Keonepoko-Nui 2
Production Well

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STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

February 25, 1998

Mr. Gary Gill
Office of Environmental Quality Control
235 S. Beretania Street
State Office Tower, Suite 702
Honolulu, Hawaii 96813

Dear Mr. Gill:

Subject: Final Environmental Assessment (EA):
Keonepoko-Nui 2 Production Well
and Supporting Facilities;
Pahoa, Puna, County of Hawaii

The State Department of Hawaiian Home Lands has reviewed the comments received during, and subsequent to, the 30-day public comment period. The agency has determined that this project will not have a significant environmental effect and has issued a Finding of No Significant Impact (FONSI). Please publish this notice in the next Environmental Notice. ✓

We have enclosed a completed OEQC Publication Form, data file disk containing the project description, and four copies of the Final EA. If you have further questions regarding the contents or preparation of the Final EA, please contact Mr. Eric Hee of Engineers Surveyors Hawaii, Inc. at (808) 591-8116.

Should you have any questions regarding the project, please call Mr. Gerald Lee of our Land Development Division at 586-3815.

Aloha,

FOR KALI WATSON, Chairman
Hawaiian Homes Commission

encl.

c. (w/o encl.): Eric Hee - ESH

1998-03-08-HI-FEA-Keonepoko-Nui 2 Production Well

Chapter 343, Hawaii Revised Statutes (HRS)

FINAL
Environmental Assessment

KEONEPOKO - NUI 2 PRODUCTION WELL & SUPPORTING FACILITIES PAHOA, PUNA, HAWAII

Prepared for:

Department of Hawaiian Home Lands
State of Hawaii

Prepared by:

Engineers Surveyors Hawaii, Inc.
1020 Auahi Street
Suite No. 1, Building No. 6
Honolulu, Hawaii 96814

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I. SUMMARY

Chapter 343, Hawaii Revised Statutes (HRS)
DRAFT
Environmental Assessment
For
Department of Hawaiian Home Lands
State of Hawaii

February, 1998

PROPOSING AGENCY:	Department of Hawaiian Home Lands State of Hawaii
ACCEPTING AUTHORITY:	Department of Hawaiian Home Lands State of Hawaii
APPROVING AGENCY:	Department of Land and Natural Resources State of Hawaii
PROJECT NAME:	Keonepoko - Nui 2 Production Well and Supporting Facilities
PROJECT LOCATION:	Keonepoko Reservoir and Well Site Pahoa, Puna, Hawaii Tax Map Key: Third Division: 1-5-08: Portion of 1
STATE LAND USE DESIGNATION:	Agricultural District
COUNTY GENERAL PLAN DESIGNATION:	Orchard
COUNTY ZONING:	AG-20-A
LANDOWNER:	Land Division Department of Land and Natural Resources State of Hawaii
PERMITS REQUIRED:	Pump Installation Permit, DLNR Building Permit Grading Permit

APPROVAL REQUIRED:

County of Hawaii
- Planning Department
- Department of Public Works
- Department of Water Supply

State of Hawaii
- Commission on Persons with Disabilities
- Department of Health

II. GENERAL DESCRIPTION OF THE ACTION'S CHARACTERISTICS

A. INTRODUCTION

The proposed project would construct a production well and supporting facilities at the existing Hawaii County Department of Water Supply (DWS) Keonepoko Nui well and reservoir site. The project has two purposes:

- o The most important objective is to develop a source of potable water supply for the Department of Hawaiian Home Lands (DHHL) Makuu Farm and Agricultural Lots.
- o Secondly, locating the well at Keonepoko Nui, adjacent to an existing well, will also provide a needed back-up well for the DWS Keonepoko Nui site.

The site is located alongside Highway 130 at an approximate elevation of 605 feet, just south of the Makuu Farm and Agricultural Lots, TMK: 1-5-08: portion of 1. It's location is approximately 2000 feet from the Pahoa Landing Airstrip on the opposite side of the highway. (See Exhibit "A", Location Map). The area of the project site is 2.113 acres.

A hydrologic feasibility report was made by Water Resource Associates, which concludes that another well to provide additional potable water supply for the Makuu Farm and Agricultural Lots can be successfully located within the Keonepoko Reservoir and Well Site. The report is included in this assessment in Appendix "A". The County of Hawaii, Department of Water Supply (DWS) has reviewed this report and they have no objections.

The exploratory well has been completed and the report is on file at the State Department of Land and Natural Resources. This phase will be the conversion of the exploratory well into a production well with supporting production facilities including permanent 700 gpm pump, piping, control building and wastewater holding tank. Since this is a public facility, State Department of Health has no objection to the use of a wastewater holding tank for this project.

B. TECHNICAL CHARACTERISTICS

DHHL will be constructing a production well and supporting facilities for potable water required for its Makuu Farm and Agricultural Lots. The well has been drilled to a depth of 650 feet. The drilling and testing phase has provided data on well capacity and drawdown (See Appendix "B") and water quality (See Appendix "C").

The existing exploratory well is located 120 feet from the existing Keonepoko Nui 1 well (See Exhibit "B", Proposed site Development Plan).

A well construction permit has been issued by the "Commission on Water Resource Management" (CWRM), DLNR. As part of that permit, the Commission authorized the Chairperson to approve and issue a pump installation permit upon completion of the exploratory well.

The site will require a minimum of clearing and grubbing. A source facility will be designed and developed such that potable water from this second production well will be pumped into the existing 0.5 mg Keonepoko reservoir by a submersible pump whenever operation requires. A control building and ancillary equipment will be provided by DHHL during this production well phase. The production well, building and equipment will be turned over to DWS who will become the licensed operators and be responsible for operation and maintenance.

DHHL has constructed their Makuu Farm and Agricultural Lots Subdivision, Phase I. Per consultation with DWS, DHHL was informed and assured that water will be available for those lots below the 520 ft. elevation from their existing Keonepoko 623 ft. elevation reservoir upon completion of DHHL's production well.

However, all lots above the 520 ft. elevation must be served by a separate higher source service system. DHHL has prepared a "Master Plan Water System Study (MPWSS) for Makuu Farm and Agricultural Lots". In the plan the high service water system must be developed and constructed if the lots above 520 ft. elevation are to be provided with potable water. A future, separate Environmental Assessment will be required for this separate high service system which will include source, storage and transmission.

This environmental assessment covers the production well and supporting facilities for a second well at the existing Keonepoko Nui well and reservoir site. This well will provide potable water for the 99 lots in the low service area (lots below the 520 ft. elevation) of Makuu Farm and Agricultural Lots Subdivision. It will also serve for an additional 30 future DHHL farm lots being planned on the adjacent lot leased by FAA. Based upon the MPWSS, the projected average daily water demand is 2,400 gallons per day (gpd) per farm lot. So for the 99 lots in the low service area, the projected average daily demand is 237,600 gpd. For the 30 future lots, the projected average daily demand is 72,000 gpd. The combined projected average daily demand of 309,600 will translate to a maximum daily demand of 464,400 gpd. Allocation of the excess potable water yield will be under the jurisdiction of DWS.

DWS plans to install a 12-inch waterline to connect the Keaau and Pahoa water systems. A portion of this waterline from the Keonepoko Nui Well and reservoir site to the Makuu Farm and Agricultural Lots will be funded by DHHL. This is a separate project. The Final Environmental Assessment for that project is on file at OEQC, entitled Environmental Assessment, Keaau-Pahoa 12-inch Waterline Extension."

C. FUNDING AND PHASING

This production well and supporting facilities project area planned to be completed in one phase with an estimated construction cost of $1,000,000.00. DHHL has funding allocated for this project and will commence construction as soon as approvals are obtained.

III. THE AFFECTED ENVIRONMENT

A. PHYSICAL CHARACTERISTICS

The ground underlying the site are classified as Lava Flows, Pahoehoe (rLW) according to the "Soil Survey of Island of Hawaii, State of Hawaii" produced in 1973 by the U.S. Department of Agriculture, Soil Conservation Service.

Lava flows, Pahoehoe (rLW), has been mapped as a miscellaneous land type. This lava has a billowy, glassy surface that is relatively smooth. In some areas, however, the surface is rough and broken, and there are hummocks and pressure domes.

B. GEOLOGY AND HYDROLOGY

A detailed review and analysis of the geology and hydrology of the affected area is included in Appendix A. The following discussion is summarized from Appendix A and various reports and records of the Hawaii State Commission on Water Resource Management (CWRM) and the Hawaii County Department of Water Supply (DWS).

The proposed project is located within the 222 square-mile Pahoa Aquifer System in an area of high rainfall. The aquifer system is composed chiefly of basaltic flank flows of the Puna volcanic series. These basaltic flows are geologically young (30 to 10,000 years at the surface), relatively unweathered, and highly permeable, and they typically yield water readily to wells. The permeable basalts readily absorb rainfall, and thus streams are essentially non-existent.

Within the Pahoa Aquifer System, median annual rainfall ranges from about 75 inches at Cape Kumukahi to 190 inches near Mountain View. This high rainfall produces about 994 million gallons per day (mgd) in groundwater recharge (Water Resources Protection Plan, Commission on Water Resource Management, June 1990). Groundwater flux in the area is of the order of 50 mgd per mile width along the Pahoa-Keaau Highway. Consequently, abundant groundwater resources are available in the basal aquifer, and well fields with pump capacities of 5 mgd or more probably can be developed. The sustainable yield of the Pahoa Aquifer System is estimated at 435 mgd. The only wells within a two-mile radius of the Keonepoko site are the two DWS Pahoa Wells 2A and 2B (CWRM Nos. 2986-01 and 2986-02) and two private domestic wells (Nos. 3185-02 and 3185-02).

The current water use and pumping capacity for these wells is as follows:

Well Name and No.	Pumping Capacity (gpm)	Current Use (mgd)
Pahoa 2a (2986-01) [1]	250	0.111
Pahoa 2b (2986-02) [1]	350	0.164
Hawn Shores (3185-01)[2]	250	0.090
Hawn Shores (3185-02)[3]	488	0.691
Keonepoko Nui (3188-01) [1]	700	0.173
Total	2038	1.229

Sources: Pumping capacity from Hawaii State Commission on Water Resources (CWRM) Well Registry and discussions with Hawaiian Beaches and Miller and Lieb personnel; Current use from average monthly CWRM pumpage reports and may vary month to month.

[1] Hawaii County Dept. of Water Supply
[2] Private system of Hawaiian Beaches
[3] Private system of Hawaiian Shores

Current pumping from this aquifer is far less than 2.0 mgd, or 0.5 percent of the sustainable yield.

When an exploratory well is drilled in proximity to other wells, pumping tests are conducted to determine whether extracting water from the new well will have any effect on levels or flows in the other wells. Pumping data at the Keonepoko Nui 2 exploratory well proposed for production indicates a stable drawdown of less than a foot at a pumping rate of 1,000 gpm. This, together with other hydrological data, indicates that no effects on other wells would occur. In fact, individual wells within a well field located in the Keonepoko-Pahoa area can probably be spaced as close as 100 feet apart without any adverse interference between wells. In terms of other wells or the Pahoa Aquifer System as a whole, hydrological impacts from pumpage in the Keonepoko 2 Well will be very negligible.

C. SITE DESCRIPTION

The site of the proposed improvements is an approximately 1 acre pad adjacent to the existing well/reservoir site. It has already been graded as part of the exploratory well project. The graded terrain was covered with cinders and is now flat. Vegetation on the pad consists mainly of weedy grasses, herbs and trees, especially sensitive plant (Mimosa pudica), sourbush (Pluchea odorata), rattlebox (Crotalaria pallida), molasses grass (Melinis minutiflora), guinea grass (Panicum maximum) gunpowder tree (Trema orientalis) and melochia (Melochia umbellata). The native `uhaloa (Waltheria indica), which thrives in disturbed conditions, is also present.

Surrounding the pad is an area of native scrub forest composed principally of `ohi`a (Metrosideros polymorpha) and uluhe fern (Dicranopteris linearis). A low forest (10-30 feet) of scattered `ohi`a trees (10% upper canopy cover) surrounded by uluhe is typical, interrupted by more disturbed vegetation emanating from the roadside verge. Additional prominent floristic elements include native and alien sword ferns (Nephrolepis spp.), the native species `uki`uki (Dianella sandwicensis), and the aliens melastoma (Melastoma candidum - which covers approximately 50% of the shrub canopy), guava (Psidium guajava), wai`awi (Psidium cattleianum), bamboo orchid (Arundina graminifolia), and broomsedge (Andropogon virginicus).

Disturbed areas such as the pad do not provide habitat for native animals. Alien bird species such as Japanese white-eye (Zosterops japonica) and cardinal (Cardinalis cardinalis) are common on the site and surrounding area. Mammals such as Indian mongoose (Herpestes auropunctatus), feral cats (Felis catus), rats (Rattus spp.), and mice (Mus musculus domesticus) are also likely to inhabit or use the area.

No listed, candidate or proposed endangered animal or plant species are found on the property. In terms of conservation value, no botanical or zoological resources requiring special protection are present.

Land use designations for the parcel are as follows: County General Plan - orchards; State Land Use - Ag; and Zoning Ag. 20-A. Electricity and telephone lines serves this parcel and will be extended as required to serve the proposed facilities.

The existing reservoir and control building are visible from the Keaau - Pahoa Highway which fronts the project site. The existing improved site has been landscaped for aesthetics. There will be no adverse long term visual or aesthetic impacts since the well, future control building, fencing and piping will be developed adjacent and mostly shielded from view from the highway by the existing facilities.

D. DRAINAGE CHARACTERISTICS

As shown on the Flood Insurance Rate Map, the project site is in Zone "X." Areas in Zone "X" have been determined to be outside of the 500-year flood plain.

At elevation 600 plus ft. and approximately 5 miles from the coastline, tsunami inundation is rather remote. At the site an existing drywell mainly disposes reservoir overflow when they occur.

Drywells have been constructed within the Makuu Farm Lots Subdivision to dispose of storm runoff. In accordance with State Department of Health regulations, all drywells are outside of the minimum one quarter mile setback from the existing and proposed water wells (See Exhibit "C", Plan Showing Existing Drywells and Individual Wastewater Systems in Relation to water Wells).

E. SOCIAL ENVIRONMENT

Data from the 1990 Census of Population showed a total of approximately 16,000 persons living in Lower Puna outside of Keaau. Lower Puna has shown growth rates of over 50 percent per decade in the last twenty years. By 1996, it is likely that the population of this section of Lower Puna will exceed 20,000.

Puna displays many of the characteristics of a disadvantaged region in its census statistics. The Pahoa-Kalapana Division (which includes most of the study area) in 1989 had a median household income of only $18,360, compared to $29,712 for the County as a whole. Thirty-two percent of individuals had income below the poverty level, a rate nearly 50 percent larger than Hawaii County. More than 25 percent of those age 25 years or over have less than a high school education, and 16 percent have a work disability, compared to 22.3 percent and 9.6 percent, respectively, for the County as a whole.

Many of Puna's problems are related to the rudimentary infrastructure of the sprawling subdivisions which contain most of its population. These were well-suited for speculation but inadequate to serve the needs of the low and middle income families who have come to occupy the district. Needs often cited by Puna residents are additional paved roads, electricity, telecommunications facilities, water systems, schools, and recreational facilities. Less than 25 percent of existing residences in the Lower Puna area are currently served by municipal domestic water systems.

The areas most directly involved is the DHHL Makuu subdivision, which contains 177 lots, with a potential population of at least 530 (based on 3 residents per lot). A condition of connecting this development to the existing DWS system was the development of additional well capacity at Keonepoko Nui, which led to the proposed project. Other nearby areas directly affected include the highway frontage that is part of large parcels belonging to the State of Hawaii. The remaining area served by the additional well is essentially the entire Pahoa Water System.

Impacts

The continuing growth in population in this (and many other) areas of Puna brings with it a demand for upgraded water services. It is expensive and difficult for residents to maintain the quality and quantity of catchment water that is optimum for domestic use, especially consumptive use. Most residents, when given the option, will choose to connect to a public water system. The proposed project would allow DHHL beneficiaries to do so. In a larger context, the proposed project represents another step in the gradual upgrading of infrastructure in the Puna District. There will be no other impacts, beneficial or adverse, upon other small or large landowners in the immediate or extended area, apart from those benefits accruing to all system users as a result of increased system reliability and capacity. Water projects may involve the potential for substantial secondary impacts associated with induced population growth. Currently, water service is available only to those lots with highway frontage. However, the growth pattern in the Puna subdivisions that have some highway frontage - fairly evenly spread throughout - suggests that water is not an overwhelming factor in the decision of the potential home builder about where to build. Lower lot prices, seclusion, preferred vegetation, and proximity to the ocean also appear to play large roles. Many lots with highway frontage and/or access to water remain undeveloped. The project will ensure that as orderly growth of the water main infrastructure (which, rather than capacity - is the restricting factor in the water service area) eventually and gradually supplies water to the subdivisions, capacity will not be a problem. The scale of the project set in the context of the existing rate of growth indicates that secondary impacts would be unlikely or negligible.

F. ARCHAEOLOGY AND HISTORIC SITES

The project area has already been graded in connection with earlier water supply projects and no historic sites are known from the area. The extensive disturbance of makes it unlikely that any further surface sites will be found. If any artifacts, charcoal deposits, or human remains are discovered during construction, work will immediately cease and the State Historic Preservation Division (SHPD) will be consulted to determine the appropriate mitigation.

G. HAZARDOUS MATERIALS

No known hazardous waste sites are present near the well, no active or former generators of hazardous waste are or were present, and no releases of hazardous materials have been reported at the well site.

Appendix C is a Water Quality Analysis Report that details the sampled levels of various potential contaminants. As expected in an area with little history of agricultural or industrial use, the sampled levels of all contaminants for which state standards exist are well below such standards. The water is of excellent quality.

Water treatment involves the application of chlorine. At the Keonepoko Nui well site, cylinders of chlorine are delivered by truck to the site on an as-needed basis, which is at least several times per year. Chlorine is injected into the water system as the water is drawn up from the well. All treatment is conducted according to strictly regulated standards. DWS personnel dealing with chlorine are trained to be Hazard One responders and are equipped with all necessary safety material, including self-contained breathing apparatus. In case of a spill or release incident, the responders call in the Hazardous Material response team of the Hawaii County Fire Department Pahoa Station. The DWS is in compliance with all applicable laws and regulations related to chlorine, and has an excellent record of safety and preparedness.

H. CONSISTENCY WITH GOVERNMENT PLANS AND POLICIES

Hawaii State Plan

The Hawaii State Plan was adopted in 1978. It was revised in 1986 and again in 1991 (Hawaii Revised Statutes, Chapter 226, as amended). The Plan establishes a set of goals, objectives and policies that are meant to guide the State's long-term growth and development activities. The proposed project is consistent with State goals and objectives that call for increases in employment, income and job choices, and a growing, diversified economic base extending to the neighbor islands.

The sections of the Hawaii State Plan most relevant to the proposed project are centered on the theme of facility systems. The following objectives and policies are taken from the section dealing with water development.

- Objective a): Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational and other needs within resource capacities.

- Objective b: To achieve the facility systems water objective, it shall be the policy of this State to:

  (1) Coordinate development of land use activities with existing and potential water supply.
  (2) Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.
  (3) Reclaim and encourage the productive use of runoff water and wastewater discharges.
  (4) Assist in improving the quality, efficiency, service and storage capabilities of water systems for domestic and agricultural use.
  (5) Support water supply services to areas experiencing critical water problems.
  (6) Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.

The proposed project supports all relevant objectives and policies of the Hawaii State Plan, and in particular responds to objectives expressed in (4) and (5).

Water Master Plan, Island of Hawaii

This County DWS plan dates from 1980. Its purpose was to provide a long-range plan for public water systems on the Island of Hawaii. Included among its proposed improvements to the subject area were:

- Various pipeline improvements with the existing system;
- Additional wells at Keonepoko Nui
- Reservoir at Keonepoko Iki
- Keaau-Pahoa Trunk Line extensions

The proposed project is specifically listed in the Plan.

Hawaii County Water Use and Development Plan

This plan fulfills the portion of the mandate of the State Water Code (Chapter 174C, HRS) to provide an integrated program for the protection, conservation, and management of the waters of the State. The current draft dates from 1992 and has not yet been officially adopted. The plan calls for additional pumping capacity at Keonepoko Nui. Thus, the proposed project is completely consistent with and fulfills the Hawaii County Water Use and Development Plan.

Hawaii County General Plan

The General Plan for the County of Hawaii is a policy document expressing the broad goals and policies for the long-range development of the Island of Hawaii. The plan was adopted by ordinance in 1989. The General Plan is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawaii. Among the goals, policies and standards for water and development in the Puna District are:

J. Public Utilities: Goals:

- Ensure that adequate, efficient and dependable public utility services will be available to users.
- Maximize efficiency and economy in the provision of public utility services.
- To have public utility facilities which are designed to fit into their surroundings or be concealed from public view.

J. Public Utilities: Water Policies:

- o Water system improvements and extensions shall promote the County's desired land use development pattern.
- o All water systems shall be designed and built to Department of Water Supply standards.
- o Water system improvements should be first installed in areas which have established needs and characteristics, such as occupied dwellings and other uses, or in areas adjacent to them if there is need for urban expansion, or to further the expansion, of the agricultural industry.
- o The fire prevention systems shall be coordinated with water distribution system in order to ensure water supplies for fire protection purposes.

Courses of Action: Puna: Public Utilities: Water

- o Improve inadequate water system facilities.

Courses of Action: Puna: Land Use: Single-Family Residential

- o Improve and develop roadways, water and sewerage systems, and other basic facilities necessary to encourage development of lands suitable for residential use.

Discussion: The proposed project satisfies the goals and objectives related to efficient and economic expansion of water service to meet public needs in areas zoned for and with existing land use in agriculture and residential uses. All standards related to water quality, appropriate design, facilities and fire protection would be met.

Puna Water Master Plan

Currently in the early stages of development, this plan will guide integration of source development and storage and distribution systems in Puna. The plan is being funded by a federal Community Development Block Grant to the DWS. The majority of Puna residents (and buildable lots) are in substandard subdivisions, which present special problems to both DWS and residents in extending the domestic water supply system. The plan, which is being developed in close coordination with community groups, targets the optimal, orderly development of water to benefit Puna. The expansion of system capacity and provision of redundancy represented by the project are likely to be highly consistent with the plan's broad and specific goals.

IV. SUMMARY OF MAJOR IMPACTS AND MITIGATION MEASURES

The proposed project will not create adverse long term environmental impacts on the site or surrounding area.

On a short term basis, there will be dust and noise increases due to construction activities. These factors should not be a problem since project specifications will require proper methods be used to achieve noise reduction and dust prevention. Such methods could include mufflers attached to construction equipment and watering.

V. ALTERNATIVES CONSIDERED

A. DO NOTHING ALTERNATIVE

Per consultation with DWS, this is not a viable alternative. An additional potable water source is required to serve the DHHL Makuu Farm and Agricultural Lots. This proposed project will meet the needs of the lots below the 520 ft. elevation which includes 99 farm lots and 30 future farm lots. Without this additional source of water, these DHHL homesteads will be without DWS supplied water. The goal of DHHL is to provide their lessees with water service that's up to county standards, as funding permits.

B. ALTERNATIVE SITE

An alternative site has been identified and studied. This is described in the "Master Plan Water System Study for Makuu Farm and Agricultural Lots." That well site is planned to be at the roughly 800-foot elevation (See Exhibit A). It is over a mile above the subdivision and would require construction of an access road and installation of utilities. It has been determined that the development cost is much more excessive than available funds. Therefore, this alternative was not considered because the DWS's existing Keonepoko Nui well and reservoir site is immediately available, has the approval of DWS and construction will cost much less at the Keonepoko Nui well and reservoir site than at the alternative site.

C. ALTERNATIVES TO ADDITIONAL WELLS

Aside from drilling more wells, there are often various other feasible methods for satisfying the demand for additional capacity in a domestic water system. This may include wastewater retreatment and re-use; use of non-potable water for agriculture and other non-drinking water purposes; rainfall catchment; and water conservation. The Hawaii County Department of Water Supply has considered all such alternatives and rejected them from further consideration as inappropriate for the water system in Puna:

- There are no municipal wastewater treatment systems in the Puna District, and there is no wastewater is available for re-use.

- o There are no sources of non-potable water - whether streams or groundwater - in or near the water service area.
- o Rainfall catchment is widely used in Puna and does provide a system of last resort for drinking water. There are many drawbacks to catchment, including high maintenance costs. If not maintained properly, such systems are susceptible to microbiological and chemical contamination. Sources of these contaminants vary from dead animals in the storage tank, to roof and gutter materials, to air particulates causing acid rain. The State Department of Health (HDOH) recommends using catchment water for non-consumptive needs and obtaining drinking or cooking water from regulated public water systems and/or purchased bottled drinking water. In the interest of public health, a long-term goal in Hawaii County is to provide central, municipal water systems for subdivisions current served by catchment.
- o There is no evidence that excessive water consumption occurs in the project area. Although extreme conservation requirements might lower consumption, the potential inconvenience and adverse economic effects that would be brought about by such measures are not justified by the minor and sustainable use of the abundant groundwater resource in Puna.

D. CONCLUSION

In summary, the proposed project is the only alternative meeting the project's purpose and need of supplying additional potable water for the DHHL Makuu development and other potential future users and providing a backup well for system redundancy.

VI. DETERMINATION, FINDINGS AND REASONS SUPPORTING DETERMINATION

The Hawaii State Department of Hawaiian Home Lands (DHHL) has determined that impacts from the proposed project will be minimal and that the project will not significantly alter the environment. Therefore, DHHL has issued a Finding of No Significant Impact (FONSI), which means that an Environmental Impact Statement is not warranted and will not be prepared (see cover letter).

Chapter 11-200-12, Hawaii Administrative Rules, outlines those factors agencies must consider when determining whether a project has significant effects:

1. *The proposed project will not involve an irrevocable commitment or loss or destruction of any natural or cultural* resources. The area to be affected by the proposed project consists of land currently dedicated to Hawaii County Department of Water Supply uses, including an existing production well, a 0.5 mg reservoir, and supporting facilities. No valuable natural or cultural resources are present or will be affected.

2. *The proposed project will not curtail the range of beneficial uses of the environment.* The proposed project would make joint use of an area already dedicated to utility uses and thus promotes efficient use of limited space. This helps prevent restriction of beneficial uses in adjacent areas.

3. *The proposed project will not conflict with the State's long-term environmental* policies. The State's long term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. A number of specific guidelines support these goals. No aspect of the proposed project conflicts with these guidelines. The project is environmentally benign and is consistent with all elements of the State's long-term environmental policies.

4. *The proposed project will not substantially affect the economic or social welfare of the community or State.* The only marked effect of the project will be to improve the water supply for residents of a portion of Puna.

5. *The proposed project does not substantially affect public health in any detrimental way.* The project improves public health by providing a reliable source of sanitary domestic water in areas that otherwise must rely on rainwater catchment systems. No other effects would occur.

6. *The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities.* The growth pattern in the Puna subdivisions that may eventually benefit from additional capacity - fairly evenly spread throughout - suggests that highway frontage (where water service is currently available) is not an overwhelming factor in the decision of the potential home builder about where to build. Lower lot prices, seclusion, preferred vegetation, and proximity to the ocean also appear to play large roles. The scale of the project set in the context of the existing rate of growth means that secondary impacts would be unlikely or negligible

7. *The proposed project will not involve a substantial degradation of environmental quality.* The project would not contribute to environmental degradation.

8. *The proposed project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat.* No rare, threatened or endangered species of flora or fauna are known to exist on the project site.

9. *The proposed project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions.* The project is not related to other activities in the region in such a way as to produce adverse cumulative effects or involve a commitment for larger actions. The project will be conducted at the same time improvements to the State Highway 130 and the installation of the Keaau-Pahoa Water Line Extension. Although all projects will improve the infrastructure of the area, they will not contribute to unplanned growth because surrounding areas have an oversupply of lots zoned for building. The project does not open up new areas for growth.

10. *The proposed project will not detrimentally affect air or water quality or ambient noise levels.* The proposed project will produce only minor and temporary impacts to noise and air quality not exceeding State Department of Health Air and Noise standards during construction. No impacts to water quality are expected.

11. *The project does not affect an environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal area.* The project is not located near coastal or inland waters. Although the proposed project is located in an zone exposed to some earthquake and volcanic hazard, there are no reasonable alternatives.

For the reasons above, the proposed project will not have any significant effect in the context of Chapter 343, Hawaii Revised Statues and Section 11-200-12 of the State Administrative Rules.

VII. LIST OF AGENCIES CONSULTED IN THE PREPARATION OF THIS ENVIRONMENTAL ASSESSMENT

Commission on Water Resource Management

Department of Land and Natural Resources

State of Hawaii

Department of Water Supply

County of Hawaii

Planning Department

County of Hawaii

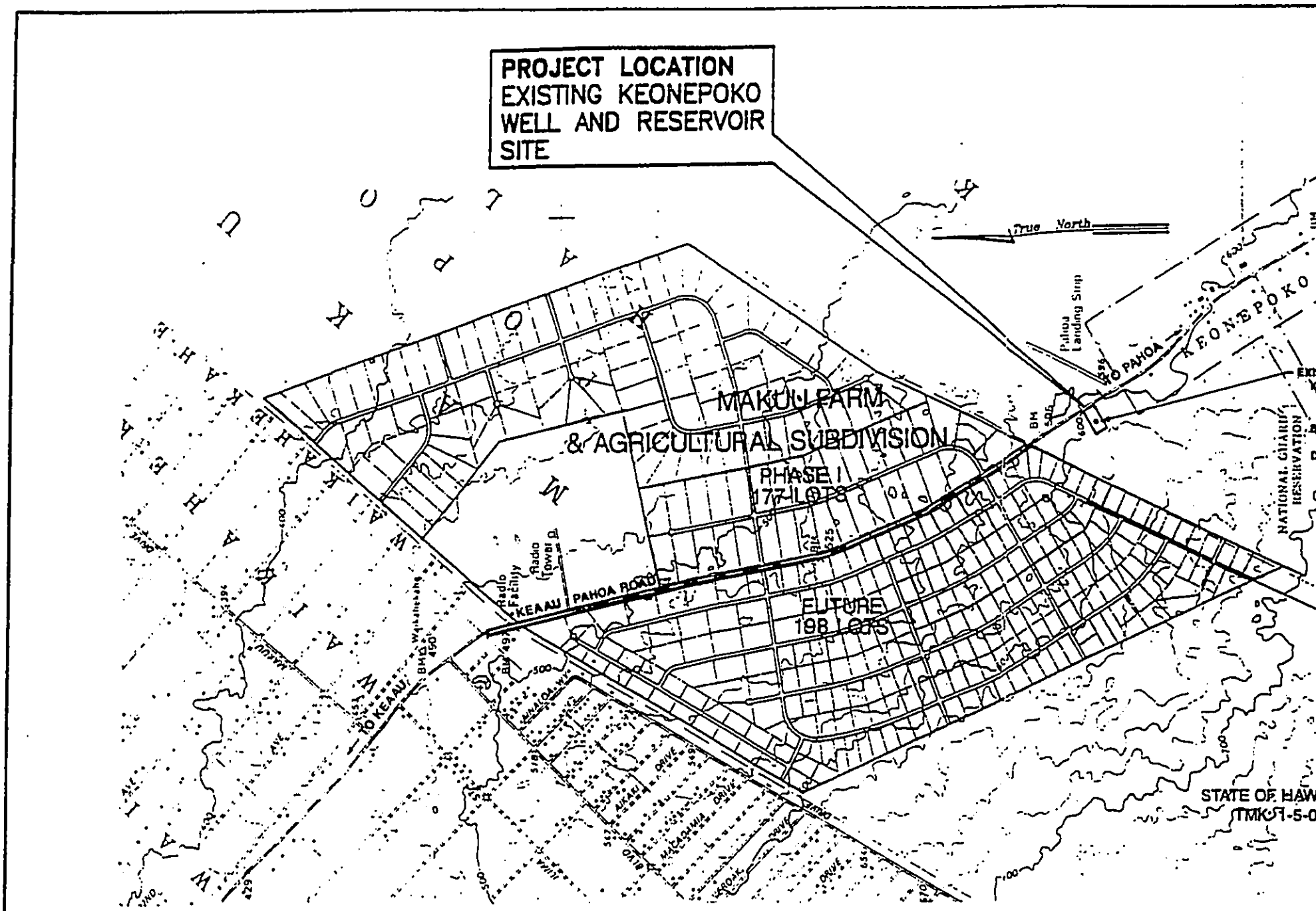
Land Division

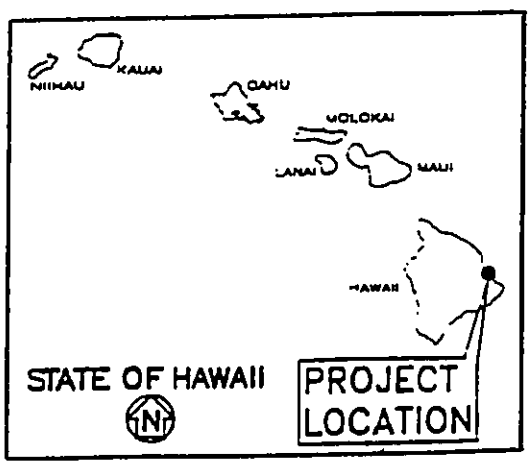
Dept. Of Land and Natural Resources

State of Hawaii

Office of Environmental Quality Control

State of Hawaii





REFERENCE: "MASTER PLAN WATER SYSTEM STUDY FOR MAKUU FARM AND AGRICULTURAL LOTS", PREPARED BY ENGINEERS SURVEYORS HAWAII, INC., JULY 1994.

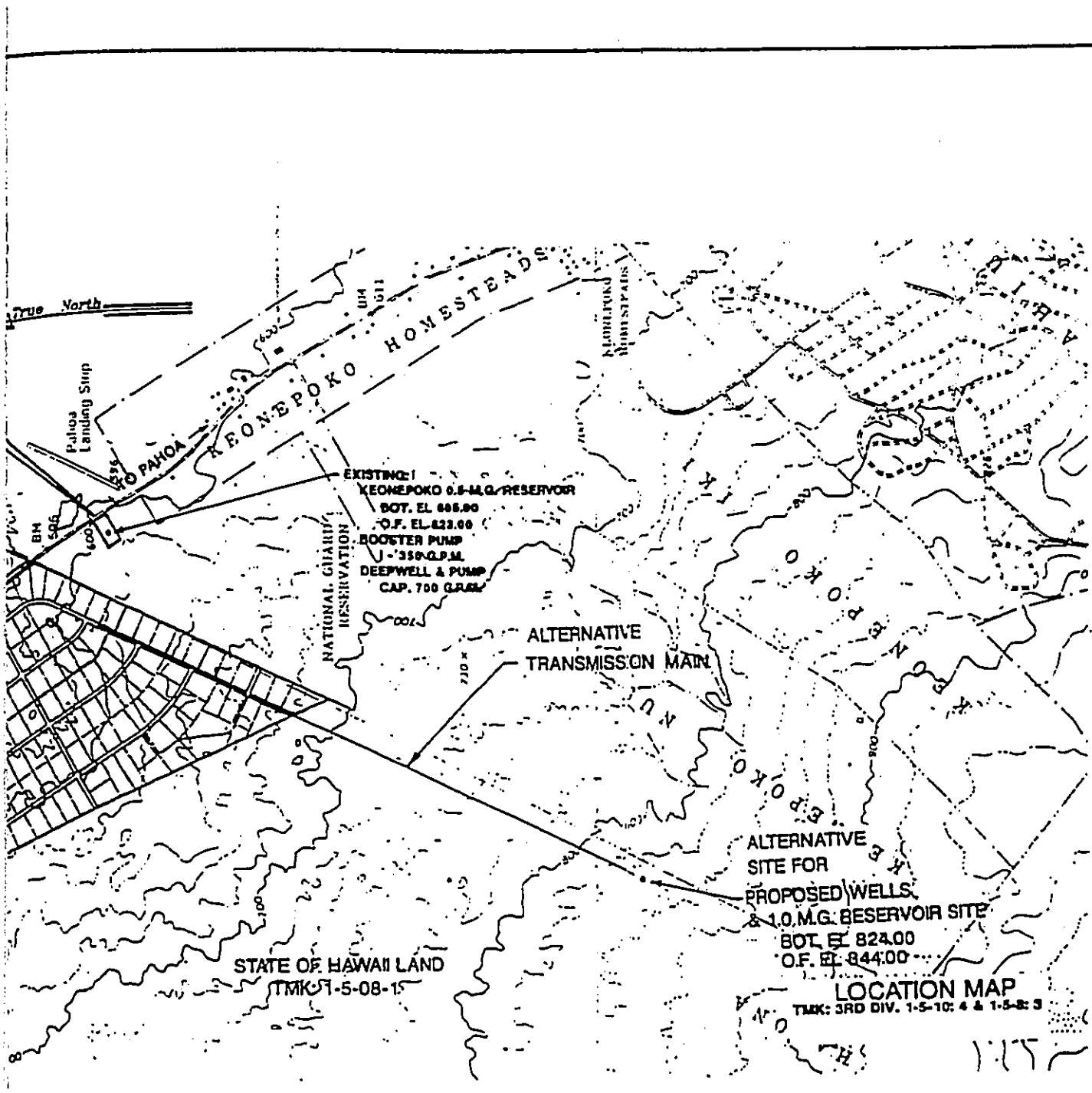
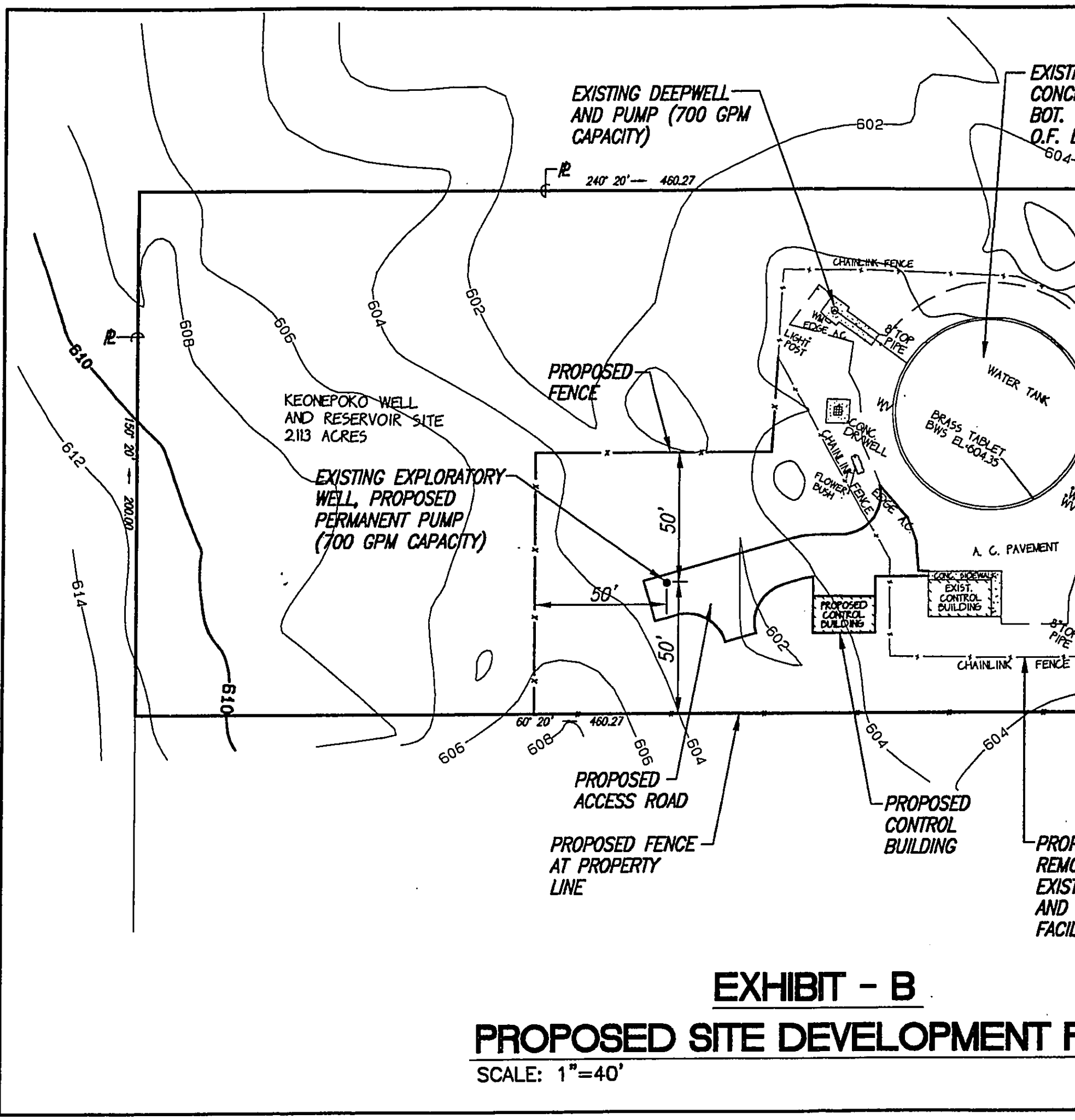


EXHIBIT – A
LOCATION MAP
SCALE: 1 IN. = 2000 FT.

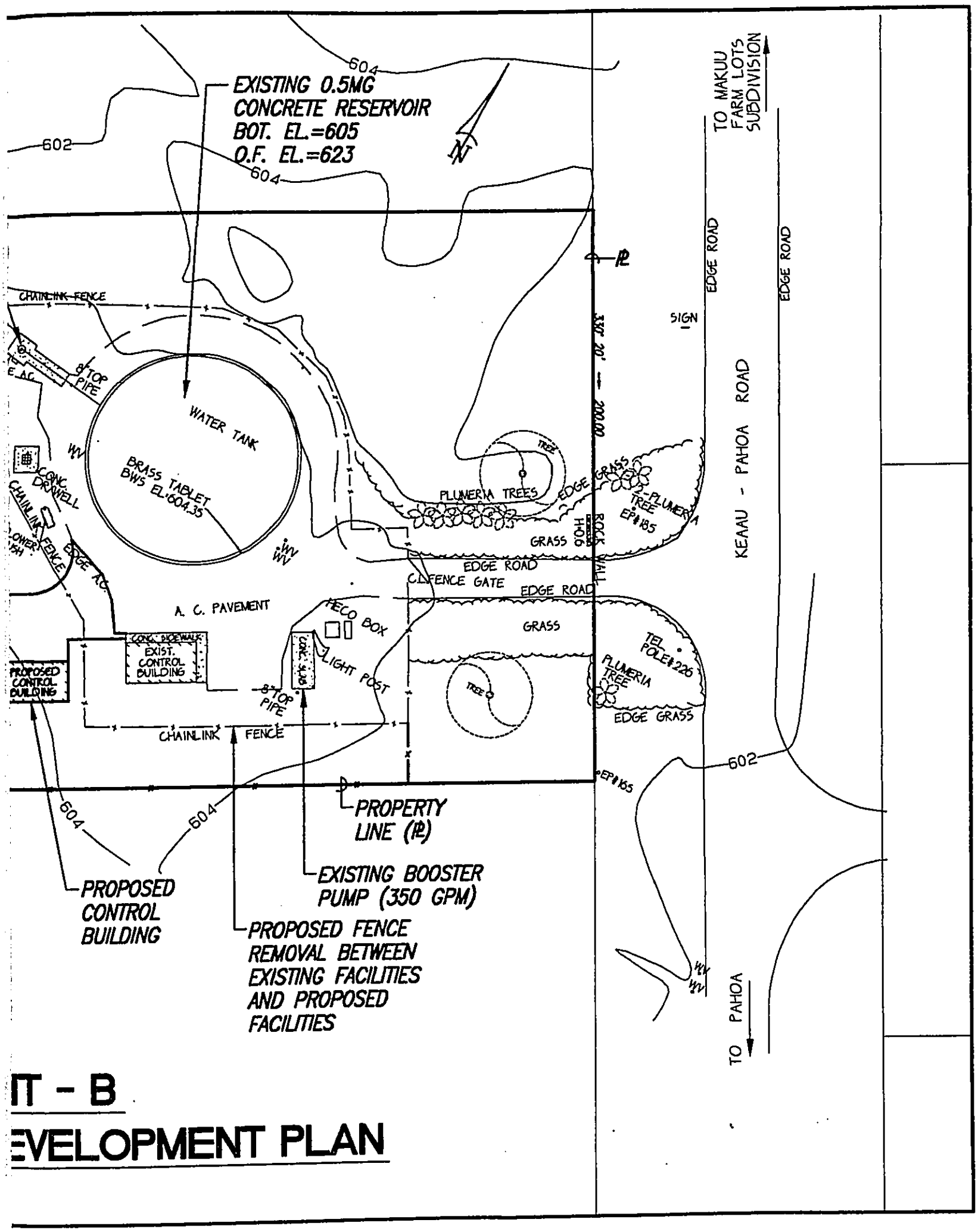


85-180.9 f:EXH-B d:MAKUU(1) 1=40 08/22/97 jky

EXHIBIT - B

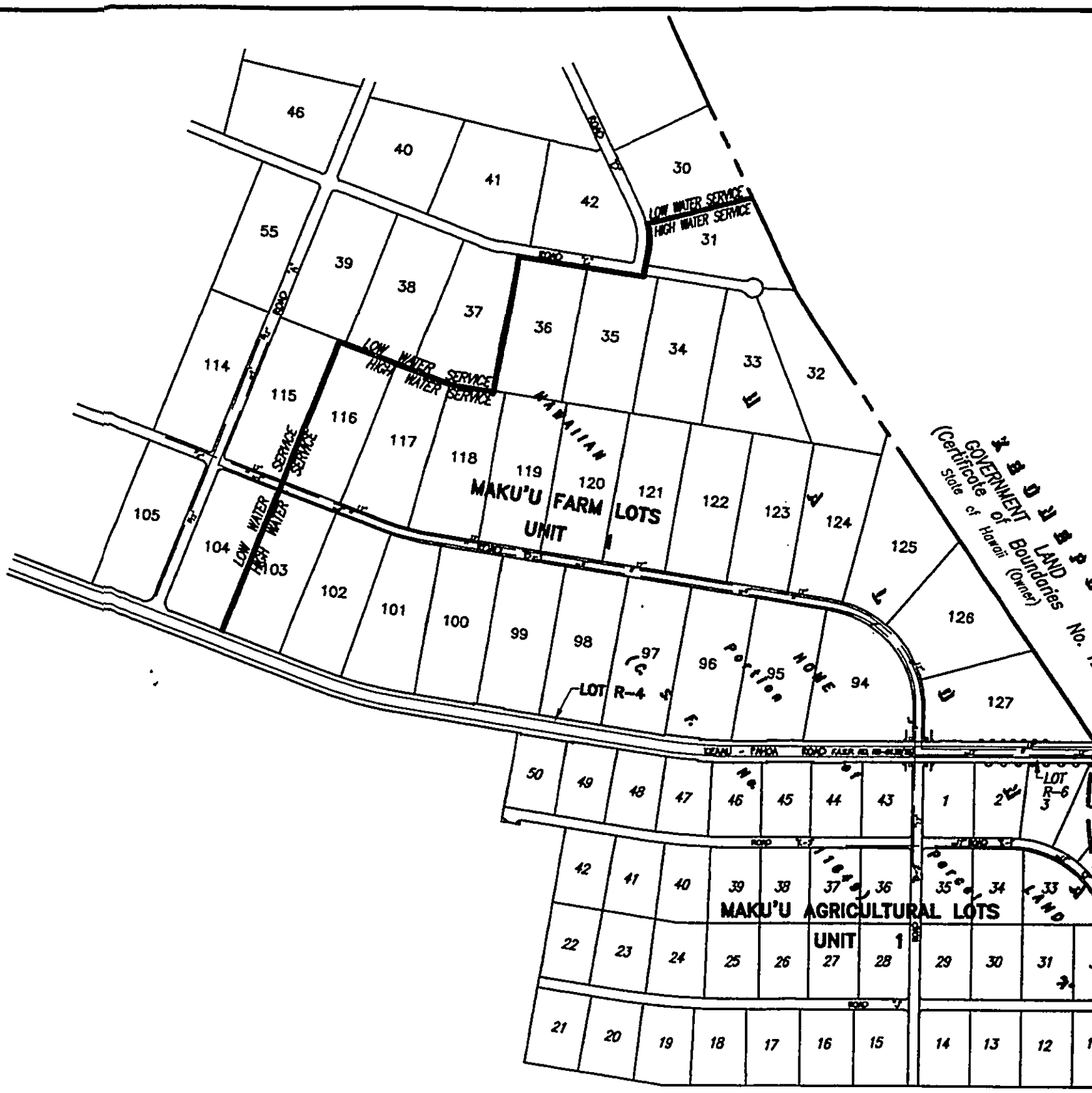
PROPOSED SITE DEVELOPMENT P

SCALE: 1"=40'



IT - B

EVELOPMENT PLAN

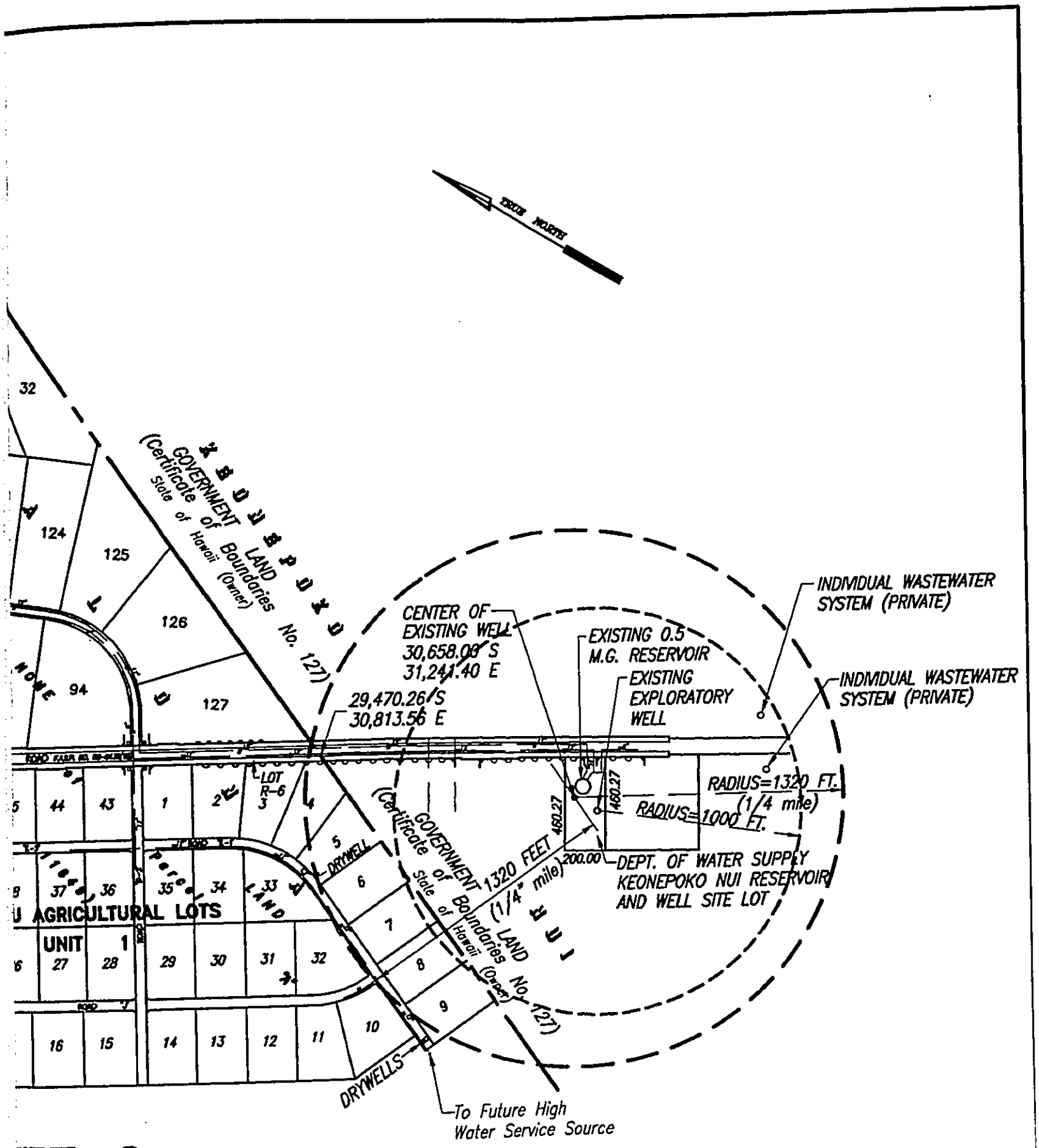


85-180.9 f:EXH-D d:MAKUU(2) 1=400 02/05/98 jky

EXHIBIT - C

PLAN SHOWING EXISTING DRYWELLS AND INDIVIDUAL W
IN RELATION TO WATER WELLS

SCALE: 1"=600'



IIBIT - C

AND INDIVIDUAL WASTEWATER SYSTEMS

TO WATER WELLS

"=600'

600 300 0 600 1200

Graphic Scale in Feet

APPENDIX A

" HYDROLOGIC FEASIBILITY OF ADDITIONAL
WELL SOURCE AT KEONEPOKO RESERVOIR SITE (DWS),
HHL MAKUU FARM LOTS, PAHOA, PUNA, HAWAII, "
BY WATER RESOURCE ASSOCIATES.

Hydrologic Feasibility of Additional Well Source at Keonepoko Reservoir Site (DWS), HHL Makuu Farm Lots, Pahoa, Puna, Hawaii

INTRODUCTION

Hawaiian Home Lands needs to develop a source of water supply for its Makuu Farmlot Subdivision located north of Pahoa town. One alternative being considered is to drill a well at the Keonepoko Reservoir Site, which belongs to the Hawaii County Department of Water Supply (see Figure 1). The site is located alongside Highway 130 at an approximate elevation of 605 feet, just south of the farm lots.

An existing deep well, Keonepoko Nui 1, is located within the reservoir site and it has an installed pump capacity of 700 gpm. This report discusses the hydrologic feasibility of developing an additional well source within this reservoir site to serve the water needs of the Makuu Farmlots Subdivision.

PAHOA AQUIFER SYSTEM

Boundaries. The proposed project is located within the Pahoa Aquifer System in an area of high rainfall. The aquifer system, which is a part of the 564 square-mile Kilauea Hydrologic Sector, embraces a wedge-shaped area of 222 square miles extending from Kilauea Crater eastward to the ocean between the Kilauea East Rift Zone and the Volcano-Keaau Highway (see Figure 2).

Geology. The Pahoa Aquifer System is comprised chiefly of basaltic flank flows of the Puna volcanic series. These basaltic flows are geologically young (30 to 10,000 years at the surface), relatively unweathered, highly permeable, and typically yield water readily to wells. The lavas are dike-free, except in the Kilauea East Rift zone.

Due to their young age and lack of weathering, the permeable basalts readily absorb rainfall and streams and streamflows are essentially nonexistent.

Groundwater Recharge. Within the Pahoa Aquifer System, median rainfall ranges from about 75 inches a year near Cape Kumukahi to about 190 inches near the town of Mountain View. The estimated volume of rainfall amounts to 1,530 million gallons per day (mgd) and the estimated groundwater recharge amounts to 994 mgd, or approximately 65% of rainfall (Water Resources Protection Plan, Commission on Water Resource Management, June 1990).

Sustainable Yield. The sustainable yield of the Pahoa Aquifer System has been estimated in the 1990 Water Resources Protection Plan to be 435 mgd, or 44% of groundwater recharge. Sustainable yield, a term used in Hawaii to define the amount of ground water that can be withdrawn from an aquifer system, is based upon selecting a head level which is a fraction of the original, or pre-development, head.

AVAILABILITY OF GROUND WATER

Existing Wells and Water Use. The only wells within a two-mile radius of the Keonepoko site are the two Department of Water Supply Pahoa Wells 2A and 2B (2986-01, 02) located to the south and two private domestic wells (3185-01, 02) located to the east. These wells, plus the Keonepoko Nui Well, have a combined total pump capacity of approximately 2.4 mgd and an average water withdrawal of only 1.8 mgd (1990-91 data).

The Pahoa area has an abundant supply of basal ground water of high quality. For the future, the Department of Water Supply has contemplated the drilling of additional wells alternatively at the Keonepoko reservoir and well site, the Pahoa well field, or at another site in order to meet anticipated increases in water use and improve system reliability (Hawaii County Water Use and Development Plan).

Groundwater Flow. The Keonepoko reservoir site is centrally located within the Pahoa Aquifer System. This aquifer is the island's largest, in terms of groundwater recharge (994 mgd) and sustainable yield (435 mgd).

Presumably, ground water flows in a general eastward direction, from areas of highest rainfall toward eventual discharge along the northeast coast of Puna. Using the median annual rainfall map (CWRM, 1990) the magnitude of groundwater

flowing eastward through the Keonepoko-Pahoa area is of the order of 50 mgd per mile width. This large amount together with the occurrence of a 600-foot thick basal lens having a head of 15 to 17 feet, the development of individual well fields with a pump capacity of at least 5 mgd should be easily attainable without any adverse effect on the aquifer's sustainable yield and water quality.

Aquifer Characteristics/Well Spacing. The basal aquifer underlying the Keonepoko-Pahoa area consists of extensive basaltic lava flows having hydrologic characteristics which rival those of the water-rich Pearl Harbor aquifer on Oahu. Fortunately, the Hawaii County Department of Water Supply conducted a reliable three-day pumping test (1977) on the Keonepoko Nui Well and the data confirms the highly permeable nature of the Puna basalts in the Keonepoko-Pahoa area. With an aquifer penetration of only 65 feet (depth of well = -50 feet, msl), the well has specific well capacity of 1600 gpm per foot drawdown, exceeding the performance of wells in the Pearl Harbor aquifer.

The drawdown and recovery of the Keonepoko Nui Well were essentially instantaneous and during the three days of pumping at 1,000 gpm, the well exhibited a stable drawdown of only 0.6 feet (see Figure 3). The chloride content of the well was also stable at 4.0 mg/l. The temperature of pumped water measured 67.5°F during the night. Elevated temperatures of up to 71°F were measured during the daytime and may have been caused by the use of recirculated pumped water to cool the diesel engine.

The Pahoa 2A Well, located approximately two miles south, has a specific well capacity of 628 gpm per foot of drawdown (about 40% that of the Keonepoko Nui Well). However, the well may not have been fully developed, based on a test pumping rate of only 314 gpm and a drawdown of 0.5 feet.

CONCLUSION

The Keonepoko-Pahoa area is underlain by a thick, highly permeable basalt aquifer of high quality (6 mg/l chlorides). Based on a head of 15 to 17 feet, the basal lens in the area extends 600 feet or more below sea level. Ground water in the aquifer presumably flows in a general eastward direction from areas of highest rainfall toward ultimate discharge along the northeastern coast of Puna.

Groundwater flux in the area is of the order of 50 mgd per mile width along the Pahoa-Keaau Highway. Consequently, abundant groundwater resources are available in the basal aquifer and well fields with pump capacities of 5 mgd or more probably can be developed.

Pumping test data confirms the geologically expected high permeability of the Puna basaltic aquifer beneath the Keonepoko-Pahoa area. The stable drawdown in the Keonepoko Nui Well of less than a foot at a pumping rate of 1,000 gpm (1.4 mgd) suggests, together with experience, that individual wells within a well field located in the Keonepoko-Pahoa area can be spaced as close as 100 feet apart without any adverse interference between wells.

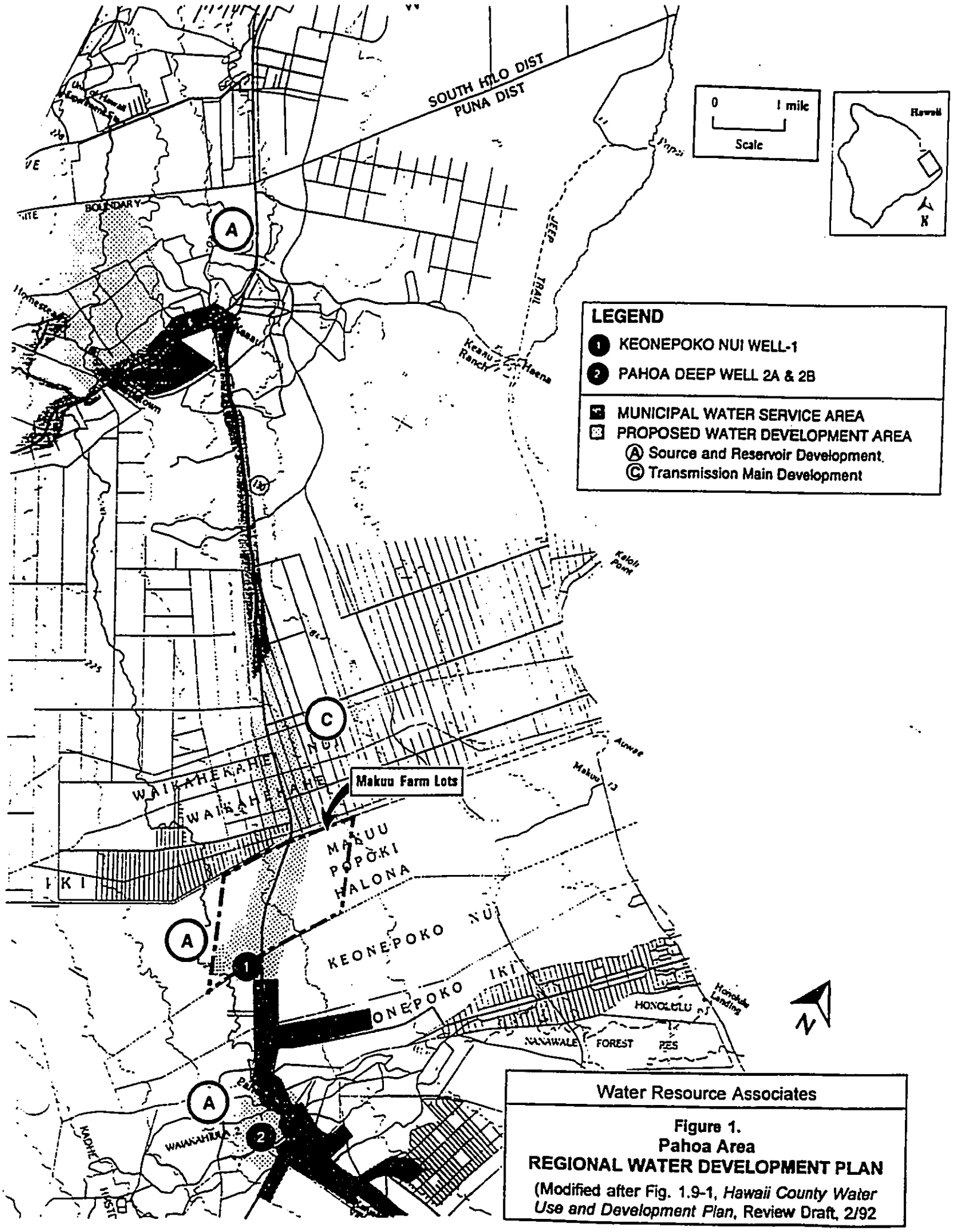
FINDINGS/RECOMMENDATION

All indications are that an exploratory well to provide additional water supply for the Makuu Farmlot Subdivision can be successfully located within the Keonepoko Reservoir and Well site.

The exploratory well may be located as close as 100 feet from the existing well, if desired.

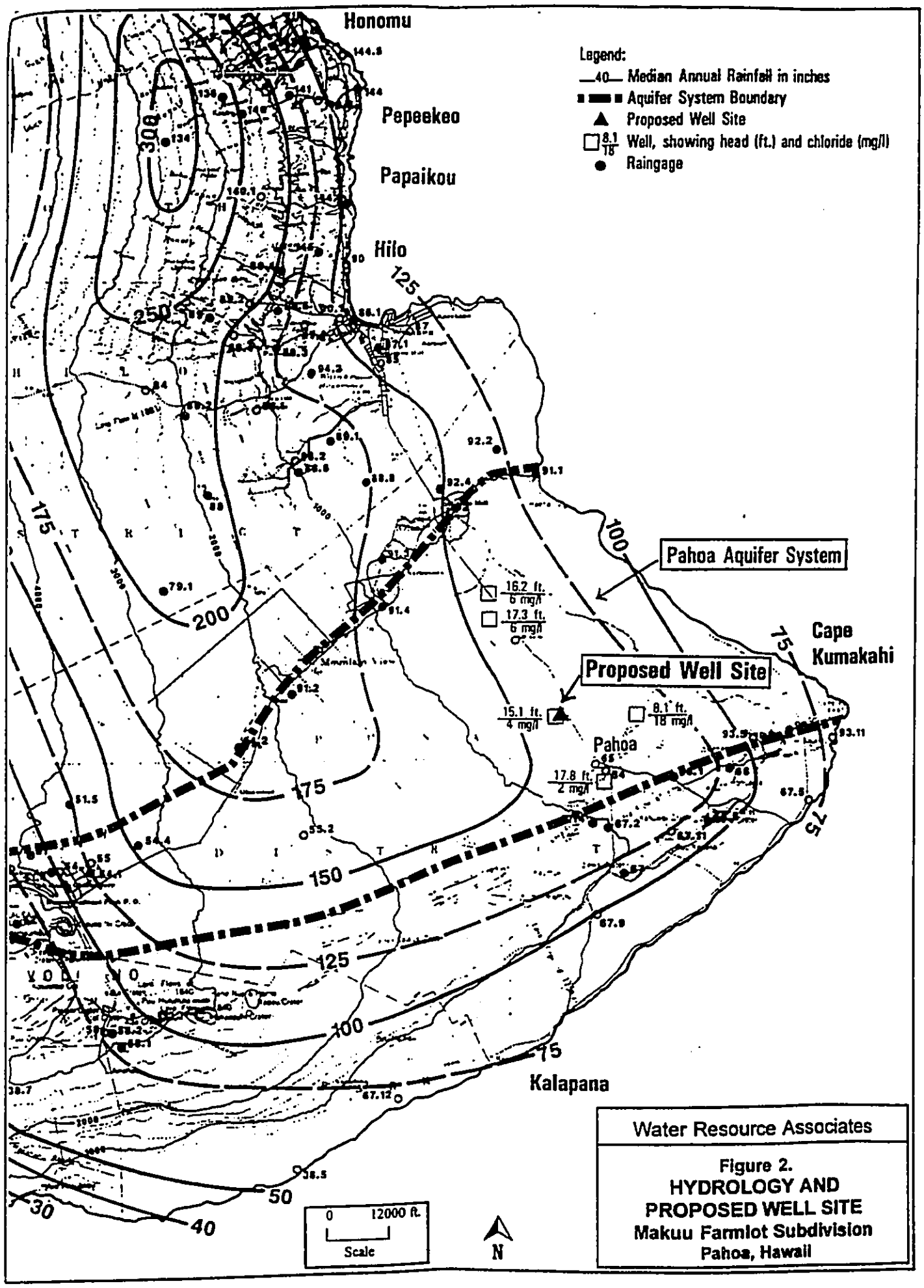
It is recommended that the exploratory well be designed to accommodate a pump capacity of at least 700 gpm.

The exploratory well be pump tested simultaneously with the existing well and the results evaluated to determine the capacity of the well field and permanent pump for the exploratory well.



Water Resource Associates

Figure 1.
Pahoa Area
REGIONAL WATER DEVELOPMENT PLAN
(Modified after Fig. 1.9-1, *Hawaii County Water Use and Development Plan*, Review Draft, 2/92



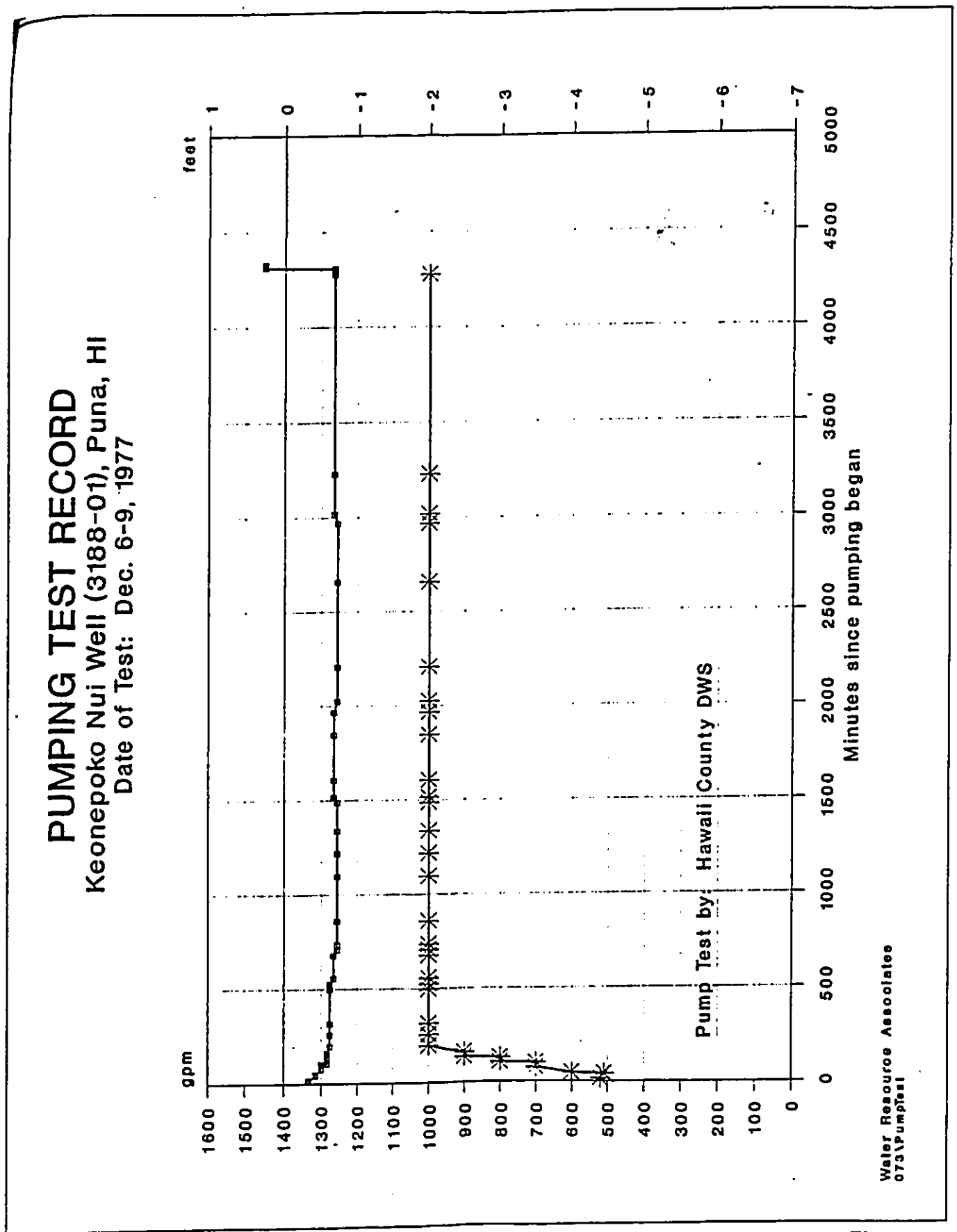

PUMPING TEST RECORD
Keonepoko Nui Well (3188-01), Puna, HI
Date of Test: Dec. 6-9, 1977
feet
1
0
-1
-2
-3
-4
-5
-6
-7
gpm
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
Minutes since pumping began
Pump Test by: Hawaii County DWS
Water Resource Associates
073\Pumptest

Figure 3

Figure 4. WELL RECORDS

Pahoa-Puna, Hawaii

Well No.	Well Name	Year Drilled	Elev. (ft.)	Depth (ft.)	Test Rate (gpm)	Draw-down (ft)	Chloride (mg/l)	Head (ft.)
2986-01	Pahoa 2A	1960	705	-50	314	0.5	4	17.8
2986-02	Pahoa 2B	1965	711				6	
3185-01	Hawn Shores	1964	402	-44	425	1.7	18	10.6
3185-02	Hawn Shores	1971	380	-50	350	3.5	23	
3188-01	Keonepoko Nui	1977	603	-47	1000	0.6	4	15.1

Source of Data: Commission on Water Resource Management.

APPENDIX B

WELL COMPLETION REPORT

WATER RESOURCE ASSOCIATES

Hydrology • Geology • Engineering

July 29, 1997

Ms. Rae Loui
Deputy Director
Commission on Water Resource Management
Department of Land & Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Loui:

Well Completion Report
Keonepoko Nui 2 Well (3188-02), Hawaii

Enclosed is the Well Completion Report for Keonepoko Nui 2 Well.

We have satisfied all conditions of the Permit and we request, on behalf of the applicant, your approval of a permit to install a permanent pump with a capacity of 700 gpm.

Please call me if there are any questions.

Sincerely,

DAN LUM

Enc.
c: Mr. Eric Hee, ESH
Mr. Kali Watson, DHHL

1188 Bishop Street, Suite ~~607~~ 1708 • Honolulu, Hawaii 96813-3302 • (808) 528-0074 • Fax 528-0808

State of Hawaii
COMMISSION ON WATER RESOURCE MANAGEMENT
Department of Land and Natural Resources

WELL COMPLETION REPORT

3/20/96 WCR Form

(Check Appropriate Box) ☒ Well Construction ☐ (Permanent) Pump Installation

Instructions: Please print or type and submit completed report within 30 days after well completion to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. An as-built drawing of the well and chemical analysis should also be submitted. For assistance call the Commission Regulation Branch at 587-0225, or 1-800-468-4644 Extension 70225.

1. State Well No.: 3188-02 Well Name: KEONEPOKO WELL Island: HAWAII
2. Location/Address: DEPT. OF HAWN. HOME LANDS, PUNA, HI Tax Map Key: 3rd Div.1-5-08:Por. 1

PART I. WELL CONSTRUCTION REPORT

3. Drilling Company: WATER RESOURCES INTERNATIONAL, INC.
4. Name of driller who performed work: KIHEI AHUNA
5. Type of rig/construction: ROTARY RIG, SPENCER-HARRIS
6. Date(s) Well Construction and pump tests (if any) completed: JUNE 4, 1997
7. GROUND ELEVATION (referenced to mean sea level, msl): 603.47 ft.
   Well Bench Mark (description/location): NORTH EDGE OF PAD Elevation(msl): 603.47 ft.
8. DRILLER'S LOG: *Please attach geologic log (if available or if required by permit)*

Depths (ft.)	Rock Description, Water Level, Dates, etc.	Depths (ft.)	Rock Description, Water Level, Dates, etc.
____ to ____	(SEE ATTACHMENT A)	____ to ____	
____ to ____		____ to ____	

(If more space is needed, continue on back.)

9. Total depth of well below ground: 650 ft.
10. Hole size: 23 inch dia. from 0 ft. to 650 ft. below ground
    ____ inch dia. from ____ ft. to ____ ft. below ground
    ____ inch dia. from ____ ft. to ____ ft. below ground
11. Casing installed: 16 in. I.D. x 3/8 in. wall solid section to 590 ft. below ground
    16 in. I.D. x 5/16 in. wall perforated section to 650 ft. below ground
    Casing Material/Slot Size: STEEL CASING - SOLID & PERFORATED WITH 1/4" OPENINGS
12. Annulus: Grouted from 550 ft. below ground to 0 ft. below ground
    Gravel packed from 650 ft. below ground to 550 ft. below ground
13. Initial water level: 586.70 ft. below ground. Date and time of measurement: 05/29/97 - 0800
14. Initial chloride: 10 ppm Date and time of sampling: 05/29/97 - 1000
15. Initial temperature: 68 °F Date and time of measurement: 05/29/97 - 1000
16. PUMPING TESTS: Reference Point (R.P.) used: TOP OF PAD, which elevation is 603.47 ft.
    (1) Step-Drawdown Test Date 05/28/97 (STEP TEST #2) (2) Long-term Aquifer Test Date 05/29/97
    Start water level 586.66 ft. below R.P. Start water level 586.70 ft. below R.P.
    End water level 586.71 ft. below R.P. End water level 586.70 ft. below R.P.
17. Aquifer Pump Test Procedures data & graphs *(1/9/96 LTAT Form)* attached? x Yes ___ No
18. As-built drawings attached attached? X Yes ___ No SEE ATTACHMENT B AND C
19. Other remarks/comments: *(On back of this form)*

Well Drilling Contractor (print): WATER RESOURCES INTERNATIONAL C-57 Lic. No.: AC-5058
Signature: Howard T. Akagi Date: July 8, 1997
Howard T. Akagi, Vice Pres-Pump Operations

Surveyor (print): JERRY S. NAKAGAWA Lic. No.: 1698
Signature: Jerry S. Nakagawa Date: July 10 1997

Applicant (print): KALI WATSON, CHAIRMAN DHHL
Signature: Kali Watson Date: July 23, 1997

cc: Blaise Clay - WRI Kamuela Office

PART II. (PERMANENT) PUMP INSTALLATION REPORT

20. Pump Installation Company: _____
21. Name of person performing work: _____
22. Date Pump Installation Completed: _____
23. PUMP INSTALLATION:
    Pump Type, Make, Serial No.: _____ Capacity: _____ gpm
    Motor type, H.P., Voltage, rpm: _____
    Depth of Pump Intake Setting _____ ft. below _____, which elevation is _____ ft.
    Depth to bottom of airline _____ft. below _____, which elevation is _____ ft.
    Pumping Head is _____ft. Type of flow meter: _____ which measures in _____
24. As-built drawings attached attached? __ Yes __ No
25. Other remarks/comments: *(See below)*

Pump Installation Contractor (print) _____ C-57 Lic. No. _____

Signature _____ Date _____

Applicant (print) _____

Signature _____ Date _____

8.(cont'd) DRILLER'S LOG (cont'd):

Water Level Dates	(ft.)	Depth (ft.)	Rock Description, Remarks,
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		

Water Level Dates	(ft.)	Depth (ft.)	Rock Description, Remarks,
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		
_____	to _____		

19.& 25. Remarks: PUMPING TEST DATA ATTACHED.-- SEE ATTACHMENT B AND C

ATTACHMENT A to
WELL COMPLETION REPORT

RE: STATE WELL NO.: 3188-02
WELL NAME: KEONEPOKO WELL
ISLAND: HAWAII - TMK: 3RD DIV. 1-5-08:POR. 1
LOCATION/ADDRESS: DEPT. OF HAWN. HOME LANDS, PUNA, HAWAII

DRILLER'S LOG

Depths (ft.)	Rock Description, etc.
0 to 24	Hard formation - smooth drilling
24 to 26	Medium soft formation - fractured drilling
26 to 27	Hard formation - smooth drilling
27 to 31	Medium hard formation - smooth drilling
31 to 33	Hard formation - smooth drilling
33 to 41	Soft formation - fractured drilling
41 to 49	Medium hard formation - smooth drilling
49 to 52	Hard formation - smooth drilling
52 to 56	Soft formation - fractured drilling
56 to 59	Medium hard formation - fractured drilling
59 to 63	Hard formation - smooth drilling
63 to 67	Medium hard formation - fractured drilling
67 to 80	Medium soft formation - fractured drilling
80 to 87	Soft formation - tubes and fractured drilling
87 to 98	Hard formation - smooth drilling
98 to 104	Medium formation - smooth drilling
104 to 120	Medium soft formation - fractured drilling
120 to 127	Medium hard formation - fractured drilling
127 to 137	Soft formation - fractured drilling
137 to 145	Medium hard formation - fractured drilling
145 to 165	Medium hard formation - smooth drilling
165 to 170	Soft formation - fractured drilling
170 to 180	Medium soft formation - fractured drilling
180 to 189	Medium hard formation - fractured drilling
189 to 195	Soft formation - fractured drilling
195 to 207	Hard formation - smooth drilling
207 to 220	Medium soft formation - fractured drilling
220 to 225	Medium hard formation - fractured drilling
225 to 237	Medium soft formation - fractured drilling
237 to 240	Hard formation - smooth drilling
240 to 271	Medium soft formation - fractured drilling

ATTACHMENT TO: WELL COMPLETION REPORT

271 to 323	Medium soft formation - fractured drilling
323 to 335	Medium hard formation - fractured drilling
335 to 340	Hard formation - smooth drilling
34o to 345	Medium formation - smooth drilling
345 to 353	Medium hard formation - smooth drilling
353 to 362	Hard formation - smooth drilling
362 to 371	Extra hard formation - smooth drilling
371 to 384	Soft formation - fractured drilling
384 to 389	Medium hard formation - smooth drilling
389 to 392	Extra hard formation - smooth drilling
392 to 400	Medium formation - fractured drilling
400 to 407	Medium hard formation - smooth drilling
407 to 412	Extra hard formation - smooth drilling
412 to 416	Medium formation - smooth drilling
416 to 423	Hard formation - smooth drilling
423 to 447	Medium soft formation - fractured drilling
447 to 456	Medium hard formation - smooth drilling
456 to 476	Hard formation - smooth drilling
476 to 484	Lava Tubes
484 to 492	Hard formation - smooth drilling
492 to 507	Medium formation - fractured drilling
507 to 521	Medium soft formation - fractured drilling
521 to 524	Medium hard formation - smooth drilling
524 to 529	Hard formation - smooth drilling
529 to 555	Medium formation - fractured drilling
555 to 575	Medium hard formation - smooth drilling
575 to 593	Hard formation - smooth drilling
593 to 600	Medium formation - fractured drilling
600 to 622	Hard formation - smooth drilling
622 to 650	Medium soft formation - fractured drilling

WRY-07/01/97
sm

ATTACHMENT B

PUMPING TEST RECORD

Test No. 1
5/29, 1992

Well Name Kapoho-Nui #2 State Well No. 3/58-02
Project _____ Island Hawai'i

DEPTH (Below Ground Surface):
Solid Csg: 591 Perforated Csg: 651
Total Depth: 651
Depth to Water: 586.70 *
*Remarks: Ref. Top of Pad

ELEVATIONS (Mean Sea Level):
Ground Surface: 603.47 ft.
Top of Casing: _____ ft. Rotary Table: _____ ft.
Bot. of Solid Csg: 12.47 Bot. of Perf. Csg: -47.53
Bot. of Well: -47.53 Static Water Level: +16.77

TEST PUMP:
Type: 10" Layne Intake Elev: -29.53

DRAWDOWN MEASUREMENT:
☐ Manometer ☐ Pressure Gage ☒ Elect. Probe

DISCHARGE MEASUREMENT: ☒ Flowmeter ☐ Other _____

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	☐ Airline ☒ DTW Reading	Observed Drawdown (feet)	Adjusted Drawdown (feet)	Sample No.	Chlorides (ppm)	Temp. (°F)	Cond. (mmhos 25°C)
	5/29/92								
	8:30A	0	586.7						
	9:00A	0	586.7						
	9:20A	0	586.7						
	9:30A	Start Pump							
8min	9:38	1014	591.25	4.55					
15min	9:45	1007	591.19	4.49					
20min	9:50	1008	591.20	4.50				2un 68.5	
30min	10:00	1002	591.22	4.52		1		wre 68	
40min	10:10	1007	591.24	4.54					
50min	10:20	1005	591.24	4.54					
60min	10:30	1005	591.25	4.55					
90min	11:00	1005	591.24	4.54					
120min	11:30	1005	591.26	4.56					
180	12:30Pm	1005	591.30	4.60					
240	1:30	1005	591.31	4.61					
300	2:30	1010	591.37	4.67				69°	
360	3:30	1010	591.39	4.69					
420	4:30	1000	591.42	4.72					
480	5:30	1005	591.42	4.72					
540	6:30	1005	591.44	4.74					
600	7:30Pm	1005	591.47	4.77					

Pumping Test Record (Cont'd)

Well Name: Keonepoko Nui 2 State Well No. 3158-02 Test No. 1

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	☐ Airline ☒ DTW Reading	Observed Drawdown (feet)	Adjusted Drawdown (feet)	Sample No.	Chlorides (ppm)	Temp. (°F)	Cond. (mmhos 25°C)
660	5/29/97 8:30PM	1000	591.49	4.79		2	6	68°	100
720	9:30	1005	591.48	4.78					
780	10:30	1005	591.47	4.77					
840	11:30	1000	591.47	4.77					
900	5/30/97 12:30AM	980	591.50	4.80					
960	1:30 Am	1000	591.94	5.24					
1020	2:30	1005	592.01	5.31				68°	
1080	3:30	1000	592.01	5.31					
1140	4:30	1005	592.04	5.34					
1200	5:30	1005	592.07	5.37					
1260	6:30	1005	592.14	5.44					
1320	7:30	1005	592.17	5.47					
1380	8:30	1005	592.19	5.49		3	6	68°	100
1440	9:30	1005	592.19	5.49					
1500	10:30	1015	592.17	5.47					
1560	11:30	1015	592.16	5.46					
1620	12:30 PM	1010	592.17	5.47					
1680	1:30	1010	592.16	5.46					
1740	2:30	1015	592.16	5.46				68°	
1800	3:30	1015	592.14	5.44					
1860	4:30	1010	592.10	5.40					
1920	5:30	1010	592.10	5.40					
1980	6:30	1010	592.13	5.43					
2040	7:30	1005	592.12	5.42					
2100	8:30	1010	592.14	5.44		4	6	68°	100
2160	9:30	1010	592.15	5.45					
2220	10:30	1010	592.15	5.45					
2280	11:30	1010	592.17	5.47					
—	5/31/97	"							
2340	12:30 Am	1005	592.17	5.47					

Pumping Test Record (Cont'd)

Well Name: Keauepaka Well State Well No. 3155-02 Test No. 1

Elapsed Time (min.)	Date & Time 5/31/97	Pumping Rate (gpm)	☐ Airline ☒ DTW Reading	Observed Drawdown (feet)	Adjusted Drawdown (feet)	Sample No.	Chlorides (ppm)	Temp. (°F)	Cond. (mmhos 25°C)
2400	1:30 AM	1010	591.88	5.18					
2460	2:30	1010	591.88	5.18				68°	
2520	3:30	1010	591.89	5.19					
2580	4:30	1010	591.90	5.20					
2640	5:30	1010	591.93	5.23					
2700	6:30	1010	591.94	5.24					
2760	7:30	1005	591.94	5.24					
2820	8:30	1005	591.91	5.21		5	6	68°	100
2880	9:30	1010	591.93	5.23					
2940	10:30	1010	591.94	5.24					
3000	11:30	1010	591.95	5.25					
3060	12:30 PM	1010	591.93	5.23					
3120	1:30	1005	591.91	5.21					
3180	2:30	1010	591.91	5.21				68°	
3240	3:30	1015	591.92	5.22					
3300	4:30	1015	591.91	5.21					
3360	5:30	1015	591.93	5.23					
3420	6:30	1015	591.92	5.22					
3480	7:30	1010	591.94	5.24					
3540	8:30	1010	591.93	5.23		6	5	65°	100
3600	9:30	1010	591.93	5.23					
3660	10:30	1010	592.00	5.30					
3720	11:30	1005	591.99	5.29					
3780	12:30 AM	1010	591.99	5.29					
3840	1:30	1005	592.00	5.30				65°	
3900	2:30	1005	592.01	5.31					
3960	3:30	1015	591.95	5.25					
4020	4:30	1010	592.01	5.31					
4080	5:30	1015	592.00	5.30					

6/1/97

Pumping Test Record (Cont'd)

Well Name: Keonepoko Nui #2 State Well No. 3158-02 Test No. 1

Elapsed Time (min.)	Date & Time 6/1/97	Pumping Rate (gpm)	☐ Airline ☒ DTW Reading	Observed Drawdown (feet)	Adjusted Drawdown (feet)	Sample No.	Chlorides (ppm)	Temp. (°F)	Cond. (mmhos 25°C)
4140	6:30 AM	1010	592.05	5.35					
4200	7:30	1005	592.04	5.34				65°	
4260	8:30	1010	592.05	5.35		7	5		100
4320	9:30	1010	592.05	5.35					
4380	10:30	1005	592.05	5.35					
4440	11:30	1005	592.06	5.36					
~~5000~~ 4500	12:30 PM	1010	592.05	5.35					
4560	1:30	1010	592.03	5.33				68°	
4620	2:30	1005	592.05	5.35					
4680	3:30	1010	592.03	5.33					
4740	4:30	1000	592.15	5.43					
4800	5:30	1000	592.18	5.48					
4860	6:30	1000	592.18	5.48					
4920	7:30	1000	592.20	5.50				68°	
4980	8:30	1000	592.24	5.54		8	5		100
5040	9:30	1000	592.29	5.59					
5100	10:30	1000	592.30	5.60					
5160	11:30	1000	592.30	5.60					
—	6/2/97	—	—	—					
5220	12:30 AM	1000	592.30	5.60				68°	
5280	1:30	1000	592.30	5.60					
5340	2:30	1000	592.31	5.61					
5400	3:30	1000	592.32	5.62					
5460	4:30	1005	592.35	5.65					
5520	5:30	1005	592.40	5.70					
5580	6:30	1005	592.39	5.69				68°	
5640	7:30	1000	592.35	5.65					
5700	8:30	1005	592.33	5.63		9	5		100
5760	9:30	1005	592.33	5.63					
5820	10:30	1005	592.34	5.64					

Pumping Test Record (Cont'd)

Well Name: Keauepoko Well #2 State Well No. 3158-02 Test No. 1

Elapsed Time (min.)	Date & Time 6/2/97	Pumping Rate (gpm)	☐ Airline ☒ DTW Reading	Observed Drawdown (feet)	Adjusted Drawdown (feet)	Sample No.	Chlorides (ppm)	Temp. (°F)	Cond. (mmhos 25°C)
5880	11:30 AM	1000	592.39	5.69					
5940	12:30 PM	1000	592.38	5.68				68°	
6000	1:30	1000	592.40	5.70					
6060	2:30	1000	592.36	5.66					
6120	3:30	1000	592.36	5.66					
6180	4:30	1005	592.40	5.70					
6240	5:30	1005	592.39	5.69					
6300	6:30	1005	592.40	5.70					
6360	7:30	1005	592.41	5.71				68°	
6420	8:30	1010	592.45	5.75		10	5		150
6480	9:30	1010	592.50	5.80					
6540	10:30	1010	592.48	5.78					
6600	11:30	1015	592.49	5.79					
—	6/3/97	—	—	—					
6660	12:30 AM	1005	592.33	5.63				68°	
6720	1:30	1005	592.34	5.64					
6780	2:30	1010	592.36	5.66					
6840	3:30	1010	592.39	5.69					
6900	4:30	1010	592.38	5.68					
6960	5:30	1010	592.38	5.68					
7020	6:30	1005	592.27	5.57				68°	
7080	7:30	1005	592.31	5.61					
7140	8:30	1010	592.30	5.60					
7200	9:30	1005	592.34	5.64					
	Stop Pumping & Monitor Recovery								
1 min	9:31		585.34	1.31					
2	9:32		585.80	0.9					
3	9:33		586.25	.45					
4	9:34		586.66	.04					
5	9:35		586.88	.18					

Pumping Test Record (Cont'd)

Well Name: Keonepoko-Nui #2 State Well No. 3/85-02 Test No. 1

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	☐ Airline ☒ DTW Reading	Observed Drawdown (feet)	Adjusted Drawdown (feet)	Sample No.:	Chlorides (ppm)	Temp. (°F)	Cond. (mmhos 25°C)
	6/3/97	Monitor	Recovery						
begin	9:36AM		586.87	0.17					
7	9:37		586.89	.19					
8	9:38		586.88	.18					
9	9:39		586.89	.19					
10	9:40		586.90	.2					
15	9:45		586.88	.18					
20	9:50		586.88	.18					
25	9:55		586.88	.18					
30	10:00		586.89	.19					
60	10:30		586.88	.18					
90	11:00		586.89	.19					
120	11:30		586.88	.18					
150	12:00PM		586.88	.18					
180	12:30		586.88	.18					
240	1:30		586.88	.18					
300	2:30		586.87	.17					
360	3:30		586.86	.16					
420	4:30		586.84	.14					
480	5:30		586.84	.14					
540	6:30		586.84	.14					
600	7:30		586.84	.14					
660	8:30		586.83	.13					
720	9:30		586.83	.13					
780	10:30		586.83	.13					
840	11:30		586.83	.13					
~	~~12:00~~	6/4/97	———						
900	12:30AM		586.83	.13					
960	1:30		586.83	.13					
1020	2:30		586.84	.14					

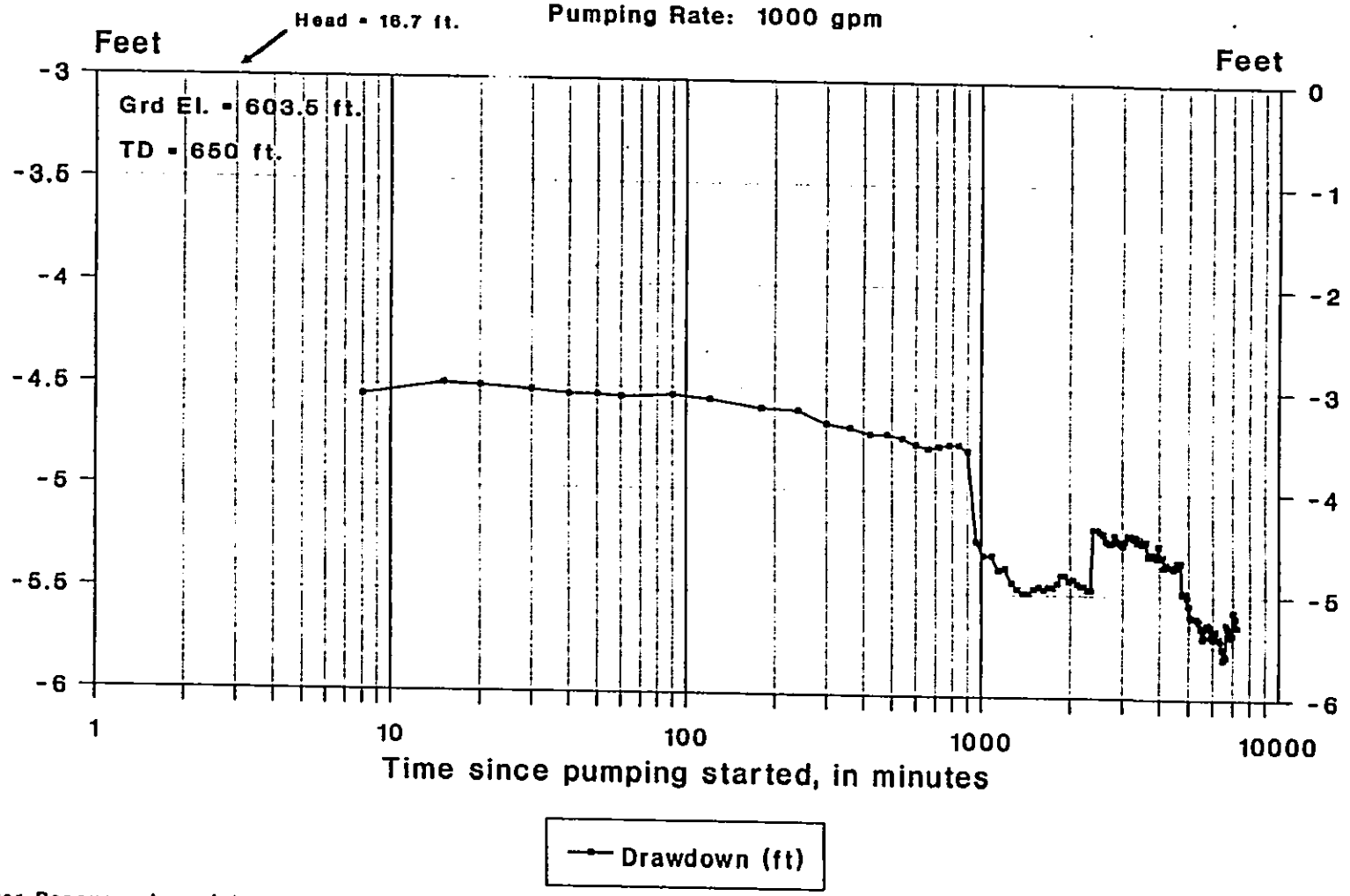
Pumping Test Record (Cont'd)

Well Name: Keawepaku-Niui #2 State Well No. 3188-02 Test No. 1

Elapsed Time (min.)	Date & Time 6/4/97	Pumping Rate (gpm)	☐ Airline ☒ DTW Reading	Observed Drawdown (feet)	Adjusted Drawdown (feet)	Sample No.	Chlorides (ppm)	Temp. (°F)	Cond. (mmhos 25°C)
1080	3:30 AM		586.84	.14					
1140	4:30		586.84	.14					
1200	5:30		586.85	.15					
1260	6:30		586.86	.16					
1320	7:30		586.87	.17					
1380	8:30		586.87	.17					
1440	9:30								

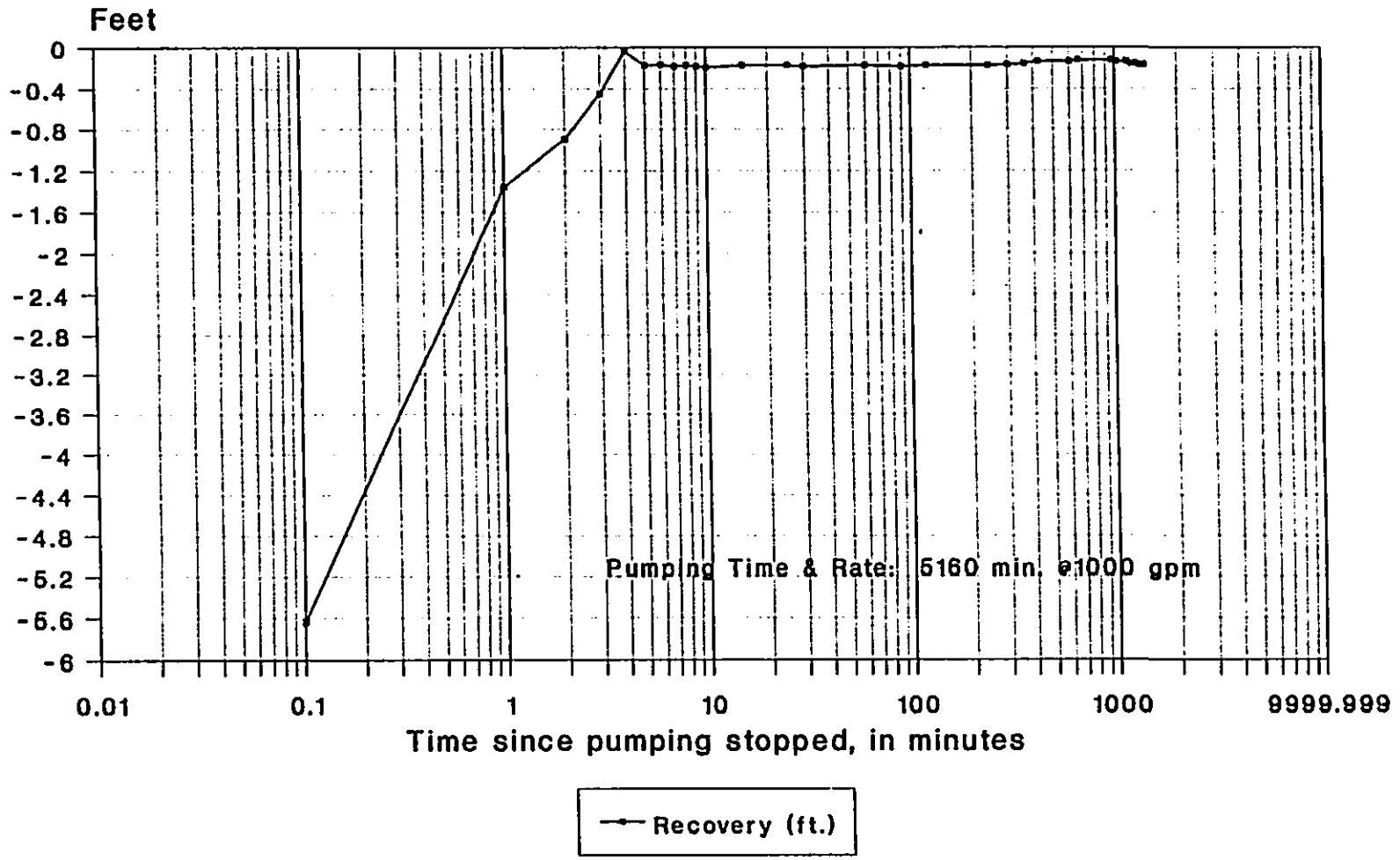
Sheet 7 of 7

TIME-DRAWDOWN CURVE
Keonepoko Nui 2 Well (3188-02), Hawaii
Date of Test: May 29-June 3, 1997



Water Resource Associates
073TDCt

TIME-RECOVERY CURVE
Keonepoko Nui 2 Well (3188-02), Hawaii
Date of Recovery: June 3-4, 1997



Water Resource Associates
073TRC1

Hi Line Static 7:40 - 9.6", 7:45 - 9.6", 7:50 - 9.6", 7:55 - 9.6", 8:00 - 9.6"

Solinst Static 7:45 - 586.66, 7:50 - 586.66, 7:55 - 586.66, 8:00 - 586.66

Pumping Test Record (Cont'd) — Step test ATTACHMENT C

Well Name: Keonepoko-Nui' #2 State Well No. _____ Test No. 2

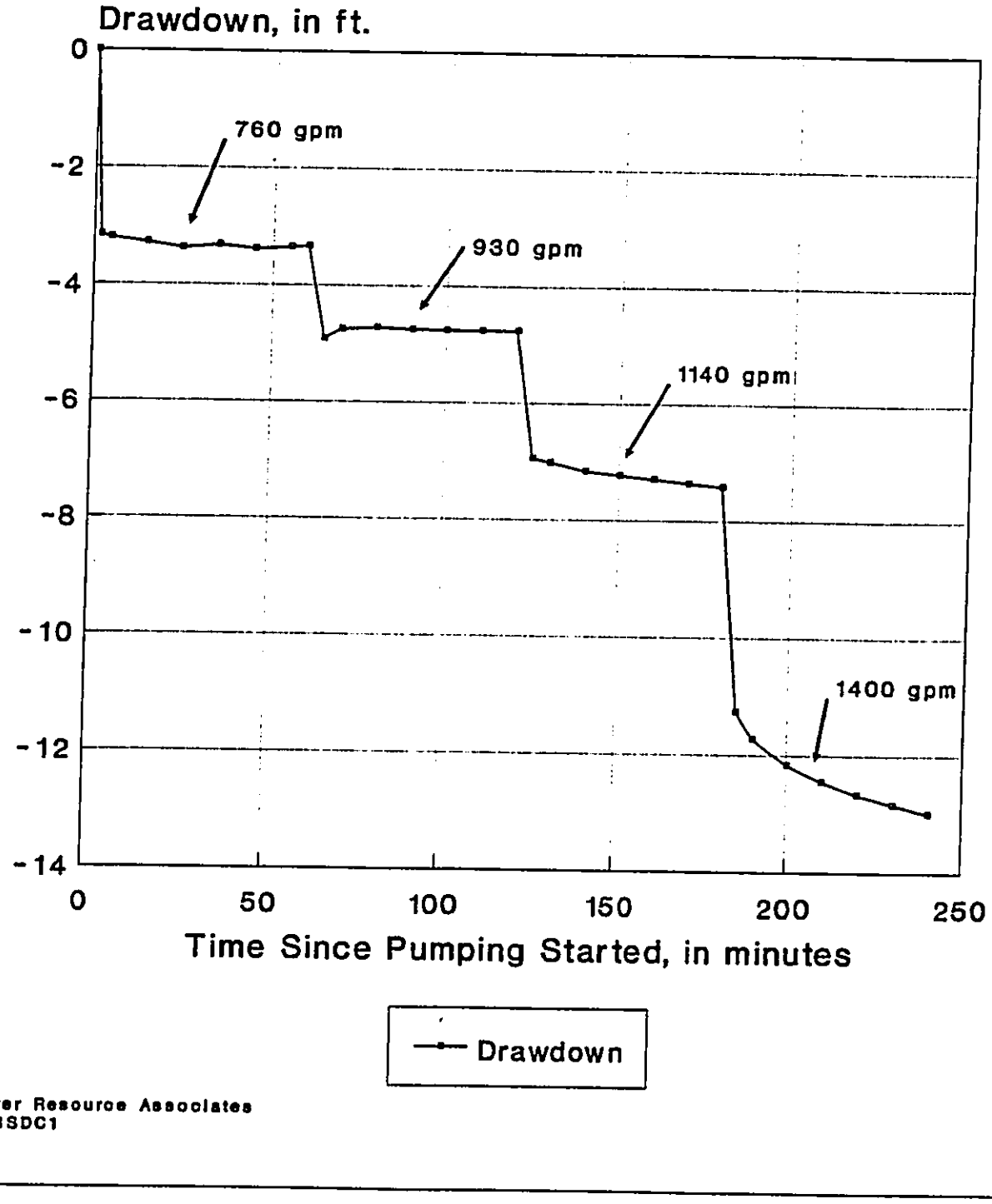
5/28/97

Solinst — Meter 4336850

Elapsed Time (min.)	Date & Time (5/28/97 Start 8:00)	Pumping Rate (gpm)	☐ Airline ☒ OTW Reading (Start 586.66)	Observed Drawdown (feet)	Adjusted Drawdown (feet)	Sample No.	Chlorides (ppm)	Temp. (°F)	Cond. (mmhos 25°C)	
2 min	8:02	760	589.82	3.16						
5 "	8:05	762	589.86	3.20						
15 "	8:15	765	589.95	3.29						
25 "	8:25	775	590.04	3.38				68°		
35 "	8:35	770	589.98	3.32						
45 "	8:45	765	590.05	3.39						
55 "	8:55	765	590.01	3.35						
60"	9:00	765	589.99	3.33						4341330
65 "	9:05	975	581.58	4.92						
70 "	9:10	930	581.41	4.75			12 PPM			
80 "	9:20	930	581.39	4.73				68°		
90 "	9:30	925	581.41	4.75						
100"	9:40	930	581.42	4.76						
110"	9:50	930	581.41	4.75						
120"	10:00	925	581.42	4.76						4346860
125"	10:05	1140	593.60	6.94						
130"	10:10	1140	593.68	7.02						
140	10:20	1140	593.82	7.16				68°		
150	10:30	1135	593.89	7.23						
160	10:40	1140	593.95	7.29						
170	10:50	1145	594.02	7.36						
180	11:00	1150	594.07	7.41						4353770
185	11:05	1405	597.92	11.26						
190	11:10	1410	598.39	11.73						
200	11:20	1406	598.83	12.17						
210	11:30	1405	599.11	12.45				68°		
220	11:40	1410	599.33	12.67						
230	11:50	1410	599.50	12.84			< 12 PPM			
240	12:00	1410	599.65	12.99						4362170
Recovery										
241	12:01		585.00	+1.66						
242	12:02		585.29	+1.37						
243	12:03		585.80	+.86						
244	12:04		586.30	+.36						
245	12:05		586.70	-.04						
246	12:06		586.71	-.05						

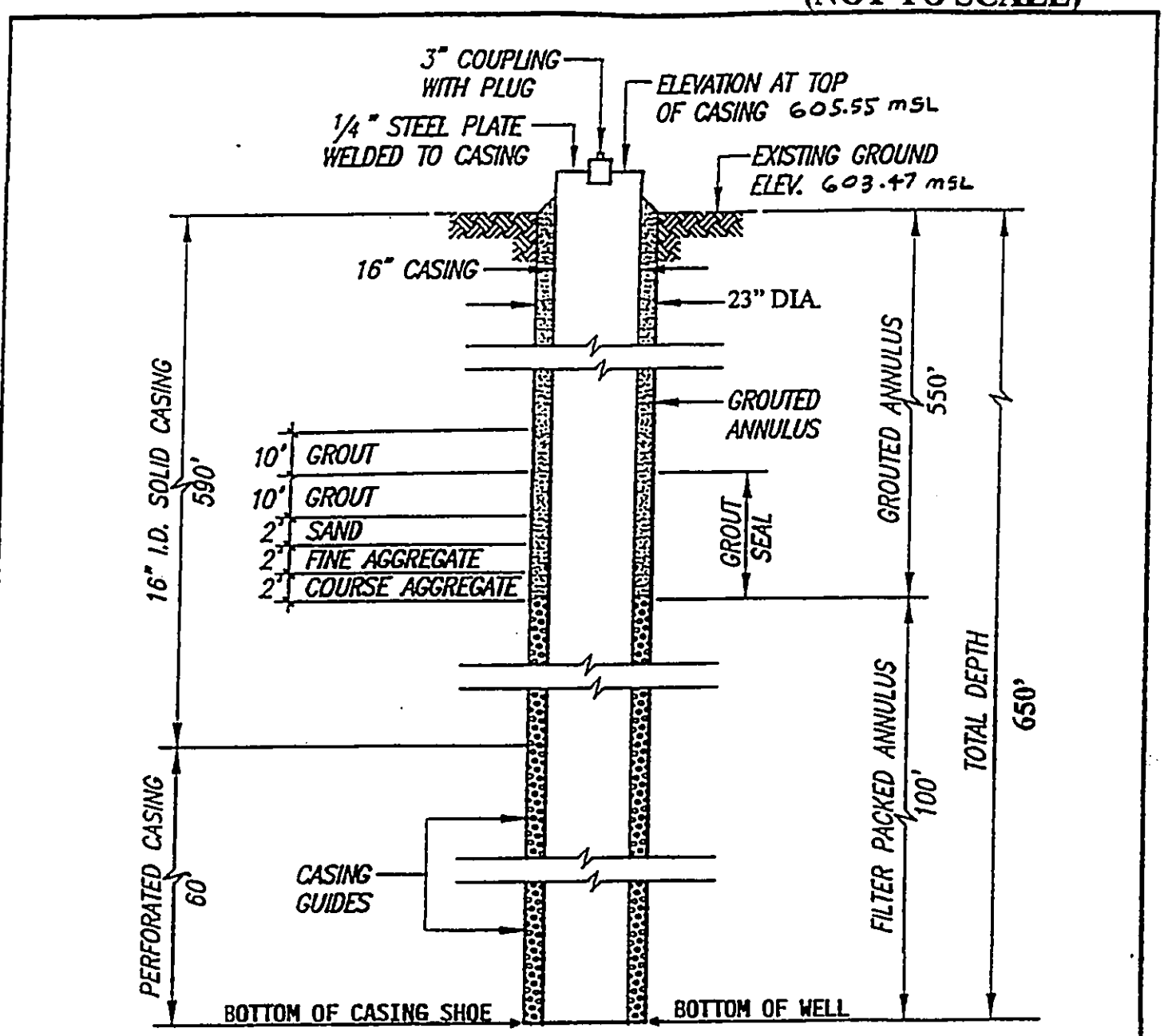
Solinst @ 586.71 thru 1 min. checks until 12:10

STEP DRAWDOWN CURVE
Keonepoko Nui 2 Well (3188-02), Hawaii
Date of Test: May 28, 1997



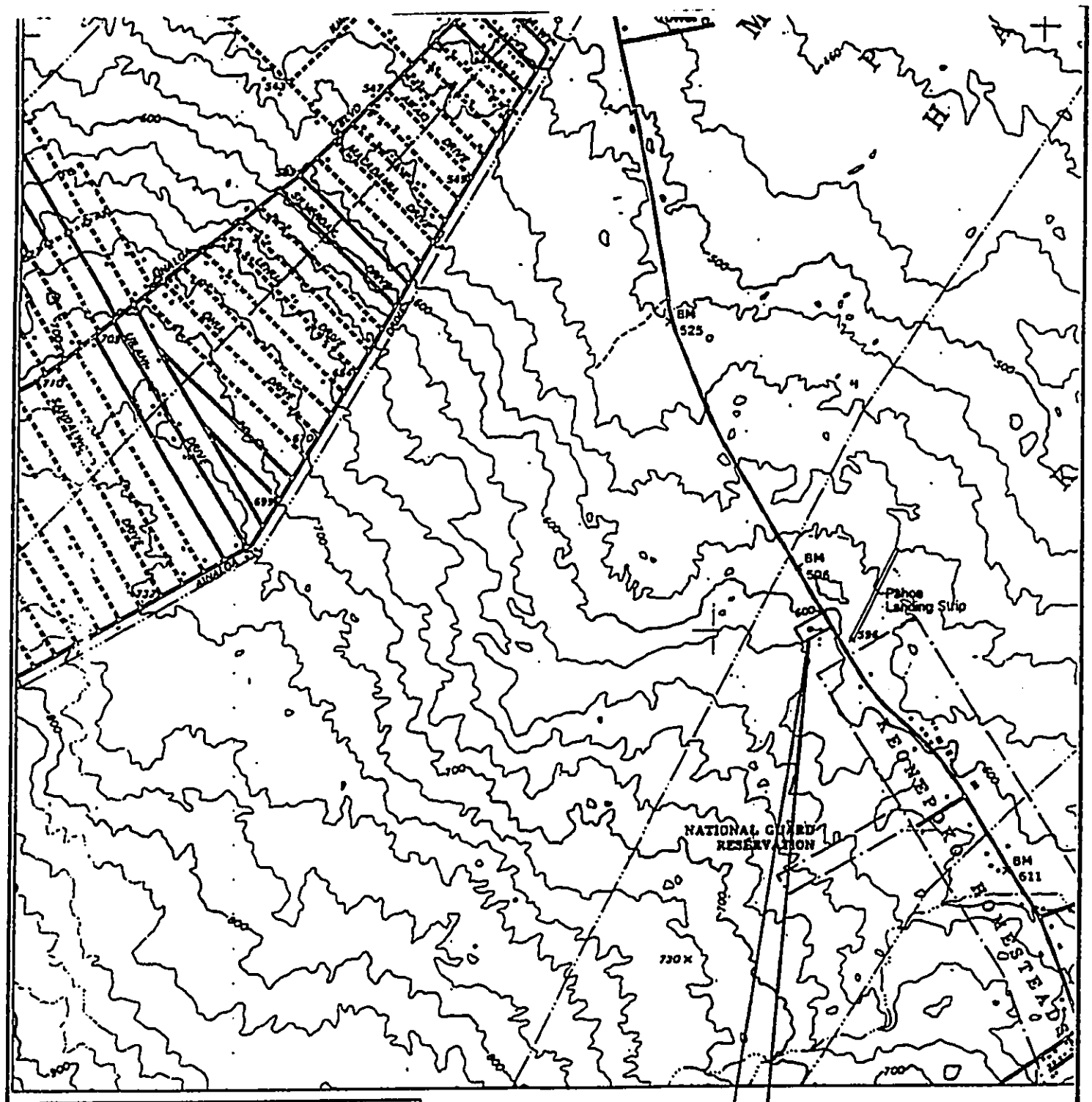
Water Resource Associates
073SDC1

(NOT TO SCALE)



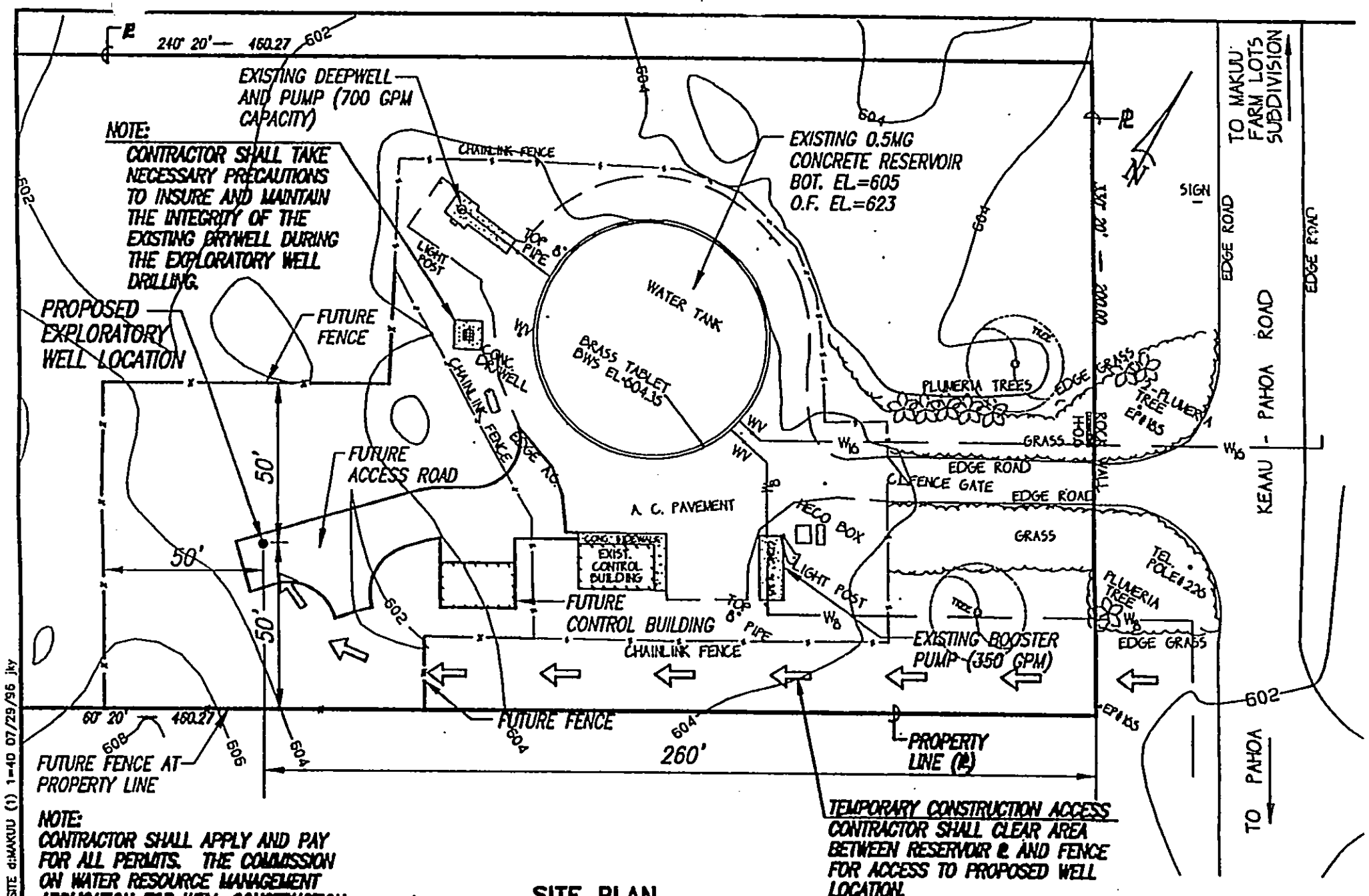
KEONEPOKO-NUI 2 EXPLORATORY WELL (WELL NO. 3188-02)
PUNA, HAWAII
T.M.K.: 3RD DIV. 1-5-08:POR. 1

As-built sectional drawing of the well.
Drilling Completed: May 5, 1997
Drilling Contractor: Water Resources International Inc.



REFERENCE: U.S.G.S. QUADRANGLE MAP; PAHOA NORTH, HAWAII

DEPARTMENT OF HAWAIIAN HOME LANDS
KEONEPOKO–NUI 2 EXPLORATORY WELL
PUNA, HAWAII
LOCATION MAP
SCALE: 1 IN. = 2000 FT.



NOTE:
CONTRACTOR SHALL APPLY AND PAY FOR ALL PERMITS. THE COMMISSION ON WATER RESOURCE MANAGEMENT APPLICATION FOR WELL CONSTRUCTION PERMIT HAS BEEN FILED BY DHHL AND TO BE SIGNED BY CONTRACTOR.

SITE PLAN
KEONEPOKO WELL AND RESERVOIR SITE

SCALE: 1"=40'

APPROVED: _____ 8/20/96
DEPT. OF WATER SUPPLY COUNTY OF HAWAII — DATE

DEPARTMENT OF HAWAIIAN HOME LANDS
KEONEPOKO-NUI 2 EXPLORATORY WELL
PUNA, HAWAII

85-180.9 f:\NEW-SITE d:\MAKUU (1) 1=40 07/29/96 jky

APPENDIX C

WATER QUALITY TEST RESULTS PER

STATE DEPARTMENT OF HEALTH

AECOS
970 N. Kalaheo Avenue, Suite C300 • Kailua, Hawaii 96734
Telephone: (808) 254-5884

CLIENT: Engineer Surveyors Hawaii

ATTENTION: Eric Hee

FILE No.:	846
REPORT DATE:	06/27/97
PAGE:	1 of 1

AECOS REPORT OF MICROBIOLOGICAL RESULTS

SAMPLE TYPE: well water

***AECOS* LOG No.:** 10703

DATE SAMPLED: 06/24/97
DATE/TIME RECEIVED: 06/24/97@1335
TEMPERATURE CONTROL: 1.3° C
CHLORINE RESIDUAL: ---

METHOD SM 9221B
SAMPLER: Dan Lum
MATRIX: water

Analysis Date/Time: 06/24/97@1400

Analyst: R. Douglas

ANALYTE (UNITS)		Total Coliform (Present/Absent)		
SAMPLE ID ⇩	DATE AND TIME SAMPLED ⇩			
"A" KPN Well #2	06/24/97 0900	Absent		

NOTES:

for J. Mello, Laboratory Director

BROOKSIDE LABORATORIES, INC.
ENVIRONMENTAL & INDUSTRIAL DIVISION
P.O. BOX 456 308 S. MAIN STREET
NEW KNOXVILLE, OH 45871

(419) 753-2448

ANALYSIS REPORT

We are pleased to submit the following Analysis Report. Please review the data and feel free to call us if you have questions or need additional tests and/or technical assistance.

GENERAL INFORMATION

Account No : 61690

Client Name : Brewer Environmental Ind.

Project Name : Lab Job #E7060206

Site Name/Location :

Report Submitted To: Verle Heyer

Report No : DE73637

Report Date : 06/20/97

Sample Collected By: H. Tonaka

Comments : Resubmitting page 4 with Dioxin results. Dioxin results were performed by Core Laboratories in Indianapolis, Indiana.

ANALYTICAL RESULTS

Analytical results are presented on page 2 through page 5 of this report.

AUTHORIZED SIGNATURES	
Peter A. Conidaris	Lam V. Ho
Peter A. Conidaris QA/QC Officer	Lam V. Ho, Ph.D., REP, Director, EID

ACCREDITED

BROOKSIDE LABORATORIES, INC.
ENVIRONMENTAL & INDUSTRIAL DIVISION
P.O. BOX 456 308 S. MAIN STREET
NEW KNOXVILLE, OH 45871

(419) 753-2448

ANALYSIS REPORT

We are pleased to submit the following Analysis Report. Please review the data and feel free to call us if you have questions or need additional tests and/or technical assistance.

GENERAL INFORMATION

Account No : 61690

Client Name : Brewer Environmental Ind.

Project Name : Lab Job #E7060206

Site Name/Location :

Report Submitted To: Verle Heyer

Report No : DE73637

Report Date : 06/17/97

Sample Collected By: H. Tonaka

Comments : VOC's, SOC's, and metals were analyzed by Environmental Health Laboratories of South Bend, Indiana; Fluoride was analyzed by BLI.

ANALYTICAL RESULTS

Analytical results are presented on page 2 through page 5 of this report.

AUTHORIZED SIGNATURES	
Zhilun Xue, Ph.D. Senior Chemist	Lam V. Ho, Ph.D., REP, Director, EID

ACCREDITED

Brookside Laboratories, Inc.

FILE NO: **61690**

CLIENT NAME : **Brewer Environmental Ind.**

PROJECT NAME : **Lab Job #E7060206**

REPORT NUMBER: **DE73637**

REVIEWER INITIALS:

TEST NAME :** METALS **

SAMPLE MATRIX : **WATER**

SAMPLE ID : **E7060206**

SAMPLE DESCRIPTION : **KEONEPOKEO NUI 2 WELL**

LAB NUMBER : **DE73637**

PREP METHOD :

DATE SAMPLED: **06/02/97**

DATE RECEIVED: **06/05/97**

DATE REQUESTED ADDITIONAL TEST:

DATE ANALYZED: **06/17/97**

ANALYST: **NT**

CODE	ANALYTE	ANALYTICAL METHOD	RESULT (ug/l)	LIMIT OF DETECTION (ug/l)
IB021	ANTIMONY	EPA 200.8	N/D	0.2
IB032	ARSENIC	EPA 200.8	N/D	0.5
IB040	BARIUM	EPA 200.8	1.9	0.1
IB051	BERYLLIUM	EPA 200.8	N/D	0.1
IB061	CADMIUM	EPA 200.8	N/D	0.1
IB091	CHROMIUM	EPA 200.8	4.1	0.2
IB120	COPPER	EPA 200.8	0.7	0.5
IB140	LEAD	EPA 200.8	0.3	0.1
IB170	MERCURY	EPA 200.8	N/D	0.1
IB191	NICKEL	EPA 200.8	4.6	0.2
IB212	SELENIUM	EPA 200.8	N/D	2.0
IB261	THALLIUM	EPA 200.8	N/D	0.1

* N/D - None Detected

FILE NO: **61690**

Brookside Laboratories, Inc.

CLIENT NAME : **Brewer Environmental Ind.**

PAGE NO : **3 of 5**

PROJECT NAME : **Lab Job #E7060206**

REPORT NUMBER: **DE73637**

REVIEWER INITIALS: _____

TEST NAME: **** GENERAL ANALYSIS ****

SAMPLE MATRIX : **WATER**

DATE SAMPLED: **06/02/97**

SAMPLE ID : **E7060206**

DATE RECEIVED: **06/05/97**

SAMPLE DESCRIPTION : ***KEONEPOKE NUI 2 WELL***

LAB NUMBER : **DE73637**

ANALYTE	PREP METHOD	ANALYTICAL METHOD	DATE ANALYZED	RESULT	LIMIT OF DETECTION
ALKALINITY - TOTAL		SM 2320 B	06/09/97	43.0 mg/l	1.0 mg/l
CYANIDE - TOTAL		EPA 335.4	06/12/97	N/D	0.02 mg/l
CONDUCTIVITY		EPA 2510 B	06/09/97	120 umhos/cm	0.1 umhos/cm
FLUORIDE		SM 4500 C	06/17/97	0.23 mg/l	0.20 mg/l
CALCIUM		EPA 3111 B	06/17/97	6.1 mg/l	0.1 mg/l
PENTACHLOROPHENOL		EPA 515.1	06/09/97	N/D	0.04 ug/l
PICLORAM		EPA 515.1	06/09/97	N/D	0.1 ug/l
DI (2-ETHYLHEXYL) ADIPATE		EPA 525.2	06/10/97	N/D	0.6 ug/l
ALDICARB		EPA 531.1	06/09/97	N/D	0.5 ug/l
ALDICARB SULFONE		EPA 531.1	06/09/97	N/D	0.4 ug/l
ALDICARB SULFOXIDE		EPA 531.1	06/09/97	N/D	0.5 ug/l
OXAMYL (VYDATE)		EPA 531.1	06/09/97	N/D	1.0 ug/l
DIQUAT		EPA 549.1	06/10/97	N/D	0.4 ug/l
ENDOTHALL		EPA 548.1	06/09/97	N/D	9.0 ug/l
DI (2-ETHYLHEXYL) PHTHALATE		EPA 525.2	06/10/97	N/D	0.6 ug/l
BENZO (a) PYRENE		EPA 525.2	06/10/97	N/D	0.02 ug/l
HEXACHLOROBENZENE		EPA 525.2	06/10/97	N/D	0.1 ug/l
HEXACHLOROCYCLOPENTADIEN		EPA 525.2	06/10/97	N/D	0.1 ug/l
G-BHC (LINDANE)		EPA 525.2	06/10/97	N/D	0.02 ug/l
CHLORDANE		EPA 505	06/10/97	N/D	0.2 ug/l
ENDRIN		EPA 525.2	06/10/97	N/D	0.01 ug/l
HEPTACHLOR		EPA 525.2	06/10/97	N/D	0.04 ug/l
HEPTACHLOR EPOXIDE		EPA 525.2	06/10/97	N/D	0.02 ug/l
PCB-AROCHLOR 1016		EPA 505	06/10/97	N/D	0.8 ug/l
PCB-AROCHLOR 1221		EPA 505	06/10/97	N/D	2.0 ug/l
PCB-AROCHLOR 1232		EPA 505	06/10/97	N/D	0.5 ug/l
PCB-AROCHLOR 1242		EPA 505	06/10/97	N/D	0.3 ug/l

* N/D - None Detected

Brookside Laboratories, Inc.

FILE NO: **61690**

PAGE NO : **4 of 5**

CLIENT NAME : **Brewer Environmental Ind.**

REPORT NUMBER: **DE73637**

PROJECT NAME : **Lab Job #E7060206**

REVIEWER INITIALS: PAC

TEST NAME: **** GENERAL ANALYSIS ****

SAMPLE MATRIX : **WATER**

DATE SAMPLED: **06/02/97**

SAMPLE ID : **E7060206**

DATE RECEIVED: **06/05/97**

SAMPLE DESCRIPTION : **KEONEPOKE NUI 2 WELL**

LAB NUMBER : **DE73637**

ANALYTE	PREP METHOD	ANALYTICAL METHOD	DATE ANALYZED	RESULT	LIMIT OF DETECTION
PCB-AROCHLOR 1248		EPA 505	06/10/97	N/D	0.1 ug/l
PCB AROCHLOR 1254		EPA 505	06/10/97	N/D	0.1 ug/l
PCB AROCHLOR 1260		EPA 505	06/10/97	N/D	0.2 ug/l
2,3,7,8-TCD-DIOXIN		EPA 1613	06/18/97	N/D	4.83 pg/L
TOXAPHENE		EPA 505	06/10/97	N/D	1.0 ug/l
AATREX-ATRAZINE		EPA 525.2	06/10/97	N/D	0.1 ug/l
ALACHLOR		EPA 525.2	06/10/97	N/D	0.1 ug/l
CARBOFURAN		EPA 531.1	06/09/97	N/D	0.9 ug/l
2,4-D		EPA 515.1	06/09/97	N/D	0.1 ug/l
DALAPON		EPA 515.1	06/09/97	N/D	1.0 ug/l
DINOSEB		EPA 515.1	06/09/97	N/D	0.1 ug/l
METHOXYCHLOR		EPA 525.2	06/10/97	N/D	0.1 ug/l
PRINCEP - SIMAZINE		EPA 525.2	06/10/97	N/D	0.07 ug/l
ROUND UP (GLYPHOSATE)		EPA 547	06/10/97	N/D	6.0 ug/l
2,4,5-TP (SILVEX)		EPA 515.1	06/09/97	N/D	0.1 ug/l
DBCP		EPA 504.1	06/06/97	N/D	0.02 ug/l
ETHYLENEDIBROMIDE (EDB)		EPA 504.1	06/06/97	N/D	0.01 ug/l

* N/D - None Detected

FILE NO: **61690**
CLIENT NAME : **Brewer Environmental Ind.**
PROJECT NAME : **Lab Job #E7060206**

REPORT NUMBER: **DE73637**
REVIEWER INITIALS:

TEST NAME:** VOLATILE ORGANIC COMPOUNDS **

SAMPLE MATRIX : **WATER**
SAMPLE ID : **E7060206**
SAMPLE DESCRIPTION : **KEONEPOKO NUI 2 WELL**
LAB NUMBER : **DE73637**

DATE SAMPLED: **06/02/97**
DATE RECEIVED: **06/05/97**
DATE ANALYZED: **06/09/97**
ANALYST: **DC**

CODE	ANALYTE	ANALYTICAL METHOD	RESULT (ug/l)	LIMIT OF DETECTION (ug/l)
IE010	BENZENE	EPA 524.2	N/D	0.5
ID040	CARBON TETRACHLORIDE	EPA 524.2	N/D	0.1
ID050	CHLOROBENZENE	EPA 524.2	N/D	0.2
ID130	1,2-DICHLOROBENZENE	EPA 524.2	N/D	0.1
ID150	1,4-DICHLOROBENZENE	EPA 524.2	N/D	0.1
ID170	1,2-DICHLOROETHANE	EPA 524.2	N/D	0.1
ID180	1,1-DICHLOROETHENE	EPA 524.2	N/D	0.2
ID219	CIS-1,2-DICHLOROETHENE	EPA 524.2	N/D	0.1
ID220	TRANS-1,2-DICHLOROETHENE	EPA 524.2	N/D	0.1
ID190	1,2-DICHLOROPROPANE	EPA 524.2	N/D	0.1
IE030	ETHYLBENZENE	EPA 524.2	N/D	0.1
ID200	METHYLENE CHLORIDE	EPA 524.2	N/D	0.5
ID207	STYRENE	EPA 524.2	N/D	0.2
ID210	TETRACHLOROETHENE	EPA 524.2	N/D	0.2
IE040	TOLUENE	EPA 524.2	N/D	0.5
IM060	1,2,4-TRICHLOROBENZENE	EPA 524.2	N/D	0.2
ID240	1,1,1-TRICHLOROETHANE	EPA 524.2	N/D	0.1
ID260	1,1,2-TRICHLOROETHANE	EPA 524.2	N/D	0.1
ID270	TRICHLOROETHENE	EPA 524.2	N/D	0.1
ID275	1,2,3-TRICHLOROPROPANE	EPA 524.2	N/D	0.2
ID290	VINYL CHLORIDE	EPA 524.2	N/D	0.2
IP810	XYLENES (TOTAL)	EPA 524.2	N/D	0.2

* N/D - None Detected

E.L. Pacific

Laboratory Report

Environmental Laboratory of the Pacific
930 Mapunapuna Street, Suite 100
Honolulu, Hawaii 96819
Phone: 808•831-3090 Fax: 808•831-3098

Brewer Environmental Lab.
311 Pacific St.
Honolulu, HI 96817
Attention: Lynette Higa

Client Project ID: E7060206
Sample Description: Water, E7060206-N
Lab Sample ID: 97060006
Work Order #: 9706004

Sampled: Jun 2, 1997
Received: Jun 2, 1997
Reported: Jun 17, 1997

LABORATORY ANALYSIS

Analyte	Method	Units	Reporting Limit	Date Analyzed	Sample Result
Nitrogen, Nitrate+Nitrite.....	EPA 353.2	mg/L	0.050	6/6/97	0.22
pH.....	EPA 150.1	units	0.010	6/2/97	7.2
Turbidity.....	EPA 180.1	NTU	0.10	6/3/97	0.13

Analytes reported as N.D. were not present above the stated reporting limit.

E.L. PACIFIC

Ken Kawabata
Project Manager

COMMENTS ON THE DRAFT
ENVIRONMENTAL ASSESSMENT

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII
25 AUPUNI STREET • HILO, HAWAII 96720
TELEPHONE (808) 961-8660 • FAX (808) 961-8657

September 8, 1997

Mr. Eric Hee, P.E.
Engineers Surveyors Hawaii, Inc.
Suite No. 1, Building No. 6
1020 Auahi Street
Honolulu, HI 96814

DRAFT ENVIRONMENTAL ASSESSMENT FOR KEONEPOKO-NUI 2 PRODUCTION WELL AND SUPPORTING FACILITIES (MAKUU WATER SYSTEM - PHASE 2)
PAHOA, PUNA, HAWAII

We reviewed the Draft Environmental Assessment and have no comments to offer.

Milton D. Pavao, P.E.
Manager

ON:dms

NO RESPONSE REQUIRED

... Water brings progress...

OCT 1 3 1997

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
P.O. BOX 621
HONOLULU, HAWAII 96809

October 6, 1997

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND DIVISION
STATE PARKS
WATER RESOURCE MANAGEMENT

LD-NAV
Ref.: DEADHHL.RCM

Honorable Kali K. Watson
Chairperson, Hawaiian
Homes Commission
State of Hawaii
P.O. Box 1879
Honolulu, Hawaii 96813

Dear Mr. Watson:

SUBJECT: Review : Draft Environmental Assessment
Applicant: State of Hawaii Department of Hawaiian Home Lands
Request : Pump Installation Permit
Project : Keonepoko - Nui 2 Production Well (No. 3188-02) and Supporting Facilities
Location : Pahoa, Puna, Island of Hawaii, Hawaii
TAX MAP : 3rd/ 1-5-08: Portion of 01

Thank you for the opportunity to review and comment on the subject Draft Environmental Assessment. Our Commission on Water Resource Management (CWRM) and Land Division Engineering Branch have the following comments to offer on the proposed project:

Commission on Water Resource Management:

1. We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan; and

2. A well Construction Permit and a Pump Installation Permit from CWRM would be required before ground water is developed as a source of supply for the project.

Land Division's Engineering Branch:

We confirm that the proposed project site is located in Zone X (unshaded). This is an area determined to be outside the 500-year flood plain.

The Department of Land and Natural Resources has no other comments to offer on the subject matter at this time.

Should you have any questions, please feel free to contact Nick Vaccaro of our Land Division's Support Services Branch at 587-0438 or Ryan Imata of our Commission on Water Resource Management at 587-0255.

HAWAII: Earth's best!

Aloha,

for Gilbert S. Coloma-Agaran,

/s/ MICHAEL D. WILSON

c: Hawaii Land Board Member
At Large Land Board Member
Hawaii District Land Office
Commission on Water Resource Management
Engineers Surveyors Hawaii, Inc
County of Hawaii, Dept. of Water Supply

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOBIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

October 29, 1997

The Honorable Michael Wilson, Director
Department of Land & Natural Resources
1151 Punchbowl Street, Room 130
Honolulu, Hawaii 96813

Attention: Ryan Imata, Commission on
Water Resources Management

Dear Mr. Wilson:

SUBJECT: Draft Environmental Assessment for Keonepoko Nui Production Well and Supporting Facilities - Makuu Off-Site Water Improvement Project, Pahoa, Puna - Island of Hawaii Tax Map: 3rd/1-5-08: Portion of 01

Thank you for your review of the subject project. In response to Item 1 of your October 6, 1997 letter, we have been coordinating this project with the Hawaii County agencies.

In response to Item 2 of your letter, we have completed construction of an exploratory well on the Keonepoko Nui well and reservoir site. The DHHL has satisfied all conditions of a Well Construction Permit for the Keonepoko Well (No. 3188-02). When the Finding of No Significant Impact (FONSI) is filed, we will request your approval of a Pump Installation Permit, as authorized by the Commission on Water Resources Management on December 27, 1996. A Well Completion Report was submitted to your Department on July 29, 1997.

You may contact our Design and Construction branch chief, Gerald Lee, at 586-3818 should you have further questions on the above.

Aloha,

Kali Watson

KALI WATSON, Chairman
Hawaiian Homes Commission

c ESH, Inc.

BENJAMIN J. CAYETANO
GOVERNOR

GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

October 22, 1997

Mr. Kali Watson, Chair
Department of Hawaiian Homelands
335 Merchant Street
Honolulu, Hawaii 96813

Dear Mr. Watson:

Subject: Draft Environmental Assessment for the Keonepoko Nui 2 Production Well, Pahoa, Puna, Hawaii

Thank you for the opportunity to review the subject document. We have the following comments and questions.

1. **Orientation Maps**

   Please provide maps that show the following:

   a) nearby streams and wetlands; and

   b) points or regions of known contamination, points of potential contamination (landfills, individual wastewater disposal systems, hazardous waste sites, dry wells and injection wells), and the likely wellhead protection area for the proposed well.

2. **Aquifer or Hydrologic Unit Status**

   Please provide current water use and installed capacity totals for the wells listed in figure 4 of Appendix A.

3. **Contamination Analysis**

   Please indicate whether any of the water quality test results shown in Appendix C exceeds the Department of Health's Standards. If contamination exists, the sources and duration of the contamination and any anticipated need for treatment or filtering systems must be listed. Any hazardous materials produced during treatment should be described. The method of handling these hazardous materials should also be disclosed.

4. **Hydrologic Impact Analysis**

Please include a discussion of the potential effects the well development may have on surface water (e.g., streams and wetlands).

5. **Watershed and Land Use Analysis**

Please discuss how the proposed well development may affect land and water uses in the region. The analysis should include a discussion of the following:

* Hawaii State Water Plan and its component parts
* County General and Development Plans
* An assessment of the well's impact on the major land owners in the region and a declaration if ceded lands are involved.
* An assessment of any impact the well development may have on small landowners or water users including farmers and kuleana residents.

6. **Alternative Analysis**

Please list alternatives to new groundwater development and discuss their related costs and benefits. The list should include but not be limited to wastewater reuse, rainfall catchment, conservation, and existing potable and nonpotable water supplies.

7. **Determination**

Please discuss the findings and reasons for supporting the FONSI determination based on the significant criteria listed in §11-200-12 of the EIS rules. Please see the enclosed example.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Gary Gill
Director

Enclosure

c: Engineering Surveyors Hawaii, Inc.

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOBIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

February 12, 1998

Mr. Gary Gill, Director
Hawaii State Office of Environmental
Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Mr. Gill:

SUBJECT: Draft Environmental Assessment for Keonepoko Nui Production Well, Pahoa, Puna, Hawaii

Thank you for your comments dated October 22, 1997 on the subject project. Below is a point-by-point response.

1. ***Orientation Maps.*** Exhibit C, which already contains maps of existing or proposed drywells in the area surrounding the well, has been revised to include those features from your list that are present and relevant. This map has been incorporated into the Final EA. For your information, there are no streams or known wetlands within many miles of the project area. There will be no effect on such. The area surrounding the well is mostly undeveloped land belonging to the State of Hawaii. No formal wellhead protection area is required or in place for the well. In any case, there are no drywells or landfills, hazardous waste sites, or injection wells within the 1,320-foot radius regulated by the Hawaii State Department of Health's (DOH) Safe Drinking Water Branch. Two individual wastewater systems pre-dating the Keonepoko Nui wells are presently approximately 800 feet from the well; under DOH rules, new individual wastewater systems would be prohibited or severely restricted within a 1,000 foot radius of the well.

2. ***Aquifer or Hydrologic Unit Status.*** The current water use and pumping capacity for the wells are as follows:

Well Name and No.	Pumping Capacity (gpm)	Current Use (mgd)
Pahoa 2a (2986-01)[1]	250	0.111
Pahoa 2b (2986-02)[1]	350	0.164
Hawn Shores (3185-01)[2]	250	0.090
Hawn Shores (3185-02)[3]	488	0.691
Keonepoko Nui (3188-01)[1]	700	0.173
Total	2038	1.229

Sources: Pumping capacity from Hawaii State Commission on Water Resources (CWRM) Well Registry and discussions with Hawaiian Beaches and Miller and Lieb personnel. Current use from average monthly CWRM pumpage reports which vary from month to month.

[1] Hawaii County Department of Water Supply
[2] Private System of Hawaiian Beaches
[3] Private system of Hawaiian Shores

It is important to note that the Pahoa Aquifer system is the island's largest, with an estimated groundwater recharge of 994 million gallons per day (mgd) and a sustainable yield of at least 435 mgd. Current pumping from this aquifer is far less than 2.0 mgd. or 0.5 percent of the sustainable yield. Pumping tests and other hydrological data indicate that impacts to nearby well sites or the Pahoa Aquifer in general from pumpage in the Keonepoko Nui 2 Well will be very negligible. A discussion of this context has been added to the Final EA.

3. ***Contamination Analysis.*** As expected in an area with little history of agricultural or industrial use, the sampled levels of all contaminants for which state standards exist are well below such standards. The water is of excellent quality.

a/pat/gill

The only hazardous material of concern is chlorine, which is used for water treatment. According to the Hawaii County Department of Water Supply, cylinders of chlorine are delivered by truck to the site on an as-needed basis, which is at least several times per year. Chlorine is injected into the water system as the water is drawn up from the well. All treatment is conducted according to strictly regulated standards. DWS personnel dealing with chlorine are trained to be Hazard One responders and are equipped with all necessary safety material, including self-contained breathing apparatus. In case of a spill or release incident, the responders call in the hazardous material response team of the Hawaii County Fire Department. The DWS is in compliance with all applicable laws and regulations related to chlorine and has an excellent record of safety and preparedness.

This information has been added to the EA.

4. ***Hydrologic Impact Analysis.*** As stated above, there are no mapped or known streams or wetlands within many miles of the project area. The geology of the area consists of highly permeable basalts of recent origin. Depth to groundwater is almost 600 feet, and no effects on any surface hydrology would occur. Please see our response to Comment No. 2.5 "Watershed and Land Use Analysis." We have responded to this comment by adding sections to the EA dealing with Consistency with Government Plans and Policies and Social Environment.

   To summarize these sections briefly, it can be stated that the only major landowner in the area is the State of Hawaii, and particularly the Department of Hawaiian Home Lands. The impact to this landowner will be to allow the Department to provide potable water to the beneficiaries who are settling the farm lots in their Makuu Subdivision. Apart from this, as there will be no effects on other wells or the availability of water service, there will be no other impacts, beneficial or adverse, upon other small or large landowners in the immediate or extended area, apart from those benefits accruing to all system users as a result of increased system reliability.

a/pat/gill

The project takes place on TMK 1-5-08:01, owned by the Department of Land and Natural Resources, State of Hawaii which is on ceded land. The Makuu Subdivision is owned by the Department of Hawaiian Home Lands and this is also on ceded lands.

5. *Alternative Analysis.* In terms of the alternatives listed in your letter, no wastewater is available for reuse; there are no sources of non-potable water in the area. Although the existing potable water supply is sufficient to meet current demand, including that of DHHL Makuu development, a backup well is necessary for system redundancy and future system demand. Rainfall catchment is widely used in Puna and does provide a system of last resort for drinking water. There are many drawbacks to catchment, including high maintenance costs. If not maintained properly, such systems are susceptible to microbiological and chemical contamination. Sources of these contaminants vary from dead animals in the storage tank, to roof and gutter materials, to air particulates causing acid rain.

The State Department of Health (DOH) recommends using catchment water for non-consumptive needs and obtaining drinking or cooking water from regulated public water systems and/or purchased bottled drinking water. In the interest of public health, a long-term goal of the County of Hawaii is to provide central, municipal water systems for subdivisions currently served by catchment. There is no evidence that excessive water consumption occurs in the project area. Although extreme conservation requirements might lower consumption, the potential inconvenience and adverse economic effects that would be brought about by such measures are not justified by the minor and sustainable use of the abundant groundwater resource in Puna.

In addition, none of these alternatives meet the component of the project's purpose and need calling for providing a back-up well at Keonepoko Nui. The discussion of alternatives in the EA has been expanded to include the discussion above.

a/pat/gill

6. ***Determination.*** The discussion of findings and reasons supporting the FONSI determination has been revised for the Final EA.

Again, thank you very much for your careful review of the document. If you have any questions on the above, you may contact my office at 586-3800 or Gerald Lee, our Design & Construction Branch Chief at 586-3818.

Aloha,

Kali Watson

KALI WATSON, Chairman
Hawaiian Homes Commission

a/pat/gill

OEQC

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813-5249
PHONE (808) 594-1888
FAX (808) 594-1865

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OFC. OF
QUALITY CONTROL

September 30, 1997

Mr. Gerald Lee
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, HI 96805

Subject: Draft Environmental Assessment (DEA) for Keonepoko-Nui 2 Production Well & Supporting Facilities at Pahoa, Puna, Island of Hawaii.

Dear Mr. Lee:

Thank you for the opportunity to review the Draft Environmental Assessment (DEA) for Keonepoko-Nui 2 Production Well & Supporting Facilities at Pahoa, Puna, Island of Hawaii. The Department of Hawaiian Home Lands proposes to construct a production well and supporting facilities as a means to provide a source of drinking water to its Makuu Farm and agricultural lots.

The Office of Hawaiian Affairs (OHA) has no objections at this time to the proposed well development. The production well apparently bears no adverse impacts on adjacent lands nor upon existing flora or fauna and no known archaeological remains exist in the area. Furthermore, the well facilities will neither significantly affect nearby scenic resources nor air quality. Moreover, water pumping will not significantly impact the sustainable yield of the Pahoa aquifer system.

Please contact Lynn Lee, Acting Officer of the Land and Natural Resources Division, or Luis A. Manrique, should you have any questions on this matter.

Sincerely yours,

Randall Ogata
Administrator

Lynn Lee
Acting Officer,
Land and Natural
Resources Division

LM:lm
cc Trustee Clayton Hee, Board Chair
Trustee Abraham Aiona, Board Vice-Chair
Trustee Rowena Akana, Land & Sovereignty Chair
Trustee Haunani Apoliona
Trustee Frenchy DeSoto
Trustee Moses Keale
Trustee Colette Machado
Trustee Hannah Springer
CAC, Island of Hawaii