

County of Maui Water
Supply

SOURCE WATER - WELLHEAD PROTECTION PROJECT

MEETING MINUTES

DATE: November 26, 2002

TIME: 5:30-7:30 PM

PLACE: Board of Water Supply Meeting Room; Kahului Shopping Center
65 West Kaahumanu Avenue, Unit 29, Kahului, Maui
(Behind Ah Fook's Supermarket)

Attending were:

Sean O'Keefe	Alexander & Baldwin
Manabu Tagomori	Kamehameha Schools
Robert Whittier	U H Water Resources Research Ctr
Aly El Kadi	UH Water Resources Research Ctr
Robert Chong	DOH - Safe Drinking Water Branch
Bill Wong	DOH - Safe Drinking Water Branch
Dan Chang	DOH - Safe Drinking Water Branch
Dean Nakano	DLNR - CWRM
Lenore Nakama	DLNR - CWRM
Nolan Perreira	Lana`i Water Company
Warren Suzuki	Maui Land & Pineapple Co., Inc.
David Craddick	Maui Dept. of Water Supply

George Tengan Maui Dept. of Water Supply
Eva Blumenstein Maui Dept. of Water Supply
Edna Manzano Maui Dept. of Water Supply
Ellen Kraftsow Maui Dept. of Water Supply

1. Meeting Introduction

Ellen Kraftsow Introduced the Meeting, indicating that it was a joint meeting of the Source Water Assessment Project and the Wellhead Protection Advisory Committee.

These two projects share compatible goals. Desired End Products of the HISWAP effort include: to develop modeled capture zones for drinking water wells in the State of Hawaii; to compile an inventory of activities that could potentially impact or contaminate drinking water; and to provide information and guidance to water purveyors. The desired end products of the Maui wellhead protection project are to develop an effective groundwater management program; delineated in a wellhead protection section for the Water Use & Development Plan update; and supported by a Draft Ordinance for proposal to County Council.

In terms of work on Maui, and in coordination with the State, accomplishments to date include preliminary wellhead protection area modeling; inventory of potential contaminant sources within those modeled areas for Maui and partially done for Lana`i, research into other programs and regulations around the Country and the State to identify desirable and implementable measures; a public process with input from an advisory committee; and preliminary drafting of a strategy and ordinance, which are the subjects of this meeting, along with the updated modeling results.

2. Review of Minutes from June 12, 2002 Wellhead Protection Advisory Committee Meeting

No objections were raised to approval of the previous meeting minutes. Minutes were approved.

3. Update from the State Department of Health and the University of Hawaii Water Resources Research Center on MODFLOW modeling results

Robert Whittier provided a presentation on the delineation of wellhead protection zones for the island of Maui using the MODFLOW model. The SWAP team included; Bill Wong & Dan Chang of DOH; Aly El-Kadi; C Ray; R. Whittier, K. Yoshida; T. Gallop; M. Rungvetvuthivitaya; P. Moracik; S. Dhal and K. Rotzoll with the UH Water Resources Research Center.

The Source Water Protection Area is defined as the zone through which contaminants, if present, are likely to migrate and reach a drinking water source. The Safe Drinking Water Amendments of 1996 emphasize pollution prevention. All States are required to develop Source Water Assessments. It is hoped that once contamination risk is identified with SWAP, it will help to identify protective measures for contingency planning, implementation of best management practices, and public education. Maui has 66 drinking water sources; 58 of which are groundwater sources; 8 of which are surface water sources.

A Groundwater source delineation starts with identifying a given well or source, followed by collection of hydrologic information about that well or source (geologic setting; open interval depth; pump capacity; maximum allocated pumpage, etc.); query of existing GIS coverages, GPS for precise location information; databases and etc.;

delineation of zones A, B and C as defined by 50', radius, 2 year time of travel and 10 year time of travel in the SWAP program, respectively. Zones B & C are determined

by tracking a particle "backwards" from the well to where it may have come from over a

2 or 10 year period based on information about geologic and hydrologic data.

The East Maui model identified recharge of 0-about 151 inches per year in the modeled protection zones. Rock formations in East Maui were Hana and Kula Volcanics,

as well as the Haleakal Rift Zone and sedimentary deposits in the isthmus. Hydraulic

conductivity ranged from 0 to 2,500 feet per day, with the early stage Kula volcanics

having a higher conductivity than the Hana volcanics. Early stage lavas are less viscous,

thinner and provide more interflow boundaries than late stage lavas, which are more viscous, thicker with less interflow boundaries and lower transmissivity. The Rift Zones and sedimentary deposits also exhibited lower hydraulic conductivity,

The model is bounded by a "no-flow" boundary, or boundary condition with specified water level and head. Source, such as recharge and flow from elsewhere; and sinks, such as wells and gaining streams are accounted for in the model. Most East Maui streams either contribute to direct run-off or arise from perched water. Only in

the Nahiku region were there actually streams that withdrew groundwater. A water table value of "0" (zero) is assigned at stream boundaries; and a specified eastern boundary was placed at the isthmus. Faults and valley sediments were modeled as horizontal flow barriers.

The general trend of flows was perpendicular to the contours. Although there was some lack of data, the overall groundwater plotted well, with reasonable error levels between simulated and observed water levels.

West Maui differs from East Maui in that dikes radiate from a central caldera, rather

than preferentially along a rift zone. The Guybhen Herzberg relationship, which states that for every 1' of water that the water table is above sea level, there will be another 40' below - applies more readily to horizontal flow regimes. Significant

vertical flow such as is found in Maui can change that relationship.

West Maui is composed primarily of the Wailuku & Honolua Basalts. The Wailuku Basalts

have a generally higher conductivity than the Honolua Basalts. As such, higher water

tables are found in areas of lower conductivity (the Honolua Basalts).

West Maui highlevel water elevations ranged up to 4,000', with basal elevations up to 15'. (Vs. East Maui basal elevations of 0-60' in the modeled area).

It was noted that the two year time of travel paths were nearly as long as the 10

year, because water that falls at a higher elevation can actually pass below the well

intakes, hence some of that water would presumably not reach the well.

Pumpage patterns also have a substantial effect on zones of contribution. West Maui WHPAs tended to be much more rounded or oval than the long narrow zones modeled in East Maui. This is due to significant drawdown in the area, such that instead of drawing from upslope, the draw spreads across the slope. Much of the unconfined area of Iao & Waihee aquifer becomes WHPA. Due to high recharge in the area, the length of the modeled WHPA does not increase as much as might otherwise be expected with a longer time of travel. (Recharge & vertical flows both effect this).

Water budget and mean error for high and basal level groundwater were provided.

Questions on the Presentation:

1. Do the Upper Limits of the Central WHPAs coincide with the dike zones?

Dike Zone traverses the upper portion of the WHPA.

2. How confident are the modelers in the results?

The model is recharge driven, recharge being the data about which there was the most confidence, especially for East Maui. For West Maui and Lahaina, recharge data is available. Other areas are extrapolated.

3. The MODFLOW results differ substantially from the WHPA results. Reason?

Implications? Which will be managed? MODFLOW is more precise, can handle 3-D interactions and more "physically based". However, need to spend some time considering

uncertainties, assumptions, etc. MODFLOW results do not account for uncertainty, whereas this had been factored in to WHPA results.

4. Iao & Waihee modeled together or seperately? Modeled together. Aquifer boundaries

tend to be "soft" with interflow. Flow changes due to pumpage. No tracer tests have

been done to verify this, but tracer tests are typically inconclusive. Prof. El Kadi

notes that at one level, the entire island should be modeled as one, to better understand interactions and flows. But smaller model portions enable more detailed analysis over those areas. So both methods have benefit. One enables better consideration of potential interaction, the other enables a more refined look at a smaller area.

5. How are public water systems defined for HISWAP modeling?

Defined as in the Safe Drinking Water Act. Can include privately owned wells.

6. Modeling on other islands? Yes. In progress.

7. How difficult to add additonal or proposed sources to the model? Relatively easy.

When cumulative wells are added the entire model may need to be revisited. It is suggested that the model be updated every five years.

iv. Overview and Discussion: Preliminary Draft Maui Wellhead Protection Strategy Plan & Ordinance

Eva Blumenstein with the Department of Water Supply presented an overview of the preliminary draft wellhead protection strategy plan and ordinance.

The wellhead protection project has involved the following to date:

- Modeling of wellhead protection areas;

- inventory of land uses and potential contaminant sources (PCS) in these areas;

 - susceptibility analysis using the HISWAP susceptibility analysis matrix
to rank the risk from the identified potential contaminant sources to the wells;

 - a review of programs and ordinances implemented elsewhere and the local regulatory
framework;

 - public participation from the advisory committee and stakeholders;
- drafting of a preliminary protection strategy and ordinance for discussion.

The plan and ordinance do not yet include input from advisory committees on Molokai and Lana`i.

Comparing wellhead protection areas modeled in MODFLOW and the WHPAs delineated in semi-analytical model by EPA, the MODFLOW WHPAs are significantly smaller in scope. Some factors to consider in determining the final delineation for the Maui program may be whether longer time frames than 10 years should be used to account fo rundertainty, to account for chemical contaminants with longer half lives; and whether any degree of widtyh should be added to the MODFLOW WHPAs to account for uncertainties regarding groundwater movement.

A summary of the HISWAP susceptibility analysis matrix based on the PCS inventory in the WHPAs before the latest MODFLOW East Maui wells modeling shows high scores for Upcountry wells, because of the high number of residences, cesspools and

septic systems in that area. Even though residential development per se is not considered a high risk use; development brings with it several potential contaminant sources, such as cess pools, septic systems, roads, etc. In comparison, the more high-risk uses such as chemical storage and certain industrial or commercial uses get high points individually, but there are relatively few of them. In a summary of the same matrix based on the more recent East Maui MODFLOW modeling, the total scores are lower because of the less extensive WHPAs. Central Maui Mokuahau / Wailuku

wellfields got the highest score for total risk to source.

The draft management strategy plan covers developed wells owned or used by the Department. More consideration is needed regarding how to address future well sites.

It is encouraged that private systems be included. Management suggestions are based on Department PCS inventories, field surveys and interviews with businesses, susceptibility analysis ranking, lessons learnt from wellhead protection programs elsewhere, the input to date from the Maui advisory committee and stakeholders, and a review of regulations in place. Major PCSs are discussed separately in the plan.

The various suggested management strategies are:

- * an overlay zoning ordinance to restrict new uses in WHPAs with performance standards and development guidelines
- * BMPs for existing PCSs
- * Land Use Agreements with private land owners that could stipulate BMPs for a specific PCS
- * Land Acquisition where feasible
- * Wellhead protection will be included as a section of the WUDP and should be a principle considered in the general plan and other long term land use plans

within the county.

The ordinance draft is modeled after research of other WHP programs and ordinances.

It establishes an overlay district with four overlay zones with land use restrictions

superimposed on the underlying county zoning. It applies to new construction, reconstruction, or expansion of existing buildings and to new or expanded uses.

In general, restrictions decrease by distance from the well. It sets performance standards for uses that are restricted, but not outright prohibited, and development guidelines for new commercial, residential or mixed development projects.

Implementation of the ordinance relies on coordination with and administration by the appropriate agencies - including the Department of Planning, Public Works, Department of Health and the Water Department.

* Zone A-1 is defined as a fixed 50 foot radius around each well. The purpose of this zone is to provide protection from vandalism, tampering, or other threats at the well site. In the 50 foot zone, any use is prohibited except necessary public utility activities.

* Zone A-2 is defined as the intersection of the modeled WHPA and a fixed 1,000 foot radius around each well. The purpose of this zone is to provide minimum distance from pollution sources consistent with the Hawaii Well Construction and Pump Installation Standards. In the other zones, permitted uses are any use allowed by the underlying zoning district, unless it is prohibited in the overlay ordinance.

Anything prohibited at farther distance from the well is not permitted in these zones either.

* Zone B is the surface area within a 2 year time of travel to protect against indirect chemical and microbial contamination. In the 2-year TOT zone, high and medium risk uses as ranked in the HISWAP Guidelines are prohibited. High risk uses are typically outright prohibited based on the nature of activities, associated contaminants and contamination history. Prohibited uses that are subject to exemptions are medium risk activities. Exemptions require that the use conforms with the underlying county zoning, meets the performance standards, implements applicable design guidelines, that case-specific concerns raised by DOH or DWS are addressed, and that adequate information to evaluate the new project is provided. Exemptions would be granted by the Department of Water Supply.

Minimum lot size for un-served residential development is 2 acres, with some exceptions spelled out in the ordinance.

* Zone C is the 10 year time of travel to primarily protect against indirect chemical contamination. In the 10 year TOT zone, high risk uses are outright prohibited and medium risk uses are subject to the same exemption conditions. Minimum lot size for un-served residential development is 1 acre.

Performance standards should primarily be consistent with existing management measures for an activity. Application and administration of BMPs needs to be worked out in detail with affected agencies.

Development guidelines are recommendations for new, commercial, residential and

mixed use development projects. They are recommendations for development which is sited all or partially within WHPAs, encouraging lower risk uses closer to the wellhead, and medium to higher risk uses at increasing distance from the wellhead. They contain provisions for IPM and other BMPs.

Outstanding tasks include development of checklists for each regulated use so that there is a clear process for applications, exemptions and administration, working out of details with other implementing agencies for each use; clear definition of the performance standards & setbacks for each use and that appropriate BMPs are made available; and review of sanitary surveys of well sites for consistency and compliance with the suggested management measures.

Preliminary comments, questions & suggestions:

1. need to consider definition of applicability and explicit mention of grandfathering. Otherwise, can become existing non-conforming uses instead of grandfathered exempt uses.
2. will the program apply to private wells? some thought it should. logistically, this was seen as much more complex.
3. will the program apply to future wells? again, some thought it should, and this was seen as even more complex logistically. it was mentioned that if an attempt were made to protect future wells this would also require advance notification of others in the area whose future use of their lands may be affected before a well is sited. Best to identify target development areas up front?

4. how will we account for changing conditions, pumpage scenarios etc.?
define whpa update schedule in the ordinance? protocols, etc.? what if science improves?
5. consider issues of scale (note zoning ordinance 19.06) - interpretation of actual boundaries can be messy if work is initially done in a large scale.
How to account for scale issues, uses that are partially in and partially out, and etc. ?
6. Internal meetings are need with operations personnel and engineers. Some of the fuel specified may not match what we currently use in a few places.
7. Issue of how to handle uncertainty still has to be decided. Use longer TOTs? Expand WHPA by some fixed degree? Assume greater pumpage for East Maui areas than was used? Etc.
8. Consistency across islands? Uncertainty aside, Molokai has asked for 25 year zones, and these were included in the SWAP. Should look at options to see if the difference between 10 & 25 year WHPAs is small enough to utilize those cross-the-board.
9. Careful treading the boundaries of land use.
10. What will the impact on new development be in terms of costs, timing, etc.
11. What can be expected from the State for groundwater protection, how is ownership and management of the resources defined?
12. Coordination with other agencies is paramount... interagency meetings for each use/process needed.
13. How does DWS expect to cover the costs , and what level of cost may be represented for other agencies.
14. Include monitoring in any areas? Root zone, soil, lysimeters, or etc. ?
15. Impacts on future well siting? Impacts on surrounding landowners?

5. HANDOUTS:

1. Bob Whittier Slides (black & white)
2. Overview of Source Water Assessment
3. Preliminary Draft Wellhead Protection Program Strategy & Ordinance
4. Preliminary Table of Zoning District Permitted, Special & Conditional Uses with Uses Prohibited or Prohibited Subject to Exemption in Wellhead Overlay Zone. (for use in reviewing impacts in each zoning district)
5. Minutes of Previous Meeting
6. PCS Susceptibility Matrix Using the HISWAP criteria for initial WHPA model zones
7. PCS Susceptibility Matrix Using the HISWAP criteria for recent MODFLOW model zones

"By Water All Things Find Life"

Department of Water Supply
County of Maui
200 South High Street
Wailuku, HI 96793-2155
Telephone (808) 244-8550
Fax (808) 244-6701

[\[Back\]](#)