



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
**COMMISSION ON WATER RESOURCE MANAGEMENT**  
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STAFF SUBMITTAL

for the meeting of the  
COMMISSION ON WATER RESOURCE MANAGEMENT

February 18, 2004  
Honolulu, Hawaii

Revisions to the  
Hawaii Well Construction and Pump Installation Standards

SUMMARY

The Water Code (§174C-86 HRS) mandates that the Commission shall adopt minimum standards for the construction of wells and the installation of pumps and pumping equipment. The first edition of the Hawaii Well Construction and Pump Installation Standards (Standards) was adopted in 1997. Since then, the Commission staff has been compiling suggestions for revisions based on our experience in working with the Standards and suggestions from drillers, consultants and well owners. In 2003, staff began revising the standards. Since August 2003, when staff distributed a revised draft (attachment A, Proposed revised Standards) for public review, the goal has been to maximize participation from the interested public. Staff's goal in this revision has been to streamline the Standards. Some of the other major goals in the revision efforts are:

- Delegate the authority to the Chairperson to approve variances from the Standards for technical matters
- Maximize resource protection
- Address the suggestions of drillers, well owners and CWRM staff (Attachment B, Summary of written and verbal comments)
- Allow drillers, consultants and well owners more latitude in designing wells and well pumps
- Remove references to regulatory procedures that are already addressed in administrative or declaratory rules

BACKGROUND:

January 23, 1997: The Commission adopted the Hawaii Well Construction and Pump Installation Standards. The adoption of the Standards facilitated the efficient processing of applications by delegating approval of well construction and pump installation permit application approvals from

Approved by Commission on  
Water Resource Management  
at the meeting held on

FEB 18 2004

Item G2

the Commission to the Chairperson. Prior to adoption of the Standards, the Commission voted to approve or disapprove each application. This typically required over 100 submittals for action per year.

1997 to 1999: The Commission staff accumulated a list of potential changes to the Standards to address the concerns of the regulated community and to lessen the number of requests for variances because of overly stringent standards.

March 19, 1999: The Commission staff attempted to bring a new version of the Standards to the Commission for adoption but the submittal was deferred because of questions on the rule-making process. Staff continued to add to the list of improvements and additions to the Standards.

April 2003: Staff received a verbal opinion from the Attorney General that HAR §13-168-14 (c) provides for the revision of the Standards without the need for rule-making.

May 2003: Staff began to revise the January 1997 edition of the Standards.

July 31, 2003: Staff informed the Waimea Round Table on the Island of Hawaii about the proposed revisions to the Standards and that a draft would be available soon for review and comments.

August 27, 2003: The first draft of the Standards was distributed with a request for review and comments (Attachment C, Public participation and notification). Emails were sent to interested parties.

August 27, 2003: Staff posts a webpage with information about the revision to the Standards (Attachment D, Hawaii Well Construction and Pump Installation Standards webpage).

September 15, 2003: Staff conducted a videoconference with conference sites in Hilo, Wailuku, Lihue and Honolulu (attachment E, List of attendees at the 9/15/03 meeting). Notice of the videoconference was emailed to the interested public.

September 17, 2003: Staff reported to the Commission on the proposed revision to Hawaii Well Construction & Pump Installation Standards

September 29, 2003: Staff conducted an Oahu Workshop in the Kalanimoku Building (Attachment F, List of attendees at the 9/29/03 meeting).

September 2003: The Well Standards revisions are featured in September/October edition of *The Water Spot*, a Department of Health water quality publication (Attachment G, *Water Spot* article).

October 21, 2003: Staff sent letters and copies of the revised Standards to the Maui, Hawaii and Kauai county water departments requesting feedback on the Standards (Attachment H, Letters to the county water departments).

October 2003 to December 2003: Comment collection period (Attachment I, Written comments from the Department of Health, Hawaii County Department of Water Supply, Honolulu Board of

Water Supply, Mink and Yuen, Inc., and Wai'eli Drilling; Attachment J, List of organizations and individuals that participated in the review process).

December 2003 to January 2004: Staff prepares a final draft that includes input from drillers, consultants and well owners for submittal to the Commission.

January 16, 2004: Staff emailed the final draft to well drillers, consultants, government agencies, county water departments and other potentially interested parties (Attachment K, Comments on final draft).

## ANALYSIS/ISSUES:

### **I. Procedures for Revising Standards**

The Water Code (§174C-86 HRS) requires that the Commission on Water Resource Management (Commission) adopt minimum standards for the construction of wells and the installation of pumps and pumping equipment. Administrative Rule §13-168-14 states:

#### §13-168-14 Well construction and pump installation standards.

- (a) The minimum standards referenced in this section, shall be such as to ensure the safe and sanitary maintenance and operation of wells, the prevention of waste, and the prevention of contamination of ground water aquifers. The standards for well construction specified in The Hawaii Well Construction and Pump Installation Standards, adopted by the Commission on Water Resource Management, and as may be amended, is hereby incorporated by reference.
- (b) The minimum standards for the installation of pumps and pumping equipment shall also provide for the installation of devices to measure the amount of ground water being withdrawn from the wells. The Hawaii Well Construction and Pump Installation Standards, as may be amended, is hereby incorporated by reference.
- (c) The well construction and pump installation standards referenced in this section shall serve as minimum guidelines and shall be subject to review and modification by the commission.
- (d) If any well construction or pump installation standard is violated and as a consequence ground water is wasted or any well is contaminated, the commission, after giving notice of the defect to the owner of the land on which the well is located, and giving such owner a reasonable time to correct the defect, may itself correct the defect and charge the land owner for the cost of such correction. Such cost constitutes a lien on the land until paid. The lien may be foreclosed in any court of competent jurisdiction, and in such foreclosure suit, the court shall allow the commission reasonable attorney's fees. [Eff. March 21, 1997]  
(Auth: HRS §174C-8) (Imp: HRS §174C-82, 174C-86)

Note that HAR §13-168-14 (c) of this rule allows the Commission to review and modify these minimum standards as necessary. The Attorney General has confirmed that the procedure for revising the Standards is through adoption by the Commission at a regular meeting.

## II. Delegation of Variance Approvals

Under the current rules, the Commission is required to rule on variances from the Standards. Staff recognizes that the Standards do not apply to all cases. The proposed adoption of the revised Standards will facilitate the efficient processing of variance requests by delegating the approval of variances to the Chairperson. There were fifteen requests for variances before the Commission from 2000 to 2003. Delegation of this authority to the Chairperson will result in faster service to the public and reduce staff and Commission time requirements. Also, the reduction of paperwork will increase the latitude for innovation in well construction among drillers and water resource consultants.

Section 1.5 of the Standards deals with exemptions (variances) from unusual conditions. Currently the standards delegate this authority to the Commission. The following paragraphs highlight the changes.

### Current Standards:

#### Section 1.5 Exemptions from Unusual Conditions

Although the Standards presented herein are considered adequate for the prevention of contamination and waste of ground water throughout the State of Hawaii, if the commission finds that compliance with any of the requirements of these Standards is impractical or will not provide adequate protection of ground-water quality because of unusual local conditions or circumstances, a variance may be requested and the commission may waive compliance and prescribe alternative requirements which will prevent contamination and waste of ground water in a manner otherwise equal to these Standards.

### Proposed Standards:

#### Section 1.5 Exemptions from Unusual Conditions

The Standards presented herein are considered adequate for the protection of ground water and the prevention of ground-water waste from improper construction. If the Chairperson finds that compliance with any of the requirements of these Standards is impractical because of unusual conditions or circumstances the Chairperson may waive compliance with that requirement and prescribe alternative requirements. If the Chairperson determines that because of unusual conditions or circumstances these Standards do not provide adequate protection of the aquifer, then the Chairperson may also prescribe alternative or additional requirements.

The Commission has previously approved some delegation of well permits. On February 15, 1989, the Commission authorized the Chairperson to approve well construction permits for monitor, sampling, observation wells and test holes and for the sealing of unused or abandoned wells. On March 16, 1994, the Commission authorized the Chairperson to approve permit applications for the replacement of pumps less than or equal to the existing pump capacity where there are no other disputes or complaints. On January 23, 1997 the Commission authorized the Chairperson to approve well construction and well modification permit applications (under Hawaii Revised Statutes §174C-86). Also, in aquifer systems that are not designated water management areas and where estimated water usage as of the date of application is less than 70% of sustainable yield, the Chairperson was authorized to approve pump installation and pump modification

permits. In January 1997 the Commission also eliminated the requirement for a new or additional permit application for the replacement of pumps less than or equal to the existing pump capacity.

### **III. Summary of Significant Revisions**

- Added a section to safeguard agricultural wells from backflow.
- Added more flexibility in grouting methods. Removed requirement for the 1-¼ inch tremie pipe.
- Added more flexibility in water-level monitoring methodology.
- Added more flexibility to the pump test procedures while still allowing for the collection of valuable water resource data.
- Added more grouting materials – cement, bentonite and other materials upon request.
- Clarified the well disinfection section to make it more useful in the field.
- Deleted text that was already in the water code or the administrative rules.
- Defer elevation surveys for permanent pump capacities less than 70 gpm.
- The driller or pump installer is responsible for applying and complying with the well drilling or pump installation permit.
- Made pump installation more flexible.
- Minimum grouted annular space is 1.5 inches if positive displacement is used.
- Reduced the testing and monitoring requirements for salt-water wells.

### **IV. Promulgation of Standards**

If the Commission adopts these revisions to the Standards:

- The revised Standards will provide a foundation for updating the permitting process. For example, the revised Standards emphasize that the driller or pump installer is responsible for applying for the drilling permit and complying with the conditions of the permit.
- Staff will arrange with the Department of Commerce and Consumer Affairs to have questions from the Standards placed on the licensing examination for new well drilling and pump installation contractors licenses.
- Staff will mail copies of the Standards to drillers, well drilling consultants, and to the county water departments. Also, the Standards will be available on the CWRM webpage and hard copies will be available on request.

RECOMMENDATION:

1. The Commission adopts the proposed February 2004 edition of the **Hawaii Well Construction and Pump Installation Standards**, Attachment A.

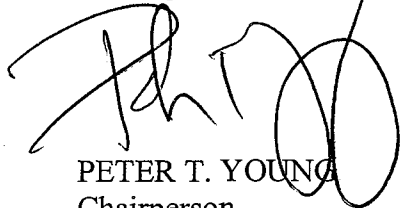
Respectfully submitted,



ERNEST Y.W. LAU  
Deputy Director

- |              |   |
|--------------|---|
| Attachment A | Proposed revised Standards  |
| Attachment B | Summary of written and verbal comments  |
| Attachment C | Public participation and notification   |
| Attachment D | Hawaii Well Construction and Pump Installation Standards webpage  |
| Attachment E | List of attendees at the 9/15/03 meeting  |
| Attachment F | List of attendees at the 9/29/03 meeting  |
| Attachment G | <i>Water Spot</i> article   |
| Attachment H | Letters to the county water departments   |
| Attachment I | Written comments from the Department of Health, Hawaii County<br>Department of Water Supply, Honolulu Board of Water Supply, Mink and<br>Yuen, Inc., and Wai'eli Drilling |
| Attachment J | List of organizations and individuals that participated in the review process   |
| Attachment K | Comments on final draft   |

APPROVED FOR SUBMITTAL:



PETER T. YOUNG  
Chairperson



**Department of Land and Natural Resources**

**COMMISSION ON WATER RESOURCE MANAGEMENT**

**HAWAII**  
**Well Construction**  
**& Pump Installation**  
**STANDARDS**

Honolulu, Hawaii  
Revised February 2004



**Linda Lingle**  
Governor

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1<sup>st</sup> Edition January 1997  
2<sup>nd</sup> Edition February 2004



## **FOREWORD**

About 50 percent of Hawaii's water supply comes from ground-water sources. Ground water, which is also used for agricultural, industrial, and domestic purposes, is the principal source of municipal water supplies in Hawaii. Consequently, protecting the quality and quantity of ground water throughout the State is essential to Hawaii's future well being.

Improperly and inadequately constructed wells can cause pollution or increase the chances of salt-water intrusion to ground-water sources to the point of requiring cessation of use or expensive treatment before use. The Hawaii State Water Code and the Administrative Rules of the Department of Land and Natural Resources require the Commission on Water Resource Management to develop minimum standards for the construction, modification, repair/maintenance, and sealing/abandonment of wells in order to protect the quality and quantity of Hawaii's ground-water resources.

The State Department of Health and county water supply departments also play a critical role in maintaining drinking water sources and protecting ground-water quality. Consequently, these government agencies may have adopted or may adopt in the future more stringent standards for wells than are provided in these statewide minimum standards.

## ACKNOWLEDGMENTS

### 1997 Edition

These standards were prepared after consideration of all comments and suggestions from private parties and public agencies. Private parties included individuals, well drillers, water users, and consultants. Public agencies included county water departments, State Department of Health, and State Department of Land and Natural Resources (Land Division).

Many comments and suggestions were received orally at public hearings and in writing and the Commission on Water Resource Management wishes to thank all for their time and effort during the review process.

### 2004 Edition

Many companies, agencies and individuals provided comments, advice and help in revising these Standards (Table 1). The Commission on Water Resource Management thanks all those who contributed to the review.

Table 1. Participation in the 2003-2004 Review Process

Written Comments	Participation in Public Meetings	Verbal Comments
Department of Health, Safe Drinking Water Branch and Underground Injection Control	Beylik Drilling	Oasis Water Systems, Inc.
Hawaii County Department of Water Supply	Department of Health, Safe Drinking Water Branch and Underground Injection Control	Tracy Runnells Well Service Inc.
Honolulu Board of Water Supply	Department of Land and Natural Resources, Engineering Division	Valley Well Drilling
Mink and Yuen, Inc.	Hawaii County Department of Water Supply	
Wai'eli Drilling	Island Resources, Ltd.	
	James A. Frazier	
	Kauai Department of Water Supply	
	Limtiaco Consulting Group	
	Maui Department of Water Supply	
	Herbert M. Richards, Jr	
	U.S. Geological Survey	
	Wai'eli Drilling	
	Water Resources International, Inc.	

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**Part 1.**

**GENERAL PROVISIONS**

**Part 1.**  
**GENERAL PROVISIONS**

**Section 1.1 Purpose and Scope**

These Standards shall be known as the Hawaii Well Construction and Pump Installation Standards (2004) of the Department of Land and Natural Resources and are referred to hereinafter as the "Standards."

These Standards establish minimum requirements for the purpose of protecting and preventing the pollution, contamination, and wasting of ground water and for the purpose of minimizing saltwater intrusion into wells and ground water in the State of Hawaii in the course of:

- Construction of wells,
- Modification of wells,
- Abandonment and permanent sealing of wells and test borings, and
- Installation and repair of pumps.

These Standards apply to all wells constructed for the purpose of locating, exploring, monitoring, developing, or recharging of ground-water aquifers. These minimum Standards do not preclude other enforcing agencies, state or county, from establishing more stringent standards to meet their objectives. These Standards also do not replace or define the regulatory permitting process.

**Section 1.2 Authority**

Under § 174C-82, Hawaii Revised Statutes, the Commission must develop these Standards. These Standards fulfill § 174C-86 of the State Water Code (Hawaii Revised Statutes) and Hawaii Administrative Rules § 13-168-14, which reads as follows:

§13-168-14 Well construction and pump installation standards. (a) The minimum standards referenced in this section, shall be such as to ensure the safe and sanitary maintenance and operation of wells, the prevention of waste, and the prevention of contamination of ground-water aquifers. The standards for well construction specified in The



Hawaii Well Construction and Pump Installation Standards, adopted by the Commission on Water Resource Management, and as may be amended, is hereby incorporated by reference.

(a) The minimum standards for the installation of pumps and pumping equipment shall also provide for the installation of devices to measure the amount of ground water being withdrawn from the wells. The Hawaii Well Construction and Pump Installation Standards, as may be amended, is hereby incorporated by reference.

(b) The well construction and pump installation standards referenced in this section shall serve as minimum guidelines and shall be subject to review and modification by the Commission.

(c) If any well construction, well abandonment or pump installation standard is violated and as a consequence ground water is wasted or any well is contaminated, the Commission, after giving notice of the defect to the owner of the land on which the well is located, and giving such owner a reasonable time to correct the defect, may itself correct the defect and charge the land owner for the cost of such correction. Such cost constitutes a lien on the land until paid. The lien may be foreclosed in any court of competent jurisdiction, and in such foreclosure suit, the court shall allow the Commission reasonable attorney's fees. [Eff. March 21, 1997 ] (Auth: HRS §174C-8) (Imp: HRS §174C-82, 174C-86)

### **Section 1.3 Standards of Other Agencies**

#### **(a) New Drinking Water Wells**

In addition to the requirements of these minimum Standards, all wells to be used to supply a public water system must meet the requirements of the State Department of Health, Safe Drinking Water Branch, under their rules, Title 11, Chapter 20, entitled "Rules Relating to Potable Water Systems" and as may be amended.

Also, for wells intended for municipal use, please be aware of the well construction standards in "Water System Standards, State of Hawaii", 2002 as amended and the American Water Works Association (AWWA) Standards for Water Wells, ANSI/AWWA A100-97, as amended.

**(b) Injection (Drainage) Wells**

Injection wells are not governed by these Standards. The location, abandonment, construction, and operation of injection wells must meet the permit requirements of the State Department of Health, Safe Drinking Water Branch under their rules, Chapter 11-23, "Underground Injection Control," as amended. The Commission does not require a permit for the construction and operation of injection wells.

**(c) Geothermal Wells**

Geothermal wells are not governed by these Standards. Geothermal wells must meet the permit requirements of the Department of Land and Natural Resources, Engineering Division under their rules, Title 13, Chapter 183, "Rules on Leasing and Drilling of Geothermal Resources," as amended. The Commission does not require a permit for geothermal wells.

**(d) Test Borings**

The Commission does not require a permit for temporary test borings and test boring sealings. However, test borings related to underground storage tanks and environmental monitoring or remediation must meet the requirements of the State Department of Health. Permanent test borings for long-term monitoring of water levels and/or chlorides are considered monitoring wells, which require a well construction permit from the Commission.

**Section 1.4 Definitions**

The following definitions shall apply in the interpretation of these Standards:

"Abandoned well" means any well whose use has been permanently discontinued. Any well shall be deemed abandoned which has been allowed to become unsealed, leaking, polluting, deteriorating in quality, uncontrollable, buried, or which is in such a state of disrepair that continued use for the purpose of obtaining ground water is impracticable or unsafe.

"Annular seal" means the grouted length of annular space between casing and the wall of the drilled or otherwise constructed hole.

"Annular space" means the space between the casing in a well and the wall of the hole or between two concentric strings of well casing.

"ANSI" means the American National Standards Institute.

"Aquifer" means a geologic formation that is sufficiently permeable to conduct ground water and to yield economically significant quantities of water to wells.

"Artesian well" means a well that is completed into an aquifer that is confined at greater-than-atmospheric pressure. Water in the well bore rises to a level above the level of the aquifer. An artesian well may or may not flow.

"ASTM" means the American Society for Testing and Materials.

"AWWA" means the American Water Works Association.

"Backflow preventor" means a device or means to prevent backflow of water into a well or potable water system.

"Basal aquifer" means an aquifer in which a body of ground water floats on a body of salt water in accordance with the buoyant density difference of the two bodies of water. As a general rule, each foot of saturated fresh ground water above mean sea level is supported by 40 feet of saturated fresh ground water below mean sea level.

"Caprock" means a geological formation or formations composed of terrigenous or marine sediments deposited over a formation or formations of volcanic origin. Caprock is substantially less permeable than volcanic formations and is often considered a confining material.

"Chairperson" means the chairperson of the Commission on Water Resource Management.

"Chemigation" means applying fertilizer or agricultural chemicals to land or crops through an irrigation system.

"Commission" means the Commission on Water Resource Management.

"Drainage Well" means a well primarily used for the disposal of rainfall runoff water. A drainage well could either be naturally dry or contain a naturally occurring water table.

"Dug well" means a shallow large diameter well or sump constructed by hand or with heavy equipment other than a drilling rig; generally used for stockwater, irrigation, or dust control.

"Enforcing agency" means a state or county governmental agency duly authorized to administer and enforce laws or rules pertaining to the construction, alteration, maintenance, operation, and closure of wells in Hawaii.

“Exploratory well” means a well drilled to obtain hydrologic data by geological analysis of the formations and aquifer testing. If conditions are adequate to develop ground water, an exploratory well can be converted to a production well. An exploratory well requires a well construction permit.

"FDA" means the United States Food and Drug Administration

"Geothermal well" means any well constructed for the location, exploration, monitoring, development, or injection of geothermal resources or the natural heat of the earth, the energy which may be extracted from the natural heat in whatever form found below the surface of the earth as defined by Chapter 182-1, HRS.

"Ground water" means any water found beneath the surface of the earth, whether in perched supply, dike confined, flowing, or percolating in underground channels or streams, under artesian pressure or not, or otherwise.

"Grout" means slurry used to seal any part of a well.

"Head" means the elevation in feet above mean sea level of the water level in a well or aquifer.

"High-level aquifer" means an aquifer in which a body of ground water is maintained at a higher level above mean sea level than that which can be explained by the buoyant density difference of ground water and salt water. Geologic structures, such as volcanic dikes or other poorly permeable formations, generally play a key role in the occurrence of high-level ground water.

"Injection well" means a well into which subsurface disposal of fluid or fluids occurs or is intended to occur by means of injection.

"Installation of pumps and pumping equipment" means the placement and preparation for operation of pumps and pumping equipment, including all construction involved in making entrance to the well, and establishing seals and repairs to existing installations.

“Modification” means any change to the physical dimensions of a well. Modification includes recasing, backfilling, redrilling or any change to increase or decrease the yield of a well. Modification does not include changes to the wellhead.

"Monitor well" means any cased permanent well drilled for the purpose of monitoring ground-water levels and salinity of ground water, or other flow properties of the aquifer. Cased

permanent wells for the purpose of monitoring contaminants other than chloride are Test Borings.

“Perched aquifer” means an aquifer that is formed by water confined on the top of an impervious to semi-pervious geologic layer of limited extent located between a large aquifer (basal or high-level) and the ground surface. The perched aquifer is separated from the primary aquifer by unsaturated material. Perched ground-water sources are generally small.

"Positive Displacement" means a procedure whereby grout is first introduced at the bottom of an interval and is pumped or forced with other applications of pressure upward through the interval, displacing fluids or air within the annulus.

“Potable water well” means any well that tap a fresh or brackish aquifer for drinking water use.

“Production well” means a well that forcibly withdraws ground water by pumping. A production well also includes artesian wells and tunnels.

“Public water system” means a system which provides water for human consumption, through pipes or other constructed conveyances if the system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least sixty days out of the year. Such term includes (1) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and (2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. A public water system may be privately or publicly owned or operated. A public water system is a “community water system” or a “non-community water system”. [Ref: Chapter 11-20-2, Hawaii Administrative Rules, “Potable Water Systems”].

"Pump installation" means the installation, replacement, or repairs of any equipment utilized or intended for use in withdrawing or obtaining water from a water source.

"Pump installation contractor" means any person licensed in the State of Hawaii to install, replace, or repair pumps and pumping equipment.

"Pumps and pumping equipment" means all equipment and appurtenances utilized or intended for use in withdrawing or obtaining ground water. It includes seals, tanks, fittings, measuring devices, and controls.

"Repairs" means any replacement, change, or modification of any well, pump or pumping equipment. Customary or normal maintenance is not included in this definition.

"Salt water well" means a well that produces water with chloride content greater than 17,000 mg/L.

"Test boring" means any excavation or drilled hole whose purpose is the immediate determination of subsurface geologic, hydrologic, or contaminated conditions usually, but not always, in the unsaturated zone above the ground-water level. This definition includes borings for foundation, underground storage tanks, environmental monitoring under the purview of other government agencies and hazardous water remediation. A test boring is not intended for the purpose of conversion to a production well.

"USDA" means the United States Department of Agriculture.

"Water well" means any well, water development shaft, or tunnel being used, intended to be used, or capable of being used to withdraw ground water or any well, water development shaft, or tunnel to be constructed for the purpose of investigating, exploring, testing, or development of ground water.

"Water management area" means a geographic area which has been designated for management of the ground or surface-water resource therein, as provided in Chapter 13-171, "Designation and Regulation of Water Management Areas."

"Well" means any excavation or opening into the ground, or an artificial enlargement of a natural opening drilled, tunneled, dug, or otherwise constructed for the location, exploration, monitoring, development, injection, or recharge of ground water and by which ground water is drawn or is capable of being withdrawn or made to flow.

"Well construction" means the drilling, tunneling, digging or otherwise constructing a well for whatever purpose, including any alteration or repairs of an existing well, but excluding the installation of pumps and pumping equipment.

"Well driller" means any person licensed in the State of Hawaii to construct, modify, or repair wells.

### **Section 1.5 Exemptions from Unusual Conditions**

The Standards presented herein are considered adequate for the protection of ground water and the prevention of ground-water waste from improper construction. If the Chairperson finds that compliance with any of the requirements of these Standards is impractical because of unusual conditions or circumstances the Chairperson may waive compliance with that requirement and prescribe alternative requirements. If the Chairperson determines that because of unusual conditions or circumstances these Standards do not provide adequate protection of the aquifer, then the Chairperson may also prescribe alternative or additional requirements.

### **Section 1.6 Well Drillers and Contractors**

All work required in the construction, modification, or sealing of wells subject to these standards shall be performed by well drillers who have obtained a C-57 license from the Hawaii Department of Commerce and Consumer Affairs, Division of Professional and Vocational Licensing.

All work required in the installation of pumps and pumping equipment shall be performed by well drillers with a C-57 license, pump installers with a C-57a license, or general contractors with an A license obtained from the Hawaii Department of Commerce and Consumer Affairs, Division of Professional and Vocational Licensing. To validate permits, licensed well drillers and/or pump installers must sign permits before any work is performed. The permit must be posted at the work site. Upon completion of work, well drillers and/or pump installers are required to sign well completion reports.

### **Section 1.7 Permits Required**

In the State of Hawaii, work on water wells, production wells, exploratory wells and monitor wells requires a well construction permit from the Commission; work on injection wells requires a permit from the State Department of Health; and work on geothermal wells requires a permit from the Department of Land and Natural Resources, Engineering Division. Work on test borings does not require a permit, but all test borings should be sealed properly

before abandonment. The various permits required, the enforcing agency, and the applicable standards are summarized in Table 2, "Well Permits and Reports Required."

Applicants for well construction (includes modification), pump installation, and well sealing permits issued by the Commission, should check with the Commission or the Commission webpage <http://www.hawaii.gov/dlnr/cwrm/> for the latest updated form.

Any applicant for a well construction, pump installation or well sealing permit whose application is rejected or amended by the Chairperson may obtain a hearing before the Commission by filing within 30 days of the mailing of the notice of a rejected or amended application, a written petition requesting such a hearing. The hearing shall be conducted as provided in Chapter 13-167, "Rules of Practice and Procedure for the Commission on Water Resource Management."

The Commission may modify, suspend, or revoke a permit, after notice and hearing, on any of the following grounds:

1. Material misstatement or misrepresentation in the application for a permit.
2. Failure to comply with the provisions set forth in the permit.
3. Willful disregard or violation of any provision of this part or any rule adopted pursuant thereto.
4. Material change of circumstances or conditions existing at the time the permit was issued.

### **Section 1.8 Reports Required**

Reports relating to construction, modification, and abandonment of water wells and monitor wells are required to be filed by the permittee with the Commission as provided in the appropriate sections of these Standards.

Persons filing a well completion report, well abandonment/sealing report, or pumping test record required by the Commission should check with the Commission for the latest updated forms or may refer to its web page at <http://www.hawaii.gov/dlnr/cwrm/>.

### **Section 1.9 Exclusions**

The requirements in Part 2, "Well Construction" of these Standards do not apply to water development tunnels, dug wells and shafts. The Chairperson shall consider the designs of these water development structures on a case-by-case basis.



Table 2. Well Permits and Reports Required

Well Type	Proposed Activity	Permit Requirements			Applicable Well Standards
		Permit	Report	Enforcing Agency	
Water Well (fresh, brackish, & salt water)	Drill new well. Modify existing well. Redrill existing well. Deepen existing well.  Abandon/seal existing well.	Well Construction	Well completion report.  Well abandonment/sealing report.	Commission	These Standards
	Install new pump. Modify existing pump to a larger capacity. Replace existing pump with a larger pump.	Pump Installation	Well completion report.	Commission	These Standards
Monitor Well	Drill new well or modify an existing well. Abandon/seal existing well.	Well Construction	Well completion report.	Commission	These Standards
Injection Well	Construct: Operate: Modify: Abandon/Seal.	Underground Injection Control (UIC)	Refer to Chap. 11-23. HAR	State Department of Health	Chapter 11-23. HAR
Geothermal Well	Drill: Modify: Modify use: Abandon/seal.	Geothermal	Refer to Chap. 13-183. HAR	State Department of Land & Natural Resources	Chapter 13-183. HAR
Test Boring	Excavate/drill. Abandon/seal.	None	None	None	None
Drainage wells	Construct: Operate: Modify: Abandon/Seal.	Underground Injection Control (UIC)	Refer to Chap. 11-23. HAR	State Department of Health	Chapter 11-23. HAR

Note: (1) New water wells to be used to supply a public water system must meet the requirements of Chapter 11-20, entitled, "Rules Relating to Potable Water Systems" of the State Department of Health.

(2) Test borings related to UIC and/or environmental monitoring or remediation are subject to the State Department of Health.

HAR = Hawaii Administrative Rule.

**Part 2.**

**WELL CONSTRUCTION**

## Part 2.

### WELL CONSTRUCTION

#### Section 2.1 Well Construction Permits

No well, except injection, drainage, geothermal, and temporary test boring wells shall be constructed, modified, repaired, or abandoned and sealed without a well construction permit approved by the Chairperson. Injection wells, drainage wells and geothermal wells require permits from other state agencies (Table 2). Temporary test borings do not require a well construction permit. Permanent test borings for hydrologic monitoring of water levels and/or water quality are considered monitor wells, which require a well construction permit.

Applications for a well construction permit shall be made on the most recent forms provided by the Commission. The forms are available at the Commission office or at [www.hawaii.gov/dlnr/cwrm/](http://www.hawaii.gov/dlnr/cwrm/). A well construction permit may be approved and issued if the proposed construction complies with all applicable laws, rules, and standards. In some cases, when the knowledge of the hydrogeology of an area is limited, an application without proposed construction will also be approved. In either case, final construction of the well must conform to these standards. The well construction permit shall be prominently displayed at the site of the well at all times until the well construction is completed. Every well construction permit shall require the well driller to file a well completion report.

Every permit for construction or modification of a water production well shall require a pumping test in accordance to these standards. Measurements of time, pumping rate, drawdown, chloride content, well recovery data, and temperature shall be recorded and reported as required in these Standards.

The holder of a well construction permit, with the approval of the Chairperson, may change the location of the well before or after start of construction. A written request to change the location shall state the location, proposed depth, method of construction, size, and expected capacity of the new well. The request to change the location shall also state the manner of sealing or plugging the abandoned well if applicable. The Chairperson may

consult with the Department of Health for compliance with their rules and standards concerning, among other things, the appropriateness of the location of the well.

## **Section 2.2 Basal Well Depth**

Except for salt-water wells, any well constructed in basal aquifers for the purpose of nonpotable or potable water withdrawal shall be initially designed and pump tested at a depth below sea level not exceeding one-fourth of the theoretical thickness (41 times the head) of the basal ground-water body, unless authorized by the Chairperson. Upon request by the permittee and submission of the supporting data and analysis, the Chairperson may allow deepening and subsequent testing of such wells to a depth below sea level not exceeding one-half of the theoretical thickness of the basal ground-water body.

Section 2.11 (a) of these standards defers the elevation survey for non-public water supply wells of less than 70 gpm installed capacity. If the permittee chooses to defer the elevation survey the exact elevation of the ground at the well and water level will be unknown. The well shall still be optimized according to an estimated water level elevation. The Chairperson shall reserve the right to revise the permittee's water-level elevation estimate. If the permittee contests the Chairperson's estimated water level then the permittee shall perform an elevation survey.

## **Section 2.3 Well Location**

### **a) Distance from Sources of Pollution**

New wells shall be sited the maximum distance possible from sources of pollution. Some possible pollution sources include wastewater lines, cesspools, septic tanks, wastewater leaching fields, landfills, chemical storage and injection wells.

### **(b) Gradients (slopes)**

Where possible, wells should be located hydraulically up-gradient (normally on a higher slope) from potential sources of pollution. Consideration should also be given to the fact that pumping a well may cause a localized reversal of the existing ground-water gradient due to drawdown of the ground-water table.

**(c) Flood and Drainage Areas**

When avoidable, wells should not be located in flood zones. Potable water wells located in flood and drainage areas shall have well casing terminated 2 feet above the 100-year level of flooding, as shown on the latest FEMA (Federal Emergency Management Agency) map and be properly designed to avoid potential contamination of the aquifer from flood waters. If necessary, the immediate area around a potable water well should be built up so that drainage moves away from the well.

**(d) Accessibility**

All wells shall be located an adequate distance from buildings and other structures to allow permanent access for well modification, maintenance, repair, and abandonment/sealing.

**Section 2.4 Well Casing**

**(a) General**

Wells which are to be used for water supply or monitoring shall be constructed with well casing adequate to maintain the structural integrity and intended use of the well and to maintain the natural pre-existing state of protection of the ground-water aquifer from pollution or contamination. Well casing shall be strong enough to resist the forces imposed upon it during and after installation. Casing standards apply only to permanent well casing and not to casing installed temporarily for construction purposes.

**(b) Wall Thickness of Casing**

The wall thickness of well casing shall be selected in accordance with good design practices applied with due consideration to conditions at the site of the well and shall be sufficient to withstand anticipated formation and hydrostatic pressures imposed on the casing during its installation, grouting, well development, and use. The minimum wall thickness of carbon-steel casings in wells shall conform to Table 3 and the AWWA standards for water wells (ANSI/AWWA A100-97), as may be amended.

The wall thickness for steel casing in public water supply wells shall be as listed in Table 4 and "Water System Standards," State of Hawaii, 2002, p. 306-3, as may be amended.

Table 3. Minimum Steel Casing Wall Thickness for Non- Public Water Supply Wells

Depth of Casing (ft)	MINIMUM WALL THICKNESS (in fractions of an inch)									
	Nominal Casing Diameter in inches:									
	8	10	12	14	16	18	20	22	24	30
0-100	1/4	1/4	1/4	1/4	1/4	1/4	1/4	5/16	5/16	5/16
100-200	1/4	1/4	1/4	1/4	1/4	1/4	1/4	5/16	5/16	5/16
200-300	1/4	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16	3/8
300-400	1/4	1/4	1/4	1/4	5/16	5/16	5/16	5/16	3/8	3/8
400-600	1/4	1/4	1/4	1/4	5/16	5/16	5/16	3/8	3/8	7/16
600-800	1/4	1/4	1/4	5/16	5/16	5/16	3/8	3/8	3/8	7/16
800-1000	1/4	1/4	1/4	5/16	5/16	5/16	3/8	7/16	7/16	1/2
1000-1500	1/4	5/16	5/16	5/16	3/8	3/8	3/8	7/16		
1500-2000	1/4	5/16	5/16	5/16	3/8	3/8	7/16	7/16		

Reference: ANSI/AWWA A100-97

Table 4. Minimum Wall Thickness for Public Water Supply Wells

Nominal Diameter (inches)	Wall Thickness (inches) decimal
2	0.154
2-1/2	0.203
3	0.216
3-1/2	0.226
4	0.237
6-8	0.280
10	0.322
12	0.375
14	0.375
16	0.375
18	0.375
20	0.375
22	0.500
24	0.500
26	0.500

Reference: 2002 County Water System Standards

**(c) Minimum length of solid casing**

All wells drilled to non-artesian (non-confined) basal, high-level, caprock or perched aquifers shall have a minimum length of solid casing equal to 90% of the depth to the water level of the aquifer to be developed. Wells drilled to artesian (confined) aquifers shall be cased so that leakage does not occur into overlying or underlying formations. In general, no well may be allowed to develop water from more than one aquifer. The minimum length of solid casing for salt-water wells shall be through the entire fresh and brackish water portion of the lens. The Chairperson may approve deviations from casing length requirements if the permittee can show that the aquifer is adequately protected.

**(d) Casing Materials**

(1) Steel. All steel casing shall be new and conform to one of the manufacturing standards listed in Table 5 and in the standards of AWWA publication ANSI/AWWA A100-97, as may be amended. The physical properties of the steel shall conform to ASTM A-242, ASTM A53, Type E or S, Grade B, or approved equal. The well casing shall be manufactured in accordance with applicable sections of ASTM A139, as may be amended.

Table 5. Water Well Casing Materials

Manufacturing Standards for Carbon-Steel Well Casing:
ANSI/AWWA C200
API Spec. 5L
ASTM A53
ASTM A139
ASTM A606

(2) Stainless Steel. Stainless steel casing for wells shall meet the provisions of ASTM A409, "Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High Temperature Service," and any revision.

(3) Plastic and Thermoset Plastic (Fiberglass). Except as determined by the Chairperson on a case-by-case basis, plastic casing shall not be used in wells where well

depth exceeds 200 feet or where drilling tools are contemplated to be used to re-enter the well following installation of the casing.

Thermoplastic well casing shall meet the requirements of ASTM F480, "Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80", and any revision. The following specifications shall apply to thermoplastic well casing.

ABS Pipe. ASTM D1527, "Standard Specifications for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80."

PVC Pipe. ASTM D1785, "Standard Specifications for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120."

Pressure-Rated PVC Pipe. ASTM D2241, "Standard Specifications for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)."

Thermoset casing material shall meet the following standards, as applicable, and any revision:

Filament Wound Resin Pipe. ASTM D2996, "Standard Specification for Filament Wound Reinforced Thermosetting Resin Pipe."

Centrifugally Cast Resin Pipe. ASTM D2997, "Standard Specification for Centrifugally Cast Reinforced Thermosetting Resin Pipe."

Reinforced Plastic Mortar Pressure Pipe. ASTM D3517, "Standard Specification for Reinforced Plastic Mortar Pressure Pipe."

Glass Fiber Reinforced Resin Pressure Pipe. AWWA C950, "AWWA Standard for Glass-Fiber-Reinforced Thermosetting-Resin Pressure Pipe."

Plastic casing or screen shall not be subjected to excessive stress during installation and shall not be driven into place. Care shall be taken to insure that plastic casing and joints are not subjected to excessive heat or pressure from grouting.

**(e) Casing Joints**

Steel casing may be joined by welds, threads, threaded couplings, or any combination thereof. Welding shall be accomplished in accordance with the standards of the American Welding Society or the most recent revision of the American Society of



Mechanical Engineers Boiler Construction Code. Casing joints shall be of the types listed in Table 6 and in AWWA publication ANSI/AWWA A100-97, as may be amended.

Table 6. Well Casing Joint Standards

Casing Material	Type of Joint	Standard
Steel Plastic	Welded or threaded Threaded solvent-welded or other mechanical joint	AWWA C206 ASTM F480

Plastic casing may be joined by solvent welding or mechanically joined by threads or other means. Solvent cement used for solvent welding shall meet specifications for the type of plastic casing used and shall be applied in accordance with solvent and casing manufacturer instructions.

The following standards for solvent cements and joints for PVC casing shall be met, including any revision:

ASTM D2564, "Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings."

ASTM D2855, "Standard Practice for Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings."

**Section 2.5 Rock or Gravel Packing the Annular Space**

Rock or gravel packing shall consist of locally produced crushed basaltic aggregate, or preferably, commercially available rounded gravel. Such rock or gravel packing material shall be obtained from clean, non-contaminated sources. The aggregate size should be larger than the slot or louver size of the casing. Handling and storage of the rock or gravel packing material at the well site shall be such that it remains free of contaminants and debris until placed in the annular space and shall be disinfected by drenching with a 100 mg/L chlorine solution, see Section 2-8(a), just before placement in the well.

## **Section 2.6 Grouting the Annular Space**

### **(a) General**

The reason that the annular space of all wells must be sealed with grout from the ground surface to a minimum specified depth is to prevent the downward passage of poor quality water, pollutants, or contaminants from surface sources and subsurface sources in the unsaturated zone above the aquifer. Other reasons for grouting the annular space are to protect the casing and stabilize the wall of the drilled hole, and to prevent vertical movement of water along casing in a saturated zone (e.g. salt-water and artesian wells). In general, only one aquifer may be exploited unless approved by the Chairperson.

### **(b) Conductor Casing**

Conductor casing (often called conductor pipe) is sometimes installed on a temporary basis to stabilize the near-surface part of the drilled hole during well construction. Conductor casing that is permanent and reached the minimum depths specified in part 2.6 (c) must be grouted as permanent casing as described in part 2.6. Conductor casings installed without a grouted annular space must be removed in a manner that will permit complete grouting of the annular space between the permanent well casing and drilled hole to the ground surface.

### **(c) Minimum Depth of Grouted Annular Space**

To prevent surface contamination, the annular space of all cased non-artesian wells must be sealed with grout from the ground surface to a minimum depth of 500 feet or 70% of the vertical distance between the ground surface and the top of the aquifer selected for exploration, long-term monitoring, or development, whichever depth is less. Wells drilled to artesian (confined) aquifers shall be grouted and cased so that leakage does not occur into overlying or underlying formations. Salt-water wells shall be grouted through the entire fresh and brackish portion of the basal lens. Perched aquifers above the target aquifer must be cased and grouted off.

### **(d) Minimum Thickness of Grouted Annular Space**

The annular space of wells to be grouted must be a minimum of one and one half inches all around the maximum dimension of the casing if the grout is placed by positive displacement. If positive displacement is not used the minimum annular space is two

inches for all wells except public water supply wells. Public water supply wells are required to have a three inch annulus if the positive displacement technique is not used.

**(e) Grouting Materials for Annular Sealing**

Drill cuttings or drilling mud shall not be used for any part of the grout material. Neat cement used to grout wells shall conform to the requirements of ASTM C150 for Portland cement, Type I. Special cement-setting accelerators and retardants and other additives may be used, if necessary. Such additives shall meet the requirements of ASTM C494, "Standard Specifications for Chemical Admixtures for Concrete", and any revision.

(1) Sand-Cement Slurry. Sand-cement for grouting shall be mixed at a ratio of not more than one part sand to one part cement, by weight, and not more than six gallons of potable water per sack of cement.

(2) Neat Cement Grout. Neat cement for grouting shall be mixed at a ratio of one 94-pound sack of Portland cement to not more than six gallons of potable water.

(3) Cement-Bentonite: a slurry of cement, bentonite and water. The amount of bentonite added shall not exceed 8% bentonite per dry weight of cement (7.5 pounds of bentonite per 94 pound sack of cement). The volume of additional water used in preparing these slurries is limited to three quarters (0.75) of a gallon per 94 pound sack of cement for each 1% of bentonite added.

(4) Other Grouts. The Chairperson on a case-by-case basis may approve other grouting materials.

**(f) Placement of the Annular Grout**

The annular space shall be grouted as soon as possible after installation of the casing. Grout can be placed by positive displacement, by pumping or gravity flowing through a grout (tremie) pipe or by freefall displacement in a shallow well. The driller shall sound annulus to check for settling of the grout within 24 hours of placement. Placing the grout in the annular space may be done in stages with time allowed for the grout to set between stages so as to prevent distortion or collapse of the casing by heat or pressure. Grouting the annular space may be accomplished by freefall placement if the annular space to be grouted is no deeper than 20 feet below ground surface and is in the unsaturated zone above the ground-water level.

## **Section 2.7 Well Development**

Well development consists of methods to remove drill cuttings or other material causing low permeability from the formation in open hole or slotted casing. Development or redevelopment of a well shall be performed with care so as to prevent damage to the well and casing. The well should be developed prior to the test pumping to maximize the flow of ground water into the well bore.

Water, sediment, or waste removed by well development or re-development operations shall be disposed of in accordance with applicable federal, state, and county requirements. The enforcing agency shall be contacted concerning the proper disposal of waste from development operations.

## **Section 2.8 Well Disinfection**

### **(a) General**

All non-artesian water supply wells for potable use or tapping aquifers having a chloride concentration of less than 250 milligrams per liter shall be disinfected with the proper amount of chlorine following the completion of any work, including pump installation and repair and well abandonment. The purpose of disinfection is to minimize the introduction of pathogens into the aquifer.

All materials installed in wells shall be thoroughly and carefully cleaned and disinfected with a 100 mg/L chlorine solution to ensure that all harmful or disease carrying organisms are eliminated.

A 100 mg/L chlorine solution can be prepared by mixing 0.7 quart of common household bleach (containing 5% available chlorine) with 100 gallons of water or by mixing 2¼ ounces of dry calcium hypochlorite (commonly used in swimming pools, containing 70% available chlorine) with 100 gallons of water.

### **(b) Disinfection of Aquifer Section**

The aquifer section of all wells shall be disinfected by using chlorine. Depending upon the situation, the chlorine shall be placed and thoroughly mixed in the aquifer by pouring directly, using a bailer, using the rotary drill pipe, or using the test pump, as appropriate. Mixing shall be accomplished by running the bailer or drill pipe up and down

the aquifer three or four times, or gently pump surging, as the case may be. The chlorine solution shall be allowed to remain in the well overnight or at least eight hours.

Sufficient chlorine shall be placed in the well to obtain a chlorine concentration of at least 100 mg/L when mixed with the volume of water in the drilled hole. The amount of common household bleach or dry calcium hypochlorite to be used for well disinfection depends upon the diameter of the drilled hole and the depth of aquifer penetration (Table 7).

Table 7. Guideline Amounts of Chlorine Necessary to Disinfect the Borehole

Drilled Hole Diameter (inches)	Volume of water in 100 ft of column (gallons)	Cups of liquid household bleach to use in 100 ft column (1)	Cups of dry calcium hypochlorite to use in 100 ft column (2)
4	65	3	1/4
6	147	5	1/2
8	261	9	3/4
10	408	14	1
12	587	19	1 1/2
14	800	27	2 1/2
16	1044	36	3
18	1322	45	3 3/4
20	1632	56	4
24	2350	74	6

(1) The volume of liquid bleach, based on 5% available chlorine, has been rounded up to the next full cup.

(2) The volume of dry powder, based on 70% available chlorine, has been rounded up to the next 1/4 cup.

## 2.9 Well Testing

### (a) Introduction

Well testing is required when new wells are drilled or when existing wells are modified and have not been previously tested in accordance with the provisions of these Standards. Well testing normally consists of a short step-drawdown test followed by a long-term constant-rate test. Well testing is not mandatory for monitor wells. The purpose of well testing in the prescribed manner is to determine the well efficiency and to gain

information on the aquifer. Water from test pumping shall be disposed of in accordance with applicable federal, state, and county requirements. Testing procedures for free-flowing artesian wells with no pump shall be determined on a case-by-case basis with the concurrence of the Chairperson. Test pumping is not necessary for salt-water wells unless specified by the Chairperson.

**(b) Step-Drawdown Tests (Well Efficiency Test)**

Step-drawdown tests are required to establish the efficiency of the well and to provide preliminary information on the yield, drawdown, and salinity (chloride content) of the well. Step-drawdown tests are not required for wells of less than 70 gpm proposed capacity. However, a step-drawdown test must be conducted for all public water supply wells. The water level in the pumped well should be measured at minimum intervals according to forms provided by the Commission. The step-drawdown test shall consist of pumping the well at progressively increasing fractions of the maximum discharge capacity proposed by the permittee or determined during well development. The minimum length of time for each discharge rate shall be one-half hour and the minimum number of discharge rates shall be three (3) and shall be sufficient to induce observable changes in pumping water levels from one pumping rate to the next. Pumping should be continuous throughout the entire step-drawdown test.

If the permittee is unable to perform a step-drawdown test according to these standards then the Chairperson may not accept the test results or in lieu of the substandard step-drawdown test the Chairperson may require a modified and more comprehensive constant rate long-term test.

**(c) Constant-Rate Tests (Aquifer Test)**

Constant rate tests are intended to determine the hydraulic properties of an aquifer. The test helps identify hydrologic boundaries such as dikes or streams. Constant-rate tests also help quantify salinity trends in basal aquifers. The constant-rate test can be important in determining and/or predicting interference with neighboring wells and streams.

The pumping rate for the constant-rate test should be determined from the results of the step-drawdown test. The constant-rate test shall not commence until the water level in the pumped well has fully recovered from the step-drawdown test. The constant pumping

rate must be equal to or greater than the final installed pump capacity (a 10% variation shall be allowed). Constant-rate tests shall be pumped continuously for a minimum period of time, as shown in Table 8. The Chairperson may require longer constant rate tests for wells near streams or for wells in high-level aquifers. As soon as possible after the termination of the constant rate test the recovering water level in the production well should be measured at intervals specified in the forms provided by the Commission. If possible, water levels should be measured until full recovery.

The water discharged from a well during constant-rate tests shall be transported to a distance sufficient to prevent the pumped water from reaching the ground-water table and affecting the test results. If possible, observation wells shall be used during the constant rate test.

Table 8. Minimum Test Period for Constant-Rate Tests

Proposed Use of Well	Proposed Capacity (gpm)	Minimum Test Period (hours)
Non-Public Water Supply	0 - 50	0
	51 - 100	8
	101 - 300	24
	301 - 700	48
	701 - 1000	72
	1001 +	96
Public Water Supply		96

**(d) Accuracy of Measurements**

The rate of pumping shall be recorded in gallons per minute (gpm). The depth to water shall be measured as accurately as possible, but in no case less accurate than to the nearest one-tenth of a foot. Time shall be measured as accurately as possible, but in no case less accurate than to the nearest minute.

**(e) Minimum Frequency of Measurements**

For constant-rate tests, the depth to water in the pumped well should be measured at intervals according to pump test forms provided by the Commission.

**(f) Pumping Test Records and Reports**

The permittee shall file with the Commission the following:

- (1) Step-Drawdown Pumping Test Record (on forms provided by the Commission or copy thereof).
- (2) Constant-Rate Pumping Test Record (on forms provided by the Commission or copy thereof).

## **Section 2.10 Well Completion**

### **(a) General**

Wells must be adequately protected at all times during and after construction to prevent the entrance of surface water runoff, pollutants, and contaminants; unauthorized access; and damage to the well. All non-producing wells must be completed with the casing extended a minimum of two (2) feet above the ground surface and capped in a manner that will prevent unauthorized entry or any pollutants from entering the well except where site conditions, such as vehicular traffic, will not allow. Such wells shall conform to the following:

(1) Lockable Cover. The top of the well casing shall be cut smooth and straight with a lockable cover to prevent unauthorized access and prevent a hazard to humans and animals. The cover shall be weather and vermin proof.

(2) Casing Cap. Alternatively, the top of the well casing may be capped with a welded steel plate or solvent-welded plastic cap (for plastic casings) fitted with a 1½-inch minimum diameter threaded cap or plug which cannot be easily opened with small or light tools. Openings or passages for probing, venting, cables, or discharge tubing shall be protected against entry of surface water, pollutants, contaminants, and vermin.

(3) Flooding. The top of the well casing should terminate above ground surface at least 2 feet above the 100 year flood elevation, except where site conditions, such as vehicular traffic, will not allow.

(4) Concrete Base. Unless otherwise approved by the Chairperson, a concrete base shall be constructed around the well casing at ground surface in contact with the annular grout seal. The base shall be at least four inches thick and shall slope slightly to drain away from the well casing. The base shall extend at least two feet laterally in all directions from the outside of the well casing. The concrete base shall be free of cracks,



voids, and other significant defects likely to prevent water tightness. Contacts between the base and the annular grout seal, and the base and the well casing must be water tight.

(5) Well Pits or Vaults. The use of well pits, vaults, or equivalent features to house the top of a potable water well below ground surface should be avoided, because of their susceptibility to the entrance of surface water runoff and pollutants. Well pits or vaults shall only be used with approval of the Chairperson.

(6) Protection from Vehicles. Protective steel posts, or the equivalent, shall be installed around a well where it is terminated above ground surface in areas of vehicular traffic. The posts shall be easily seen and shall protect the well from vehicular impact.

(7) Paint and Markings. The well shall be permanently marked by an engraved plate, engraved label or painted label showing the well's assigned State well number and the casing painted so as to be easily visible, located, and identified in the field.

(8) Artesian Wells. Flowing wells shall be equipped so that the discharge can be controlled or stopped at all times. It is the responsibility of the well owner to ensure this equipment is maintained and operational.

**(b) Well Completion Report and Records**

Within 60 days after the completion of the construction, modification, or repair of a well the permittee shall file with the Commission, as appropriate, the following:

1. For all wells, a well construction report (Part I of Well Completion Report form provided by the Commission).
2. For all permanent pumps, a pump installation report (Part II of Well Completion Report form provided by the Commission).

**Section 2.11 Elevation Survey and GPS Location**

**(a) Elevation Survey**

An accurate elevation benchmark shall be clearly established on the concrete base by a licensed surveyor. Documentation and surveyor's stamp shall be submitted. The surveyor's documentation shall identify the original elevation benchmark that was used to establish the well benchmark. The required establishment of elevation benchmarks for non-public water supply wells of less than 70 gpm installed pumping capacity is deferred

until the Chairperson deems it necessary before or after well construction or pump installation. Salt water wells do not require an elevation survey.

**(b) GPS Location**

The well shall be located with a GPS receiver. The GPS coordinates shall be reported in the NAD83 datum.

**Part 3.**

**WELL ABANDONMENT/SEALING**

## Part 3.

### WELL ABANDONMENT/SEALING

#### Section 3.1 General

All wells and test borings as defined in these Standards must be properly abandoned and permanently sealed to protect the ground-water resources of the State of Hawaii from contamination and waste and to protect public health and safety, whenever:

- 1) The well has served its purpose, or
- 2) The use of the well has been permanently discontinued, or
- 3) The well is not being properly maintained, or
- 4) The physical condition of the well is causing a waste of ground water or is impairing or threatens to impair the quality of the ground-water resources, or
- 5) The well is in such a state of disrepair that its continued use is impractical or it is a hazard to public health or safety

The objective of permanently sealing a well or test boring before abandonment is to restore the geological and hydrological conditions that existed before the well or test boring was constructed, taking into account any changes which may have occurred since the time of construction. (For example, a well that may have originally produced potable water, but which now produces nonpotable water.) The well casing must be removed if such removal is necessary to accomplish the objective. However, if the casing cannot be readily removed, the blank casing above the aquifer must be perforated to allow grouting of the annular space. Permanent sealing of a well shall be accomplished by grouting with a tremie pipe from bottom to top. The Chairperson shall review the sealing plan for shafts and pits on a case-by-case basis.

Abandonment and permanent sealing of a well requires a permit from the Commission. A permit is not required for abandonment/sealing of test borings. A licensed well driller with a C-57 license shall perform all well abandonment and sealing. A detailed record of the abandonment and sealing of all wells must be maintained by the well driller

for future reference and demonstration that the well was properly sealed. A well abandonment/sealing report (forms available at the Commission office or at <http://www.hawaii.gov/dlnr/cwrn/>) must be filed with the Commission within 60 days after completion of the work.

The Commission shall be notified in accordance with permit conditions before work on abandonment and sealing begins.

### **Section 3.2 Responsibility for Abandonment/Sealing**

The responsibility and cost for voluntary or involuntary abandonment/sealing of a well rests with the well owner and/or operator. The owner and/or operator of a well to be abandoned and sealed shall not commence with the required remedial work until an application has been made and a well construction permit has been approved by the Chairperson.

### **Section 3.3 Initiation of Abandonment/Sealing**

#### **(a) Initiated by Well Owner or Operator**

The owner and/or operator of a well may voluntarily seek abandonment/ sealing of a well by first causing an application to be made for a well construction permit on forms provided by the Commission (forms available at the Commission office or at <http://www.hawaii.gov/dlnr/cwrn/>). The application shall include the reason for abandonment and a description of the proposed procedure and work to be performed.

#### **(b) Initiated by Commission**

The Chairperson may declare that a water well is abandoned and shall notify the owner and/or operator that it must be permanently sealed if it finds that one or more of the five criteria in section 3.1 have been met.

### **Section 3.4 Grouting Materials for Permanent Sealing**

Grouting materials acceptable for use to permanently seal wells and test borings are neat cement, sand-cement slurry, concrete, cement bentonite or bentonite pellets. The materials selected depend on field conditions and must be approved by the Chairperson

prior to sealing. After grouting, all wells must be sounded to determine if the grout has settled.

Cement used for neat cement, concrete, cement-bentonite and sand-cement slurry shall conform to the requirements of ASTM C150 for Portland cement, Type I.

(1) Sand-Cement Slurry. Sand-cement for grouting shall be mixed at a ratio of not more than one part sand to one part cement, by weight, and not more than six gallons of water per sack of cement. Clean well sorted sand shall be used.

(2) Neat Cement Grout. Neat cement shall be mixed at a ratio of one 94-pound sack of Portland cement to not more than six gallons of potable water.

(3) Concrete. Concrete shall contain 5.3 sacks of ASTM C150 type 2 Portland cement per cubic yard of concrete and a maximum of 7 gallons of water per 94-pound sack of cement. The aggregate shall consist of 47 percent sand and 53 percent coarse aggregate conforming to ASTM C33.

(4) Cement-Bentonite: a slurry of cement, bentonite and water. The amount of bentonite added shall not exceed 8% bentonite per dry weight of cement (7.5 pounds of bentonite per 94 pound sack of cement). The volume of additional water used in preparing these slurries is limited to three quarters (0.75) of a gallon per 94 pound sack of cement for each 1% of bentonite added

(5) Bentonite grout. Bentonite grout shall consist of a high-solids bentonite grout and water mixture with a minimum of twenty percent solids, mixed and placed in accordance with the manufacturer's written instructions. Bentonite shall not be used in brackish or salt water wells. Bentonite has a higher tendency to settle and may not be appropriate for some conditions.

### **Section 3.5 Preliminary Work**

Wells that are to be abandoned and permanently sealed shall be investigated by studying existing well records and verifying the physical conditions and as-built dimensions of the well. Such wells shall be sounded with an appropriate tool to check and clear the well of any obstructions, undesirable debris or cave-in material, oil from an oil-lubricated pump, or other pollutants that could interfere with a satisfactory well seal.

Depending upon the situation, such wells may also be probed with a magnet, video camera, caliper log, or other well tools to determine depths, dimensions, and conditions of the well casing and artesian leakage.

All equipment, loose casing, foreign materials, and obstructions that may interfere with sealing operations must be removed from the well, if possible. Any casing and conductor pipe not removed from the well must be cut off at least two feet below the ground surface and the remaining hole filled with material appropriate to the site or grouted with cement-based material, if in hard rock.

The Chairperson shall be notified as soon as possible if pollutants or contaminants are known, discovered, or suspected to be present in the to-be-abandoned and sealed well. If a well is found to be contaminated the Chairperson may require more stringent sealing procedures. If a well pump is found to contain mercury seals, then the owner shall be required to mitigate any possible contamination.

### **Section 3.6 Sealing the Aquifer Section of a Well**

#### **(a) Open Hole Section**

After the preliminary work of abandonment and sealing has been completed, the well must be grouted as soon as possible from bottom to top beginning with the open hole section, if any, of the well.

The open hole section of the well shall be grouted with the appropriate grouting material by pumping or gravity-flowing it through a grout (tremie) pipe. The bottom of the grout pipe shall be withdrawn in stages as the open hole becomes filled, but shall extend into the slurry column while the grout is being placed so as to prevent inclusion of cave-in or foreign material, bridging, dilution or separation of grout materials.

If an interval of open hole occurs in cavernous or highly fractured formation that causes excessive loss of grout, crushed aggregate (conforming to ASTM 10M) or concrete sand (conforming to ASTM C-33) may be used to fill such intervals of loss. before continuing to grout. The Chairperson may approve alternative designs if the applicant can show that the well will be adequately sealed.

**(b) Perforated Casing Section**

After the open hole section of the well has been grouted, the perforated casing section of the well shall next be sealed with neat cement placed from bottom to top with a tremie pipe in a manner conforming to the grouting of the open hole section

**Section 3.7 Sealing the Solid Casing Section of a Well**

**(a) Properly Grouted Wells**

The solid casing section of a well with a properly grouted annular space may be sealed with sand-cement slurry in one continuous operation from bottom to the ground surface.

**(b) Improperly Grouted Wells**

If a well has no record of having a properly grouted annular space and poses a significant threat of surface contamination of an underlying potable aquifer or waste of artesian ground water, the solid casing must be perforated before grouting begins. The solid casing section shall be sealed with neat cement in one continuous operation from bottom to ground surface using a tremie pipe in a manner conforming to these Standards. If an interval of the solid casing section cannot be filled after placement of a reasonable amount of neat cement slurry, sand-cement slurry conforming to the standards for permanent sealing may be used to fill such interval before continuing the sealing of the blank casing section with neat cement.

**Section 3.8 Special Provisions for Artesian Wells**

**(a) General**

Many artesian wells in Hawaii are old and may have deteriorated and leaking casings. Consequently, such artesian wells must be abandoned and permanently sealed. Artesian wells usually require a very thorough investigation of the physical condition of the well and any possible artesian flow or leakage in the well before satisfactory grouting can be accomplished.



**(b) Preliminary Work**

In addition to the preliminary work required for wells in general and described elsewhere in these Standards, artesian wells to be abandoned must be investigated to determine the occurrence, depths and magnitude of any ground-water leakage from the aquifer upward into overlying strata through corroded or improperly grouted well casing. A video or caliper log of the well may be required in such cases, especially if leakage may interfere with proper sealing of the well. An assessment of well conditions and proposed sealing procedures shall be discussed with the Commission staff before sealing operations are started. The assessment may include a survey of water levels in adjacent wells, a video log, or a vertical flow meter log to confirm whether or not the artesian well is leaking.

**(c) Sealing Procedures**

Before placement of grout to permanently seal an artesian well, any flow or leakage in the well must be stopped or reduced so that the confining strata above the artesian aquifer can be effectively sealed with neat cement or sand-cement slurry.

If the artesian flow is occurring from the open hole section of the well, placement of large rounded cobbles followed by lesser size cobbles and crushed aggregate, or placement of specially formed concrete cylinders may significantly reduce flow in the well. Packers with grout pipe extending below the packer may also be effective in sealing the open hole section.

Once flow from the artesian aquifer has been stopped or significantly reduced, the solid casing may have to be perforated (see Sec. 3.7.b) before grouting the remaining part of the artesian well with sand-cement slurry. If artesian leakage continues to occur, placing or pumping the sand-cement slurry at a high rate through a grout pipe may be required to successfully complete the sealing operation.

If the solid casing is intact and there is no flow in the annular space, the flow inside the casing may be stopped by installing a riser pipe before sealing an artesian well from bottom to top with sand-cement slurry.

### **Section 3.9 Well Abandonment/Sealing Report**

Within 60 days after completion of the required work, permittee shall file with the Commission a well abandonment/sealing report containing the owner's and operator's name and address, the water use permit number, if any, the reason for abandonment/sealing, and a complete description of the work performed.

**Part 4.**

**PUMP INSTALLATION**

**Part 4.**  
**PUMP INSTALLATION**

**Section 4.1 Pump Installation Permits**

(a) **General**

No pump or pumping equipment shall be installed in a well without an appropriate permit, unless otherwise provided for in this section (applications are available at the Commission office or at <http://www.hawaii.gov/dlnr/cwrm/>). A pump installation permit shall be issued only if the proposed construction complies with all applicable laws, rules, and standards. The permit shall be prominently displayed at the site of the well at all times until the pump installation is completed.

Within Commission-designated water management areas (or aquifer systems), a pump installation permit to install a new pump or replace, modify, or repair an existing pump in a well may be approved by the Chairperson if the well user or owner holds an approved water use permit for such a well. If no water use permit has been obtained, the Commission must first act on the application for a water use permit.

The replacement, modification, or repair of an existing permanent pump does not require a pump installation permit if such work does not exceed the existing or permitted pump capacity. The well owner/operator is still required to submit a completed pump installation report (Part II of Well Completion Report form available at the Commission office or at <http://www.hawaii.gov/dlnr/cwrm/>). Every pump installation permit shall require the pump installation contractor to file a well completion report as required in these Standards. Every pump installation permit for a new or existing well without a pumping test meeting these Standards may require that a pumping test under these Standards be conducted.

(b) **Emergencies**

When emergency installation, alteration, repair, or replacement of a pump or pumping equipment which normally requires a permit is required to prevent or minimize

loss of life, risk to public health and safety, or damage to property, a well owner may proceed with the emergency work without a permit.

As soon as possible after initiation of any emergency work, the well owner doing the work shall notify the Chairperson and describe the nature and circumstances of the remedial work. Within 60 days of notification to the Chairperson the well owner doing the emergency work shall submit to the Chairperson a pump installation report and a description of the emergency

## **Section 4.2 General Installation Requirements**

### **(a) Pumps and Pumping Equipment**

All installations of pump and pumping equipment on wells shall be constructed in such a manner as to prevent the pollution and contamination of the well from surface sources. Pumping systems shall be designed to not exceed the permitted pumping rate at the point of delivery when operating under normal design conditions.

### **(b) Above-Grade Pump Connections**

All pump installations should be completed such that the top of the well casing extends a minimum of 12 inches above the prepared ground surface or pump house floor. If the pump is too heavy to permanently rest on the well casing then the reinforced concrete slab must extend at least 12 inches above the prepared ground level. For wells located in floodplains, the top of the well casing should extend at least two feet above the 100-year flood level.

### **(c) Well Vents**

Well vents, when needed or used, shall permit air to freely enter and exit the well with changing water levels in the casing. Vents may be an integral part of the well seal or be attached to the seal and terminate a minimum of one (1) foot above the finished ground level, be turned down, and screened to prevent entry of vermin.

### **(d) Water Level Measuring Device**

Public water supply wells shall have a means of measuring water level. Also wells with a pump capacity greater than 70 gpm or casing diameter above 6 inches shall also have a means of measuring water level. In some cases the Chairperson may also require

other wells to have a way of measuring water level. If a means of measuring water level is required by the Chairperson, the well owner or operator shall maintain the device in operating condition. The airline pressure gage or pressure transducer shall have an accuracy of 0.1 feet.

Water Level Measurement Access - An airline, water level sounding tube, permanent pressure transducer or other method approved by the Chairperson shall be installed on all wells whenever the permit issued by the Commission requires the installation of water level measuring equipment.

An airline tube shall consist of tubing extending from the wellhead to the top of the pump discharge case. This tubing shall be capable of withstanding the maximum pressures developed during use. The tube shall be securely fastened to the pump discharge case, column pipe or drop pipe. The specifications and depth of the airline shall be recorded on the Pump Installation Report.

The water level sounding tube shall have a minimum inside diameter of 3/4 inch. It shall extend from the wellhead to the top of the pump discharge case and shall be securely attached to the column or drop pipe so that it hangs straight and plumb. All water level sounding tubes shall be equipped at the top end with a removable cap or plug to prevent entry of foreign material. The bottom of the tube shall be constructed to allow the free entry and exit of water and to prevent the measuring device from passing out of the bottom of the tube.

**(e) Standards of Other Agencies**

The published standards for vertical turbine pump-line shaft and submersible types of the American Water Works Association (ANSI/AWWA E101-88) and as may be amended are incorporated by reference as a part of these Standards. In addition to these Standards, pump and pumping equipment installations for wells to be used by the Water Department of the respective Counties of the State of Hawaii shall meet the standards specified in "Water System Standards, State of Hawaii," 2002, and as may be amended.

## **Section 4.3 Pumps**

### **(a) Mounting**

Pumps shall be installed in such a manner that the well, pump and surrounding area can be kept in a sanitary condition, and will provide adequate protection against contamination from any surface or subsurface source. All pumping equipment shall be installed with an effective seal including a concrete pad at the top of the casing that will prevent the entry of contaminants into the well and support the weight of the pump and motor.

### **(b) Lubrication**

If water lubrication is not adequate for a lineshaft pump, then oil-lubrication may be used for potable wells provided the oil lubricant conforms to USDA or FDA approved food contact grade formulations.

### **(c) Hazardous Materials**

Pumps that contain mercury seals shall not be used in potable or non-potable wells.

### **(d) Potable and Non-Potable Interconnections**

If the well is used to supply both potable and non-potable purposes in a single system, the user shall eliminate cross-connections and backflow connections by physically separating potable and non-potable systems by an air gap or an approved backflow preventor, and by clearly labeling all non-potable spigots with warning signs to prevent inadvertent consumption of non-potable water. Backflow prevention devices should be routinely inspected and tested. Further, if the well is used to supply non-potable purposes and the water system is used to distribute fertilizers, pesticides, herbicides, or any other irrigation-related chemical, commonly known as chemigation, the user shall install a backflow prevention device acceptable to the Department of Health, in accordance with §149A-31(6) HRS. This is to prevent accidental backflow contamination of the aquifer during chemigation.

## **Section 4.4 Water Meter**

All discharge line configurations shall include an approved water meter (with a totalizer) or other appropriate device or means for measuring and reporting total water

withdrawal on a monthly calendar or work-schedule basis. The water meter shall be easily accessible and shall be installed according to the manufacturer's specifications.

Owners/operators of salt water wells are not required to install a water meter unless otherwise specified by the Chairperson.

#### **Section 4.5 Pump Installation Report**

Within 60 days after the completion of a pump installation, modification, or repair, the permittee shall file with the Commission the following:

1. Pump installation report (on forms provided by the Commission).
2. As-built sectional drawing of the well and pump installation.
3. Pumping test record (if no pumping test conforming to these Standards has been performed).



## Attachment B

### Summary of Written and Verbal Comments

Organization/person	Comment	Response
Department of Health	Add section on chemigation Misc. detailed comments Keep section 2.3(c) (wells up-gradient from potential contamination) 1.5(c), Exemptions from Unusual Conditions is confusing 2.6, technical comments related to grouting 2.10 Emphasize survey and GPS Recommended longer step-drawdown test	added in 4.3(d) addressed comments concur rewrote section not minimum standard concur not minimum standard
Mink and Yuen, Inc.	Grouting to 200 feet is not adequate	concur (2.6 c)
Honolulu Board of Water Supply	Should not use bentonite 1.5 inch annulus adequate in all cases Water level measuring device accuracy requirement to stringent	not minimum standard 1.5 in. not adequate concur (2.9d, 4.2)
Hawaii County Department of Water Supply	Misc. detailed comments  Likes three inch annulus Requests change in minimum wall thickness for stainless steel casing (2.4)	addressed comments  concur (2.6) not included -depends on the strength of the alloy used
Island Resources	shaft boring & sealing should be subject to Chair Make test pumping more flexible Use permanent pump as test pump Require all wells to have a airline Grouting to 200 feet is not adequate  Why chlorination?  Why not solid casing 100% of the distance to the aquifer? Wells should have 2 airlines and a sounding tube	concur (1.5) addressed in 2.9 addressed in 2.9 not a minimum standard concur (2.6c) Well disinfection important for aquifer protection (2.8) not a minimum standard not a minimum standard
Water Resources International	200 ft grout not adequate  Submersible pumps can't do a proper step-drawdown test Requiring positive displacement not fair to those that don't have the equipment Wants flexibility on constant rate test	concur (2.6c)  addressed in 2.9 not required, tremie still OK if the annulus is 3 in. (2.6) concur (1.5 & 2.9)
Waiele Drilling	Keep requirement for a sounding tube Standards not consistent with the rules All wells should have an elevation survey 1.5 inch annulus not adequate for tremie	not a minimum standard concur, addressed in several sections concur but compromised (2.11) concur (2.6)
USGS	want provisions for monitor wells	addressed (1.5)
DLNR - Engineering	HWCPIS often used for construction standards	These are minimum standards
Beylik Drilling	1.5 inch annulus may not be enough	concur (2.6)

# Attachment C

## Public Participation and Notification

Drillers	8/27/03 email	9/3/03 email	1/16/04 email	called/other	attended 9/15/03 conference	attended 9/29/03 workshop	written response
Blaise Clay (Water Resources Int.)	X	X	X				
Dale Stromquist (Waieli Drilling)	X	X	X	X	X		X
David Pico	X	X	X				
Dwight Ho (Beylik)	X	X	X	X		X	
Foundation International	X	X	X				
Fred Page	X	X	X				
Geolabs Hawaii	X	X	X				
Howard Akagi (Water Resources Int.)	X	X	X	X	X	X	
Mel's Water Works	X	X	X				
Mike Sober (Valley Well Drilling)	X	X	X	X			
Oasis Systems	X	X	X	X			
Steve Goldberg (Oasis)	X	X	X	X			
Tracy Runnells	X	X	X	X			
Wailani Drilling	X	X	X	X			

### County Water Managers

Clifford Jamile (Honolulu)	X	X	X	X			X
Edward Tschupp (Kauai)	X	X	X	X	X		
George Tengan (Maui)	X	X	X	X	X		
Milton Pavao (Hawaii)	X	X	X	X	X		X

### Other Interested Parties

Alva Nakamura (Maui DWS)	X	X	X				
Barry Muranaka (Akinaka & Assoc.)	X	X	X				
Bernie Giron	X	X	X				
Bill Eddy (Kauai DWS)	X	X	X				
Bruce Inouye	X	X	X		X		
Chauncy Hew (DOH)				X	X		
Chester Lao (Honolulu BWS)	X	X	X	X			
Christine Bean (WB Kukio Resort, LLC)	X	X	X				
Dan Lum (Water Res. Assoc.)	X	X	X	X			
Dave Houle (Parker Ranch)	X	X	X				
David Tarnas (MCSI)	X	X	X				
Delwyn Oki (USGS)	X	X	X				
Denis Lau (DOH)	X	X	X		X		
Department of Health	X	X	X	X	X		X
Ellen Kraftsow (Maui DWS)	X	X	X				
Eric Hirano (DLNR-Engineering)	X	X	X			X	
General Contractors Association	X	X	X				
Glenn Ahuna (Dept. of Water Supply)	X	X	X		X		
Glenn Oyama (Honolulu BWS)	X	X	X	X			

Other Interested Parties	8/27/03 email	9/3/03 email	1/16/04 email	called/other	attended 9/15/03 conference	attended 9/29/03 workshop	written response
Gordon Tribble (USGS)	X	X	X	X		X	
Harold Yee (DOH)	X	X	X				
Hawaii's Friends	X	X	X				
Heather Cole (The Nature Conservatory)	X	X	X				
Horst Brandes (ASCE/UH)	X	X	X				
Jay Ueda (Hualalai Development Company)	X	X	X				
Jim Greenwell (Lanihau Properties)	X	X	X				
John Mink (Mink & Yuen)	X	X	X	X			X
John Ray (HLPC)	X	X	X				
John Santangelo (Waimea Water Services)	X	X	X				
Kainoa Lavea (WM Kukio Resort, LLC)	X	X	X				
Kapua Sproat (Earth Justice)	X	X	X				
Keith Fujimoto (Kauai DWS)	X	X	X		X		
Keith Okamoto (Hawaii DWS)				X	X		
Ken Ishizaki (Engineering Concepts)	X	X	X				
Ken Masatsugu (Navy Public Works)				X			
Lawrence Winters (Maui DWS)	X	X	X		X		
Les Goya (The Queen Emma Foundation)	X	X	X				
Limtiaco Consulting	X	X	X		X		
Lucienne deNaie	X	X	X				
Malcom Patten (Hokulia)	X	X	X				
Manabu Tagomori (KS)	X	X	X				
Mark Beck (Hokulia)	X	X	X				
Mark Murphy (URS)	X	X	X				
Michael Kaha (Waste Management Hawaii)	X	X	X				
Murrayd C. Gardner (IND.)	X	X	X				
Pat Tummons (Environment Hawaii)	X	X	X				
Paul Eyre (Navy)	X	X	X				
Pete Hendricks (County of Hawaii)	X	X	X				
Rick Vidgen (Consultant MacFarms)	X	X	X				
Riley Smith (Sandwich Isles)	X	X	X				
Robert Akinaka (Akinaka & Assoc.)	X	X	X				
Robert Spetich (West Hawaii Utilities)	X	X	X				
Sachiko Murano (East West Consulting Services)	X	X	X				
Sierra Club	X	X	X				
Stephen Skipper (USDA/NRCS)	X	X	X				
Steve Anthony (USGS)	X	X	X				
Steve Bowles (Waimea Water Services)	X	X	X		X		
Steve Gingrich (USGS)	X	X	X				
Ted Vorfeld (Hualalai Engineering)	X	X	X				
Thomas Arizumi (DOH)	X	X	X				
Tom Nance (TNWR)	X	X	X	X			
Villi Wilson (Island Utility Services, Inc.)	X	X	X				
Wally Campbell (Kohala Ranch/Waikii Ranch)	X	X	X				
Wayne Hinazumi	X	X	X		X		

**COMMISSION ON WATER RESOURCE MANAGEMENT**  
*The waters of the State are held for the benefit of the citizens of the State.*

## Attachment D

**The Commission | Regulations | Public Information | Planning | Water Data | Questions?**

[Home](#) > [Regulations](#) > [Hawaii Well Construction and Pump Installation Standards](#)

The Hawaii Well Construction and Pump Installation Standards were amended to the Hawaii Administrative Rules in January 1997. In accordance with the State Water Code, and as stated in §13-168-14, HAR, the goal of the standards are to "ensure the safe and sanitary maintenance and operation of well, and the prevention of contamination of ground water aquifers." Click on the link below to view the Hawaii Well Construction and Pump Installation Standards in Acrobat Reader.

### **Hawaii Well Construction and Pump Installation Standards**

[January 1997, 207Kb]

The Commission on Water Resource Management (Commission) is in the process of revising the Hawaii Well Construction and Pump Installation Standards. Please read and comment on the proposed Draft Hawaii Well Construction and Pump Installation Standards below. A Listing of Changes to the Draft HWCPIS are also provided for assistance. Comments submitted to the Commission shall be also be posted in the blue box below.

The public's input is being sought to establish practical, yet flexible, standards to guide the well construction and pump installation process. Any comments will be greatly appreciated. The Commission will be holding a future workshop on Oahu and video-conference workshops for Hawaii, Maui, and Kauai.

Please address any comments to Kevin Gooding via e-mail at [kevin.l.gooding@hawaii.gov](mailto:kevin.l.gooding@hawaii.gov) or by telephone at (808) 587-0265. Comments may also be mailed to the Commission on Water Resource Management, P.O. Box 621, Honolulu, HI 96809.

**February 18, 2004:** The Final Draft of the Hawaii Well Construction and Pump Installation will be submitted to the Commission on Water Resource Management. Please review this final draft and provide your comments to the Commission. Comments are due by **January 30, 2004**.

### **Final Draft - Hawaii Well Construction and Pump Installation Standards** NEW

[January 2004, 118Kb]

**September 29, 2003:** The Commission on Water Resource Management will hold a Hawaii Well Construction and Pump Installation Standards Revisions Workshop at the Kalanimoku Building, 1151 Punchbowl St., DAGS Conference Room 322C.

### **Agenda for the HWCPIS Revisions Workshop**

[September 2003, 6Kb]

**September 15, 2003:** The Commission on Water Resource Management held a videoconference to discuss the revisions to the Hawaii Well Construction and Pump Installation Standards. The following information was presented by Commission staff.

### **CWRM Presentation on the HWCPIS Revisions**

[September 2003, 338Kb]

**August 2003:** The Commission on Water Resource Management initiated a review and revision process for the Hawaii Well Construction and Pump Installation Standards. List below are the first draft of the revision and a list of changes.

### **First Draft - Hawaii Well Construction and Pump Installation Standards**

[August 2003, 204Kb]

### **Listing of Changes to the First Draft HWCPIS**

[August 2003, 7Kb]

### **Comments to Draft Hawaii Well Construction and Pump Installation Standards**

Please review the written comments listed below. The Commission is currently accepting written comments via mail, fax, or e-mail.

- [Bill Wong, Department of Health, Environmental Management Division, Safe Drinking Water Branch](#)
- [Clifford Jamile, City and County of Honolulu, Board of Water Supply](#)
- [Larry Beck, County of Hawaii, Department of Water Supply](#)

**The Commission | Regulations | Public Information | Planning | Water Data | Questions?**

[Adobe Acrobat](#) | [Disclaimer](#) | [Privacy Policy](#) | [Contact CWRM](#)

## ATTACHMENT E

Attendance  
VIDEOCONFERENCING PUBLIC INFORMATION MEETING  
Hawaii Well Construction and Pump Installation Standards (HWCPIS)  
September 15, 2003

### CWRM Staff

Ernest Lau  
Glenn Bauer  
Ryan Imata  
Kevin Gooding  
Lenore Nakama  
Faith Ching

### Department of Health

Chauncy Hew  
Bill Wong

Howard Akagi (Water Resources International)  
Eric Kadooka (Limtiaco Consulting Group)

### Hawaii County

Steve Bowles (Island Water Services)  
Herbert Richards (Kahua Ranch)  
Bob Richardson (Waieli Drilling)  
Tracy Underwood (Water Resources International)  
James Frazier, CWRM

### Hawaii Department of Water Supply

Glenn Ahuna  
Kurt Inaba  
Larry Beck  
Owen Nishioka  
Dennis Lee  
Clyde Young  
Keith Okamoto

### Kauai Department of Water

Wayne Hinazumi(Kauai DWS)  
Keith Fujimoto  
Bruce Inouye

### Maui Department of Water Supply

Larry Winter  
Herb Kogasaka

# Attachment F

List of attendees at the 9/29/03 Oahu Workshop

9/29/2003

Hawaii Well Construction and Pump Installation Standards Workshop

Attendance (not including CWRM)

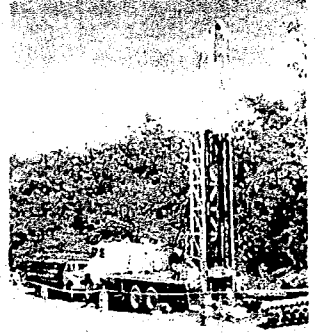
Gordon Tribble	USGS
Howard Akagi	Water Resources International
Carty Chang	DLNR Engineering
Eric Yuasa	DLNR Engineering
Dwight Ho	Beylik

**WATER COMMISSION SEEKS INPUT ON WELL CONSTRUCTION & PUMP INSTALLATION STANDARDS**

The Commission on Water Resource Management (CWRM) is in the process of revising the Hawaii Well Construction and Pump Installation Standards (Well Standards). They are seeking public input to establish practical, yet flexible, standards to guide well construction and pump installation. All comments will be greatly appreciated.

The Well Standards are important because improperly constructed wells can introduce pollutants into our groundwater or increase the chances of salt-water intrusion. Most of our State's drinking water comes from groundwater, so we cannot afford to endanger this resource.

The first edition of the Well Standards was adopted in 1997. Since then they have received many comments on the Well Standards. The revised draft of the Well Standards, a list of major changes to the standards and other well construction and pump installation information is available on the CWRM website at [www.hawaii.gov/dlnr/cwrn](http://www.hawaii.gov/dlnr/cwrn). This draft is the next step in the process of creating well standards that will help protect our water resources and provide for the needs of well owners and drillers. Please send written comments to the Commission on Water Resource Management at P.O. Box 621, Honolulu, HI, 96809 or email your comments to [dlnr\\_cwrn@hawaii.gov](mailto:dlnr_cwrn@hawaii.gov). Any questions, call Kevin Gooding at (808) 587-0265.

**REQUEST FOR PROPOSALS: SANITARY SURVEY OF PUBLIC WATER SYSTEM**

**Request for Proposals: Sanitary Survey of Public Water System  
No. 331, BWS Honolulu-Windward-Pearl Harbor**

On October 15, 2003, the Department of Health published a request for proposals for a third party to conduct the sanitary survey of the Honolulu-Windward-Pearl Harbor water system owned and operated by the Honolulu Board of Water Supply. The Honolulu water system is the largest public water system in the state. The selected contractor will be required to satisfactorily complete the DOH sponsored sanitary survey training course, perform, document, photograph, and write up the survey report. A pre-proposal meeting will be held on October 22, 2003, at 9:00 a.m., at the Safe Drinking Water Branch office in Honolulu. The deadline for the receipt of all sealed bids by the SDWB will be Monday, November 24, 2003, 4:00 p.m. Hawaii Standard Time. This contract is the brainchild of Bill Wong and is intended to help alleviate the sanitary survey load on its limited staff. In addition, this project will allow the SDWB to evaluate the feasibility of allowing third parties to conduct sanitary surveys for other public water systems in the future.

**SDWB BIDS A FOND FAREWELL TO LORRAINE ASANO**

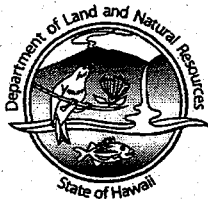
Lorraine Asano, clerk-stenographer extraordinaire, closed her career in public service on September 30, 2003. Lorraine has been a vital part of the Safe Drinking Water Branch since she joined us in November of 1987. These almost 16 years are combined with another 16 years in the Department of Health (with Maternal and Child Health, the Noise and Radiation and the Children's Mental Health branches of the Department). While she is still young, able, and full of vitality, Lorraine has decided that now is the time for a well deserved rest and to pursue other interests.

Lorraine was always a pleasure to work with. She willingly gave her support to all the staff who needed it, often rearranging her time to help others complete projects with immediate deadlines. As the Branch's responsibilities grew, Lorraine took on additional responsibilities, at one point, taking on the job of supporting the Water Treatment Plant Operator Certification program by herself. In 1997, Lorraine's work was recognized by earning her a Sustained Superior Performance Award. As the name of the award indicates, her work was of consistently high quality every year.

While we all wish her the best of health, endless happiness, good fortune, and the greatest and most fulfilling retirement ever, her friendship, helpfulness and dedication will be sorely and deeply missed by all the staff here at the Safe Drinking Water Branch. Words cannot express all that she has meant for the Branch. **Aloha nui loa.**

# Attachment H

LINDA LINGLE  
GOVERNOR OF HAWAII



PETER T. YOUNG  
CHAIRPERSON

MEREDITH J. CHING  
CLAYTON W. DELA CRUZ  
JAMES A. FRAZIER  
CHIYOME L. FUKINO, M.D.  
STEPHANIE A. WHALEN

ERNEST Y.W. LAU  
DEPUTY DIRECTOR

STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT

P.O. BOX 621  
HONOLULU, HAWAII 96809  
OCT 21 2003

Mr. Milton Pavao, Manager  
Department of Water Supply  
County of Hawaii  
345 Kekuaaoa Street, Suite 20  
Hilo, HI 96720

Dear Mr. Pavao:

Hawaii Well Construction and Pump Installation Standards (HWCPIS) Revisions

As you know, we circulated a revised draft of the HWCPIS for public review in August 2003. Please send us your comments. Changes in the HWCPIS may affect your well construction methods. We will begin finalizing the draft in November. An electronic version is available on our webpage at <http://www.hawaii.gov/dlnr/cwrm/>.

If you have any questions, please contact Kevin L. Gooding of the Commission staff at 587-0265.

Sincerely,

A handwritten signature in black ink, appearing to read "Ernest Y.W. Lau".

ERNEST Y.W. LAU  
Deputy Director

KLK:sd  
Attachment



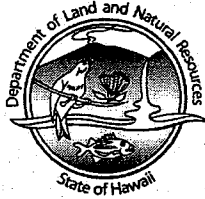
LINDA LINGLE  
GOVERNOR OF HAWAII



PETER T. YOUNG  
CHAIRPERSON

MEREDITH J. CHING  
CLAYTON W. DELA CRUZ  
JAMES A. FRAZIER  
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STEPHANIE A. WHALEN

ERNEST Y.W. LAU  
DEPUTY DIRECTOR



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT

P.O. BOX 621  
HONOLULU, HAWAII 96809  
OCT 21 2003

Mr. Edward Tschupp  
Manager and Chief Engineer  
Department of Water  
County of Kauai  
3498 Pua Loke St.  
Lihue, HI 96766

Dear Mr. Tengan:

Hawaii Well Construction and Pump Installation Standards (HWCPIS) Revisions

As you know, we circulated a revised draft of the HWCPIS for public review in August 2003. Please send us your comments. Changes in the HWCPIS may affect your well construction methods. We will begin finalizing the draft in November. An electronic version is available on our webpage at <http://www.hawaii.gov/dlnr/cwrm/>.

If you have any questions, please contact Kevin L. Gooding of the Commission staff at 587-0265.

Sincerely,

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ERNEST Y.W. LAU  
Deputy Director

KLK:sd  
Attachment

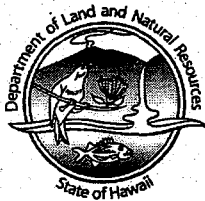
LINDA LINGLE  
GOVERNOR OF HAWAII



PETER T. YOUNG  
CHAIRPERSON

MEREDITH J. CHING  
CLAYTON W. DELA CRUZ  
JAMES A. FRAZIER  
CHIYOME L. FUKINO, M.D.  
STEPHANIE A. WHALEN

ERNEST Y.W. LAU  
DEPUTY DIRECTOR



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT

P.O. BOX 621  
HONOLULU, HAWAII 96809  
OCT 21 2003

Mr. George Tengan, Director  
Department of Water Supply  
County of Maui  
200 South High Street  
Wailuku, HI 96793-2155

Dear Mr. Tengan:

Hawaii Well Construction and Pump Installation Standards (HWCPIS) Revisions

As you know, we circulated a revised draft of the HWCPIS for public review in August 2003. Please send us your comments. Changes in the HWCPIS may affect your well construction methods. We will begin finalizing the draft in November. An electronic version is available on our webpage at <http://www.hawaii.gov/dlnr/cwrm/>.

If you have any questions, please contact Kevin L. Gooding of the Commission staff at 587-0265.

Sincerely,

A handwritten signature in black ink, appearing to read "Ernest Y.W. Lau".

ERNEST Y.W. LAU  
Deputy Director

KLG:sd  
Attachment

# Attachment I

'08-28-03' 11:16am From

-408 P.001 F-477

LINDA LINGLE  
GOVERNOR OF HAWAII



CHRYOME L. FUKINO, M.D.  
DIRECTOR OF HEALTH

STATE OF HAWAII  
DEPARTMENT OF HEALTH  
P.O. BOX 3378  
HONOLULU, HAWAII 96801-3378

In reply, please refer to:  
EMOISDWB

September 26, 2003

Mr. Ernest Lau, Deputy Director  
Commission on Water Resource Management  
Department of Land and Natural Resources  
State of Hawai'i  
1151 Punchbowl Street  
Honolulu, Hawai'i 96814

ATTENTION: Mr. Kevin L. Gooding

Dear Mr. Lau:

SUBJECT: COMMENTS ON THE PROPOSED REVISIONS TO THE  
COMMISSION ON WATER RESOURCE MANAGEMENT'S (CWRM)  
WELL CONSTRUCTION AND PUMP INSTALLATION STANDARDS  
REVISED AUGUST 2003

Thank you for the opportunity to review and comment. Our comments are from two program areas listed below: Safe Drinking Water and Underground Injection Control (UIC).

#### Safe Drinking Water

1. Section 1.3 (a) New Drinking Water Wells:

Change municipal use to potable use.

Also, for wells intended for potable use, please be aware of the well construction standards in "Water System Standards, State of Hawaii," 2002 as amended and the American Water Works Association (AWWA) Standards for Water Wells, ANSI/AWWA A100-97, as amended.

2. Section 1.4 Definitions:

Add:

"Backflow preventor" means a device or means to prevent backflow into the potable water system.

Mr. Ernest Lau  
September 26, 2003  
Page 2

"Chemigation" means applying fertilizer or agricultural chemicals to land or crops through an irrigation system.

"USDA" means United States Department of Agriculture

3. Section 2.3 (c) Gradients (slopes)

During the September 15, 2003, video conference workshop, it was suggested that this section be deleted. Upon further review, it is our position that in the interest of public health protection, this section should remain intact.

4. Section 4.2 (a) Pumps and Pumping Equipment:

Change should be to shall be:

All installations of pump and pumping equipment shall be constructed in such a manner as to prevent the pollution and contamination of the well from surface sources.

5. General Comments:

- a. Include a brief description of a irrigation well pump using chemigation.
- b. Include statement on regulatory penalties if standards are not met.
- c. The supporting document, "Well Standards Update, Summary List of Significant Changes":

The statement, "deleted parts 2.8(b) and 2.8(d)" is misleading. We offer the following description:

Section 2.8 has been simplified by addressing the disinfection of all materials installed in wells in section (a), instead of separate references to the well casing, pump and pumping equipment.

If you have any question on the safe drinking water portion comments, please call William Wong of the Safe Drinking Water Branch at 586-4258.

Mr. Ernest Lau  
September 26, 2003  
Page 3

Underground Injection Control (UIC)

1. Section 1.3 (b) Injection Wells:

Include injection well abandonment; and

For notifying the Commission of an injection well, the DOH UIC permit's transmittal letter should be adequate. The UIC permit is generally up to 25 pages, so its bulk is difficult to manage. (Is this a manageable requirement for the Commission, in terms of enforcing compliance on injection well owners/operators?)

2. Section 1.3 (d) Test Borings:

The Commission may want to reconsider and require permitting for test borings that are unusually deep for the main purpose of insuring proper backfilling. Improperly backfilled test borings, that may extend to depths of hundreds of feet, can pose a significant groundwater contamination risk.

3. Section 1.4 Definitions:

For definition consistency of an injection well, we suggest using the same wording as Chapter 11-23: "Injection well means a well into which subsurface disposal of fluid or fluids occurs or is intended to occur by means of injection."

4. Section 1.5 Exemptions from Unusual Conditions:

The perspective between the Commission and an Applicant is confusing in this section. In reading the script, it is not clear who should request (apply for?) a variance, based on the finding of which party.

5. Table 1. Well Permits and Reports Required:

For an Injection Well, include the term "Modify" under proposed activity; and

Under Well Type for Dry Wells, eliminate the term "Dry" and use "Drainage Well" to describe this category, and insert all of the same requirements as listed for an injection well.

Mr. Ernest Lau  
September 26, 2003  
Page 4

6. Section 2.1 Well Construction Permits:

Regarding application fees, the trend is to collect application fees from all entities. You may want to consider this at this time; and

Revise the language to say that changes to a well construction permit, regarding such parameters as location, depth, construction method, size, capacity, etc., shall not occur unless approved in advance in writing by the commission. This requirement is needed to maintain regulatory control over well construction.

7. Section 2.3 Well Location:

Subsections (b) and (c) could be combined to comprehensively address keeping water wells away from pollution sources. For example, a new drinking water well should be sited horizontally away from pollution sources in a manner that compatibly conforms to protection measures and objectives that have been established by other public health or environmental protection agencies. Furthermore, groundwater gradient concerns, as well as pumping-induced gradient concerns, should be incorporated as a factor to consider when siting a drinking water well away from pollution sources.

8. Section 2.6 Grouting the Annular Space:

Subsection (c), Minimum Depth of Grouted Annular Space, should not offer a minimum grout depth. Grouting should be for the entire length of annular space, from the ground surface to the top of the aquifer.

Subsection (d), Minimum Thickness of Grouted Annular Space, should not offer the nonpositive emplacement of grout. Grouting should always be under positive displacement.

Subsection (e)(1), Grouting Materials for Annular Sealing, Sand-Cement Grout, should specify "approximately 5 gallons of potable water per 94-pound sack of cement" instead of 6 gallons. Six gallons will produce a watery mixture.

Subsection (e)(2), Grouting Materials for Annular Sealing, Neat Cement Grout, should specify "5 gallons of potable water per 94-pound sack of cement. A six-gallon mix is too watery.

Mr. Ernest Lau  
September 26, 2003  
Page 5

Subsection (e) (3), Grouting Materials for Annular Sealing, Cement-Bentonite, may present problems with quality control. Cement-bentonite mixing is typically done under field conditions and under a driller's intuitive knowledge. The chance of wide variation in quality assurance is likely high. If cement-bentonite mixtures are allowed, quality assurance needs to be specifically addressed, in addition to having the appropriate driller's credentials.

Subsection (f), Placement of the Annular Grout, should not allow free-fall; however, UIC has allowed free-fall up to 6 feet for certain injection well backfilling projects. Six feet may be used as the cut off. However, if free-fall grouting is used, the grouting must fully incorporate the use of vibrators to settle the grout and to remove entrapped air.

9. Section 2.9 Well Testing:

Subsection (b), Step-Drawdown Tests (Well Efficiency Test), should require that the minimum amount of testing time for each discharge rate should be the time needed to reach a steady-state condition, in order to measure the representative water level. If the steady-state condition cannot be achieved in the minimum time of one-half hour, the testing needs to continue. A water level reading from a nonsteady-state condition is merely transient.

10. Section 2.10 Well Completion:

Subsection (b), Well Completion Report and Records: Please emphasize that the well's coordinates be accurately determined through professional survey, including GPS verification.

11. Section 3.4 Grouting Materials for Permanent Sealing:

Please incorporate the comments of item No. 7 above regarding the Sand-Cement Grout, the Neat Cement Grout, and the Cement-Bentonite mixture; and

Consider including a subsection addressing mechanical compaction requirements, if mechanical compaction using soil or aggregate is a viable backfilling alternative for wells having shallow depths and wide diameters.

Mr. Ernest Lau  
September 26, 2003  
Page 6

12. Section 4.2 General Installation Requirements:

Subsection (a), Pumps and Pumping Equipment: Please change the word should to shall in the first sentence, "... wells shall be constructed in such a manner ..."

If you have any questions about the UIC-portion comments, please call Chauncey Hew of the Safe Drinking Water Branch at 586-4258.

Sincerely,



WILLIAM WONG, P.E., CHIEF  
Safe Drinking Water Branch  
Environmental Management Division

CH:nbp

c: Tom Arizumi, P.E., Chief  
Environmental Management Division



Larry Beck  
Hawaii County Department of Water Supply  
9/16/03

Pg. viii  
Add dotted lines (typical) between title and page number (for consistency).

Pg. 1-4  
**Abandoned well** – confusing to call a well “abandoned” if still in use, even if in derelict condition. It is a candidate for being declared abandoned.

**Aquifer** – “geologic formation” may be better vs. “body of rock”

Pg. 1-5  
**Groundwater** definition could read more simply: “...whether perched, confined by dike, flowing, or ...”

**High-level Aquifer** “...a key role in the occurrence of high-level groundwater.” Vs. “high-level occurrence of groundwater.”

Pg. 1-6  
Define **Open hole section** of well?

Pg. 1-7  
**Test Boring** definition does not seem to encompass reference to *test borings* found within definition of **Monitor well** (pg. 1-6) in terms of being *cased* or *permanent*. Note also that Table 1. shows Test Boring to be “(temporary)”. See also Table 1 footnote and compare to definition of **Monitoring well**.

Pg. 1-8  
**Well** definition only applies to groundwater?

Pg. 1-9  
Beginning of line near middle of page: change “andwell” to “and well”.

Pg. 2-1  
Recommend recording recovery time (time vs. return to static level from pumping level) in addition to other data although this is somewhat addressed on pg. 2-15.

Pp. 2-2, 2-3  
“...the maximum distance possible from sources of pollution.” is ambiguous. Better to use minimum allowable distance? Case by case basis with review?

Pg. 2-9  
Any standards for gradation of the gravel?

Recommend placing suction end of pump assembly (typically the suction tube/strainer below the impeller bowls) away from perforations to minimize localized velocities through perforations which tends to draw finer particles into gravel pack and can eventually lead to reduced flow due to clogging of (interstitial) voids between gravel rocks.

Pg. 2-11

two periods at end of first paragraph under (f), delete one

Pg. 2-16, under (e)

Change "...intervalaccording..." to "...intervals according..."

Pg. 2-18, second line

Change "...a elevation..." to "...an elevation..."

Pg. 3-1, 1)

"The well has *completed serving* its purpose, or"

Pg. 3-4

near middle of second paragraph

Change "...cavein..." to "...cave-in..."

Pg. 3-5

near end of second paragraph

Change "...cavein..." to "...cave-in..."

Pg. 3-6, middle of page

Change "...using a in a manner conforming..." to "...using a tremie in a manner conforming ..."

Pg. 3-7

Second to last paragraph ends with a coma – change to a period.

Pg. 4-2

Change "permitis" to "permit is"

Pg. 4-3, (d) last two paragraphs

Suggest providing an I.D. or range of I.D. (i.e. 1/4" to 3/8") for airline tube so as not to confuse with 3/4" ID of sounding tube. Large diameter air lines would take too much effort

Not always clear when referencing an airline vs. a sounding tube.

Possible suggestion: take out "All tubes shall be equipped..." sentence from last paragraph and begin new paragraph at bottom of page:

“All tubes shall be equipped *at the top end* with a cap or plug to prevent entry of foreign material. The airline air pressure gage shall...and the pressure transducer shall....”

May wish to provide for future location of pressure transducer or other permanent recorder to convert system to SCADA monitoring of pumping and static water levels by to provide better data and eliminate labor of collecting data.

Regarding today's (9/15/03) discussion regarding *well test pumps becoming permanent pumps* :  
If this if for a production well, the test pump is not likely the most efficient pump. Typically the operating design point is best determined after well yield has been determined by the draw down tests. The impellers are specifically trimmed for the most efficient operation after the total dynamic head has been determined and that is based, in part, on draw down levels. Installing a number of well pumps that are operating inefficiently it is not only costly to the owner or customer(s) it is also an unnecessary burden on the power grid and a waste of resources.

# BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU  
630 SOUTH BERETANIA STREET  
HONOLULU, HI 96843



September 16, 2003

JEREMY HARRIS, Mayor (9/30)

EDDIE FLORES, JR., Chairman  
CHARLES A. STED, Vice-Chairman  
JAN M.L.Y. AMII  
HERBERT S.K. KAOPUA, SR.  
DAROLYN H. LENDIO

RODNEY K. HARAGA, Ex-Officio  
LARRY J. LEOPARDI, Ex-Officio

CLIFFORD S. JAMILE  
Manager and Chief Engineer

DONNA FAY K. KIYOSAKI  
Deputy Manager and Chief Engineer

Mr. Ernest Y. W. Lau, Deputy Director  
Commission on Water Resource Management  
Department of Land and Natural Resources  
State of Hawaii  
P. O. Box 621  
Honolulu, Hawaii 96809

Dear Mr. Lau:

Subject: Revisions to Well Construction and Pump Installation Standards

Thank you for the opportunity to comment on the proposed revisions to the standards for well construction and pump installations. The proposed revisions are an improvement and we are pleased that most of our previous concerns with the existing standards have been addressed. Aside from some minor comments already made by Mr. Kevin Gooding of your staff, the following comments were of sufficient importance to register in writing.

1. Section 3.4 Grouting Materials for Permanent Sealing Subsection (5) Bentonite grout. Comment: Bentonite is not a satisfactory material for well abandonment because it lacks physical strength in its hydrated and dry states.
2. Section 2.6 Grouting the Annular Space (d) Minimum Thickness of Grouted Annular Space. Comment: The proposed minimum grouted annular space of 1½ inch should be satisfactory for all wells grouted by the tremie method. Positive displacement of grout with either use of a float shoe or water displacement are very satisfactory methods used in oil fields and foundation grouting but offer no advantage over tremied grout in an annulus of 1½ inch. When grout pumping ceases, the grout in the annulus is under the same static pressure regardless of the placement method. As a general rule, drilled well diameters exceed gage diameter of the bit because of formation properties.

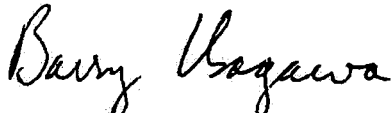
A larger than necessary annulus and the cost of grouting is an unnecessary expense. The added costs of drilling a larger hole and filling the space with grout are considerable for large diameter deep wells. Most of all, we know of no cases on Oahu where the 1½ inch grouted annulus has failed to provide the intended purpose of sealing the casing to formation to prevent contaminants and pollutants from leaking down this pathway.

Mr. Ernest Y. W. Lau  
September 16, 2003  
Page 2

3. Section 4.2 General Installation Requirements (b) Above Grade Pump Connections. Comment: The requirement for the well casing to project 12 inches above the prepared ground surface or pump house floor is satisfactory for small pumps but not for large heavy pumps that require bolting of the pump base to a thick reinforced concrete slab.
4. Section 4.2 General Installation Requirements (d) Water Level Measuring Device. Comment: The accuracy level for the air pressure gauge and pressure transducer should be both 0.1 foot.

If you have any questions, contact Chester Lao at 748-5931.

Very truly yours,


  
for CLIFFORD S. JAMILE  
Manager and Chief Engineer

Attachment

CL:rk  
cc: C. Lao



Glenn R  
Bauer/DLNR/StateHiUS  
09/30/2003 06:56 AM

To JMNK809@cs.com  
cc Kevin L Gooding/DLNR/StateHiUS@StateHiUS  
bcc  
Subject Re: Grouting 

Thanks, John for your comments. We will incorporate them into the next draft that will be posted soon. I'll let you know when. Glenn  
JMNK809@cs.com



JMNK809@cs.com  
09/30/2003 06:43 AM

To: glenn.r.bauer@hawaii.gov  
cc:  
Subject: Grouting

Subject: Draft standards well construction.  
From: John F. Mink, Mink and Yuen, Inc.

Grouting the annulus to a depth of just 200 feet as proposed in the new standards is insufficient protection in many geological situations throughout the State. For example, wells drilled to access the Honomanu aquifer in East Maui must first penetrate the Kula volcanics, which may exceed 200 feet in thickness. The Kula acts as a reservoir for contaminants, and if it is not fully grouted off the contaminants will pass down the open annulus to the Honomanu aquifer. A similar situation exists in the Lahaina sector of West Maui where the Honolua formation overlies the Wailuku basalt, the main aquifer. Also in some areas the depth of saprolite may reach or exceed 200 feet, and if grouting is absent contaminants may be released to the underlying volcanic rock. The same argument applies to wells drilled through the caprock.

The depth of grouting of each well should depend on local geological conditions. A minimum depth of 200 feet may be acceptable in numerous situations but not in all. A greater depth of grouting should be specified, say 500 feet, but the final depth could be negotiated, depending on geological conditions encountered. An absolute minimum depth should be required.

July 31, 2003

Dept. of Land & Natural Resources  
Commission of Water Resources

We at Wai'eli Drilling & Development recognize the need for a comprehensive program for the regulation, planning and protection of the states water resources. As water is our primary business; we are dedicated to compliance with the rules initiated for these purposes. We do, however, feel that there are several areas that require clarification and/or consideration, and would like to take this opportunity to bring them to your attention.

A primary issue of concern for us, as contractors, is the responsibility for permits and completion reports. Hawaii Administrative Rule (H.A.R.) 13-168-13 states that "within thirty (30) days after the completion of any well, the well driller or pump installation contractor, as the case may be, shall file with the commission on forms provided by the commission a well completion report...". H.A.R. 13-168-12 (E) says, "Every well construction and pump installation permit shall direct the well driller or pump installation contractor to file a well completion report as provided in 13-168-13." However, what the permit actually state is, "The permittee, well operator, and/or well owner are responsible for all conditions of the permit. This includes ensuring that the pump installation contractors submits a completed Part II of the well completion report within sixty (60) days after the pump installation work is completed." Permit condition #5 says, "The permittee, well operator, and/or well owner shall complete and submit as-built drawings and Part II (Permanent) Pump Installation report of the well completion report (attached) to the chairperson within sixty (60) days after completion of work." A letter sent June 21<sup>st</sup>, 1996 from C.W.R.M. to all drilling and pump contractors states, "... please be aware that well and pump contractors are ultimately responsible for these reports under Administrative Rule 13-168-13 ...".

We feel that this is very ambiguous. It makes sense to us that since the contractor has performed the work they would be better able to provide the necessary information required; as-builts, photos etc. And we are certainly willing to do so as part of our professional responsibility to our clients. However, in several instances the situation has arisen where we have completed and signed the necessary reports and sent them to the owner or owners representative for signature and forwarding to C.W.R.M. only to find out later that they have for various reasons, failed to do so (Ryan Res.). We feel that since the permittee, well operator, and/or well owner are responsible for all conditions of the permit clearly they are responsible for the required reports.

With regards to permit revocations, section 2.1 of the Hawaii Well Construction & Pump Installation Standards states, "If the commencement or completion date is not complied with, the permittee shall be notified by certified mail that the permit is to be revoked by the commission within 60 days of the notice, unless the permittee can show good cause that it should not be revoked". Condition #8 of the permit states, "If the commencement date is not met, the commission may revoke the permit after giving the permittee, well operator and/or well owner notice of the proposed action and an opportunity to be heard." To our knowledge the commission has never given notice of any kind prior to the revocation of a permit. This omission by C.W.R.M. creates unnecessary burdens upon the permittee, who must re-file and wait for approval, and the commission who must again go through the evaluation process. Advance notice would give the permittee time to request an extension before revocation. We firmly believe that the commission should be required to comply with the rules and permit conditions just as the permittee and contractors are.

Other areas we feel deserve consideration:

1. To obtain a permit (drilling or pump installation) in Hawaii is ninety (90) days. We know of two states (Cal., and Minn.) where a permit is usually issued the day after the application is filed. Why does it take three months here?
2. Why is it necessary to file a pump installation completion report for a pump or motor replaced with identical equipment?
3. Why is the use of the permanent (production) pump as the test pump in a well still considered a violation unless a "variance" is granted by C.W.R.M.? Under existing rules the pump used to test a well must be removed until the test data is evaluated and a pump installation permit issued. At this time the same pump may be re-installed in the well and is now considered the permanent pump.



The additional time and expense involved is unnecessary. The well should be pump tested and secured pending C.W.R.M.'s approval of well completion and pump test data. If the test data supports the issuance of the requested pump capacity a permit will be issued and well completion Part II filed. If a permit is denied, or requested capacity reduced, the pump must then be removed. The requirement to request a 'variance' for this purpose is, we feel, superfluous.

## Attachment J

List of organizations and individuals that participated in the review process

Written Comments	Participation in Public Meetings	Verbal Comments
Department of Health, Safe Drinking Water Branch and Underground Injection Control	Beylik Drilling	Oasis Water Systems, Inc.
Hawaii County Department of Water Supply	Department of Health, Safe Drinking Water Branch and Underground Injection Control	Tracy Runnells Well Service Inc.
Honolulu Board of Water Supply	Department of Land and Natural Resources, Engineering Division	Valley Well Drilling
Mink and Yuen, Inc.	Hawaii County Department of Water Supply	
Wa'eli Drilling	Island Resources, Ltd.	
	James A. Frazier	
	Kauai Department of Water Supply	
	Limtiaco Consulting Group	
	Maui Department of Water Supply	
	Herbert M. Richards, Jr	
	U.S. Geological Survey	
	Wa'eli Drilling	
	Water Resources International, Inc.	

# Attachment K

Comments on final draft

No comments received as of February 4, 2004. The comment period ended January 30, 2004.