FREE FLOW:

Project outline for incentivized water catchment for subsistence family farm use in Upcountry Maui.

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I. INTRODUCTION

PROJECT NAME:

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PROJECT PURPOSE:

The purpose of this project is to assist with water sovereignty for sustainable family farming operations in the area known as Upcountry Maui, Hawaii. In the spirit of sustainability and honoring traditional knowledge, this project will provide for on-site

water harnessing and utilizing, and in doing so will be in step with the long-term goal of strengthening the local economy, promoting conservation, honoring traditional knowledge, and increasing sustainability consciousness throughout the community. This 'Free Flow' project is the Phase I in a larger visioning process for Maui.

ISSUES:

Supply and Demand

There is much pressure on all existing water systems across Maui to fulfill residential, agricultural, business, and visitor industry demands. This project will focus on the water demands in Upcountry Maui, specifically, though it should be noted that the water systems across the Island are connected. Currently, Upcountry commercial farmers use treated water from the County of Maui, as there are no large storage facilities or distribution lines that provide what is called 'Ag' water (untreated water). The farmers are given lower/adjusted water rates, but the water that they receive is still subject to Countywide drought restrictions. Restrictions are placed on residential units first and foremost, exempting farm operations, yet the threat of lacking water is a constant concern.

Kula Dual Ag Line

The State and County are currently deliberating and are moving forward with the "Kula Dual Ag line" water system. The Dual Ag Line is the creation of an additional waterline across the district, which will be supplied by an additional water storage system providing solely "raw" untreated water to agricultural operations. The farmers would then be able to supply their crops with untreated water, and would not be in competition for residential water, particularly in times of drought. This proposed Dual Ag Line system would definitely, when constructed, fulfill a need yet there are valid concerns with its development. One major concern is that the project proposes to construct a100 million-gallon water storage system in an area, which is zoned as a conservation district. Because of inherent difficulties such as; challenging terrain, native habitat, lack of transportation

infrastructure, bureaucratic delay and the sheer magnitude of the reservoir, it is projected that construction may take up to 20 years before it is able to come online. The Kula Dual Ag Line also perpetuates the model of centralized resource control by a governmental agency. The individuals in the Maui County Department of Water Supply work hard and care greatly about what they do, their dedication and skill is not in question. With increasing demand on water resources from a growing population, shifting power structures as large plantations switch focus from agriculture to residential developments, and the rise of water rights cases, the Department of Water Supply is kept busy trying to repair and maintain ailing systems, while working to accommodate a rapidly growing demand.

LONG TERM VISION:

The 'Free Flow' project is part of a long-term vision of self-sufficiency by encouraging the decentralization and localization of resource management, congruent with the traditional concepts of the ahupuaa system.

By empowering small family farms to harness their own rainwater, and maximize their usage, a culture of resource independence and conservation is born. The investors involved in this project will be regarded as supportive of a thriving agricultural community and will be seen as progressing towards a true indigenous model of sustainability and green living; the ahupuaa. These small sustainable family farms can lead other communities towards a more conscious state of living, one that displays the capacity of decentralization while empowering rural communities that take it upon themselves to move away from the import/export model and provide food and water for their neighbors. Hawaii, and Upcountry Maui in particular are perfectly situated with

regards to the geography, meteorology, soil science, infrastructure, existing community morals and mentality, as well as a rich local knowledge to revitalize the ahupuaa model. Because of the diverse environmental factors in Upcountry Maui, this district could serve as a model of a locally based economy for Hawaii as well as the world.

DESCRIPTION OF PROJECT:

The financing for this project was modeled off a successful prototype used for promoting solar hot water. With the case of solar hot water, in 2006 the state and federal governments provided tax credits for those individuals that installed solar hot water systems on their homes. The state tax credits covered up to 35% of the actual cost of the installation. The utility companies in each county also offered a $1000 incentive to those who switched from electric water heaters to solar hot water systems. These tax credits were made available through an appropriation made by the State Legislature as described in Act 240, Session Laws 2006.

This significantly increased the installation of solar hot water systems on existing homes, and particularly on new homes being built. This model has proven successful, and it is the aim of this project to emulate the solar hot water model and adapt it for the purposes of incentivized water catchment of non-potable water for small sustainable family farms.

II. DESIGN ASPECTS

BACKGROUND

Geologic Overview

The traditionally accepted model is that there are two separate water lens systems on Maui: underneath the East Maui Watershed and the West Maui Watershed. Yet another theory now proposes that there exists a single basal water lens underneath the entire island, 3 to 4 miles beneath the surface of the islands and oceans. The theory that Maui has one continuous water lens under the island does not the serve certain business and development interests, particularly those in the drier areas of the island. Many new

developments are being constructed on Maui and due to severe water restraints and the sheer inability to obtain a water-meter from the Department of Water Supply, developers are looking into drilling wells as a source of freshwater.

The depth/height of the water lens varies throughout the island. Shaped much like the lens of a pair of glasses, the fresh water seeping down through the mountain, meets the salt water underneath and displaces it creating a concave water lens. According to the Ghyben-Herzberg principle, for every foot of water above sea level there exists 40 feet of fresh water below sea level. The mathematical formula for calculating the depth of fresh water when drilling a well, for example is as follows:

$$hs = hf \ / \ es - ef$$

"hs" being the depth of fresh water below sea level, "hf" being the depth of fresh water above sea level, "es" being the density of salt water, and "ef" being the density of fresh water. This formula can be simplified as the following:

$$hs = hf \ / \ .025$$

The above formula becomes vital when drilling for wells to assure that the water lens is not punctured, therefore saving the entire freshwater source from being contaminated. This contamination, known as upwelling, has been extensively recorded within the West Maui Watershed from wells drilled in the Iao area of Maui. With further knowledge about the fragility and vulnerability of our water lens developers, which largely include the tourist industry, would be required to take more caution and responsibility for their water usage.

The integrity of both systems is seriously threatened at this current juncture. With the evidence that the lenses are indeed connected it is apparent that in the event that one lens should be punctured by being overdrawn, leading to contamination of salt water, that

both systems would subsequently be compromised. Considering the Iao aquifers are already experiencing upwelling, this has grim implications for the East Maui Watershed.

Current Water Distribution Infrastructure

The Upcountry water system is currently comprised of (4) reservoirs located to the East of the district:

15 Million Gallon reservoirs in the area of Waikamoi

(2) 50 Million Gallon reservoirs in the area of Kahakapao

Both sets of these reservoirs are fed by a collection of flumes that run laterally across a series of streams in the East Maui Watershed. This water is carried through a 36" transmission line from the mountain sources to the above-mentioned reservoirs. The water from these (4) reservoirs is then transported to the Olinda Water Treatment Plant and Reservoir. Here the "raw" water is treated with a series of filtration and chemical processes before being released into the existing distribution pipeline, which runs perpendicular across the mountain from Olinda out to Kanaio. From this main water line, (11) lateral lines drop down and service lower areas throughout the district.

The vulnerability of our dependence on these extensive water systems was displayed during a large storm in the winter of 2007. Severe flooding blew a portion of the upper Kula transmission line out of a gulch rendering the areas from Keokea to Kanaio cutoff from County water supply completely. An emergency water wagon was provided in the area during the interim, which lasted for one week.

Meteorological Overview

The majority of the area for which this project addresses is in the range of 30"-40" inches of rainfall per year. There are locations in the Upcountry area that receive up to 60" of rainfall, but these areas are mostly conservation districts with little to no agricultural activity. It is approximated that 2/3 of this rainfall occurs during the winter months of November through April. Rainfall is heavier during winter seasons and can be scarce in certain districts during the summer months. Droughts are typical during late summer, though they have been occurring earlier over the past two years.

Agricultural Overview

Commercial*:*

For a wider, more national perspective, let it be noted that in the United States there are nearly five million less farms today then there were in the 1930's.

Today there are approximately 169 farms in the Upcountry area according to Olinda-Kula Soil and Water Conservation District records. Agricultural crops are of a wide variety, the most prominent in the discussed are livestock grazing, ranching, small scale vegetable farming (truck farming), flower farming, and orchard crops. Perhaps the most famous agricultural products from the district are the Kula Sweet Onion and Protea flowers, in particular the King Protea. Much of the vegetable crops grown in the project area are directed to the ethnic and tourism markets such as; Chinese cabbage and daikon. A variety of salad greens are also successfully grown in the area, in the soil as well as hydroponically. The district of Kula provides for much of the small-scale local vegetables for the entire island of Maui. Currently the Maui County Department of Water Supply offers discounted rates to those that are actively pursuing agriculture for commercial purposes. Though the rates vary, the water is exactly the same, forcing farmers to apply treated water to their crops. This becomes a costly and possibly environmentally degrading process.

With regards to agriculture (dependent upon the specific crop) the drier months

necessitate more water consumption in order to keep crops healthy and strong. Water storage then becomes a necessary aspect of a self-sufficient farm operation.

According to the *USDA NRCS Final Watershed Plan – Environmental Impact Statement Upcountry Maui Watershed Maui County, Hawaii. Honolulu HI. 1997*. The number of actively cultivated acres in the project area are as follows: truck crops, 81 acres; cut flowers, 19 acres; protea, 56 acres; orchard, 12 acres; and Christmas trees, 7 acres. The project area includes 280 acres of Prime Agricultural Land, and 10,685 acres of Important Agriculture Lands. Many local farms are linking up with the tourist industry in order to provide fresh, locally grown, and often, organic produce to a niche market in restaurants and hotels.

Subsistence Family Farms:

What is a small sustainable family farm (SFF)? For the purposes of this proposal subsistence family farm is:

- Not for commercial purposes
- Smaller diversified garden style farming
- Primarily run and operated by the residents of the property
- Ideally utilizes permaculture design to maximize available resources
- May include livestock, not for commercial use

Cultural Overview

We mustn't ever forget the "culture" in agriculture. When talking about agriculture it is often forgotten that agriculture is more than the business of producing food or live products. Agriculture has a strong culture associated with it that has traveled with it, adapted, and transformed throughout the years. This culture of agriculture is the basis for much of the cultural richness and diversity of the Upcountry district. Perhaps the most prevalent of these practices are that of the Paniolo (cowboys). The historic town of Makawao is considered to be a cowboy town, and draws crowds of tourists seeking an

'authentic' experience. Makawao does provide a certain type of authenticity that the hotel districts of Maui are unable to produce, as does the entire district of Upcountry. It could be argued that the whole of Maui, therefore the whole of the State benefits off the continued authenticity of the Upcountry district, and other rural districts due to their ability to draw tourists to places such as Haleakala, Kula, Ulupalakua, and Makawao. Much of this authenticity is preserved in agriculture. Though this is a compelling argument, it is important to realize that this authenticity has larger implications and benefits than simply its relation to the tourist industry. Keeping land in productive agriculture undoubtedly fosters closer-knit community ties, and preserves a unique and robust district. It is apparent that many of Hawaii's agricultural communities are being torn apart by the difficulties associated with farming, the primary challenge being economic. It should be assumed that the reader understand the inherent and staggering benefits of preserving communities, and avoiding the suburbanization of open space.

The upcountry district of Maui is also home to the Waiahole Hawaiian Homesteads, with another Hawaiian Homes project on the books. Perhaps one of the largest obstacles in constructing more hoes is the lack of access to water-meters. Many of the occupants of Hawaiian Homes have expressed the intention to farm, specifically in kalo. Without a dependable supply of clean, fresh water, growing kalo becomes nearly impossible.

Much of the most contentious water rights battles on Maui involve important cultural aspects such as kuleana lands, and appurtenant water rights. These issues are by nature sensitive and often heated. By improving self-sufficiency with regards to water supply, the stress on the 'commons' will decrease. Once the stress on the water in the streams as the sole resource for fresh water decreases, other uses, many that are traditional cultural uses are made available again. This increased use could be for environmental purposes; in preserving the intricate ecosystems of water systems. Many streams have been used for generations for recreational purposes, and community members complain of these streams drying up. Without these streams flowing in their

natural, or near natural state many ramifications ensue, one of which is the inability to utilize these commons for traditional use.

Political Implications

Both water systems of Maui: the East Maui Water System and Na Wai Eha or the Iao Aquifer are perpetually involved in contentious water rights legal battles. One such battle was that of the East Maui Irrigation Co. (EMI) ditches. EMI diverts and directs water from the East Maui Watershed to the central valley to supply for sugarcane, pineapple, and development. This activity has left downstream users with barely a trickle to utilize. Many of these downstream users are self-sufficient and use the water for all purposes, potable and non-potable. Perhaps the most notable use is that of kalo farmers in the district. In September of 2008, in an historic ruling by the State Water Commission (a Division of the Department of Land and Natural resources) ordered that East Maui Irrigation Co. return 12.21 million gallons/day into the Honopou, Hanehoi, Piinaau, Waiokamilo and the Wailuanui Hydrologic units, which contain a total of eight streams.

This trend of resource battles will only increase as resources become less and less available. These battles and others like it clearly display that without seriously pursuing self-sufficiency, we are bound to continue down these paths of litigation.

Water Catchment Systems

Brief Background

The catchment systems that would be utilized in this project are not complex in nature, and are widely used on the island of Maui as well as in the discussed district. This project is hoping to encourage on-site subsistence family farming. It is not a proposal to encourage individuals to pull completely off of the grid. Because of this level of simplicity many bureaucratic and costly steps are avoided. “The grid” is a term used to describe the infrastructure setup by a local utility or government that supplies resources to an individual home. On Maui we have an electric utility grid, which is owned and operated by a private company. We also have water infrastructure in place, which is

owned and operated by the County of Maui.

For potable water, specific roofing material, gutter structure, and tank material are necessary. Potable water also necessitates approval from the Department of Health and the Department of Water supply if one is planning to remain tied into the grid. The dangers of backflow are one of the major reasons people are not encouraged to install their own water systems for potable water while remaining tied into the county grid system. Backflow is a phenomenon that happens when a user has their own source of water, such as a well or storage tank, but is also tied into the county grid. If for some reason, the pressure in the county system drops, water from within the storage facilities at a specific residence will be drawn out by the pressure drop, exposing that water to the entire water system. This undoubtedly can have serious effects in the water quality of a given system.

The issue of backflow and other health concerns can be avoided by separating the water sources into potable and non-potable. This project proposes that the residents continue to use County water for their internal home purposes: cooking, showering, cleaning, etc.... The catchment system and storage tank can provide for enough irrigation for external fixtures such as a garden or water for livestock.

As mentioned above, this is Phase I in a larger visioning project for Maui. The next phase of this project will incorporate the use of grey water recycling, further reducing the demand on freshwater.

Logistics:

Because the water is non-potable a variety of materials can be used for the projects. Different materials, different sizes, and different shapes will be used depending on the terrain, environmental factors, aesthetic qualities, and placement feasibility.

Currently there are water storage tanks being used by farmers for agricultural purposes on a commercial level. These farmers typically use tanks ranging in size from 20,000 gallons to 60,000 gallons. These tanks are not used so much as catchment tanks,

as they are use as backup water should the County experience drought or water is cutoff completely for a period of time. Another use for the tanks on commercial farms relates to water pressure. Because most of the Upcountry district is gravity fed, often times once water is distributed to a farm the pressure is such that it makes irrigation very difficult if not impossible. The farmers will fill tanks with County water in order to redistribute the water at a higher pressure.

This project is directed towards small subsistence family farmers, therefore the targeted audience already has in place at the least a superficial knowledge of conservation consciousness. Because this water will be used only for agricultural purposes (non-potable) and the families will still be tied into the County water grid a 5,000 gallon water tank would be sufficient to cover the irrigation of a well planned family garden. This project, once funded by the investor and matched by the State of Hawaii, will be able to assist 200 subsistence family farms acquire water catchment systems for their farm operations at an average of $10,000 per water catchment system. Should subsistence family farms display a higher demand for water, this project may also provide 100 farms with $20,000 water catchment facilities. These numbers are based on the premise that the homeowner would be reimbursed in full for their costs through tax credits. Further breakdowns are provided in the Budgetary Considerations.

Conclusion:

It is vital to move away from the golden cow concept of growth economics and bring our focus back to our communities, fostering their strength and immunity to ever changing world economics.

Encouraging people to harvest their own water for agricultural purposes creates a stronger bond between the process of growing and producing food, while inevitably increasing the level of conservation consciousness. Our economy, our society is suffering from great hubris and over-reaching. The key to our success is going to be in learning

how to live within our means. Humans best do this through learning by examples set by others in their community. We all have in our communities those that are more experimental and motivated to take matters into their own hands, but often they do not have the means to do so. This project allows those individuals to move forward with their innovations and not be overwhelmed or hindered by the daunting economic aspects of the start up costs associated with self-sufficiency. Though the payoffs in the end are financially clear people very often do not see that far into he future and only can see the immediate effect it will have on their well being, by having to payout such a large lump sum.

In order to achieve any level of true sustainability, true self-sufficiency we must move away from the top down model of the government or large private companies providing us with all of the solutions through jobs, technology, or new products. We must realize that in order for any of these movements to be sustained and truly be effective the have to start at the grassroots level; they have to be made for the people, by the people. Once individual households start making the transition back to what much of this district use to be like, others will follow. It is then that a movement is started and from that movement, government, and companies will follow suit.

This proposal is the first step in a larger vision to create a culture of independence, self-reliance, self-determination, cultural identification, environmental accountability, and honoring our personal responsibilities as users logged into in this large network of ecosystems.

III. PUBLIC POLICY

Investors and Sponsors:

Investors:	Investing $1,000,000 into a dedicated fund.
State of Hawaii:	Supply matching funds in tax credits.
County of Maui:	Expedited permitting process
Homeowner/Farmer:	Invest in initial costs, to be reimbursed via tax credits.

Budgetary Considerations

Item		Total Cost
Storage Tank	Size	
Polymer Plastic	5000 gallon	**$2,000**
Corrugated Steel	5000 gallon	**$8,500**
Concrete	5000 gallon	**$4,000**
Cost of Excavation and Foundation (including labor)		**$4,000**
Shipping Cost per system		**$2,000**
Average Cost per 5,000 gallon water storage system using Polymer Plastic Tank		**$8,000**

Cost of Water Catchment System	Size of Water Storage tank	# of Beneficiaries	Gallons of water saved per day (at an average of 600 gallons per day usage rate)	Gallons of water saved per month (at an average of 600 gallons per day usage rate)	Percentage of total usage for Upcountry district:
$10,000	**5,000 gallon**	**200**	**120,000**	**3,600,000**	**1.5% /day**

Cost of Water Catchment System	Cost of Water Storage Tank	# of Beneficiaries	Gallons of water saved per day (at an average of 1,200 gallons per day usage rate)	Gallons of water saved per month (at an average of 1,200 gallons per day usage rate)	Percentage of total usage for Upcountry district:
$20,000	**10,000 gallon**	**100**	**120,000**	**3,600,000**	**1.5%/day**

Due to the larger size of the 10,000 gallon water storage system, these subsistence family farms are able to use more water per day than the smaller systems while maintaining a safe buffer for water to be replenished at a reasonable rate without threatening their own supply.

APPENDIX A:

PROPOSED STATE LEGISLATION

Whereas, there is recurring drought in the Upcountry district of Maui each year that effects all of its citizens adversely.

Whereas, much of the Island's diversified agriculture comes from the Upcountry district.
Whereas, the agricultural lifestyle is one that contributes greatly to the cultural foundation of Upcountry residents and all residents of Hawaii.

Whereas, rising costs of production for agriculture are driving many long time farmers out of business resulting in the rapid loss of farming in Upcountry.

Whereas, the Governor has stated that food-security shall be a top priority for the administration and the Upcountry district has the capability to provide much produce consumed on the Island of Maui.

Whereas, much of the equipment and materials associated with these water catchment systems are available for purchase within Hawaii, therefore supporting local businesses.

Whereas, it is assumed that moving towards a sustainable future will be in the greater interest of all of Hawaii.

Whereas, the harnessing of water resources has the capability of greatly alleviating much of the pressures on the current water infrastructure, as well as the stress on the natural stream resources.

Therefore, by encouraging the construction of water catchment systems for non-potable water for agricultural use, the State is encouraging a conservation and sustainability mindset, while preserving the most precious of all of our Islands' resources: water.

Let it be enacted by the State of Hawaii to accept the donation of $1,000,000 to be placed into a dedicated fund with the purpose of providing for tax credits. The State will match the funds with an appropriation of $1,000,000 also to be placed into the dedicated fund. This fund is to be managed under the Department of Business and Economic Development.