

**Testimony of  
Tom Nance  
Tom Nance Water Resource Engineering  
SLUC Docket No. A10-787 Maui R&T Partners, LLC.**

In the Matter of the Petition of Maui R&T Partners, LLC. to Amend the State Land Use District Boundary of Lands Situated at Kihei, Island of Maui, State of Hawaii, Consisting of 253.05 Acres from the Agricultural District to the Urban District,  
Tax Map Key Nos. (2) 2-2-024: 016 and 017, and (2) 2-2-002: 054 (por.)

My name is Tom Nance and I am the owner of Tom Nance Water Resource Engineering and I prepared the *Assessment of the Potential Impact on Groundwater Resources of the Proposed Expansion of the Maui Research and Technology Park* (March 2012) (included as Appendix I in the Final Environmental Impact Statement). I have worked on water resource development projects in Hawaii since 1972 and have been the President of Tom Nance Water Resources Engineering since 1989. A copy of my resume is attached.

My report presents an assessment of the potential impact on groundwater resources of the proposed expansion of the Maui Research and Technology Park (MRTP). The presently developed portion of the MRTP obtains its water supply from the Maui County Department of Water Supply (DWS). Based on DWS water use rate design criteria, the proposed expansion would ultimately require about 0.80 million gallons per day (MGD) of potable supply and 0.37 MGD of non-potable supply for landscape irrigation. The DWS system is the preferred source of supply for the proposed MRTP expansion's potable supply. However, due to its current source limitations, DWS can only commit to supplying a portion of the expansion. As an alternative to the potable supply by DWS, MRTP has proposed a privately owned and operated system. The expansion's required non-potable supply would be provided by R-1 treated wastewater supplemented by brackish groundwater.

**Groundwater Source**

Groundwater beneath the project site occurs as a brackish basal lens overlying saline groundwater at depth. For regulatory purposes, this groundwater body has been named the Kamaole Aquifer by the State Commission on Water Resource Management (CWRM). It has set its sustainable yield at 11 MGD. In a 2007 report, the U.S. Geological Survey estimated that the

aquifer's total recharge is 37 MGD, equivalent to an average of about 3.4 MGD per coastal mile of the aquifer. Present pumpage in the aquifer is about five MGD, most of it occurring for golf course irrigation in the Wailea-Makena area to the south and unlikely to significantly influence the rate of flow beneath the MRTP site.

### **Potable Supply Alternatives Using Brackish Groundwater**

Groundwater beneath the site and for several miles inland is brackish. To produce the required drinking water supply, this water would need to be desalinized by high pressure filtration, a process called reverse osmosis (RO). The RO process removes dissolved solids from the product water stream and puts these solids into the portion of the raw water supply referred to as the concentrate. This concentrate, essentially a more saline brackish water, would be returned to groundwater via disposal wells. The delivery would be to a depth below the basal lens where the receiving groundwater would be of equal or greater salinity.

Two alternatives for the raw water supply wells were evaluated: five wells at 580-foot elevation inland of the MRTP site; and five wells located within the MRTP site and near its mauka boundary. For the wells at 580-foot elevation, expectable product recovery is two thirds of the raw water supply from the wells. The remaining third of the raw water supply would be concentrate. For the slightly higher salinity of onsite wells, the estimated product recovery rate is 60 percent, leaving 40 percent as concentrate for disposal in wells.

### **Estimated Changes in the Groundwater Flowrate**

In addition to the RO raw water supply and concentrate disposal, other aspects of the project will impact the groundwater flowrate: use of brackish water to supplement R-1 wastewater for landscape irrigation; percolation of excess applied irrigation water; and the possible change in onsite rainfall-recharge. Computed decreases to the groundwater flowrate are 13.6 percent for the 580-foot wells alternative and 17.3 percent for the onsite wells alternative. Discounting the return of the RO concentrate to a depth below the usable portion of the basal lens, the net drafts of groundwater from the usable portion of the basal lens would be 20 and 28 percent respectively.

There are 24 wells on record in the area downgradient of the project site, although none report their ongoing use, if any, to the CWRM. It appears that four of these wells may actually be in use. Although the project's use rates for either alternative are well within the CWRM's guidelines for sustainable use, it is likely that the salinity of the water pumped by actively used downgradient wells would be increased on the order of 10 percent.

**Changes to Groundwater Nutrient Concentrations**

Changes to the groundwater flow rate, both as drafts from wells and returns by various processes, will also remove and add nutrients (nitrogen and phosphorus) which will ultimately discharge into the marine environment. The estimated increase in nitrogen for both supply alternatives is from 0.8 to 0.9 percent. For phosphorus, the estimated increase is .03 to .04 percent. None of these increases would be significant.

**Education**

M.S., Civil Engineering, Stanford University, 1970  
 B.S., Mechanical Engineering, Stanford University, 1966  
 B.S., Economics, Claremont Men's College, 1966  
 Graduate Work in Hydrology, University of California at Berkeley, 1977-1978  
 Graduate Work in Physical Oceanography, University of Hawaii, 1970-1972

**Registration**

Professional/Civil Engineer – Hawaii #03878, 1975  
 Certified Diver – Hawaii

**Affiliations**

American Society of Civil Engineers  
 American Water Works Association

**Expertise**

Groundwater and Surface Water Development  
 Hydraulics and Water System Design  
 Flood Control and Drainage  
 Coastal Engineering

**EXPERIENCE**

1989 –Present  
 President

**Tom Nance Water Resource Engineering - Honolulu, Hawaii**

1972 – 1989

**Belt Collins & Associates - Honolulu, Hawaii**

Senior Water  
 resource  
 Resources Engineer  
 such as  
 1979 – Present

Specializes in hydrologic and engineering studies and designs for water development, flood control projects, and unusual drainage applications injection wells.

Project Engineer  
 studies and  
 1975 – 1979

Responsible for hydrologic investigations, engineering feasibility, and design environmental impact statements.

Civil Engineer  
 statements.  
 1972 – 1975

Engineering feasibility studies; environmental impact assessments and

Planner/Civil Engineer  
 1970

Donald Wolbrink & Associates, Honolulu, Hawaii  
 Participated in engineering and planning studies.

Civil Engineer/Teacher  
 1966 – 1968

U.S. Peace Corps  
 Served as volunteer in Micronesia.

Student Engineer  
 1964 – 1965

Hawaiian Electric Company, Hawaii

Student Engineer  
 1962 – 1963

Honolulu Board of Water Supply, Hawaii

**SELECTED**  
**2011**  
**PROJECTS**

Disney Aulani Resort Saltwater Supply and Disposal Wells, Island of Oahu,

- Covanta (HPOWER) Disposal Wells, Island of Oahu, 2011
- New Well at St. Stephens Diocesan Center, Island of Oahu, 2011
- New Well at Fort Shafter, Island of Oahu, 2011
- Lanai Well 15, Island of Lanai, 2011
- DWS Halaula Well, Island of Hawaii, 2011
- DWS Kapulena Well, Island of Hawaii, 2010
- Robinson Well No. 1, Island of Oahu, 2010
- Central Maui Baseyards Well, Island of Maui, 2009
- New Wells at Kealia NWR, Island of Maui, 2009
- Kaanapali P-5A Well, Island of Maui, 2009
- Kamakana Villages Deep Exploratory Well, Island of Hawaii, 2009-2010
- NOAA Ford Island Deep Saltwater Well, Island of Oahu, 2009-2010
- Alii Turf Helemano Well, Island of Oahu, 2009-2010
- Villages of Lealii Potable Water Master Plan, Island of Maui, 2009
- Kaanapali P-3 Well, Island of Maui, 2008
- Kaupulehu Well 11, Island of Hawaii, 2008
- Princeville Well No. 5, Island of Kauai, 2008
- Lanai Well 3, Island of Lanai, 2008
- Waikoloa Drinking Well No. 8, 2008-2009
- Potable Water Master Plan for Kikiaola, Island of Kauai, 2008
- A&B's Waiale Well Nos. 1 and 2, Island of Maui, 2007 and 2008
- Maui Lani Irrigation Well No. 3, Island of Maui, 2007
- DWS' Ahualoa Well, Island of Hawaii, 2006
- Kula 1800 Well Nos. 1 and 2, Island of Maui, 2007 and 2008
- Kamaole Well Nos. 1 and 2, Island of Maui, 2007
- Waikoloa Drinking Water Well No. 7, Island of Hawaii, 2007
- DWS' Waiohinu Well, Island of Hawaii, 2007
- Hapuna Irrigation Well No. 4, Island of Hawaii, 2006
- Kapalawai Resort Potable Wells, Island of Kauai, 2006
- Poipu Wastewater Treatment Plant Disposal Wells, Island of Kauai, 2006
- Ko Olina Resort Deep Saltwater Supply Well, Island of Oahu, 2006
- Kealahewa Potable Wells 1 and 2, Island of Hawaii, 2006
- Falko Potable Wells 3 and 4, Island of Kauai, 2006
- Kaupulehu Potable Well No. 6, Island of Hawaii, 2005-06
- Kaupulehu Irrigation Well No. 6, Island of Hawaii, 2005-06
- Maui Lani Potable Wells 5, 6, and 7, Island of Maui, 2005-06
- Groundwater Exploration Program, Pohnpei Island of FSM, 2005
- Waikoloa Drinking Water Well No. 6, Hawaii Island, 2004
- Honomu Potable Well, Hawaii Island, 2004
- Saltwater Wells for the Hilton Hawaiian Village Lagoon, Oahu, Hawaii, 2004
- Groundwater Modeling of Saltwater Disposal at the Oceanic Institute,

Oahu,

Hawaii, 2004

Stormwater Modeling for the Pacific Missile Range Facility, Kauai, Hawaii,

2004

- Waikoloa Effluent Disposal Well, Hawaii Island, 2004
- Kiahuna Mauka Water Master Plan, Kauai, Hawaii, 2004
- Village at Poipu Water Master Plan, Kauai, Hawaii, 2004

**SELECTED**

**PROJECTS**  
(continued)

2004

Kukui'Ula Offsite Water Master Plan, Kauai, Hawaii, 2004  
 Kaupulehu Potable Well No. 5, Hawaii Island, 2003 to 2004  
 Anderson AFB Drinking Water Wells, Guam, 2002 to 2004  
 Four Saltwater Disposal Wells at the Oceanic Institute, Oahu, Hawaii, 2003-

2001

Piawai Well Nos. 2 and 3, Kauai, Hawaii, 2001 and 2003  
 Hapuna Irrigation Well No. 3, Hawaii Island, 2003  
 Kaleie Mauka Well, Hawaii Island, 2002  
 Kaupulehu Potable Well No. 4, Hawaii Island, 2002  
 Kauaula Well No. 3, Maui, Hawaii, 2002  
 Kaluakoi Resort Brackish Irrigation System, Molokai, Hawaii, 2002  
 Kaluakoi Potable Water System, Molokai, Hawaii, 2002  
 East Maui Irrigation Ditch / Stream Study, Maui, Hawaii, 2001  
 Mana Plain Drainage Study, Kauai, Hawaii, 2001  
 Hanamaulu Bay Oceanfront Wells, Kauai, Hawaii, 2001  
 Evaluation of Koloa Well F, Kauai, Hawaii, 2001  
 Trex Disposal Well, Kauai, Hawaii, 2001  
 Koele Golf Course Irrigation Supply, Lanai, Hawaii, 2001  
 Poeleele Well, Kauai, Hawaii, 2001  
 Pump Testing of the DLNR Oahu (Kaimuki) Exploratory Wells, Oahu, Hawaii,

Kealia Pond for Maui National Wildlife Refuge, Maui, Hawaii, 2001  
 Falalop Island Water System - Ulithi Atoll, Yap Islands, 2001  
 Kii Well Rehab at Kahuku Wildlife Refuge, Oahu, Hawaii, 2001  
 Waiau Pipeline for HECO, Oahu, Hawaii, 2001  
 Ameron Quarry, Oahu, Hawaii, 2001  
 Department of Water Supply Waiaha Well and Tank, Island of Hawaii, 2001  
 South Kohala Groundwater Assessment, Island of Hawaii, 2000  
 Lihue Energy Services Center Water System Design, Kauai, Hawaii, 2000  
 1.5 MG Reservoir at Mauna Lani WWTP, Island of Hawaii, 2000  
 Yyin to Gargey Pipeline, Yap Islands, 2000  
 HASEKO Ocean Pointe Water Master Plan, Oahu, Hawaii, 2000  
 Irrigation Wells for Hualalai Resort, Island of Hawaii, 2000  
 CEATECH Plantations Wells 3 and 4, Kauai, Hawaii, 2000  
 Dillingham Airfield Water Supply Evaluation, Oahu, Hawaii, 2000  
 Hanaliilolilo Intake and Pipeline, Molokai, Hawaii, 2000  
 Hapuna Well No. 3, Island of Hawaii, 2000  
 Launiupoko Well, Maui, Hawaii, 2000  
 Department of Water Supply Waiaha Well, Island of Hawaii, 2000  
 Design of the Maap-Rumung Pipeline Extension, Yap Islands, 2000  
 Gagil-Tomil System Extension, Yap Islands, 2000  
 Kaupulehu Potable Well No. 4, Island of Hawaii, 2000  
 Kapalawai Resort Water Systems, Kauai, Hawaii, 1999  
 Kadday to Yyin Pipeline, Yap Islands, 1999  
 Kekaha Sugar Plantation Infrastructure Study, 1999  
 Maui Land & Pineapple Well in Hailiimaile, Maui, Hawaii, 1999  
 Mauna Lani Resort Irrigation Well Nos. 8 and 9, South Kohala, 1999  
 Coral Creek Golf Course Well Development, Oahu, Hawaii, 1998  
 Uplands Water System Design, South Kohala, Hawaii, 1998  
 Puu O Hoku Ranch Well Development, Molokai, Hawaii, 1998

**SELECTED**  
**PROJECTS**  
(continued)

Kailua Well Development for East Maui Irrigation, Maui, Hawaii, 1998-99  
 Waikele Stream Evaluation, Oahu, Hawaii, 1998  
 Groundwater Development in Eyeb Valley, Yap Islands, 1998-99  
 Drainage Assessment for Hawaii Reserves, Inc., Laie, Oahu, Hawaii, 1998-99  
 Well Development at Papaa Bay Ranch, Kauai, Hawaii, 1998-99  
 Bay View Golf Course Irrigation Wells, Kaneohe, Oahu, 1996-97  
 Molokai Ranch Replacement Pipelines, Molokai, 1996-97  
 Molokai Ranch 15 MG Storage Reservoirs, Molokai, 1996-97  
 Waiola Well, Molokai Ranch, 1996-97  
 Parker Wells Outfitting, Lalamilo, Hawaii, 1996-97  
 Royal Kunia Golf Course Irrigation Well, 1996  
 Hawaii Reserves, Inc. Contested Case, Laie, Oahu, 1996  
 Puuloa Caprock Users Group Master Plan, Ewa, Oahu, 1996  
 Kauai Electric-Chevron Groundwater Evaluation, Port Allen, Kauai, 1997  
 Ewa Caprock Aquifer Monitoring For 1994-97, Oahu, Hawaii  
 Kaupulehu Potable Wells Evaluation, Island of Hawaii, 1995  
 Pecatu Graha Project, Bali, Indonesia, 1995  
 Taman Dayu Well Drilling, Surabaya, Indonesia, 1995  
 Princeville Water Master Plan, Kauai, Hawaii, 1995  
 Kaupulehu Brackish Pond Turnover, Island of Hawaii, 1995  
 Honolulu Resource Recovery Venture Disposal Wells Report, Oahu, Hawaii,

1995

Outfit Mauna Lani Resort's Parker Wells, Island of Hawaii, 1995  
 Princeville PUC 1995 Rate Case, Kauai, Hawaii, 1995  
 EPWDC Non-Potable Source Plan, Oahu, Hawaii, 1995  
 Kaupulehu Disposal Wells, Island of Hawaii, 1995  
 DWS Piihonua Well Pump Test, Maui, Hawaii, 1995  
 Kaupulehu Potable Well Nos. 1 and 2, Island of Hawaii, 1995  
 Ookala Well (DWS), Maui, Hawaii, 1995  
 Waiahole Irrigation Company, Oahu, Hawaii, 1995  
 Gentry Area 26 Well, Oahu, Hawaii, 1995  
 Second Honouliuli 228 Tank, Oahu, Hawaii, 1995  
 Lanai Well No. 14 Outfitting, Lanai, Hawaii, 1995  
 Big Island Country Club Estates Potable Wells Certification, Island of Hawaii,

1995

Mauna Kea Hotel Drainage Improvements, Island of Hawaii, 1995  
 Gentry Area 26 Irrigation Station, Oahu, Hawaii, 1995  
 Waialua Sugar Company Pump 3 DOH Certification, Oahu, Hawaii, 1994  
 Islands Saltwater Well Permits, Mauna Lani Resort, Island of Hawaii, 1994  
 Kehena Ditch Evaluation For Kohala Ranch, Island of Hawaii, 1994  
 Chiyoda Makakilo Golf Course, Oahu, Hawaii, 1994  
 Gentry Walawa Recharge Study, Oahu, Hawaii, 1994  
 Gentry East-Side Irrigation, Oahu, Hawaii, 1994  
 Kawaihae Cogeneration Supply and Disposal Wells, Island of Hawaii, 1994  
 Kapolei Irrigation Pump Station, Oahu, Hawaii, 1994  
 Campbell Agricultural Lands Water System, Oahu, Hawaii, 1994  
 AES Federal UIC Permit, Oahu, Hawaii, 1994  
 Campbell Estate's Malaekahana Water System, Oahu, Hawaii, 1994  
 Hauula Well Evaluation, Oahu, Hawaii, 1994  
 Kapalua's Well No. 3, Maui, Hawaii, 1994

**SELECTED**  
**PROJECTS**  
 (continued)

Waikoloa's Tank 1200S-2, Island of Hawaii, 1994  
 Gentry Golf Course Irrigation Pump Station, Oahu, Hawaii, 1994  
 HRT's Makaha Site Groundwater Evaluation, Oahu, Hawaii, 1994  
 Kalaeloa Partners' New Monitoring Wells, Oahu, Hawaii, 1994  
 Castle & Cooke Central Oahu Master Plan, Oahu, Hawaii, 1994  
 Kaupulehu Makai Irrigation Well Outfitting, Island of Hawaii, 1994  
 Villa Escudero, Phillipine Islands, 1994  
 HPOWER Disposal Wells DOH Report, Oahu, Hawaii, 1994  
 Lost River Water Supply Evaluation, Guam, 1994  
 Makakilo Golf Course, Oahu, Hawaii, 1994  
 Lanai Water System Development, Lanai, Hawaii, 1993  
 Kapolei City Irrigation System, Oahu, Hawaii, 1993  
 Laie Water Master Plan, Oahu, Hawaii, 1992-93  
 Kohala Ranch Well Nos. 3 and 4, Island of Hawaii, 1992-93  
 Mauna Lani Resort's Parker Wells, Island of Hawaii, 1992-93  
 SNM Rota Island Resort, Rota Island, CNMI, 1992-93  
 ABB Cogeneration Plant Saltwater Supply Wells, Oahu, Hawaii, 1993  
 Keauhou High Level Well Development, Island of Hawaii, 1991-93  
 Waiawa by Gentry Water System Development, Oahu, Hawaii, 1992-93  
 Kaupulehu Resort Water System Development, Island of Hawaii, 1990-93  
 Kona Country Club Irrigation Well, Island of Hawaii, 1991-92  
 Lihilani Groundwater Development, Oahu, Hawaii, 1992  
 Honouliuli Wastewater Reclamation and Reuse Study, Oahu, Hawaii, 1992  
 Big Island Country Club Irrigation Well, Island of Hawaii, 1992  
 Hapuna Golf Course Irrigation Wells, Island of Hawaii, 1991-92  
 Ewa Caprock Aquifer Computer Model, Oahu, Hawaii, 1991-92  
 South Kohala Water Master Plan, Island of Hawaii, 1991-92  
 Princeville Well Development, Kauai, Hawaii, 1992  
 Waikoloa Well Nos. 1, 2, and 3, Island of Hawaii, 1990-92  
 Waikoloa Water System Master Plan, Island of Hawaii, 1991  
 Lalamilo Water System Expansion, Island of Hawaii, 1991  
 Saltwater Wells for the Islands at Mauna Lani Resort, Island of Hawaii, 1991  
 Bali Golf & Country Club Irrigation Wells, Bali, Indonesia, 1990-91  
 Honouliuli Well Nos. 1 to 6, Oahu, Hawaii, 1990-91  
 Ewa by Gentry Irrigation System Development, Oahu, Hawaii, 1990-92  
 Saltwater Supply and Disposal Wells for the AES Cogeneration Plant, Oahu,

Hawaii,

1990

Makakilo Golf Course Supply Wells and Desalination Plant Design, Oahu,

Hawaii,

1990

Kapalua Resort Well Nos. 1 and 2, Maui, Hawaii, 1990-91

Lalamilo Water System, Mauna Lani Resort, Island of Hawaii, 1989

Waikoloa Water System Expansion, Island of Hawaii, 1989-90

Clark AFB Well Development, Phillipine Islands, 1988-90

Mangilao Golf Course Irrigation Well Development, Guam, 1988-90

Waikoloa Stream Flood Study, Island of Hawaii, 1990

Ewa Water System Development, Oahu, Hawaii, 1986-88

Reclamation &amp; Beach Construction, Sentosa, Singapore, 1986-88

Waikoloa Beach Resort Irrigation Well Development, Island of Hawaii, 1988

**SELECTED  
PROJECTS**

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Mauna Lani Resort Irrigation Well Development, Island of Hawaii, 1988, 1990,  
and 1992  
Westin Kauai Irrigation Well Development, Kauai, Hawaii, 1987-88  
Makaiwa Bay Beach Development, Mauna Lani Resort, Island of Hawaii, 1986  
Kosrae Groundwater Development, Trust Territory, 1984  
Palau Islands Groundwater Development, 1984-88  
Keauhou Resort Golf Course Irrigation Well Development, Island of Hawaii,  
1983-84  
Kula Up-Country Water Study, Maui County, Hawaii, 1983-84  
Ewa Water Master Plan, Oahu, Hawaii, 1983-84  
Lalamilo Water System, Island of Hawaii, 1984 & 1988  
Beach Construction, Mauna Lani Bay Hotel, Island of Hawaii, 1983  
Southern Water System, Yap State, Federated States of Micronesia, 1983  
Water Development, Saipan, CM, 1983  
Molokai Water Master Plan, Molokai, Hawaii, 1982  
Yap Island Groundwater Exploration & Development, Yap State, 1982  
Molokai Ranch Mountain Water System, Molokai, Hawaii, 1983 & 1988  
Princeville Golf Course Irrigation System, Kauai, Hawaii, 1981  
Kiahuna Golf Course Irrigation System, Kauai, Hawaii, 1981  
Prototype High Capacity Injection Well Field Testing, Waiale, Maui, 1978-80  
Irrigation Well, Liliuokalani Trust, Island of Hawaii, 1979  
Yap Island Sewage Treatment Plant Ocean Outfall, Trust Territory, 1980  
Design of the Gagil-Tomil Water System, Yap State, 1981  
Tripler Hospital Traffic Study, Oahu, Hawaii, 1979  
Kaunapali Harbor Breakwater Repair, Lanai, Hawaii, 1980 & 1982  
Beach Development Study for Mauna Loa Land Resort, Hawaii, 1979  
Drainage Master Plan, Waiale Development, Kahului, Maui, Hawaii  
Conceptual Water Development Plans for Colonia, Gagil-Tomil, and Southern  
Yap areas of Yap State, Trust Territory of the Pacific Islands, 1980  
Appeal of FIA Flood Hazard Designations for the Mauna Loa Land, Inc.  
Resorts, South Kohala, Hawaii, 1980  
Irrigation Wells for Kiahuna Golf Village, Koloa, Kauai, Hawaii, 1979  
Yap Islands Groundwater Investigation, Yap State, 1979  
Yap Wastewater Facility Plan, Trust Territory of the Pacific Islands, 1978  
Wailua Basin Water Resources Development Study (Dam Feasibility Study,  
Hydropower, Flood Control, Irrigation), Kauai, Hawaii, 1976-77  
Irrigation Study, Kilauea Agricultural Subdivision, Kauai, Hawaii, 1977  
Waimea to Kawaihae Water Transmission Line Study, Hawaii, 1977  
Sewerage Master Plan, U.S. Naval Facility, Diego Garcia, 1976

**SELECTED**  
**PROJECTS**  
(continued)

South Kohala Groundwater and Deep Well Evaluation Study, Hawaii, 1975  
Fort Shafter Sewage Pump Station, Oahu, Hawaii, 1975  
Tafuna Industrial Park, Tutuila Island, American Samoa, 1974  
Kapalua Master Plan, Maui, Hawaii, 1974