to be charged with its contents.

13. **Counterparts**. This Agreement may be executed in counterparts, each of which shall be an original, with the same effect as if the signatures were upon the same instrument, and all counterparts together shall constitute a single agreement.

[SIGNATURES APPEAR ON FOLLOWING PAGES]

[ENTITY Grantor]

20

[fill in Grantor's legal name**]**

By: _____
Printed Name:
Its:

Grantor

STATE OF HAWAII)
) SS.
_____)

On this _____ day of _____, _____, in the _____ Circuit, State of Hawaii, before me personally appeared _____, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such person is the _____ of _____, a _____, that said person executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as such person's free act and deed as having been duly authorized to execute such instrument in such capacity.

The foregoing instrument is dated _____, _____ and contained _____ pages at the time of this acknowledgment/certification.

_____
Notary Public, State of Hawaii

_____
Printed Name of Notary Public

My commission expires: _____

[INDIVIDUAL Grantor]

20

[fill in Grantor's legal name**]**

By: _____
Printed Name:

Grantor

STATE OF HAWAII)
) SS.
_____)

On this _____ day of _____, _____, in the _____ Circuit, State of Hawaii, before me personally appeared _____, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such person executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as the free act and deed of such persons, and if applicable, in the capacities shown, having been duly authorized to execute such instrument in such capacities.

The foregoing instrument is dated _____, _____ and contained _____ pages at the time of this acknowledgment/certification.

_____
Notary Public, State of Hawaii

_____
Printed Name of Notary Public

My commission expires: _____

[ENTITY Grantee]

20

[fill in Grantee's legal name**]**

By: _____
Printed Name:
Its:

Grantee

STATE OF HAWAII)
) SS.
_____)

On this _____ day of _____, _____, in the _____ Circuit, State of Hawaii, before me personally appeared _____, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such person is the _____ of _____, a _____, that said person executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as such person's free act and deed as having been duly authorized to execute such instrument in such capacity.

The foregoing instrument is dated _____, _____ and contained _____ pages at the time of this acknowledgment/certification.

_____
Notary Public, State of Hawaii

_____
Printed Name of Notary Public

My commission expires: _____

[INDIVIDUAL Grantee]

20

[fill in Grantee's legal name**]**

_____

Printed Name:

Grantee

STATE OF HAWAII)
) SS.
_____)

On this _____ day of _____, _____, in the _____ Circuit, State of Hawaii, before me personally appeared _____, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such person executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as the free act and deed of such persons, and if applicable, in the capacities shown, having been duly authorized to execute such instrument in such capacities.

The foregoing instrument is dated _____, _____ and contained _____ pages at the time of this acknowledgment/certification.

_____

Notary Public, State of Hawaii

_____

Printed Name of Notary Public

My commission expires: _____

EXHIBIT A

Property Description

EXHIBIT B

Map Depicting Easement Area and/or Description of Easement Area

EXHIBIT C

Existing Infrastructure

Instructions

(explaining how to fill out the Grant of Easement form)

INSTRUCTIONS

Steps:

1. Name and address where the grant of easement, after it is recorded, is to be returned and indicate whether it will be returned by mail or pickup.

2. Name, marital status, and address of Grantor. Depending upon whether the property is Regular System, Land Court, or Dual System property, different rules apply. The rules are summarized at Steps 7 and 8 below.

3. Name, marital status, and address of Grantee. Depending upon whether the property is Regular System, Land Court, or Dual System property, different rules apply. The rules are summarized at Steps 9 and 10 below.

4. Tax Map Key number for the property upon which the easement will be located. You can find out the current Tax Map Key number by going to the County of Hawaii Real Property Tax Office website (www.hawaiipropertytax.com), clicking on "Search Records", and then following the prompts.

5. Total number of pages making up the grant of easement document, including the notary acknowledgments and all exhibits.

6. Date of grant of easement document. This date is usually the latter date of notarization /certification of the Grantor's or Grantee's signing.

7. Grantor's name and marital status:

Regular System	Land Court or Dual System
• For a person, fill in name, marital status, & spouse's name (if applicable), as stated in current title report or ownership deed. For further information, refer to the Guidelines, at I.A.1. • For an example of how to fill in the form if the person's name has changed from when the person acquired the property, refer to the Guidelines, at I.A.1.d. • For an entity, fill in entity name, type, and state of formation, as registered with the applicable government agency. For an example, refer to the Guidelines, at I.A.2.	• For a person, fill in full legal name, marital status, and spouse's full legal name, as stated in current title report, ownership deed, or Land Court original certificate of title or transfer certificate of title. For further information, refer to the Guidelines, at I.B.1. • If name or marital status has changed since the property was acquired, a Land Court order amending the name and/or marital status must be obtained. For further information, refer to the Guidelines, at I.B.1.d. • For an entity, fill in entity name, type, and state of formation, as registered with the applicable government agency. For an example, refer to the Guidelines, at I.B.2.

8. Grantor's address:

Regular System	Land Court or Dual System
Current address not required but most people fill this in	Current address not required but most people fill this in

9. Grantee's name and marital status:

Regular System	Land Court or Dual System
• For a person, fill in name, marital status, & spouse's name (if applicable). For further information, refer to the Guidelines, at II.A.1. • For an entity, fill in entity name, type, and state of formation, as registered with the applicable government agency. For an example, refer to the Guidelines, at II.A.2.	• For a person, fill in full legal name, marital status, and spouse's full legal name. For further information, refer to the Guidelines, at II.B.1. • For an entity, fill in entity name, type, and state of formation, as registered with the applicable government agency. For an example, refer to the Guidelines, at II.B.2.

10. Grantee's address:

Regular System	Land Court or Dual System
Current address required	Current address required

11. Recital A, prepare and attach Exhibit A, "Property" description.

12. Recital B, select either Option 1 or Option 2.

13. Recital C, select either Option 1 or Option 2.

14. Recital D, prepare and attach Exhibit B, "Easement Area" description.

15. Recital E, prepare and attach Exhibit C, "Infrastructure" list or illustrations or photographs.

16. and 17. Insert tenancy; i.e., Tenant in Severalty, Tenants by the Entirety, Joint Tenants, or Tenants in Common with specified interest. For further information, refer to the Guidelines, at III.

18. Paragraph 2, Term, select either Option 1 or Option 2. If Option 2 is selected, insert number of years that the easement will remain in effect.

19. Paragraph 12, Notices, insert the name and address and to whom notices are to be provided to Grantor and Grantee.

20. Select and complete the appropriate signature and notary acknowledgment/certification pages. The Grantor's and Grantee's names must be the same as recited in Instructions Steps 2, 3, 7, and 9. Inconsistencies will result in the Bureau of Conveyances rejecting the grant of easement document for recordation.

The above Instructions explain how to fill in the grant of easement form. The Kohala Water Report, at Section 4.21, describes the entire process for obtaining an easement, including what should be done before the grant of easement form is completed and how to record the grant of easement document at the State of Hawaii Bureau of Conveyances.

GUIDELINES

I. **Grantor (the owner of the land upon which the easement will be located)**:

A. Regular System property:

1. For a person:

a. Name: The name should be written the same as when the person acquired the property, unless the person's name has changed. If the person's name has changed, see below.

b. Marital Status / Spouse's name: This is not required, but most people fill in this information.

c. Address: optional.

d. If a person's name or marital status has changed since that person acquired the property write the person's current name/marital status, followed by "formerly known as" and the name shown on the deed through which the person acquired the property. Example: Leilani A. Doe, wife of John Doe (formerly known as Leilani Apo, unmarried).

2. For an entity:

a. Entity name, type, and state of formation, as registered with the applicable government agency. Example: XYZ Corporation, a Hawaii corporation.

b. Address: optional.

B. Land Court or Dual System property:

1. For a person:

a. Name: The full legal name must be written in exactly the same way the name was written in the ownership deed and the certificate of title, OR if the person's name has changed since acquiring the property, the name must be written exactly as recited in a Land Court order recognizing such change. Information about how to obtain a Land Court order is provided below.

b. Marital Status / Spouse's full legal name: These must be written in exactly the same way as they were written in the ownership deed and the certificate of title, OR if the person's marital status or spouse's name has changed since acquiring the property, these must be written exactly as recited in a Land Court order. Information about how to obtain a Land Court order is provided below.

c. Address: optional.

d. If a person's name, marital status, or spouse's name has changed since acquiring the property, a Land Court order regarding such changes must be obtained. To obtain the Land Court order, you must complete and file the following two documents:

- Land Court Information Sheet: For a copy of this form see Appendix A and: http://www.courts.state.hi.us/docs/form/land_court/SCRU_1_1089_Rules_RLC_27Dec2011.pdf

- Petition for Amendment of Land Court Certificate of Title: For a copy of this form see Appendix B. and: http://oaoa.hawaii.gov/jud/LandNTaxCt/LT-P-018LandwFF-.pdf. The Land Court is currently (as of December 2018) revising the Petition Instructions and Samples. For assistance in completing the Petition form, contact the Land Court at (808) 539-4777.

2. For an entity:

a. Entity name, type, and state of formation, as registered with the applicable government agency. Example: XYZ Corporation, a Hawaii corporation.

b. Address: optional.

II. **Grantee (the person, people, or entity who need the easement)**:

A. Regular System property:

1. For a person:

a. Name.

b. Marital Status / Spouse's name: This is not required, but most people fill in this information.

c. Address: required.

2. For an entity:

a. Entity name, type, and state of formation, as registered with the applicable government agency. Example: XYZ Corporation, a Hawaii corporation.

b. Address: required.

B. Land Court or Dual System property:

1. For a person:

a. Name: Full legal name, do not use initials.

b. Marital Status / Spouse's name: Marital status and spouse's full legal name, do not use initials.

c. Address: required.

2. For an entity:

a. Entity name, type, and state of formation, as registered with the applicable government agency. Example: XYZ Corporation, a Hawaii corporation.

b. Address: required.

III. **Tenancy**. The Grantee (the person, people, or entity who need the easement) should seek professional advice (from a real estate attorney and/or a tax attorney or certified public accountant) in determining the tenancy, since the choice of tenancy may have legal and tax implications.

A. Tenant in Severalty: The ownership interest in the easement/infrastructure is held solely by one individual or entity:

1. Example language for a person: John Doe, his/her heirs, devisees, personal representative, and assigns.

2. Example language for an entity: XYZ Corporation, its successors and assigns.

B. Tenants by the Entirety: The ownership interest in the easement/infrastructure is held only by a married couple, with rights of survivorship. Example language: John Doe and Jane Doe, as Tenants by the Entirety with full rights of survivorship, their assigns and the survivor of them and the heirs, devisees, personal representatives and assigns of the survivor of them.

C. Joint Tenants: The ownership interest in the easement/infrastructure is held only by multiple individuals. Example language: John Doe and Mary Jones, as Joint Tenants with full rights of survivorship, their assigns and the survivor of them and his or her heirs, devisees, personal representatives and assigns.

D. Tenants in Common: Specified percentages of the ownership interest are held by multiple individuals or entities

Example:

John Doe and Jane Doe, husband and wife, as Tenants by the Entirety with full rights of survivorship, their assigns and the survivor of them and the heirs, devisees, personal representatives and assigns of the survivor of them, as to an undivided 25% interest;

Mary Jones, as Tenants in Severalty, her heirs, devisees, personal representatives, and assigns, as to an undivided 25% interest; and

XYZ Corporation, as Tenant in Severalty, its successor and assigns, as to the remaining undivided 50% interest;

as among Grantee John Doe and Jane Doe, Grantee Mary Jones, and Grantee XYZ Corporation, as Tenants in Common in and to the whole of the same.

Sample of a completed Grant of Easement form for a Dual System property

LAND COURT SYSTEM | REGULAR SYSTEM

AFTER RECORDATION, RETURN BY MAIL (√) OR PICKUP ( )

1 → NORTH KOHALA WATER CORPORATION
12345 MAIN STREET
HILO, HAWAII 96720
ATTN: MAE KALAMA

TYPE OF DOCUMENT:
GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION

PARTIES TO DOCUMENT:

GRANTOR: 2 → JOHN KEOKI ALAPAI AND ANNE PIKAKE ALAPAI, HUSBAND AND WIFE
P.O. BOX 99-3030
KAPAAU, HAWAII 96755

GRANTEE: 3 → NORTH KOHALA WATER CORPORATION, A HAWAII CORPORATION
12345 MAIN STREET
HILO, HAWAII 96720

TAX MAP KEY FOR PROPERTY:
4 → 5-9-002-015 AND 069, THIRD TAXATION DIVISION

5 → (TOTAL PAGES: __11____)

GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION

THIS GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION ("Agreement"), effective as of _____, 20___, is made between **JOHN KEOKI**

6 → 7 →

ALAPAI and ANNE PIKAKE ALAPAI, husband and wife, whose address is **P.O. Box 99-3030, Kapaau, Hawaii 96755,** ("Grantor") and **NORTH KOHALA WATER CORPORATION, a Hawaii corporation**, whose address is **12345 Main Street, Hilo, Hawaii 96720** ("Grantee") (each, a "Party", collectively, "Parties").

RECITALS

A. Grantor is the owner of the real property described in Exhibit A attached hereto and incorporated herein by reference ("Property").

B. Grantee operates the **NORTH KOHALA WATER SYSTEM,** a non-potable water system ("Water System"), which provides agricultural water service to agricultural users in the North Kohala area on the Island of Hawaii, State of Hawaii.

C. Certain Water System infrastructure ("Infrastructure") that is essential to Grantee's operation of the Water System: (i) exists on the Property, or (ii) pursuant to Grantee's plans, will be constructed on the Property.

D. Grantee seeks to obtain, from Grantor, and Grantor agrees to convey, an easement over portion(s) of the Property as described in and/or shown on Exhibit B, attached hereto and incorporated herein by reference (collectively, "Easement Area") for the existence, construction, maintenance, and operation of the Infrastructure through the Easement Area.

E. Grantor seeks to quitclaim and dedicate any presently existing Infrastructure, as listed or depicted in Exhibit C, attached hereto and incorporated herein by reference, within the Easement Area to Grantee.

F. Accordingly, Grantor desires to provide to Grantee and Grantee desires to acquire rights sufficient for these purposes, all as more particularly set forth below.

AGREEMENT

NOW THEREFORE, for and in consideration of the sum of TEN AND NO/100 ($10.00) and other good and valuable consideration paid by Grantee to Grantor, the receipt whereof is hereby acknowledged by Grantor, and of the covenants of Parties as hereinafter contained, Grantor does hereby grant and convey unto Grantee, as Tenant in Severalty, and its successors and assigns, an easement over the Easement Area to use, maintain, operate, replace, repair, reconstruct, and remove any and all Infrastructure now or at any time hereafter located within the Easement Area, including those facilities, equipment, appliances, and appurtenances necessary to convey, transmit and distribute water through the Easement Area and to properly measure and control water so conveyed, transmitted, and distributed, including the items listed or depicted in Exhibit C.

TOGETHER WITH the right to enter upon the Easement Area and the lands adjacent thereto for all purposes in connection with the rights and easements hereby granted;

AND with the right, title, and interest in the presently existing Infrastructure described in said Exhibit C;

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TO HAVE AND TO HOLD the same unto Grantee, as Tenant in Severalty, and its successors and assigns.

In consideration of the rights hereby granted, the acceptance thereof and obligations hereby assumed, Grantor and Grantee hereby covenant and agree as follows:

1. **Quitclaim, Surrender, and Dedication**. Grantor hereby quitclaims and surrenders forever, and dedicates and conveys to Grantee all of its right, title and interest in and to any and all Infrastructure installed within the Easement Area for non-potable water purposes, including but not limited to the items listed or depicted in Exhibit C, said personal property is conveyed by Grantor to Grantee "AS IS", "WHERE IS", without warranty or representation, express or implied as to the condition or fitness for any purpose whatsoever, Grantee hereby affirming to Grantor that Grantee has had the opportunity to inspect and accepts the same "AS IS", "WHERE IS", together with any and all warranties or product support agreements to which Grantor may have rights applicable to such facilities, equipment, appliances and appurtenances, and all such facilities, equipment, appliances and appurtenances hereinafter shall be and remain the property of Grantee.

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2. **Term**. The rights granted in this Agreement shall be possessed and enjoyed on a perpetual basis.

3. **Automatic Termination of Easement**. This Agreement shall lapse, terminate, and become automatically null and void if Grantee fails, for a continuous period of ten (10) years, to maintain, operate, replace, repair, reconstruct, or remove any Infrastructure within the Easement Area.

4. **No Interference**. Grantee will exercise its rights hereunder in such manner as to occasion only such interference with the use of the Property by the owners and occupants thereof as is reasonably necessary.

5. **Restoration**. That after any construction, repair or other work has been completed by Grantee, the surface of the ground and of any road, walkway or curb disturbed by Grantee shall be restored by Grantee to its condition existing prior to such construction, repair or other work to the extent that such restoration is reasonably possible.

6. **Indemnity**. That Grantee shall indemnify and save harmless Grantor against all loss or damage to the Property or to the property of others situated adjacent to the Easement Area, and from all liability for injury to or death of persons when such loss, damage, injury or death arises or proximately results from the negligence of Grantee, its agents or servants.

7. **Placement of Improvements Below, on Surface of, or Above Easement Area**. That Grantor shall not at any time during the term of this indenture erect or place any building foundation of any kind below the surface of the Easement Area or at any time erect or place any landscaping, building, structure or improvements of any kind, other than roads, walkways, curbs or appurtenances thereof, or stockpile any material above or on the surface of the Easement Area, unless the plans for the landscaping, building foundation, building, structure, improvements or stockpile shall be first approved in writing by Grantee and unless the same shall be so constructed or placed as not to interfere with Grantee's exercise of its rights hereunder; provided, however, that this provision shall not prohibit Grantor from constructing and maintaining roads, walkways, curbs, or appurtenances thereof within the Easement Area or from laying, constructing, operating, maintaining, repairing or removing Grantor's own pipelines, conduits or drains below the surface of the Easement Area provided that such uses do not interfere with the exercise by Grantee of the rights herein granted; provided, further, that if it becomes necessary to excavate, grade or change the existing ground conditions or Grantor's pipelines, conduits or drains within the Easement Area, the plans shall first be submitted to Grantee for its prior written approval, which approval shall not be unreasonably withheld.

8. **Condemnation**. That if at any time the premises across which the rights and easements are hereby granted, or any part thereof, shall be condemned or taken by any governmental authority, Grantee shall have the right to claim and recover from the condemning authority, but not from Grantor, such compensation as is payable for the rights and easements granted herein and for the pipelines, conduits, meters, fire hydrants, control cable, storage tanks, facilities, equipment, appliances and appurtenances within the Easement Area owned by Grantee, all of which shall be payable to Grantee.

9. **Parties in Interest**. The covenants contained in this Agreement shall inure to the benefit of, and be binding upon, the Parties and their respective heirs, devisees, personal representatives, successors, and assigns. As such, the Property shall be held, conveyed, hypothecated, encumbered, leased, used and occupied subject to the covenants, terms and provisions set forth in this Agreement, which shall run with the Property and each portion thereof and interest therein as equitable servitudes, and shall be binding upon and inure to the benefit of the Parties and any other person and entity having any interest therein during their ownership thereof, and their respective heirs, devisees, personal representatives, successors and assigns.

10. **Attorney's Fees**. In any action arising out of this Agreement, the losing or defaulting Party shall pay to the prevailing Party reasonable attorney's fees, costs and expenses incurred in prosecuting such action.

11. **Governing Law**. This Agreement shall be governed by and construed in accordance with the laws of the State of Hawaii.

12. **Notices**. All notices and demands by one Party to another shall be made in writing and delivered by personal service or sent by registered or certified mail, return receipt requested, to the address of the appropriate Party as set forth herein and shall be deemed effective upon mailing:

If to Grantor: 19 → John Keoki Alapai & Anne Pikake Alapai
P.O. Box 99-3030
Kapaau, Hawaii 96755

If to Grantee: 19 → North Kohala Water Corporation
12345 Main Street
Hilo, Hawaii 96720
Attention: Mae Kalama

Any Party may from time to time change its address for the purpose of notices to that Party by a similar notice specifying a new address, but no such change is effective until it is actually received by the Party sought to be charged with its contents.

13. **Counterparts**. This Agreement may be executed in counterparts, each of which shall be an original, with the same effect as if the signatures were upon the same instrument, and all counterparts together shall constitute a single agreement.

[SIGNATURES APPEAR ON FOLLOWING PAGES]

20

Grantor Signature and Notary Public Acknowledgment/Certification

_____
JOHN KEOKI ALAPAI

_____
ANNE PIKAKE ALAPAI

Grantor

STATE OF HAWAII)
) SS.
COUNTY OF HAWAII)

On this _____ day of _____, 20___ in the Third Circuit, State of Hawaii, before me personally appeared JOHN KEOKI ALAPAI and ANNE PIKAKE ALAPAI, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such persons executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as the free act and deed of such persons, and if applicable, in the capacities shown, having been duly authorized to execute such instrument in such capacities.

The foregoing instrument is dated _____, 20___, and contained _____ pages at the time of this acknowledgment/certification.

_____
Notary Public, State of Hawaii

_____
Printed Name of Notary Public

My commission expires: _____

20

Grantee Signature and Notary Public Acknowledgment/Certification

NORTH KOHALA WATER COMPANY

By: _____
RICHARD S. WAIPALI
Its: President

Grantee

STATE OF HAWAII)
) SS.
COUNTY OF HAWAII)

On this _____ day of _____, 20___, in the Third Circuit, State of Hawaii, before me personally appeared RICHARD S. WAIPALI, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such person is the President of NORTH KOHALA WATER CORPORATION, a Hawaii corporation, that said person executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as such person's free act and deed as having been duly authorized to execute such instrument in such capacity.

The foregoing instrument is dated _____, 20___, and contained _____ pages at the time of this acknowledgment/certification.

_____
Notary Public, State of Hawaii

_____
Printed Name of Notary Public

My commission expires: _____

EXHIBIT A

FIRST:

ALL of that parcel of land situate at North Kohala, Island of Hawaii, State of Hawaii, more particularly described as follows:

LOT 14, area 15.25 acres, more or less, as shown on Map 10, filed in the Office of the Assistant Registrar of the Land Court of the State of Hawaii with Land Court Application No. 1036 of Medeiros Ranch, Limited.

TOGETHER WITH access to a public road over Roadway Lot 5, as shown on Map 2 of said Land Court Application No. 1036, as set forth by Land Court Order No. 2015, filed in said Office of the Assistant Registrar on June 30, 1949.

BEING the same land described in and covered by Transfer Certificate of Title No. 56,202, issued to JOHN KEOKI ALAPAI and ANNE PIKAKE ALAPAI, husband and wife, as Tenants by the Entirety,

SUBJECT, HOWEVER, to all encumbrances, whether recorded or unrecorded.

TMK 3-5-9-002-015

SECOND:

ALL of that parcel of land situate in the District of North Kohala, Island of Hawaii, State of Hawaii, more particularly described as follows:

LOT D, area 0.531 acre, more or less, being a portion of Royal Patent 4475, Land Commission Award 7713, Apana 4 to V, Kamamalu.

Beginning at the Northwest corner of this parcel of land, being also the Southeast corner of Lot 2-A, being a portion of Royal Patent 4475, Land Commission Award 7713, Apana 4 to V. Kamamalu, the coordinates of said point of beginning referred to Government Survey Triangulation Station “PUU PILI” being 25,254.35 feet South and 10,139.11 feet East and thence running by azimuths measured clockwise from true South:

1.	260°	38’	56”	231.39	feet along Lot C-1, being a portion of R.P. 4474, L.C. Aw.7713, Apana 4 to V. Kamamalu;

2.	350°	40’		100.00	feet along Lot C-1, being a portion of R.P. 4474, L.C. Aw.7713, Apana 4 to V. Kamamalu;
3.	80°	38’	56”	231.36	feet along Lot C-2, being a portion of R.P. 4474, L.C. Aw.7713, Apana 4 to V. Kamamalu;
4.	170°	38’	56”	100.00	feet along Lot C-2, being a portion of R.P. 4474, L.C. Aw.7713, Apana 4 to V. Kamamalu to the point of beginning and containing an area of 0.531 acre.

TOGETHER WITH access to a public road over Roadway Lot C-3, being a portion of R.P. 4474, L.C. Aw. 7713, Apana 4 to V. Kamamalu, and Roadway Lot 5, as shown on Map 2 of said Land Court Application No. 1036, as set forth by Land Court Order No. 2015, filed in said Office of the Assistant Registrar on June 30, 1949.

BEING the same land conveyed to JOHN KEOKI ALAPAI and ANNE PIKAKE ALAPAI, husband and wife, as Tenants by the Entirety, by Deed dated March 1, 1957.

SUBJECT, HOWEVER, to all encumbrances, whether recorded or unrecord.

TMK 3-5-9-002-019

EXHIBIT B

FIRST:

Easement 23, for water pipeline purposes, containing an area of 114 square feet, as shown on Map 20, filed in the Office of the Assistant Registrar of the Land Court of the State of Hawaii with Land Court Application No. 1036 of Medeiros Ranch, Limited, as set forth in Land Court Order No. 1601, recorded April 1, 2018, affecting Lot 14.

Said Lot 14 is shown on Map 10 of Land Court Application No. 1036, such lot being situate in the District of North Kohala, County of Hawaii, State of Hawaii, and is more particularly described in and covered by Land Court Certificate of Title No. 56,202, issued to JOHN KEOKI ALAPAI and ANNE PIKAKE ALAPAI, husband and wife, as Tenants by the Entirety,

SECOND:

Easement L, for water pipeline purposes, containing an area of 710 square feet, more or less, affecting Lot D, being a portion of Royal Patent 4475, Land Commission Award 7713, Apana 4 to V, Kamamalu.

Beginning at the Northeast corner of this easement, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU PILI" being 24,149.22 feet South and 11,226.47 feet East, thence running by azimuths measured clockwise from true South:

1.	359°	02'	56"	16.5	feet;
2.	89°	02'	56"	43.00	feet;
3.	179°	02'	56"	16.40	feet;
4.	269°	02'	56"	43.00	feet along the South side of Lot C-2, being a portion of R.P. 4474, L.C. Aw.7713, Apana 4 to V. Kamamalu to the point of beginning and containing an area of 710 square feet, as shown on survey map prepared by Christopher Robbins, Licensed Professional Surveyor, Certificate No. 202018.

EXHIBIT C

Existing Infrastructure

2" Meter
Pressure Reducing Valve set at 75 psi
4" Gate Valve
Approximately 341’ of 2.5” PVC pipe

Sample of a completed Grant of Easement form for a Regular System property

LAND COURT SYSTEM | REGULAR SYSTEM

AFTER RECORDATION, RETURN BY MAIL ( ) OR PICKUP ( )

1 → JOSEPH AND JENNIFER SMITH
P.O. BOX 99-2020
KAPAAU, HAWAII 96755

TYPE OF DOCUMENT:
GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION

PARTIES TO DOCUMENT:
GRANTOR: 2 → ANNE P. ALAPAI (FORMERLY KNOWN AS ANN SOUZA), WIFE OF JOHN K. ALAPAI
GRANTEE: 3 → JOSEPH P. SMITH AND JENNIFER J. SMITH, HUSBAND AND WIFE
P.O. BOX 99-2020
KAPAAU, HAWAII 96755

TAX MAP KEY FOR PROPERTY:
4 → 5-9-002-019, THIRD TAXATION DIVISION

5 →

(TOTAL PAGES: __10__)

GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION

6 →

THIS GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION ("Agreement"), effective as of _____, 20_____, is made between **ANNE P. ALAPAI (formerly known as Anne Souza), wife of John K. Alapai** ("Grantor") and **JOSEPH P. SMITH and JENNIFER J. SMITH, husband and wife,** whose address is **P.O. Box 99-2020, Kapaau, Hawaii 96755** ("Grantee") (each, a "Party", collectively, "Parties").

7 →

9 →

10 →

RECITALS

A. Grantor is the owner of the real property described in Exhibit A attached hereto and incorporated herein by reference ("Property").

B. Grantee is or will receive agricultural water service in the North Kohala area on the Island of Hawaii, State of Hawaii.

C. Certain infrastructure ("Infrastructure") that is essential to Grantee's receipt of agricultural water service: (i) exists on the Property, or (ii) pursuant to Grantee's plans, will be constructed on the Property.

D. Grantee seeks to obtain, from Grantor, and Grantor agrees to convey, an easement over portion(s) of the Property as described in and/or shown on Exhibit B, attached hereto and incorporated herein by reference (collectively, "Easement Area") for the existence, construction, maintenance, and operation of the Infrastructure through the Easement Area.

E. Grantor seeks to quitclaim and dedicate any presently existing Infrastructure, as listed or depicted in Exhibit C, attached hereto and incorporated herein by reference, within the Easement Area to Grantee.

F. Accordingly, Grantor desires to provide to Grantee and Grantee desires to acquire rights sufficient for these purposes, all as more particularly set forth below.

AGREEMENT

NOW THEREFORE, for and in consideration of the sum of TEN AND NO/100 ($10.00) and other good and valuable consideration paid by Grantee to Grantor, the receipt whereof is hereby acknowledged by Grantor, and of the covenants of Parties as hereinafter contained, Grantor does hereby grant and convey unto Grantee, as Tenants by the Entirety with full rights of survivorship, their assigns and the survivor of them and the heirs, devises, personal representatives and assigns of the survivor of them, an easement over the Easement Area to use, maintain, operate, replace, repair, reconstruct, and remove any and all Infrastructure now or at any time hereafter located within the Easement Area, including those facilities, equipment, appliances, and appurtenances necessary to convey, transmit and distribute water through the Easement Area and to properly measure and control water so conveyed, transmitted, and distributed, including the items listed or depicted in Exhibit C.

TOGETHER WITH the right to enter upon the Easement Area and the lands adjacent thereto for all purposes in connection with the rights and easements hereby granted;

AND with the right, title, and interest in the presently existing Infrastructure described in said Exhibit C;

17

TO HAVE AND TO HOLD the same unto Grantee, as Tenants by the Entirety with full rights of survivorship, their assigns and the survivor of them and the heirs, devises, personal representatives and assigns of the survivor of them.

In consideration of the rights hereby granted, the acceptance thereof and obligations hereby assumed, Grantor and Grantee hereby covenant and agree as follows:

1. **Quitclaim, Surrender, and Dedication**. Grantor hereby quitclaims and surrenders forever, and dedicates and conveys to Grantee all of its right, title and interest in and to any and all Infrastructure installed within the Easement Area for non-potable water purposes, including but not limited to the items listed or depicted in Exhibit C, said personal property is conveyed by Grantor to Grantee "AS IS", "WHERE IS", without warranty or representation, express or implied as to the condition or fitness for any purpose whatsoever, Grantee hereby affirming to Grantor that Grantee has had the opportunity to inspect and accepts the same "AS IS", "WHERE IS", together with any and all warranties or product support agreements to which Grantor may have rights applicable to such facilities, equipment, appliances and appurtenances, and all such facilities, equipment, appliances and appurtenances hereinafter shall be and remain the property of Grantee.

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2. **Term**. The term of this Agreement shall commence on the effective date of this Agreement (as first written above) and shall run for a period of twenty (20) years (the "Term"). If Grantee is not in default under this Agreement, Grantee shall, starting at five (5) years prior to the end of the Term, have the option to renew this Agreement for a further period of ten (10) years. Any such renewal shall be upon the same terms and conditions of this Agreement. Grantee shall give prior written notice to Grantor of its intent to renew this Agreement at least four (4) years prior to the end of the Term.

3. **Automatic Termination of Easement**. This Agreement shall lapse, terminate, and become automatically null and void if Grantee fails, for a continuous period of ten (10) years, to maintain, operate, replace, repair, reconstruct, or remove any Infrastructure within the Easement Area.

4. **No Interference**. Grantee will exercise its rights hereunder in such manner as to occasion only such interference with the use of the Property by the owners and occupants thereof as is reasonably necessary.

5. **Restoration**. That after any construction, repair or other work has been completed by Grantee, the surface of the ground and of any road, walkway or curb disturbed by Grantee shall be restored by Grantee to its condition existing prior to such

construction, repair or other work to the extent that such restoration is reasonably possible.

6. **Indemnity**. That Grantee shall indemnify and save harmless Grantor against all loss or damage to the Property or to the property of others situated adjacent to the Easement Area, and from all liability for injury to or death of persons when such loss, damage, injury or death arises or proximately results from the negligence of Grantee, its agents or servants.

7. **Placement of Improvements Below, on Surface of, or Above Easement Area**. That Grantor shall not at any time during the term of this indenture erect or place any building foundation of any kind below the surface of the Easement Area or at any time erect or place any landscaping, building, structure or improvements of any kind, other than roads, walkways, curbs or appurtenances thereof, or stockpile any material above or on the surface of the Easement Area, unless the plans for the landscaping, building foundation, building, structure, improvements or stockpile shall be first approved in writing by Grantee and unless the same shall be so constructed or placed as not to interfere with Grantee's exercise of its rights hereunder; provided, however, that this provision shall not prohibit Grantor from constructing and maintaining roads, walkways, curbs, or appurtenances thereof within the Easement Area or from laying, constructing, operating, maintaining, repairing or removing Grantor's own pipelines, conduits or drains below the surface of the Easement Area provided that such uses do not interfere with the exercise by Grantee of the rights herein granted; provided, further, that if it becomes necessary to excavate, grade or change the existing ground conditions or Grantor's pipelines, conduits or drains within the Easement Area, the plans shall first be submitted to Grantee for its prior written approval, which approval shall not be unreasonably withheld.

8. **Condemnation**. That if at any time the premises across which the rights and easements are hereby granted, or any part thereof, shall be condemned or taken by any governmental authority, Grantee shall have the right to claim and recover from the condemning authority, but not from Grantor, such compensation as is payable for the rights and easements granted herein and for the pipelines, conduits, meters, fire hydrants, control cable, storage tanks, facilities, equipment, appliances and appurtenances within the Easement Area owned by Grantee, all of which shall be payable to Grantee.

9. **Parties in Interest**. The covenants contained in this Agreement shall inure to the benefit of, and be binding upon, the Parties and their respective heirs, devisees, personal representatives, successors, and assigns. As such, the Property shall be held, conveyed, hypothecated, encumbered, leased, used and occupied subject to the covenants, terms and provisions set forth in this Agreement, which shall run with the Property and each portion thereof and interest therein as equitable servitudes, and shall be binding upon and inure to the benefit of the Parties and any

other person and entity having any interest therein during their ownership thereof, and their respective heirs, devisees, personal representatives, successors and assigns.

10. **Attorney's Fees**. In any action arising out of this Agreement, the losing or defaulting Party shall pay to the prevailing Party reasonable attorney's fees, costs and expenses incurred in prosecuting such action.

11. **Governing Law**. This Agreement shall be governed by and construed in accordance with the laws of the State of Hawaii.

12. **Notices**. All notices and demands by one Party to another shall be made in writing and delivered by personal service or sent by registered or certified mail, return receipt requested, to the address of the appropriate Party as set forth herein and shall be deemed effective upon mailing:

If to Grantor: 19 Anne P. Alapai
P.O. Box 99-3030
Kapaau, Hawaii 96755

If to Grantee: 19 Joseph P. Smith and Jennifer J. Smith
P.O. Box 99-2020
Kapaau, Hawaii 96755

Any Party may from time to time change its address for the purpose of notices to that Party by a similar notice specifying a new address, but no such change is effective until it is actually received by the Party sought to be charged with its contents.

13. **Counterparts**. This Agreement may be executed in counterparts, each of which shall be an original, with the same effect as if the signatures were upon the same instrument, and all counterparts together shall constitute a single agreement.

[SIGNATURES APPEAR ON FOLLOWING PAGES]

20

Grantor Signature and Notary Public Acknowledgment/Certification

_____
ANNE P. ALAPAI

Grantor

STATE OF HAWAII)
) SS.
COUNTY OF HAWAII)

On this _____ day of _____, 20_____, in the Third Circuit, State of Hawaii, before me personally appeared ANNE P. ALAPAI, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such person executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as the free act and deed of such person, and if applicable, in the capacity shown, having been duly authorized to execute such instrument in such capacity.

The foregoing instrument is dated _____, 20_____, and contained _____ pages at the time of this acknowledgment/certification.

_____
Notary Public, State of Hawaii

_____
Printed Name of Notary Public

My commission expires: _____

20

Grantee Signature and Notary Public Acknowledgment/Certification

JOSEPH P. SMITH

JENNIFER J. SMITH

Grantee

STATE OF HAWAII)
) SS.
COUNTY OF HAWAII)

On this _____ day of _____, 20_____, in the Third Circuit, State of Hawaii, before me personally appeared JOSEPH P. SMITH and JENNIFER J. SMITH, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such persons executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as the free act and deed of such persons, and if applicable, in the capacities shown, having been duly authorized to execute such instrument in such capacities.

The foregoing instrument is dated _____, 20_____, and contained _____ pages at the time of this acknowledgment/certification.

Notary Public, State of Hawaii

Printed Name of Notary Public

My commission expires: _____

EXHIBIT A

ALL of that parcel of land situate in the District of North Kohala, Island of Hawaii, State of Hawaii, more particularly described as follows:

LOT D, area 0.531 acre, more or less, being a portion of Royal Patent 4475, Land Commission Award 7713, Apana 4 to V, Kamamalu.

Beginning at the Northwest corner of this parcel of land, being also the Southeast corner of Lot 2-A, being a portion of Royal Patent 4475, Land Commission Award 7713, Apana 4 to V. Kamamalu, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU PILI" being 25,254.35 feet South and 10,139.11 feet East and thence running by azimuths measured clockwise from true South:

1.	260°	38'	56"	231.39	feet along Lot C-1, being a portion of R.P. 4474, L.C. Aw.7713, Apana 4 to V. Kamamalu;
2.	350°	40'		100.00	feet along Lot C-1, being a portion of R.P. 4474, L.C. Aw.7713, Apana 4 to V. Kamamalu;
3.	80°	38'	56"	231.36	feet along Lot C-2, being a portion of R.P. 4474, L.C. Aw.7713, Apana 4 to V. Kamamalu;
4.	170°	38'	56"	100.00	feet along Lot C-2, being a portion of R.P. 4474, L.C. Aw.7713, Apana 4 to V. Kamamalu to the point of beginning and containing an area of 0.531 acre.

TOGETHER WITH access to a public road over Roadway Lot C-3, being a portion of R.P. 4474, L.C. Aw. 7713, Apana 4 to V. Kamamalu, and Roadway Lot 5, as shown on Map 2 of said Land Court Application No. 1036, as set forth by Land Court Order No. 2015, filed in said Office of the Assistant Registrar on June 30, 1949.

BEING the same land conveyed to JOHN KEOKI ALAPAI and MARYANNE PIKAKE ALAPAI, husband and wife, as Tenants by the Entirety, by Deed dated March 1, 1957.

SUBJECT, HOWEVER, to all encumbrances, whether recorded or unrecord.

TMK 3-5-9-002-019

EXHIBIT B

Map Depicting Easement Area

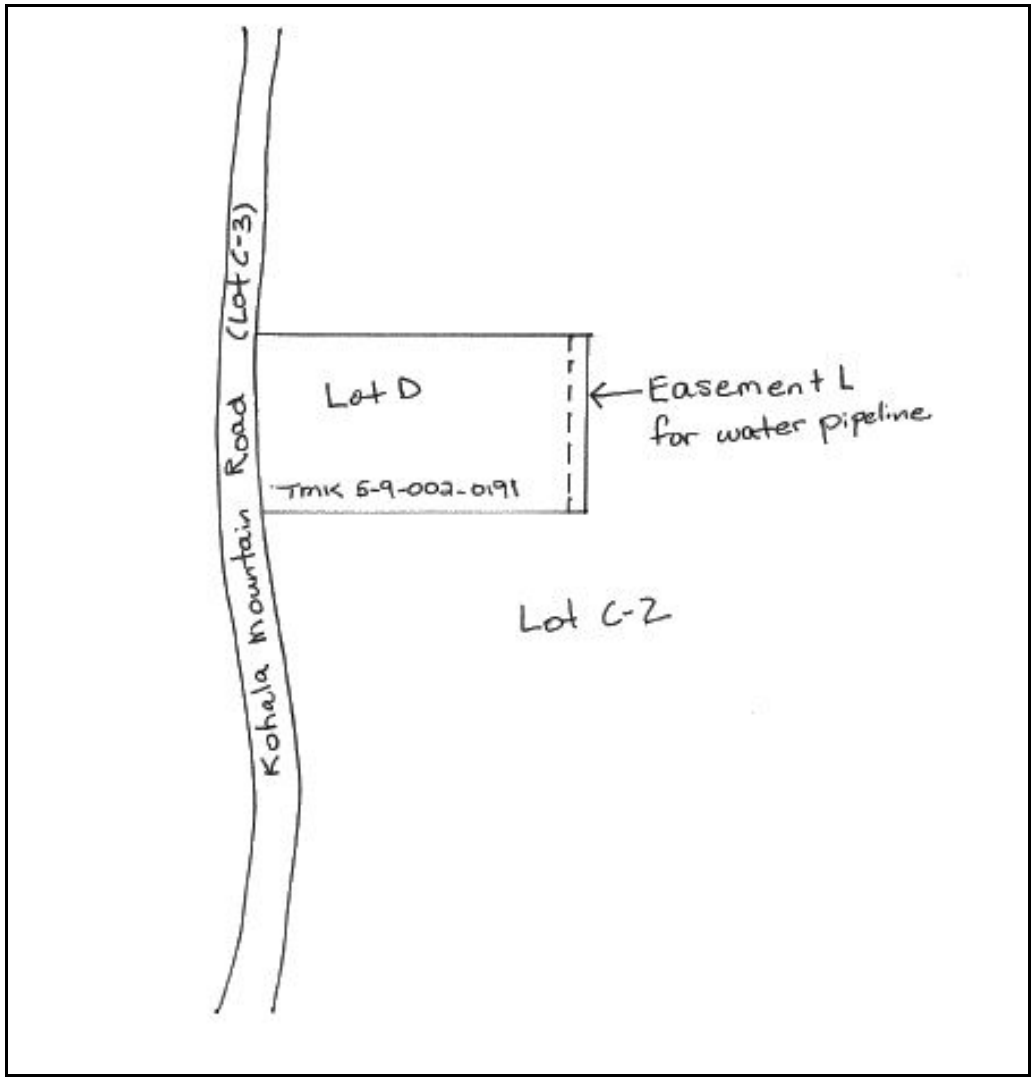


EXHIBIT C

2" Meter
Pressure Reducing Valve set at 75 psi
4" Gate Valve
Approximately 341’ of 2.5” PVC pipe

Sample of a completed Grant of Easement form for a Land Court property

LAND COURT SYSTEM | REGULAR SYSTEM

AFTER RECORDATION, RETURN BY MAIL ( ) OR PICKUP ( )

1 → JOSEPH P. SMITH
JENNIFER JACOBS SMITH
P.O. BOX 99-2020
KAPAAU, HAWAII 96755

TYPE OF DOCUMENT:
GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION

PARTIES TO DOCUMENT:

GRANTOR: 2 →
ANNE PIKAKE ALAPAI, WIFE OF JOHN KEOKI ALAPAI
P.O. BOX 99-3030
KAPAAU, HAWAII 96755

GRANTEE: 3 →
JOSEPH P. SMITH (WHOSE FULL LEGAL NAME IS JOSEPH P. SMITH) AND JENNIFER JACOBS SMITH, HUSBAND AND WIFE
P.O. BOX 99-2020
KAPAAU, HAWAII 96755

TAX MAP KEY FOR PROPERTY:
4 → 5-9-002-015, THIRD TAXATION DIVISION

5 ↓

(TOTAL PAGES: __10__)

GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION

6 ↓ 7 →

THIS GRANT OF EASEMENT, QUITCLAIM, SURRENDER AND DEDICATION ("Agreement"), effective as of _____, 20_____, is made between, **ANNE PIKAKE ALAPAI**, wife of John Keoki Alapai, whose address is **P.O. Box 99-3030,**

8 →

Kapaau, Hawaii 96755 ("Grantor") and **JOSEPH P. SMITH (whose full legal name is Joseph P. Smith) and JENNIFER JACOBS SMITH, husband and wife**, whose address is P.O. Box 99-2020, Kapaau, Hawaii 96755 ("Grantee") (each, a "Party", collectively, "Parties").

RECITALS

A. Grantor is the owner of the real property described in Exhibit A attached hereto and incorporated herein by reference ("Property").

B. Grantee is or will receive agricultural water service in the North Kohala area on the Island of Hawaii, State of Hawaii.

C. Certain infrastructure ("Infrastructure") that is essential to Grantee's receipt of agricultural water service: (i) exists on the Property, or (ii) pursuant to Grantee's plans, will be constructed on the Property.

D. Grantee seeks to obtain, from Grantor, and Grantor agrees to convey, an easement over portion(s) of the Property as described in and/or shown on Exhibit B, attached hereto and incorporated herein by reference (collectively, "Easement Area") for the existence, construction, maintenance, and operation of the Infrastructure through the Easement Area.

E. Grantor seeks to quitclaim and dedicate any presently existing Infrastructure, as listed or depicted in Exhibit C, attached hereto and incorporated herein by reference, within the Easement Area to Grantee.

F. Accordingly, Grantor desires to provide to Grantee and Grantee desires to acquire rights sufficient for these purposes, all as more particularly set forth below.

AGREEMENT

NOW THEREFORE, for and in consideration of the sum of TEN AND NO/100 ($10.00) and other good and valuable consideration paid by Grantee to Grantor, the receipt whereof is hereby acknowledged by Grantor, and of the covenants of Parties as hereinafter contained, Grantor does hereby grant and convey unto Grantee, as Tenants by the Entirety with full rights of survivorship, their assigns and the survivor of them and the heirs, devises, personal representatives and assigns of the survivor of them, an easement over the Easement Area to use, maintain, operate, replace, repair, reconstruct, and remove any and all Infrastructure now or at any time hereafter located within the Easement Area, including those facilities, equipment, appliances, and appurtenances necessary to convey, transmit and distribute water through the Easement Area and to properly measure and control water so conveyed, transmitted, and distributed, including the items listed or depicted in Exhibit C.

TOGETHER WITH the right to enter upon the Easement Area and the lands adjacent thereto for all purposes in connection with the rights and easements hereby granted;

AND with the right, title, and interest in the presently existing Infrastructure described in said Exhibit C;

TO HAVE AND TO HOLD the same unto Grantee, as Tenants by the Entirety with full rights of survivorship, their assigns and the survivor of them and the heirs, devises, personal representatives and assigns of the survivor of them.

In consideration of the rights hereby granted, the acceptance thereof and obligations hereby assumed, Grantor and Grantee hereby covenant and agree as follows:

1. **Quitclaim, Surrender, and Dedication**. Grantor hereby quitclaims and surrenders forever, and dedicates and conveys to Grantee all of its right, title and interest in and to any and all Infrastructure installed within the Easement Area for non-potable water purposes, including but not limited to the items listed or depicted in Exhibit C, said personal property is conveyed by Grantor to Grantee "AS IS", "WHERE IS", without warranty or representation, express or implied as to the condition or fitness for any purpose whatsoever, Grantee hereby affirming to Grantor that Grantee has had the opportunity to inspect and accepts the same "AS IS", "WHERE IS", together with any and all warranties or product support agreements to which Grantor may have rights applicable to such facilities, equipment, appliances and appurtenances, and all such facilities, equipment, appliances and appurtenances hereinafter shall be and remain the property of Grantee.

2. **Term**. The rights granted in this Agreement shall be possessed and enjoyed on a perpetual basis.

3. **Automatic Termination of Easement**. This Agreement shall lapse, terminate, and become automatically null and void if Grantee fails, for a continuous period of ten (10) years, to maintain, operate, replace, repair, reconstruct, or remove any Infrastructure within the Easement Area.

4. **No Interference**. Grantee will exercise its rights hereunder in such manner as to occasion only such interference with the use of the Property by the owners and occupants thereof as is reasonably necessary.

5. **Restoration**. That after any construction, repair or other work has been completed by Grantee, the surface of the ground and of any road, walkway or curb disturbed by Grantee shall be restored by Grantee to its condition existing prior to such construction, repair or other work to the extent that such restoration is reasonably possible.

6. **Indemnity**. That Grantee shall indemnify and save harmless Grantor against all loss or damage to the Property or to the property of others situated adjacent to the Easement Area, and from all liability for injury to or death of persons when such loss, damage, injury or death arises or proximately results from the negligence of Grantee, its agents or servants.

7. **Placement of Improvements Below, on Surface of, or Above Easement Area**. That Grantor shall not at any time during the term of this indenture erect or place any building foundation of any kind below the surface of the Easement Area or at any time erect or place any landscaping, building, structure or improvements of any kind, other than roads, walkways, curbs or appurtenances thereof, or stockpile any material above or on the surface of the Easement Area, unless the plans for the landscaping, building foundation, building, structure, improvements or stockpile shall be first approved in writing by Grantee and unless the same shall be so constructed or placed as not to interfere with Grantee's exercise of its rights hereunder; provided, however, that this provision shall not prohibit Grantor from constructing and maintaining roads, walkways, curbs, or appurtenances thereof within the Easement Area or from laying, constructing, operating, maintaining, repairing or removing Grantor's own pipelines, conduits or drains below the surface of the Easement Area provided that such uses do not interfere with the exercise by Grantee of the rights herein granted; provided, further, that if it becomes necessary to excavate, grade or change the existing ground conditions or Grantor's pipelines, conduits or drains within the Easement Area, the plans shall first be submitted to Grantee for its prior written approval, which approval shall not be unreasonably withheld.

8. **Condemnation**. That if at any time the premises across which the rights and easements are hereby granted, or any part thereof, shall be condemned or taken by any governmental authority, Grantee shall have the right to claim and recover from the condemning authority, but not from Grantor, such compensation as is payable for the rights and easements granted herein and for the pipelines, conduits, meters, fire hydrants, control cable, storage tanks, facilities, equipment, appliances and appurtenances within the Easement Area owned by Grantee, all of which shall be payable to Grantee.

9. **Parties in Interest**. The covenants contained in this Agreement shall inure to the benefit of, and be binding upon, the Parties and their respective heirs, devisees, personal representatives, successors, and assigns. As such, the Property shall be held, conveyed, hypothecated, encumbered, leased, used and occupied subject to the covenants, terms and provisions set forth in this Agreement, which shall run with the Property and each portion thereof and interest therein as equitable servitudes, and shall be binding upon and inure to the benefit of the Parties and any other person and entity having any interest therein during their ownership thereof, and their respective heirs, devisees, personal representatives, successors and assigns.

10. **Attorney's Fees**. In any action arising out of this Agreement, the losing or defaulting Party shall pay to the prevailing Party reasonable attorney's fees, costs and expenses incurred in prosecuting such action.

11. **Governing Law**. This Agreement shall be governed by and construed in accordance with the laws of the State of Hawaii.

12. **Notices**. All notices and demands by one Party to another shall be made in writing and delivered by personal service or sent by registered or certified mail, return receipt requested, to the address of the appropriate Party as set forth herein and shall be deemed effective upon mailing:

If to Grantor: 19 → Anne Pikake Alapai
P.O. Box 99-3030
Kapaau, Hawaii 96755

If to Grantee: 19 → Joseph P. Smith and
Jennifer Jacobs Smith
P.O. Box 99-2020
Kapaau, Hawaii 96755

Any Party may from time to time change its address for the purpose of notices to that Party by a similar notice specifying a new address, but no such change is effective until it is actually received by the Party sought to be charged with its contents.

13. **Counterparts**. This Agreement may be executed in counterparts, each of which shall be an original, with the same effect as if the signatures were upon the same instrument, and all counterparts together shall constitute a single agreement.

[SIGNATURES APPEAR ON FOLLOWING PAGES]

20

Grantor Signature and Notary Public Acknowledgment/Certification

_____
ANNE PIKAKE ALAPAI

Grantor

STATE OF HAWAII)
) SS.
COUNTY OF HAWAII)

On this _____ day of _____, 20_____, in the Third Circuit, State of Hawaii, before me personally appeared ANNE PIKAKE ALAPAI, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such person executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as the free act and deed of such person, and if applicable, in the capacity shown, having been duly authorized to execute such instrument in such capacity.

The foregoing instrument is dated _____, 20_____ and contained _____ pages at the time of this acknowledgment/certification.

_____
Notary Public, State of Hawaii

_____
Printed Name of Notary Public

My commission expires: _____

20

Grantee Signature and Notary Public Acknowledgment/Certification

JOSEPH P. SMITH, whose full legal name is Joseph P. Smith

JENNIFER JACOBS SMITH

Grantee

STATE OF HAWAII)
) SS.
COUNTY OF HAWAII)

On this _____ day of _____, 20_____, in the Third Circuit, State of Hawaii, before me personally appeared JOSEH P. SMITH (whose full legal name is Joseph P. Smith) and JENNIFER JACOBS SMITH, ☐ personally known to me -OR- ☐ proved to me on the basis of satisfactory evidence, who, being by me duly sworn or affirmed, did say that such persons executed the foregoing instrument identified or described as Grant of Easement, Quitclaim, Surrender and Dedication, as the free act and deed of such persons, and if applicable, in the capacities shown, having been duly authorized to execute such instrument in such capacities.

The foregoing instrument is dated _____, 20_____ and contained _____ pages at the time of this acknowledgment/certification.

Notary Public, State of Hawaii

Printed Name of Notary Public

My commission expires: _____

EXHIBIT A

ALL of that parcel of land situate at North Kohala, Island of Hawaii, State of Hawaii, more particularly described as follows:

LOT 14, area 15.25 acres, more or less, as shown on Map 10, filed in the Office of the Assistant Registrar of the Land Court of the State of Hawaii with Land Court Application No. 1036 of Medeiros Ranch, Limited.

TOGETHER WITH access to a public road over Roadway Lot 5, as shown on Map 2 of said Land Court Application No. 1036, as set forth by Land Court Order No. 2015, filed in said Office of the Assistant Registrar on June 30, 1949.

BEING the same land described in and covered by Transfer Certificate of Title No. 56,202, issued ANNE PIKAKE ALAPAI, wife of John Keoki Alapai, as Tenant in Severalty.

SUBJECT, HOWEVER, to all encumbrances, whether recorded or unrecorded.

NOTE: Land Court Order recorded as Land Court Document No. 2,123.555 on January 24, 2018, sets forth the marriage of Anne Pikake Souza and John Keoki Alapai, in Kapaau, Hawaii on December 15, 2017; surname Alapai.

TMK 3-5-9-002-015

EXHIBIT B

Easement 23, for water pipeline purposes, containing an area of 114 square feet, as shown on Map 20, filed in the Office of the Assistant Registrar of the Land Court of the State of Hawaii with Land Court Application No. 1036 of Medeiros Ranch, Limited, as set forth in Land Court Order No. 1601, recorded April 1, 2018, affecting Lot 14.

Said Lot 14 is shown on Map 10 of Land Court Application No. 1036, such lot being situate in the District of North Kohala, County of Hawaii, State of Hawaii, and is more particularly described in and covered by Land Court Certificate of Title No. 56,202, issued to ANNE PIKAKE ALAPAI, wife of John Keoki Alapai, as Tenant in Severalty.

EXHIBIT C

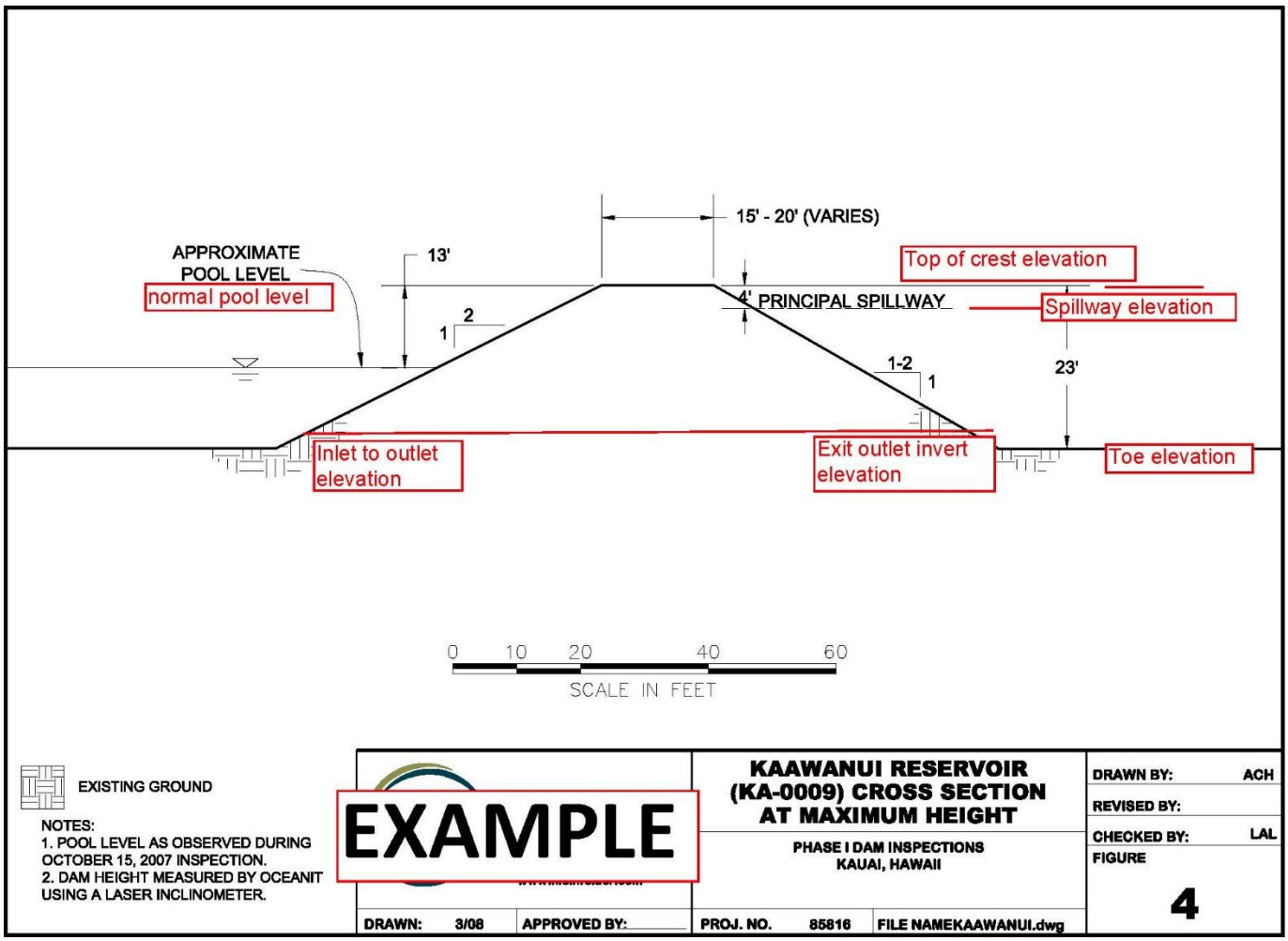
Existing Infrastructure

2" Meter
Pressure Reducing Valve set at 75 psi
4" Gate Valve
Approximately 341’ of 2.5” PVC pipe

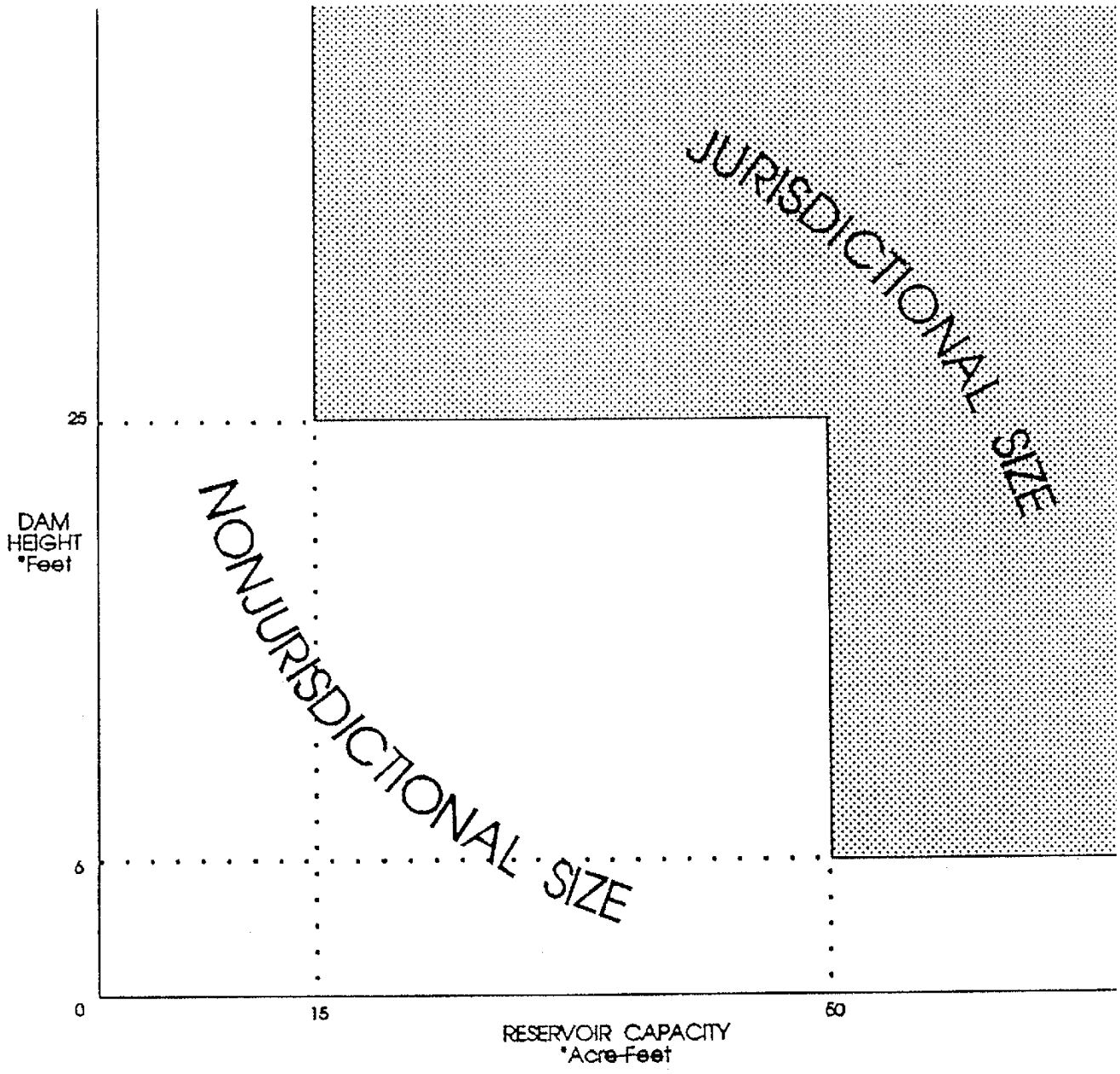
Appendix D - Dam Regulations

Appendix D Dam Regulation

As stated in the report, impoundment of water requires substantial permitting and compliance. Included in the Appendix are a sample diagram to help understand term, a jurisdictional diagram to show what is regulated and the regulations flow chart with the forms. HRS 179D-21 and HAR 13-190.1-11 are the governing Statutes and Rules.



PROVISIONS OF HAWAII DAM SAFETY ACT
AFFECTING JURISDICTION OVER DAMS AND RESERVOIRS

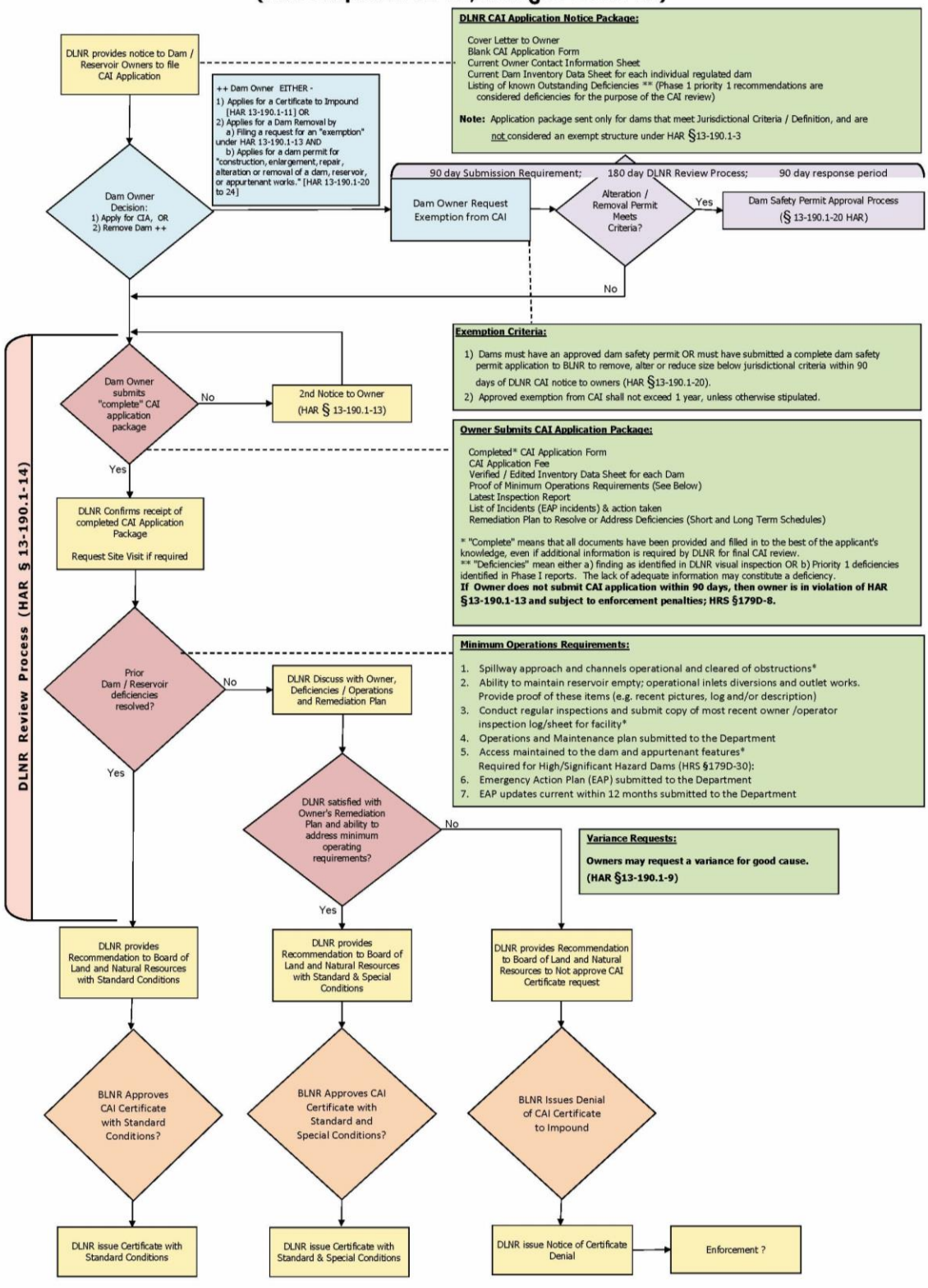


*Metric units not specified in the Water Code are:

1.83 metres = 6 feet
7.62 metres = 25 feet
18.50 cubic dekametres = 15 acre-feet
61.68 cubic dekametres = 50 acre-feet

Dam Safety Certificate of Approval to Impound (CAI)

(HRS Chapter 179D-21, HAR §13-190.1-11)



DAM SAFETY CERTIFICATE OF APPROVAL TO IMPOUND
INSTRUCTIONS TO FILE A CERTIFICATE OF APPROVAL TO IMPOUND (CAI) APPLICATION

Requirements for obtaining a Certificate of Approval to Impound (CAI) for the impoundment of water at a dam or reservoir in the State of Hawaii are outlined in Hawaii Administrative Rules, Title 13, Department of Land and Natural Resources, Sub-Title 7 – Water and Land Development, Chapter 190.1 – Dams and Reservoirs.

The completed application shall include the following items:

1. Application fee of $400.00. Make check payable to the "State of Hawaii."
2. Completed CAI application form
3. Completed Owner Contact Information Sheet
4. Review and Verification of Dam Inventory Data Sheet
5. Remediation Plan for Addressing Dam Deficiencies [1]

   The remediation plan should include the following:
   1. Detailed description of plans to address all known dam deficiencies.
   2. Timeline to accomplish addressing all known dam deficiencies.
   3. For major improvements, listing of milestones and implementation schedule.

All these items are to be received and reviewed by the Department of Land and Natural Resources (DLNR) Engineering Division before a recommendation to the Board of Land and Natural Resources for the CAI application will be provided. Please return completed application package to:

Chairperson, Board of Land and Natural Resources
Department of Land and Natural Resources
Engineering Division
P.O. Box 373
Honolulu, Hawaii 96809

INSRUCTIONS FOR COMPLETING THE APPLICATION FORM

All information shall be typed or printed. Every item on the form should be completed. If a specific item does not apply to your structure, mark it NA (not applicable). Make sure the application form is signed and dated. If you are planning to remove/breach the dam or reservoir within the next 3 months, please contact the Engineering Division to verify if your facility qualifies for an exemption from the CAI. Any questions pertaining to the completion of this form should be directed to the Engineering Division – Telephone No: (808) 587-0230.

[1] "Deficiencies" means either finding as identified in DLNR visual inspection or Priority 1 and Priority 2 deficiencies identified in phase I reports. The lack of adequate information may constitute a deficiency.

DEPARTMENT OF LAND AND NATURAL RESOURCES
DAM SAFETY CERTIFICATE OF APPROVAL TO IMPOUND APPLICATION FORM
(HRS Chapter 179D)

State Dam Inventory Number: _____ Date: _____
Name of Dam / Reservoir: _____

CURRENT RESERVOIR'S USE (Check all that apply; include description):

- ☐ Irrigation: _____ Acres served: _____ IAL acres served: _____
- ☐ Sedimentation: _____
- ☐ Recreation: _____
- ☐ Flood Control: _____
- ☐ Drinking Water: _____ MGD: _____
- ☐ Power Generation: _____ MWD:_____
- ☐ Other: _____

MINIMUM OPERATIONS REQUIREMENTS:

- ☐ Yes ☐ No Spillway approach and channels operational and cleared of obstructions
- ☐ Yes ☐ No Ability to maintain reservoir empty; operational inlets diversions and outlet works. Provide proof of these items (e.g. recent pictures, log and/or description)
- ☐ Yes ☐ No Operations and Maintenance plan submitted to the DLNR
- ☐ Yes ☐ No Access maintained to the dam and appurtenant features
- ☐ Yes ☐ No Conduct regular inspections and submit copy of most recent owner /operator inspection log/sheet for facility

Required for High/Significant Hazard Dams:

- ☐ Yes ☐ No Emergency Action Plan (EAP) submitted to the DLNR
- ☐ Yes ☐ No EAP updates current within 12 months submitted to the DLNR

Please provide the following activities at the facility over the last 2 years: (use addition page if needed):

1. Recent improvements or modifications

_____
_____
_____
_____
_____
_____
_____

2. Incidents (include any level 1 EAP events):

_____
_____
_____
_____
_____
_____
_____
_____
_____

Rev: 04/15/2013

List all parties that have ownership or other interest on the parcels where the dam and reservoir are located. The owners herein listed below concur with the intent of the application for the certificate of approval to impound (CAI) by his/her signing hereto, the owner of the land extends to the Board of Land and Natural Resources, and its designated representatives, a right-of-entry onto the dam and reservoir site to conduct any inspections required in compliance with the provisions of Chapter 13-190.1, Hawaii Administrative Rules. (Submit additional copies of this sheet should there be more owners)

Owner's name (Please print)	Signature	TMK of parcel on Dam or Reservoir
Owner's name (Please print)	Signature	TMK of parcel on Dam or Reservoir
Owner's name (Please print)	Signature	TMK of parcel on Dam or Reservoir
Owner's name (Please print)	Signature	TMK of parcel on Dam or Reservoir
Owner's name (Please print)	Signature	TMK of parcel on Dam or Reservoir
Owner's name (Please print)	Signature	TMK of parcel on Dam or Reservoir
Owner's name (Please print)	Signature	TMK of parcel on Dam or Reservoir
Owner's name (Please print)	Signature	TMK of parcel on Dam or Reservoir

I, _____, the applicant, hereby certify that the information herein is true and factual to the best of my knowledge.

Name of Applicant (Please Print)	Signature	Date
Applicant address	Telephone	Fax
Applicant email		

Rev: 04/15/2013

Appendix E - Tanks

Appendix E

Below are examples of ridged and non-ridged tanks. This is not an endorsement but simply examples of what are available. There is a range in prices that start at the plastic tanks and goes up all the way into the stainless and glass lined bolt together tanks.

Not included are ferrocement tanks installed by a Big Island company and municipal concrete tanks. The ferrocement are an excellent product that has been used successfully throughout the islands. It is best to look directly at the website, Pacificgunite.com, to see the products. This is the only provider of this type of tank on the island.

The municipal type tanks were not included as they are the most expensive by far. There are features that are required by Department of Water Services that are not required for agriculture or personal tanks. As such, these sorts of tanks are very seldom used in agricultural setting.

Again, these samples are just some of the options. They are provided to allow a starting point to researching available water storage options. With the ever-changing costs of materials, shipping and import restrictions, each tank will have price and availability levels that will constantly be changing. Each option should be considered during the water system planning phase.

Ridged tanks

MODULAR STEEL WATER TANKS

COMMERCIAL & INDUSTRIAL

AQUAMATE
ENGINEERED STEEL TANKS

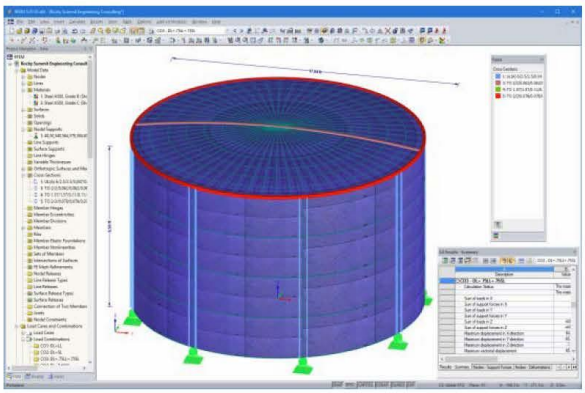
Modular Water Tanks Engineered for North American Conditions

Just like any steel building structure, our water tanks are designed to American loading, concrete and steel structure codes:

- ASCE 7-10 Minimum Design Loads For Buildings and Other Structures
- ACI 318-14 Building Code Requirements for Structural Concrete
- AISC 360-10 Specification for Structural Steel Buildings
- AISI S100-07 North American Specification for the Design of Cold-Formed Steel Structural Members
- AWS D1.1 Structural Welding - Steel
- NSF/ANSI 61: Drinking Water System Components

Applications Include

- *Fire Protection*
- *Potable Water*
- *Rainwater*
- *Stormwater*



Tank Sizes
Commercial Range

Tank Diameter	Tank Gross Capacity (Gal)					
	7'3" Tall	9'6" Tall	11'9" Tall	14' Tall	16'3" Tall	18'6" Tall
8'6"	3,100	4,100	5,000	6,000	6,900	7,900
10'8"	4,800	6,300	7,800	9,400	10,900	12,400
12'10"	7,000	9,100	11,300	13,500	15,600	17,800
14'11"	9,500	12,400	15,400	18,300	21,300	24,200
17'1"	12,400	16,200	20,100	23,900	27,800	31,600
19'2"	15,700	20,600	25,400	30,300	35,200	40,000
21'4"	19,400	25,400	31,400	37,400	43,400	49,400
23'5"	23,400	30,700	38,000	45,300	52,500	59,800
25'7"	27,900	36,600	45,200	53,900	62,500	71,200
27'9"	32,700	42,900	53,100	63,200	73,400	83,500
29'10"	38,000	49,800	61,500	73,300	85,100	96,900
32'	43,600	57,100	70,600	84,200	97,700	111,200
34'1"	49,600	65,000	80,400	95,800	111,200	126,600
36'3"	56,000	73,400	90,700	108,100	125,500	142,900
38'5"	62,800	82,200	101,700	121,200	140,700	160,200
40'6"	69,900	91,600	113,300	135,100	156,800	178,500
42'8"	77,500	101,500	125,600	149,600	173,700	197,700

Standard Sizes Non-standard Sizes

info@aquamatetanks.com (844) 320-TANK (8265)

About Us

Since 1986, Aquamate has manufactured and installed thousands of galvanized steel water tanks for fire protection, stormwater management, potable water and rainwater storage.

Aquamate

4906 Dillehay Drive

Suite #200,

Allen, Texas 75002

844.320.TANK (8265)

info@aquamatetanks.com

aquamatetanks.com

AQUAMATE

ENGINEERED STEEL TANKS

Water Catchment Tanks N

Plastic Storage Tanks

Plastic Bulk Storage Tanks

Plastic Horizontal Bulk Storage Tanks

Rectangular Plastic Tanks

Special Low Prices

Open Top Cylindrical Plastic Tanks

Septic Tanks

Material Handling

Utility Trucks and Liners

Bulk Delivery and Turnabout Trucks

Tilt Trucks

Water Transportation Tanks

Hauling Tanks

Transport Tanks N

Water Storage Tanks

Plastic Water Tanks are an effective, economical way to collect rain water, or store potable (drinking) water for Residential and Commercial applications.

- Water Tanks are available in Green or Black
- Dark color reduces algae growth.
- UV Stabilized for outdoor use.
- Excellent impact resistance
- Our polyethylene resin complies with U.S. Food and Drug Administration regulation 21CFR 177.1520 (1) 3.1 and 3.2 for storage of potable water.

Call for Pricing - 1-800-870-5494

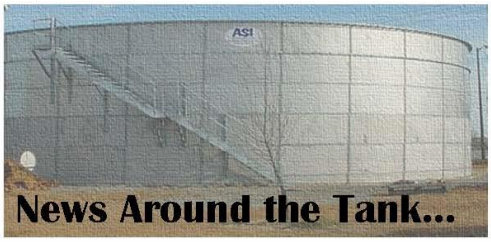
Part #	Capacity	Diameter	Height	Manway	Weight
TC2331	60 Gal. Water Catchment Tank	23"	31"	16"	20 lbs
TC3731	120 Gal. Water Catchment Tank	37"	31"	8"	50 lbs
TC4236	170 Gal. Water Catchment Tank	42"	36"	8"	60 lbs
TC4642	250 Gal. Water CatchmentTank	46	42	20"	80 lbs
TC3581	300 Gal. Water Catchment Tank	35"	81"	16"	80 lbs
TC6442	500 Gal. Water Catchment Tank	64"	42"	16"	120 lbs
TC4772	500 Gal. Water Catchment Tank	47"	72"	16"	130 lbs
TC7272	1000 Gal. Water Catchment Tank	72"	72"	16"	200 lbs
TC8868	1550 Gal. Water Catchment Tank	88"	68"	20"	300 lbs
TC9592	2500 Gal. Water Catchment Tank	95"	92"	22"	425 lbs
TC3000	3000 Gal. Water Catchment Tank	95"	107"	22"	535 lbs
TC4000	4000 Gal. Water Catchment Tank	95"	140"	22"	820 lbs
TC5000	5000 Gal. Water Catchment Tank New!Chem-Tainer now the only manufacturer in Hawaii to offer a 5000gal vertical poly water catchment tank	102"	152"	22"	1050 lbs

16-118 Li'i Li'i Street / Keaau, HI 96749 / 1-800-870-5494 Fax: (808) 966-5455
sales@chemtainerofhawaii.com

Other Chem-tainer Sites:

maxi-movers CHEM-TAINER INDUSTRIES, INC Shingle Creek todd KODIAK MARINE PRODUCTS DAN'S TRACY AQUA WORLD LIVEWELLS

Modular glass lined steel tank on Lanai.



News Around the Tank...

Here are a few of our newest site locations.

Batavia, NY

Anaerobic Tank

27.69' x 30.66'

Dallas, TX

Equalization Tank

80' x 24.5'

Carthage, MS

Equalization Tank 15.38' x 21.17'

Aeration Tank 36.92' x 21.17'

Product Spotlight: Anaerobic Digester Tanks (Continued)

Below are some of the anaerobic digester tanks American Structures, Inc. has manufactured and assembled.

Where: Brownsville, WI
Capacity: 244,400 Gallons

Where: Bloomfield, PA
Capacity: 199,020 Gallons

What's New

American Structures, Inc. recently completed a project in Troy, Indiana. Originally, American Structures, Inc. was to replace the steel panels on a glass-lined tank with stainless steel panels. Instead, the entire tank was replaced with a bolted stainless steel tank. Within a week, American Structures, Inc. had disassembled the old tank and assembled the new tank onsite, making for a quick turnaround and a happy customer!

Product Spotlight: Clarifier Tanks (Continued)

Below are some of the clarifier tanks that American Structures, Inc. has manufactured and assembled.

Where: Brownsville, WI
Capacity: 126,864 Gallons
Customer: Grande Cheese

Where: Slidell, LA
Capacity: 138,821 Gallons
Customer: Huntwyck Wastewater Treatment Plant

Non-Ridged Tanks

Commercial Bladder Tank Solutions

Reo Sac® Onion Tanks by Waterplex®

Waterplex produces a standard range of Onion tanks ranging from 5,000 litres to 25,000 litres.

But because no two applications are the same, a large number of the **Reo Sac®** Onion tanks manufactured are customised to suit a particular application or site.

The material used in the construction of **Reo Sac®** Onion tanks is determined by the nature of the end use and the type of liquid being stored.

Typically reinforced material is used to ensure the strength and integrity required for large amounts of water storage. Reinforced material also provides greater resistance to abrasion and rough handling in the field.

Reo Sac® Onion tanks are self-erecting. A "floating collar" enables them to rise to the maximum fill height as they fill. The key advantage of a **Reo Sac®** Onion tank over a pillow tank is the ability to fill and empty it faster than a standard pillow bladder tank. This is due to the large opening aperture within the floating collar.

The large opening also makes Onion tanks particularly easy to empty and clean. The ability to ensure it is empty also makes it easier to pack and transport relative to a standard pillow tank.

The most common applications for **Reo Sac®** Onion tanks are:

- Temporary liquid storage for maintenance of another storage tank
- Bushfire fighting
- Temporary containment of almost any waste liquids

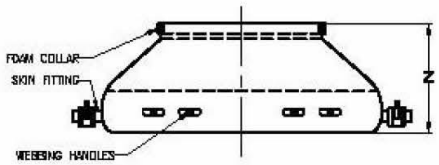
Waterplex™
A.C.N. 132 385 310 P O Box 59 Lane Cove NSW 1595
Ph: +61 2 9113 5593 Fax: +61 2 9113 5597

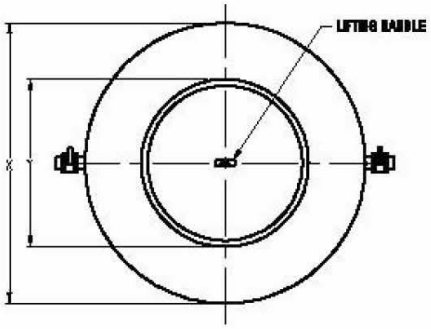
Waterplex

Commercial Bladder Tank Solutions

Options available with **Reo Sac®** Onion tanks include:

- Protective collar covers to provide protection from sunlight and dust
- Groundsheets (reinforced or non-reinforced)
- Webbing handles for easy relocation
- A range of different fitting types and sizes depending on the requirement
- Carry bag





Reo Sac® Onion Tank Capacities and Dimensions					
		Filled Dimensions			
Part No.	Capacity (litres)	X (mm)	Y (mm)	Z (mm)	Weight (kg)
RSOT05	5,000	2,800	1,500	1,000	30
RSOT10	10,000	4,000	2,280	1,100	40
RSOT12	12,000	4,400	3,100	1,100	45
RSOT18	18,000	5,000	3,300	1,500	55
RSOT25	25,000	6,000	3,500	1,200	74

Call Waterplex® on 1300 72 60 70 for a Quote for a Reo Sac® Onion Tank today

Waterplex™
A.C.N. 132 385 310 P O Box 59 Lane Cove NSW 1595
Ph: +61 2 9113 5593 Fax: +61 2 9113 5597

Waterplex

BladderPak
Industrial Liquid Storage Bladders

What is a Liquid Storage Bladder?

Made by Fabric Solutions Australia, BladderPak Industrial bladders are self supporting, flexible containers that can be used to store all types of liquids including drinking water, waste liquids and many chemicals. The greatest benefit of a BladderPak Bladder is that they are tough, portable, and easy to install. This makes them ideal for temporary storage use or where it is difficult or too costly to build a more permanent solution.

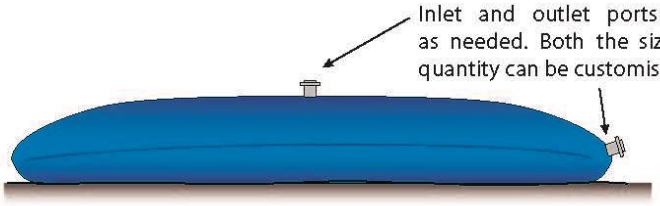
The Main Parts of a Bladder

Tough materials are needed to withstand the high load stresses that a bladder is subjected to. That is why we only use high quality, reinforced materials.

Tough joins are needed to make sure leaks don't occur. All seams are either HF or Hot Wedge Welded. This technique makes joins that are super strong with no glues that can fail or split apart.

A geotextile or RPVC underlay is used as a protection layer when the surface is rough. RPVC can also act as a secondary containment barrier.

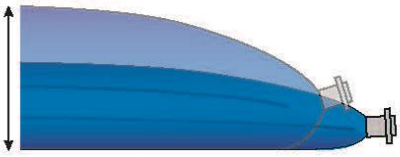
Liquid containment bladders are ideally suited for short term, but repeated use applications.



Bladders use Reinforced Membranes Engineered for Strength

We can make bladders up to 600,000 litres* which can be daisy chained for unlimited storage.

How a Bladder Works



As the bladder fills it will gain height but in the process will lose some width. This leads to an increase in the circumferential load (hoop stress), limiting the maximum fill height achievable.

The maximum fill height of a water bladder is usually limited to approx. 1.3m in height for very large bladders. This is why only strong materials can be used in making a bladder.

Another advantage of bladders is that they only take up the volume of the contents. So not only can you save on space, but this means there is only a minimal amount of air trapped inside.

This greatly reduces the chances of contamination from oxidation, condensation or insects. Plus there will be no evaporation.

Water
Waste
Chemical

Potable, Waste & Chemical Liquid Containment Solutions

Emergency - Mining - Industrial - Residential

*maximum storage capacity of a bladder is dependent on several factors, including the material used.

Free Call: 1800 039 996
Email: info@fabricsolutions.com.au
Website: www.fabricsolutions.com.au/water-bladders/

"Innovative Solutions"

Water
Waste
Chemical

Potable, Waste & Chemical Liquid Containment Solutions

Emergency - Mining - Industrial - Residential

Technical Specifications

(sample only, many more sizes available)

Vol. (litres)	Unfilled Size (metres)	Max. Fill Height	Empty Weight (kg)
500	1.5 x 1.2	0.4m	12.5
1000	2.3 x 1.6	0.4m	16
2000	2.3 x 2.4	0.5m	18
3000	2.3 x 3.1	0.6m	22
3800	2.3 x 4.0	0.6m	37
5000	3.5 x 3.2	0.65m	41
7600	3.5 x 4.4	0.7m	57
10000	3.5 x 5.8	0.7m	59
15200	4.7 x 4.6	1.0m	82
20000	4.7 x 5.6	1.1m	93
25000	4.7 x 6.8	1.1m	106
30000	5.9 x 6.0	1.2m	114
40000	7.2 x 6.0	1.3m	131
50000	7.2 x 7.6	1.3m	157
60000	7.2 x 9.0	1.3m	180
76000	9.6 x 8.6	1.3m	221
95000	9.6 x 10.8	1.3m	248
100000	9.6 x 11.4	1.3m	283
152000	12.0 x 13.8	1.3m	499
200000	12.0 x 18.0	1.3m	637

Applications

grey/black water, ***contaminated water***, effluent, ***slurries***, diesel fuel, ***potable water***, chemicals & oils, ***AV gas***, temporary water storage when a tank is being repaired, ***emergency water***, remote areas ...

Benefits

Tough - Portable - Easy to Install

store fuel#, chemicals or waste liquids up to 600,000 litres* ***modular: daisy chain to increase storage space*** chemical, UV and algae resistant ***bladders are closed storage, so no: oxidation, condensation, evaporation, mosquitoes or other contamination***.

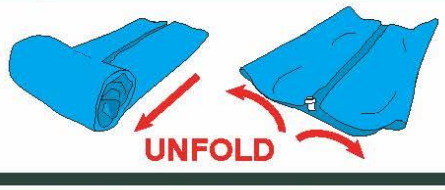
Strength of Materials

We use strong reinforced membranes to make an industrial liquid bladder. In fact the tensile strength is 5000N/50 mm for our standard material. This means if we were to put a weight on a 50 mm strip, it can take a load of 500kg!

To ensure quality, every bladder is pressurised and leak tested after

Bladders can also be daisy chained to create extra storage capability.

Installation is simple: Just UNPACK - UNFOLD - CONNECT & GO!



Quick To Set Up, Can Be Installed Just About Anywhere

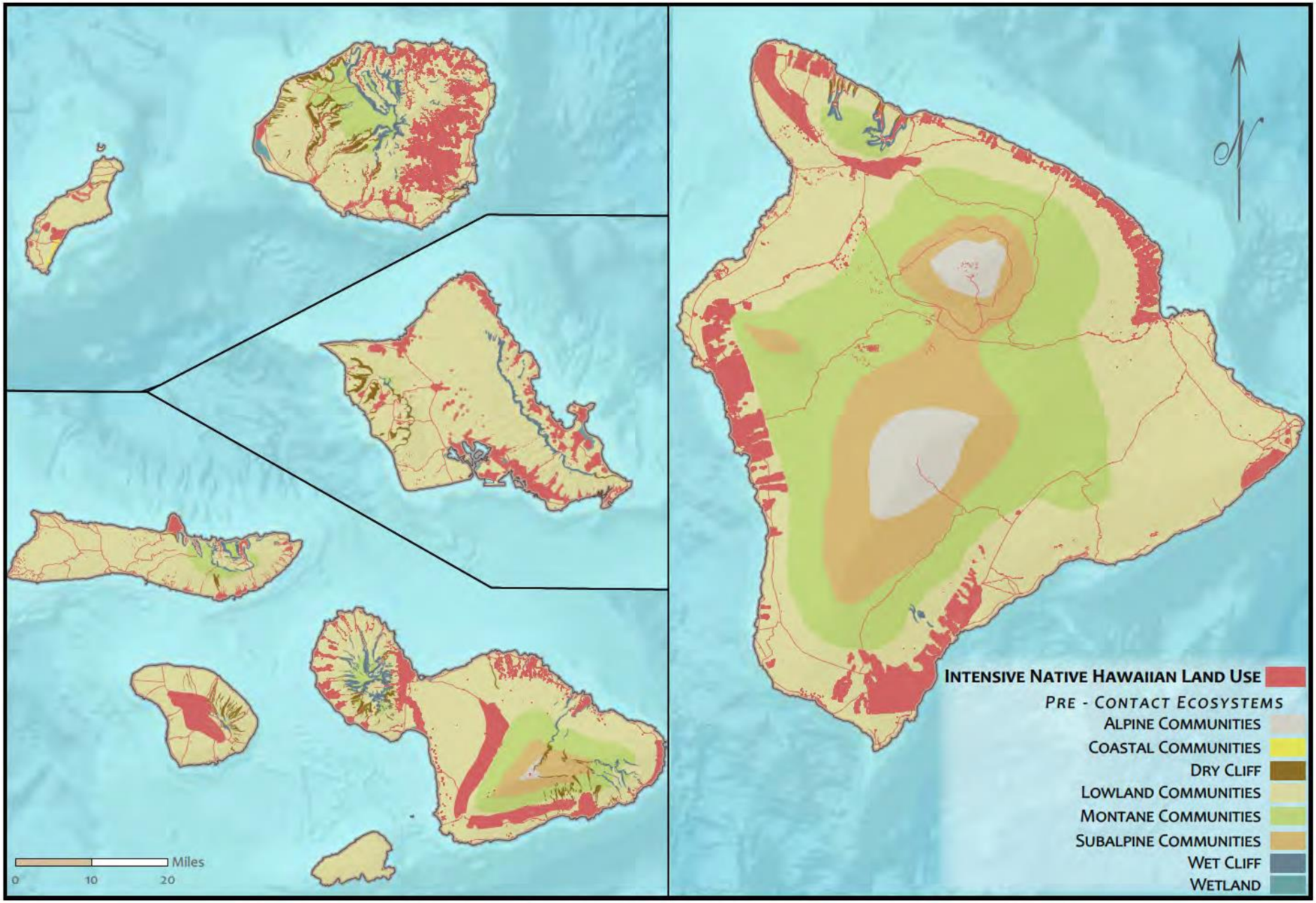
*maximum storage capacity of a bladder is dependent on several factors, including the material used. #Due to the aggressive nature of petrol, this liquid cannot be stored.

Free Call: 1800 039 996
Email: info@fabricsolutions.com.au
Website: www.fabricsolutions.com.au/water-bladders/

"Innovative Solutions"

Appendix F – Figures and Maps

Figure 1



ESTIMATED NATIVE HAWAIIAN LAND UTILIZATION - PRE CONTACT

SOURCE: THE NATURE CONSERVANCY,
OFFICE OF HAWAIIAN AFFAIRS, AND
LADEFOGED ET AL. (2011)

UNIVERSITY of HAWAI'I· HILO

SDAV UH HILO

Department of Agriculture
STATE OF HAWAII

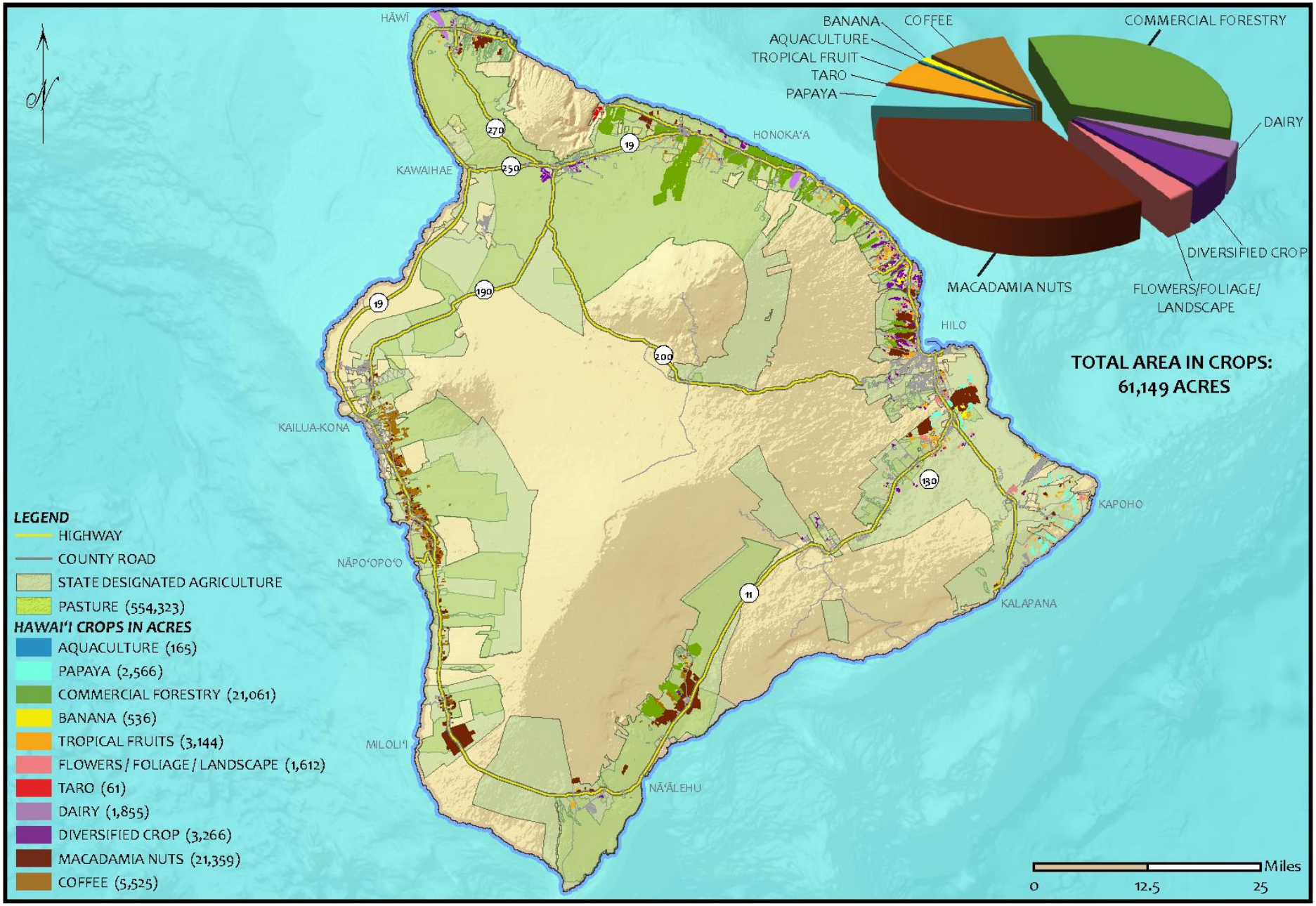


Figure 2

HAWAI'I ISLAND CROP SUMMARY (2015)

University of Hawai'i Hilo

SDAV UH Hilo

Department of Agriculture STATE OF HAWAII

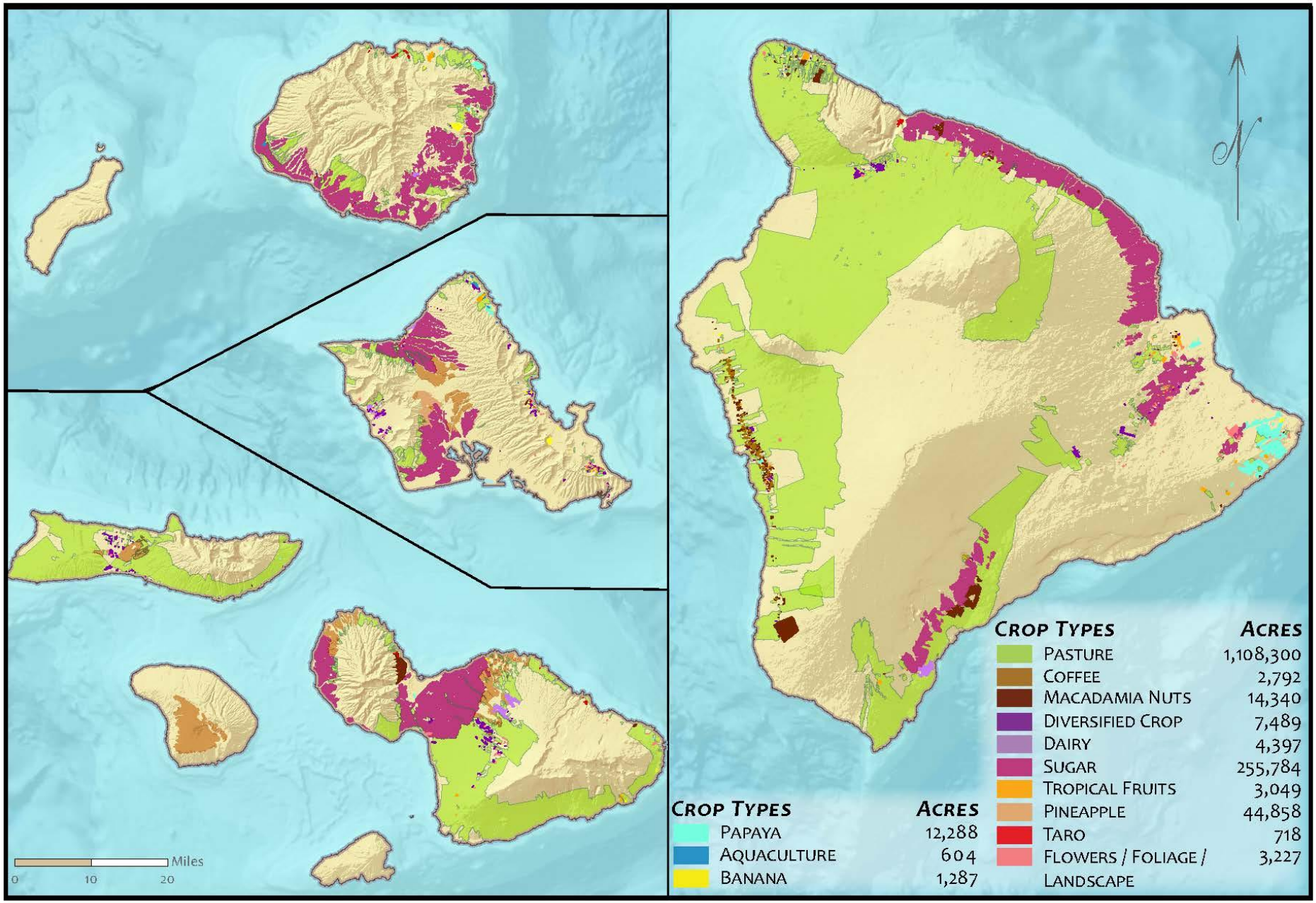


Figure 3

University of Hawai'i Hilo

SDAV UH Hilo

Hawai'i's Agricultural Land Utilization (1980)

Source: Department of Agriculture and State Office of Planning

Department of Agriculture State of Hawaii

Figure 4

ISLAND-BY-ISLAND AGRICULTURAL SUMMARIES 2015 CONT'D.

Hawai'i Island is the largest and youngest in the Hawaiian archipelago. It is the size of all the other islands put together, so it is no surprise it hosts 30% of the State's total crop area at 61,000 acres. Two-thirds are planted in macadamia nuts or commercial forestry. In addition, there are roughly 560,000 acres in pastureland, or 73% of the State's total.

NORTH KOHALA

North Kohala was once one of the most active agricultural areas on Hawai'i Island. For centuries, wetland taro was produced in the windward valley, and an extensive dryland field system stretched for miles along the mid-level slopes of Kohala's leeward coast. By the 1860s, sugar began to replace subsistence farming as the primary agricultural activity. By the early 1900s, nearly 20,000 acres were planted in sugar, partially fed by a surface irrigation system that served six sugar mills and irrigated most leeward plantation fields. Sugar production ended in 1974, and new agricultural activity has emerged sporadically over the last 40 years.

The foliage industry, led by Kohala Nursery, was the first successful post-plantation agricultural venture to develop from a series of unsuccessful efforts envisioned by the State's Kohala Task Force in the mid to late 1970's. For a time, Kohala Nursery was the biggest foliage plant exporter in the State. Rising competition and economic cycles, both locally and nationally, have seen the foliage industry grow and then recede. There are currently about 85 acres of land in North Kohala dedicated to foliage production, most of it in Honomaka'u and Kapa'au. Products include palms, potted plants, and landscape trees and shrubs.

Macadamia orchards were part of plantation diversification experiments in the 1960's. It was not until the early 1980's that commercial planting began in earnest. Today, over 1,080 un-irrigated acres are planted in macadamia trees, and the success of growers and processors fluctuates with global market conditions.

Kohala is home to Clover Leaf Dairy, which moved into a State-owned feedlot near 'Upolu Point in 1985. It operates on 840 acres and has 600 milking cows. The dairy has used Kohala Ditch water to irrigate pastureland to produce green chop, which has been used as feed to reduce the grain imports. Clover Leaf is one of only two commercial dairy operations in the State. Milk is sold to Meadow Gold Dairies and processed at its facility in Hilo.

There is a small amount of diversified crop production in North Kohala although there is significant interest within the Kohala community to strive for community food self-sufficiency. A Food Forum held in North Kohala in 2009 identified a relatively short list of five to six commercial farmers in the region, most of whom were organic vegetable growers who marketed their crops to local residents, restaurants, and to retail outlets around the Island. In addition to these commercial and private farm operations, there are several community-based efforts to educate Kohala young people in the business of farming and to promote family farming for local self-sufficiency.

There are about 150 acres of tropical fruit in the North Kohala district, most of which is sold locally or shipped to distributors on other islands.

Cattle production is the largest single agricultural land use in the district. Ponoholo, Kahuā, Kukuipahu, and Parker Ranches use much of Kohala's pastureland along with a number of smaller independent producers. The bulk of North Kohala's cattle are exported to the West Coast.

FIGURE 29

Right: Hawai'i Island crop pattern 2015

ISLAND-BY-ISLAND AGRICULTURAL SUMMARIES 2015 CONT'D.

NORTH KOHALA CONT'D.

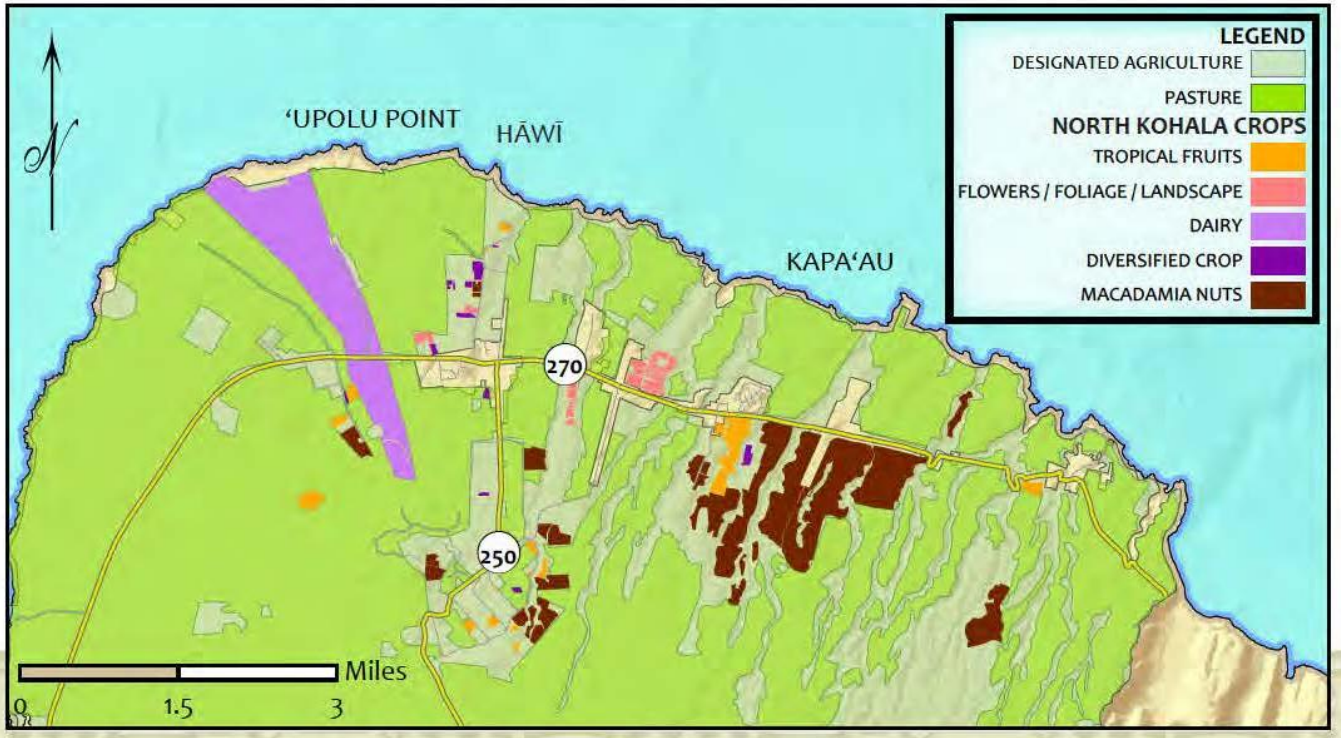
The Kohala Ditch was built in 1906 and is owned and operated by the district's largest landowner, Surety Kohala Ltd.

The ditch's principal stream intake is on land owned by KS in the remote east branch of Honokāne Valley. The Kohala Ditch is an anomaly in Hawai'i plantation irrigation systems.

It survived for nearly 40 years after the sugar industry shut down without being acquired or subsidized by the State or other government agency. As originally designed, the system had the capacity to convey an average of 30 to 40 million gallons per day (mgd) at high flow. A renovated intake in Honokāne now limits average flow to 10.0 mgd. The ditch is currently operational, but there are ongoing issues with trail access to intakes and the condition of flumes and distribution lines.

The largest income producers for the ditch are kayak float tours that use the ditch to transport visitors through the district on private flume adventures. There is also a small hydroelectric power plant near the end of the ditch, which has produced intermittent electrical power to the public utility company for several decades.

In addition to the Kohala Ditch, there are several perched water springs that provide reasonably dependable water. The privately owned Bond and Watt Tunnels in I'ole are two important resources. Together they produce approximately 1.5 mgd. Improvements are underway to replace piping and increase storage capacity so these sources can serve both domestic and agricultural uses on the 'Iole lands, now owned by The Kohala Institute.



SOUTH KOHALA

Farmland in South Kohala is concentrated around Waimea. Farm lots in Lālāmilo and Pu'ukapu account for about 500

Figure 5

Figure 6

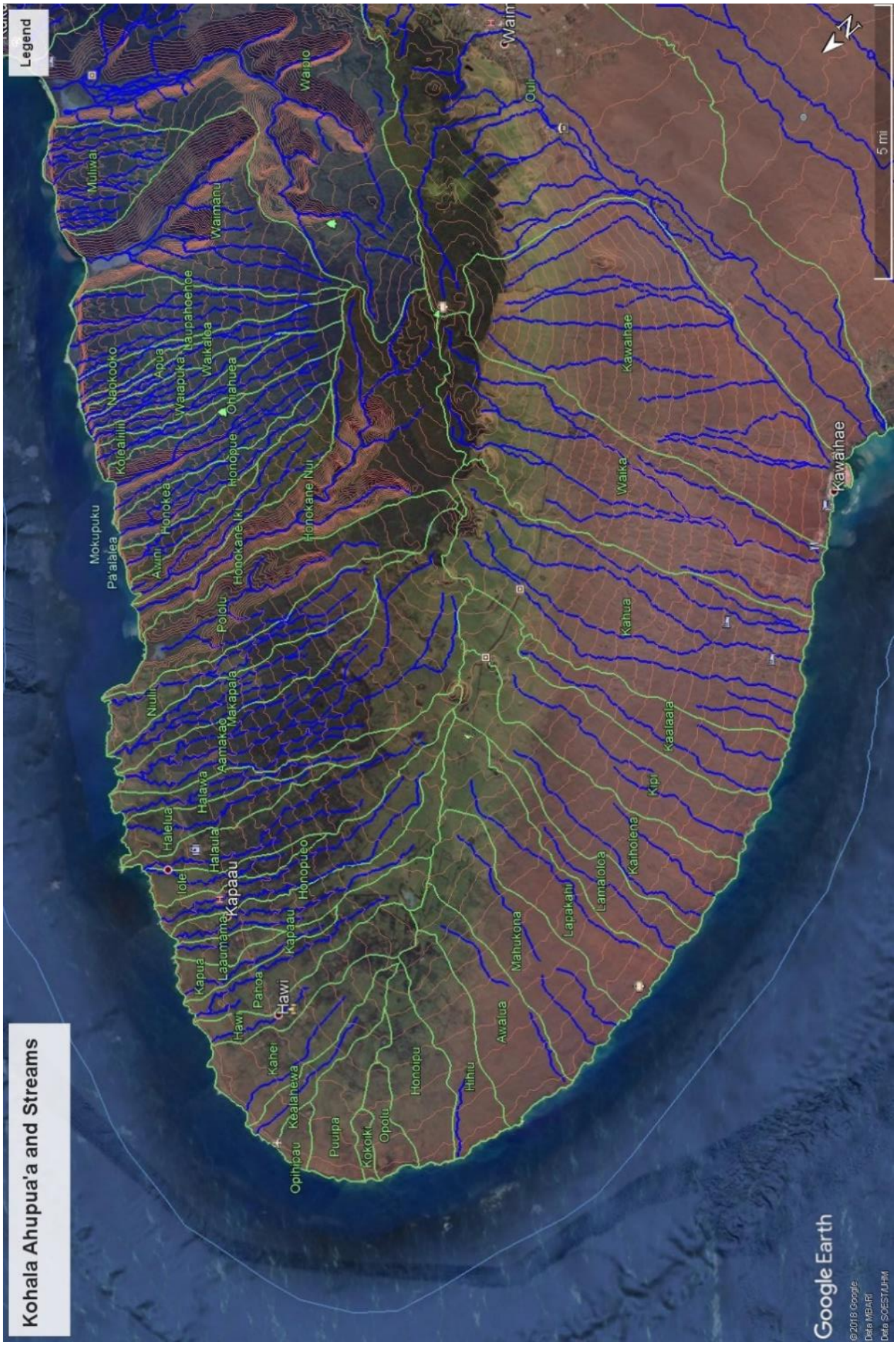

Kohala Ahupua'a and Streams
Legend
5 mi
Google Earth
© 2018 Google
Data MBARI
Data SOEST/UHM
Mokupuku
Pa'alalea
Awini
Honokea
Koleaiiii
Naokooko
Apua
Waiapuka
Waikaloa
Kaupaehoehoe
Waimanu
Waipio
Muliwai
Honopue
Ohiahuea
Honokane Iki
Honokane Nui
Pololu
Nuulii
Makapala
Aamako
Halawa
Halaula
Halelua
Iole
Kapaau
Honopueo
Laaumana
Kapua
Panoa
Hawi
Kahei
Kealahewa
Puuipa
Kokoiki
Opolu
Honoipu
Opihipau
Hihiu
Awaiua
Mahukona
Lapakahu
Lamaiolea
Kaiholena
Kipi
Kaalaala
Kahua
Waika
Kawaihae
Kawaihae
Ouli
Wain

Figure 7

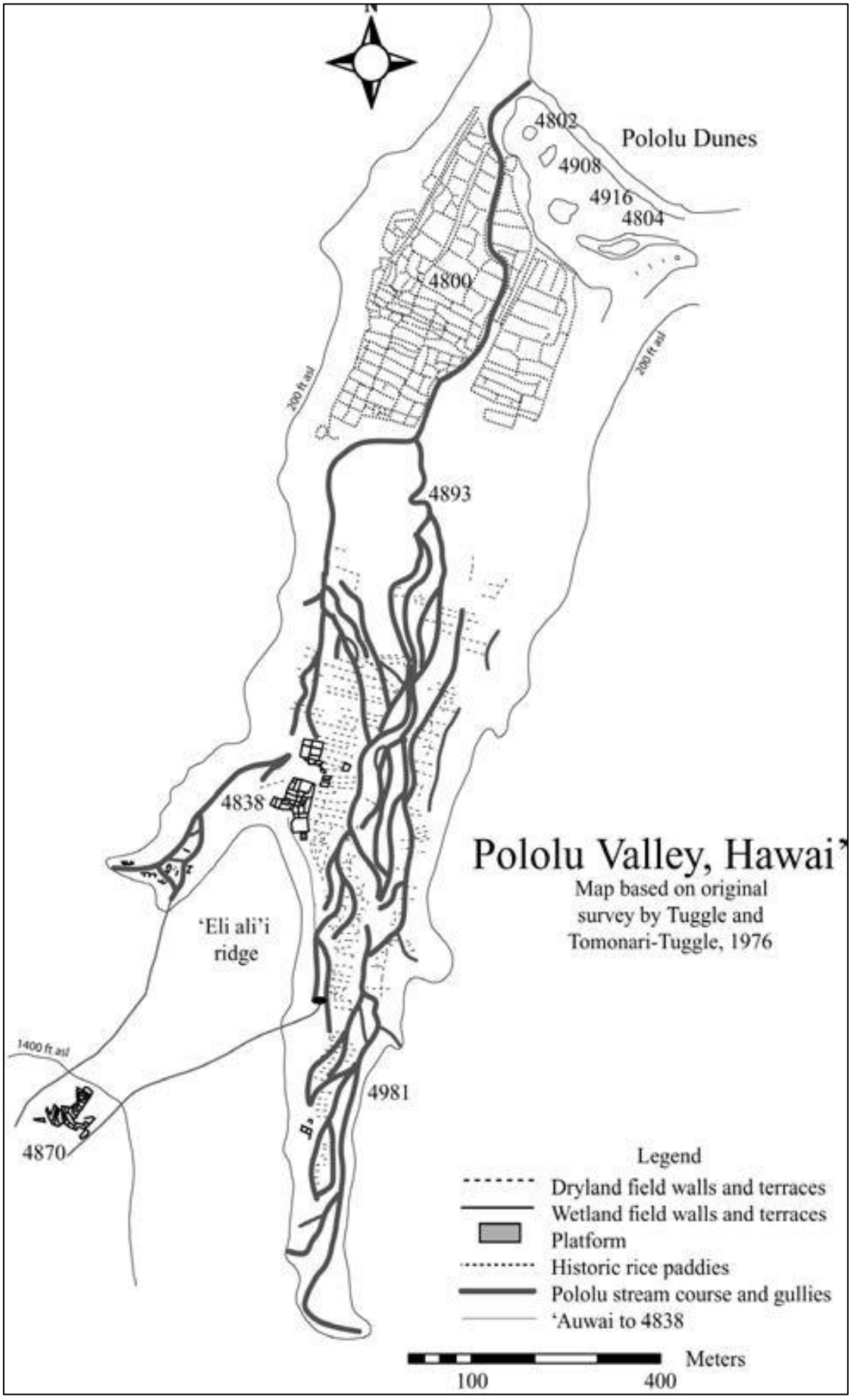

N
4802
Pololu Dunes
4908
4916
4804
4800
200 ft asl
200 ft asl
4893
4838
'Eli ali'i
ridge
1400 ft asl
4981
4870
Pololu Valley, Hawai'
Map based on original
survey by Tuggle and
Tomonari-Tuggle, 1976
Legend
Dryland field walls and terraces
Wetland field walls and terraces
Platform
Historic rice paddies
Pololu stream course and gullies
'Auwai to 4838
Meters
100
400

Figure 14 - Pipelines and Distribution at System Peak

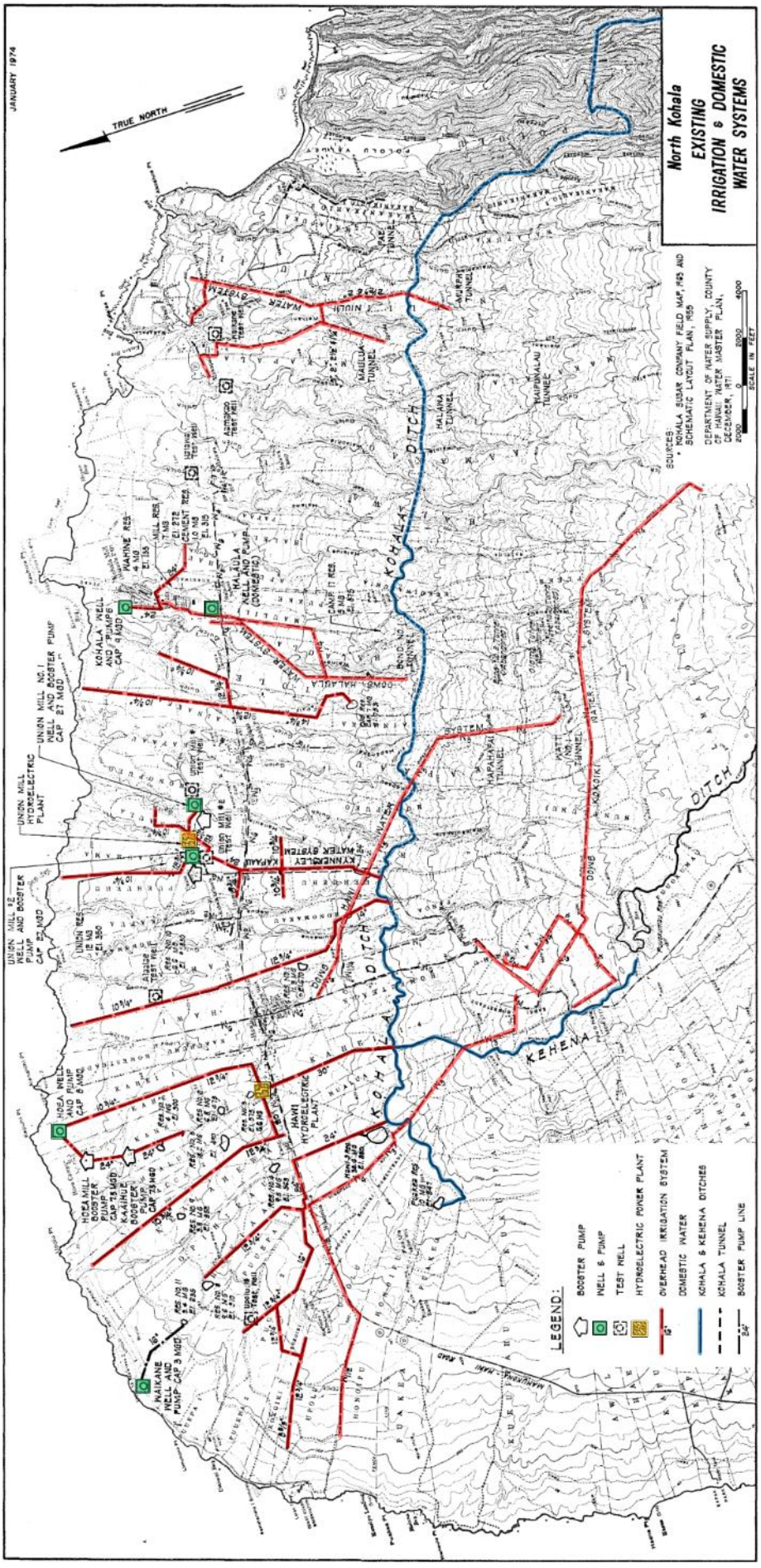


Figure 15 - Pipelines and Distribution Remaining