

A Regulatory Guide to Geothermal Direct Use Development
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HAWAII

Introduction

Geothermal resource temperatures range from low temperatures of 50 to 80 degrees F (10 to 27 °C), to temperatures exceeding 650 degrees F (343°C). Although power can be generated economically from resources as low as 218 degrees F (103° C), power generation projects typically favor resource temperatures above 300 degrees F (149° C). High temperature resources (>300 degrees F, 149° C) can also be used for direct-use applications. However, lower temperature resources (< 212° F, 100° C) are often better suited for these projects.

Low temperature, direct-use projects cover a variety of applications. Projects may include traditional space heating applications, as well as greenhouse heating, spas and swimming pools, aquaculture, crop drying, industrial processing and other activities requiring lower temperatures. Because these projects are primarily water use applications, they often fall under a different regulatory process than high temperature, power generation projects. Typically this process is shaped by water and wastewater laws and regulations, and administered by their respective state, and in some cases, federal water and wastewater resource agencies.

The intent of this document is to help guide developers of direct use geothermal projects through the regulatory process of drilling, using and disposing of low temperature geothermal fluids in Hawaii. This guide will provide background on the state regulatory process and identify contact information necessary for completing the various applications and permits. This guide; however, cannot substitute for direct communication with the regulatory agencies. These agencies need to be contacted early in the process so that any regulatory hurdles are identified upfront and in time. Projects that are located on federal lands are regulated according to the national Geothermal Steam Act and related federal regulations.

Regulatory Process for Direct Use Applications

HRS 182, Reservation and Disposition of Government Mineral Rights presents the statutory basis for regulating geothermal development in Hawaii. *HRS 182* can be viewed at http://www.capitol.hawaii.gov/hrscurrent/Vol03_Ch0121-0200D/HRS0182/HRS_0182-.htm. The corresponding administrative rules to *HRS 182*, is *Title 13, Subtitle 7, Chapter 183, Rules for Leasing and Drilling of Geothermal Resources*. These rules are administered by BLNR and can be found at <http://www.hawaii.gov/dlnr/land/rules/CHAP183.pdf>.

A “geothermal resource” is defined under *HRS 182-1* as “...*the natural heat of the earth, the energy, in whatever form, below the surface of the earth present in, resulting from, or created by, or which may be extracted from, such natural heat, and all minerals in solution or other products obtained from naturally heated fluids, brines, associated gases, and steam, in whatever form, found below the surface of the earth, but excluding oil, hydrocarbon gas, other hydrocarbon substances, and any water, mineral in solution, or other product obtained from naturally heated fluids, brines, associated gases, and steam, in whatever form, found below the surface of the earth, having a temperature of 150 degrees Fahrenheit or less, and not used for electrical power generation.*” .

The State of Hawaii also passed *Act 296 (SLH 1983)*, as amended by *Act 151 (SLH 1984)*, which provides for the designation of Geothermal Resource Subzones within which geothermal development activities are allowed in the State of Hawaii. The Board of Land and Natural Resources (BLNR) is responsible for designating and administering these subzones. *Chapter 205-5.1 of the Hawaii Revised Statutes (HRS)* provides that the BLNR may designate Geothermal Resource Subzones in any of the four land-use districts of the State—urban, rural, agricultural, or conservation. Geothermal development activities are defined as the “...exploration, development, or production of electrical energy from geothermal resources and direct use applications of geothermal resources.” *HRS 205-5.1* further declares that direct use applications are permitted both within and outside of Geothermal Resource Subzones provided that they are located within urban, rural and agricultural districts and are in conformance with all other applicable state and county land use regulations. The complete statute can be viewed by at http://www.capitol.hawaii.gov/hrscurrent/Vol04_Ch0201-0257/HRS0205/HRS_0205-0005_0001.htm.

In Hawaii, the definition for geothermal resources specifically excludes natural warm ground waters below 150° F (65.6° C) as a geothermal resource. Instead, low temperature geothermal water applications, (including but not limited to greenhouse heating, warm water aquaculture, space heating, irrigation, swimming pools and hot spring baths), follow the same regulatory path as conventional water projects. This process involves obtaining the necessary water rights and well construction permits. In addition, direct use projects must also dispose of the “water” once it has been used for its design application. Disposal is accomplished either through returning the water back into the ground by way of an injection well, or through surface disposal if injection is not an option.

The Commission on Water Resource Management (Commission) is the lead agency in charge of administering the various rules and regulations governing water appropriations and use in Hawaii. The Commission is responsible for issuing water rights and well construction permits but does not have authority over fluid disposal. The Hawaii State Department of Health – Clean Water Branch and Safe Drinking Water Branch are the lead state agencies that manage geothermal fluid disposal activities, including underground injection.

Beyond state rules governing low temperature water resources, project developers must also secure ownership or lease rights to a proposed geothermal development site. For access to state lands, the Department of Land and Natural Resources-Lands Division covers state land leases in Hawaii. In addition, developers also need to contact local and county agencies to ensure compliance with local land use laws including building permits and zoning restrictions.

The regulatory process for developing a low temperature, direct use geothermal project consists of the following steps:

- Gain access to lands either through lease or direct ownership.
- Contact local and/or county agencies to ensure compliance with local land use laws including building permits and zoning restrictions.
- Obtain water right. (*Commission on Water Resources Management*)
- Permit/construct production well. (*Commission on Water Resources Management*)
- Determine fluid disposal option and obtain permits for either injection or surface disposal. (*State Department of Health*)

A developer may also want to contact the Department of Health- Office of Environmental Quality to determine if an environmental impact statement (EIS) is required. Generally, direct use projects will not trigger an environmental assessment process. However, projects located within certain areas such as shorelines, or conservation lands may require an EIS. A guidebook on the environmental review process for the State of Hawaii can be viewed at <http://www.hawaii.gov/health/oeqc/publications/guidebook.pdf>.

Water Rights

Background:

In 1978, the State of Hawaii's Constitutional Convention identified the State's "obligation to protect, control and regulate the use of Hawaii's water resources for the benefit of its people." Under *Article XI, Section 7*, of the State Constitution, "*The legislature shall provide for a water resources agency which, as provided by law, shall set overall water conservation, quality and use policies; define beneficial and reasonable uses; protect ground and surface water resources, watersheds and natural stream environments; establish criteria for water use priorities while assuring appurtenant rights and existing correlative and riparian uses and establish procedures for regulating all uses of Hawaii's water resources.*"

As a result, the Commission on Water Resource Management was established in 1987 as part of the Department of Land and Natural Resource. A state water code was also passed at this time which set forth the regulations governing water use in the State of Hawaii. The State Water Code is codified in *Chapter 174C* of the Hawaii Revised Statutes (HRS) and can be downloaded at <http://www.hawaii.gov/dlnr/cwrm/code.htm>.

Chapters 13-167 to 13-171 of the Hawaii Administrative Rules specify how the Code is to be administered. HAR 13.167-171 can be viewed at <http://www.hawaii.gov/dlnr/cwrn/har.htm>.

Accordingly, the waters of Hawaii collectively belong to the public and cannot be owned by any one individual or group. Instead, individuals or groups may be granted rights to use them. A water right is a legal authorization to use a predefined quantity of public water for a designated purpose. This purpose must qualify as a *beneficial use*. Beneficial use involves the application of a reasonable quantity of water to a non-wasteful use, such as irrigation, domestic water supply, or power generation, to name a few.

The State of Hawaii law requires users of public waters to receive approval from the state prior to use of the water - in the form of a water right permit or certificate. Any use of surface water (lakes, ponds, rivers, streams, or springs) requires a water-right permit or certificate. Likewise, ground-water withdrawals require a water-right permit or certificate.

Water Right Permit Process

A geothermal direct use project will need to acquire a water right permit unless it is located outside of a Water Management Area (WMA) or the withdrawal is solely for domestic consumption. Water right permits are issued by the Commission on Water Resource Management (Commission), only if the proposed use meets the following requirements:

- Can be accommodated with available water source;
- Is a reasonable-beneficial use as defined in section 174 C-3;
- Will not interfere with any existing legal use of water;
- Is consistent with the public interest;
- Is consistent with state and county general plans and land-use plans, policies and designations; and,
- Will not interfere with the rights of the department of Hawaiian Home Lands as provided in section 221 of the Hawaiian Homes Commission Act.

The process for obtaining a permit involves a series of steps and is outlined in the attached diagram which can be downloaded at <http://www.hawaii.gov/dlnr/cwrn/diagrams.htm>. Depending on the complexity of water use and availability, obtaining a water permit may take from 90 days, up to 180 days if a public hearing is required. Early consultation with the Commission should provide the applicant with a better understanding of the time required and any outstanding issues that may complicate the process. The following steps outline the permit process:

1. Prepare and submit an application and a \$25 filing fee to the Commission. The applicant is required to provide information on the proposed use, amount, location,

- ownership and any other relevant information. A copy of the form with instructions is available on-line at <http://www.hawaii.gov/dlnr/cwrn/forms.htm>.
2. Upon receipt of the application, the Commission determines if an EIS is required. If an EIS is necessary, the applicant must complete this action before the permit process moves forward. A guidebook explaining the environmental review process can be downloaded at <http://www.hawaii.gov/health/oeqc/publications/guidebook.pdf>.
 3. Next, the Commission publishes a legal notice in a local newspaper for a period of two weeks describing the project. In addition, the Commission will send a notice to any interested parties requesting notification of any pending applications and to the mayor and water board of the affected county. These parties have 10 working days to submit written objections to the Commission. For projects that have competing water permit applications or there are existing uses, a public hearing process is required.
 4. The Commission evaluates the application for completeness (and considers any additional input or objections) and determines whether the application meets the conditions set forth in section *HRS 174C-49(a)* (as described above).
 5. Depending on the evaluation process, the Commission will either reject the application outright or will issue an interim water use permit or a final water use permit. At this time, the Commission can also set permit conditions such as metering devices.

Well Construction

The Department of Land and Natural Resources- Commission on Water Resource Management oversees well construction activities in the state as directed by *HRS 174C-81:87*. These statutes can be viewed at <http://www.hawaii.gov/dlnr/cwrn/code.htm>. The Hawaii Well Construction and Pump Installation Standards were amended to the Hawaii Administrative Rules in January 1997, and have subsequently been revised in February 2004. In accordance with the State Water Code, and as stated in *HAR 13-168-14*, the goal of the standards are to "*ensure the safe and sanitary maintenance and operation of wells, the prevention of waste, and the prevention of contamination of ground water aquifers.*"

Before starting well construction, the developer of a geothermal project may want to review data from other wells in the area. County planning and or health departments should also be contacted at this time to check for any additional county regulations or ordinances covering well placement and construction.

The Commission maintains a Well Index Database to track specific information pertaining to the construction and installation of production wells in Hawaii. Formerly, this information was provided in a compressed table format via the Internet. Due to the heightened security concerns of information provided via the Internet and the potential misuse of information by terrorist organizations, the Commission has removed the Well Database from this website. In order to get hardcopy information on existing maps,

database, or file documents concerning wells in Hawaii, a developer must complete a Well Information Release Request Form. A copy of the form can be downloaded at <http://www.hawaii.gov/dlnr/cwrn/data/database.htm>.

The regulatory process for constructing an open loop, low temperature geothermal well is the same as for a conventional water well. A diagram of the permitting process can be viewed at <http://www.hawaii.gov/dlnr/cwrn/diagrams.htm>. The permit process is currently being updated so there may be some future changes to the process.

To begin well construction, a developer must submit an application to the Commission for a permit for well construction. A well construction permit application form can be downloaded at <http://www.hawaii.gov/dlnr/cwrn/forms.htm>. An applicant must submit information on ownership, location, water use, well depth, size and capacity, as well as construction method and type of pumping equipment. An applicant must also have an existing water use permit before obtaining a well construction permit. The cost of filing a permit is \$25. The Commission review and approval process for the permit should be completed within 90 days of submittal.

A well construction permit is issued if all of the information provided by the applicant complies with all applicable law, rules and standards. For guidance, a copy of Hawaii Well Construction and Pump Installations Standards can be downloaded at <http://www.hawaii.gov/dlnr/cwrn/rules/wellstnd.pdf>. It should be noted that geothermal wells are not governed by these standards. Geothermal wells (resource temperatures above 150 degrees F) must meet the permit requirements described under *Title 13, Chapter 183, "Rules on Leasing and Drilling of Geothermal Resources"*.

Once issued, the permit must be displayed at the site of the well at all times during construction. A pump test recording drawdown, pumping rate, temperature and other relevant data is also required by the permit. When construction is complete, the applicant must submit a well completion report. A well completion report form can be downloaded at <http://www.hawaii.gov/dlnr/cwrn/forms.htm>.

Only a duly licensed and bonded well contractor is permitted to construct wells in the state of Hawaii. The C-57 license is issued by the Department of Commerce and Consumer Affairs, Division of Professional and Vocational Licensing. Their webpage can be accessed at <http://www.hawaii.gov/dcca/pvl/>.

Disposal of Geothermal Fluids

The regulations governing the disposal of low temperature geothermal fluids will depend on the type of application. Non contact geothermal projects, where the geothermal fluids are kept in a closed system and do not come in contact with outside contaminants, will typically have an easier compliance path than projects where contact with potential contaminants is made. When contact is made and water quality is potentially degraded, regulatory requirements may become more stringent to ensure that water quality is maintained.

There are basically three disposal options available to a developer of a direct use geothermal project: underground injection; disposal to surface waters; and/or, disposal to the ground or land application. In some cases, the regulatory agency(s) will specify the preferred disposal method. For example, in critical groundwater areas, reinjection may be required to ensure that the aquifer is maintained. However, it will be up to the project developer to determine the best disposal method based on regulatory requirements and the cost of compliance. For most cases, reinjection will be the preferred method of disposal.

Whatever disposal method is selected, a developer needs to work closely with the Hawaii Department of Health. Early consultation with the Department will help decide the scope and direction of the disposal plan, and will help the developer understand the time and resources necessary to complete the process.

Underground Injection Control

From a resource perspective, the preferred method of disposing of geothermal fluids is to return them to the ground by way of injection wells. Injection wells are wells that are used as an entry point for fluids, including geothermal fluid, which is put underground for temporary or permanent disposal or storage.

The Underground Injection Control (UIC) Program was established in 1982 when the U.S. Congress passed the Safe Drinking Water Act. This program regulates, to one degree or the other, every "injection" of "fluid" into the subsurface. An "injection" is the emplacement of "fluids" regardless of whether the injection requires the application of pressure or not, and a fluid is defined as any liquid, gas or semisolid which can be made to flow. The intent of the program is to preserve and protect underground water from becoming polluted.

In Hawaii, the Underground Injection Control Program is administered by the Safe Drinking Water Branch (SDWB) of the Department of Health. The mission of the Safe Drinking Water Branch is to safeguard public health by protecting Hawaii's drinking water sources (surface water and groundwater) from contamination and assure that owners and operators of public water systems provide safe drinking water to the

community. The Underground Injection Control and Ground Water Protection Section is responsible for managing the UIC program within SDWB. Their duties include:

- To protect the quality of Hawaii's underground sources of drinking water from chemical, physical, radioactive, and biological contamination that could originate from injection well activity.
- Process permits and project reviews for new and renewal permits, modifications, and abandonment of injection wells.
- Evaluate geologic logs of soil and rock, injectivity tests, geologic maps, and groundwater quality profiles to determine the viability of subsurface injection.
- Maintain inventory and database of all injection well files.
- Organize and conduct site inspections to verify the location and performance of injection wells and to verify compliance with all testing or well closure plans.
- Conduct site investigations to identify problems such as unpermitted facilities and correction of deficiencies.
- Enforce Underground Injection Control rules and permit conditions.

The rules and regulations governing the UIC program are codified in *HRS 340E and HAR 11.23, Underground Injection Control*. The Safe Drinking Water statutes can be viewed at http://www.capitol.hawaii.gov/hrscurrent/Vol06_Ch0321-0344/HRS0340E/. The specific UIC administrative rules can be downloaded at <http://www.hawaii.gov/health/about/rules/11-23.html>.

Injection wells associated with geothermal projects are defined as Class V wells. For the most part, low temperature, direct use geothermal applications are further defined as Class V, subclass B injection wells. This subclass includes air conditioning and cooling water return flows, as well as most applications associated with aquaculture. A separate category, Class V, subclass E, covers injection wells associated with higher temperature geothermal resource projects.

Before construction, all new Class V wells must receive a UIC permit issued by the Department of Health. In addition, all injection wells must be operated in compliance with *HAR 11*, and chapters *342-B*, *342-D*, *342-F*, *342-H*, *342-J*, *342-L*, and *342-N*, *HRS*. Copies of the permit application can be found at <http://www.hawaii.gov/health/environmental/water/sdwb/uic/uicprogrm.html>.

The application includes information needed to satisfy the requirements of *HAR 11.23* (http://www.hawaii.gov/health/about/rules/11-23.html#sec_12). Each application must include location, ownership and operator information. Other information requirements include the nature and source of injected fluids, well capacity(s) and volume of fluids, and number and type of injection wells including construction details, testing procedures and system operations. A full list of applicant requirements can be found on the application form or in section *HAR 11.23.13*.

The UIC application must be prepared and signed by a licensed professional engineer or a geologist. All submittals must also include a filing fee of \$100. Upon receipt of the application, the department will issue a public notice which will be circulated within the impacted area. This process is similar to the procedure outlined above for obtaining a water use permit. The public comment period is open for 30 days, during which time a public hearing on the application can be requested. When public notice is required, as provided in *HAR 11.23.14*, the applicant must pay all fees assessed for publishing legal notice or notices. If a public hearing is required, as provided in section *11.23.15*, the applicant shall pay all fees assessed for publishing legal notice or notices.

A UIC permit will be issued to the applicant once the department is satisfied that all permit conditions are met and the public comment period is complete. The UIC permit is issued for a period not to exceed 5 years. At that time, the operator must resubmit their application for an injection permit.

Surface Disposal of Geothermal Fluids

Surface disposal of low-temperature geothermal water is generally covered under either an NPDES (National Pollution Discharge Elimination System) or WPCF (Water Pollution Control Facility) permit. The NPDES permit typically addresses a “point source” type discharge directly to a surface body of water (river, creek, lake, etc.); whereas, the WPCF addresses discharge to the ground (or groundwater). In general, surface disposal to ground (wastewater treatment facility) is preferable to discharging into surface waters. Discharging to ground minimizes the chance of degrading existing

water quality. Discharging to ground should also keep the water within the same geographic resource area.

National Pollution Discharge Elimination System (NPDES)

Discharge of low temperature fluids to surface waters would require an NPDES permit. The NPDES Individual Permit is regulated under *Hawaii Administrative Rules, Chapter 11.55, Water Pollution Control*, effective November 7, 2002. The National Pollutant Discharge Elimination System (NPDES) General Permit Coverage is regulated primarily under Sections *11.55.34 to 34.12* and Appendices of *HAR 11.55, Water Pollution Control*. These rules can be viewed at <http://www.hawaii.gov/health/about/rules/11-55.pdf>.

The NPDES permit is administered by the Clean Water Branch of the Department of Health and is renewed at five year intervals. Permits are issued under a general permit which includes a large group of similar operators, or for individual projects, which address large or unique discharges by a single operator. The potential to be included under a general permit is typically advantageous since both the level of paperwork and the fees are much less burdensome than for an individual permit. A general permit covers a set of like facilities, such as a coal facility or a fish farm. Here, a set of conditions are already developed which meet the general operating conditions of these similar facilities. If eligible for a general permit, a developer would need to submit a Notice of Intent form or equivalent, which provides additional information needed by the resources agency administering the NPDES program. The advantage of the general form is that the resource agency can issue the permit as soon as all information needs are satisfied. For individual permits, there is an additional 30 day public notice process, as well as the potential for intervention on the terms and conditions of the permit.

At this point, Hawaii does not have a general NPDES permit covering low temperature geothermal projects. However, there is a general permit covering projects that operate using once through cooling water of less than one (1) million gallons per day. Some direct use projects may qualify under this definition. To apply, a developer would complete a Notice of Intent Form E. A filing fee of \$500 is required. The notice of intent form can be downloaded at <http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html>.

For projects that are unable to file under a general permit, project developers would need to complete an application for an individual permit. The most likely permit forms covering a direct use application are EPA NPDES forms 1 and 2D or 2E. Form 1 collects general information from the applicant and must be filled out in addition to a supplemental form. Form 2D covers process wastewater discharge. Because many direct use geothermal applications involve non-contact heat exchange, a developer may consider using Form 2E. This form was designed by the US Environmental Protection Agency to cover projects which do not discharge process wastewater. The applicant will need to consult with the Department of Health to determine the appropriate form for use. NPDES forms for individual permits can be downloaded at

<http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html>.

Along with these forms, an applicant will also need to complete a Clean Water Branch-NPDES Signatory and Certification Statement. The Statement can be downloaded at the above noted URL. A filing fee of \$1000 must also be submitted at this time.

An NPDES applicant will need to provide mapping information, flow data, an estimate of the type and quantities of pollutants discharged and a brief description of any planned treatment. This information will be used to determine the conditions of the permit including appropriate control or treatment strategies, monitoring and reporting requirements. Since most direct use applications involve non-contact geothermal heat exchange, the water quality of the source water will be unaffected. For these type of projects, permit conditions should be strait-forward. Even so, a developer may still be required to cool the geothermal water before discharging into a surface water source.

Waste Water Discharge

The Wastewater Branch of the Department of Health is responsible for the review and approval of planning/environmental documents, wastewater project plans and specifications, final construction inspections of wastewater projects, and for regulating wastewater systems in accordance with Administrative Rule, Chapter 11-62, entitled, "Wastewater Systems. These rules can be viewed at <http://www.hawaii.gov/health/about/rules/11-62.pdf>.

At this time, there is no general permit in place covering low temperature geothermal applications. As a result, a project developer would need to work directly with the Wastewater Branch to determine project design, water quality standards and operator conditions. Contact information for the Hawaii Department of Health Wastewater Branch is presented in Appendix A.

Aquaculture

The Hawaii Department of Agriculture's Agricultural Development Program (ADP) oversees aquaculture activities in the state of Hawaii. The ADP provides a wide range of support for Hawaii's aquaculture industry including planning and coordination, business counseling, marketing, and research and development. The ADP maintains an informative webpage with specific links to various activities and contacts. The webpage can be accessed at <http://www.hawaii.aquaculture.org/>.

Appendix A

Hawaii State Contacts

Geothermal

Department of Land and Natural Resources
Land Division
Alyson Yim
1151 Punchbowl Street, Room 220
Honolulu, Hawai`i 96813
Phone: (808) 587-0259 and fax: (808) 587-0283
Email: Alyson.K.Yim@hawaii.gov

Water Resources Program Contacts

Commission on Water Resource Management
1151 Punchbowl Street, Room 227
Honolulu, Hawai`i 96813
Phone: 808/587-0214 and Fax: 808/587-0219
Email: dlnr.cwrp@hawaii.gov
Internet: www.hawaii.gov/dlnr/cwrp

Water Quality Program Contacts

Underground Injection Control Program

Safe Drinking Water Branch
Environmental Management Division
Hawaii State Department of Health
919 Ala Moana Blvd., Room 308
Honolulu, HI 96814-4920
Phone: (808) 586-4258
Fax: (808) 586-4351
Internet: <http://www.hawaii.gov/health/environmental/water/sdwb>

National Pollution Discharge Elimination System (NPDES)

Clean Water Branch
Environmental Management Division
Hawaii State Department of Health

PO Box 3378
Honolulu, HI 96801-3378
Phone: 808/586-4309 and Fax: 808/596-4352

Internet:

<http://www.hawaii.gov/health/environmental/water/cleanwater/water/cleanwater/index.html>.

Wastewater Permits

Wastewater Branch
Environmental Management Division
Hawaii State Department of Health
919 Ala Moana Blvd., Room 309
Honolulu, HI 96814-4920
Phone: 808/586-4294 and Fax: 808/586-4300
Internet: <http://www.hawaii.gov/health/environmental/water/wastewater/index.html>.

Aquaculture

Department of Agriculture
Aquaculture Development Program
1177 Alakea Street #400
Honolulu, Hawaii 96813
Phone: (808) 587-0030
Fax: (808) 587-0033
E-mail: info@hawaiiaquaculture.org
Internet: <http://www.hawaiiaquaculture.org/>.

Appendix B

Geothermal References and Contacts

References

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Rafferty, Kevin, 2001, Small Geothermal Systems: A Guide For The Do-It Yourselfer: Geo-Heat Center, Oregon Institute of Technology, Contract No. FG01-99-EE35098, pp. 1-30.

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Boyd, Tanya, Rafferty, Kevin, **date**, Aquaculture Information Package: Geo-Heat Center, Oregon Institute of Technology, Contract No. DE-FG07-90ID 13040, pp. 1-60.

Rafferty, Kevin, Boyd, Tonya, **date**, Geothermal Greenhouse Information Package: Geo-Heat Center, Oregon Institute of Technology, Contract No. DE-FG07-90ID 13040, pp.1-80.

Contacts

Geothermal Resources in Hawaii

Website: http://www.hawaii.gov/dbedt/ert/geo_hi.html#anchor367806.

Geo-Heat Center

Website: www.oit.edu/-geoheat

Geothermal Education Office

Website: www.geothermal.marin.org

Geothermal Resources Council

Website: www.geothermal.org

Geothermal Heat Pump Consortium

Website: www.geoexchange.org

International Ground-Source Heat Pump Association

Website: www.igshpa.okstate.edu

U.S. Department of Energy

Website: www.eren.doe.gov/geothermal

Washington State University Energy Program

Website: <http://www.energy.wsu.edu/projects/renewables/geothermal.cfm>