References

USDA Economic Research Service. 1989. Agricultural Resources/Situation and Outlook Report, No. AR-13.

Iowa Cooperative Extension Service. 1989. Estimated Costs of Crop Production in Iowa - 1989, Report No. FM-1712.

Iowa DNR. 1988. Pesticide and Synthetic Organic Compound Survey. Report to Iowa General Assembly Required by House File 2303.

Illinois Farm Bureau. 1989. Farmweek. 17 (34) August 28.

Jeffrey Lorimor. Personal communication. Soil and Water Engineering Specialist, Cooperative Extension Service, Mason City, IA.

HAWAIIAN ISLANDS GROUNDWATER: A NEW BALL GAME

L. Stephen Lau, Director
Water Resources Research Center
University of Hawaii at Manoa, Honolulu

Without groundwater sources, the Hawaiian Islands would not have been as vital as they are today—a very popular vacation destination for millions of global visitors, a booming commercial hub of the Pacific, a strong agricultural producer, and an important national defense base.

The beginning of a changing era was the year 1879 when James Campbell sponsored the drilling of a well that struck artesian water on Oahu. That copious groundwater source was the impetus at that time for sugarcane cultivation as a large scale mechanized agricultural industry. More important, it is the high quality of groundwater—potable without treatment—that makes it the premier and most economical source for Hawaii's drinking water supply. Groundwater provides 99+% of the drinking water for Honolulu with its present population of 838,000 and 90% of all water uses including irrigated agriculture. Although it is self-evident, ocean imposes freshwater self-sufficiency for each island.

As a part of Hawaii's artesian water centennial (1879-1979), the University of Hawaii Water Resources Research Center documented in a book a century of progress in exploration, discovery, and study of Hawaii's remarkable aquifers. That book provides a benchmark of the state of the Hawaii groundwater resources.

Now, a century plus ten years later, a new ball game is being played regarding allocation of water for use and contamination of water sources. Three major issues are the talk of the town and preoccupy the water professionals in Hawaii today.

(1) Water Allocation

Hawaii finally got its first state water code in 1987 to manage the state's water resources by regulation of the uses of water. The code spells out who may develop water from what sources, at what quantity, for what purpose, and for how long. A state water commission is vested with the authority to allocate water by a permit system. Are the great expectations fulfilled by a document that is perfect or a disaster? The answer is neither. Perhaps to the surprise of no one, the legislation is generally regarded as a masterpiece of compromise. It is a compromise between two traditional opposing water resources management approaches—free market and regulation— and a compromise among strong, vested interests in Hawaii. The water commission needs to provide fairness and wisdom to make an imperfect legislation work.

(2) Organic Contamination of Groundwater

While the water code addresses primarily

water resources management, water quality management was not really regarded compelling until a time bomb exploded about 1983. The prolonged transport of organics since their first use many decades ago has surfaced in trace amounts in potable groundwater sources on the island of Oahu. The immediate response was immense public concern. Evidence of pesticides used in pineapple cultivation and pipeline spills of aviation fuels in groundwater caused several essential wells to become unusable. Federal and state officials took immediate action to address public health concerns. The state legislature mandated closer monitoring on the sale and distribution of pesticides and the strengthening of the authority of state officials. From this unprecedented experience, the several measures outlined can be used by other water utilities to forecast or to meet similar contingencies. The Hawaii experience is a landmark because the action level of the pesticides concerned was set at an unprecedented low level—20 ng/l or parts per trillion—the laboratory detection limit and many times lower than all other states.

(3) Aquifer Protection Policy Dilemma

How can we protect aquifer and groundwater sources from contamination and yet, at the same time, not unduly restrict land use when we know that its development can cause aquifer depletion and contamination? In this regard, Hawaii faces more problems than continents because of the shortage of land for development on a small island. Then, too, much land suitable for development and those areas already developed overlie potable groundwater sources. Hawaii's groundwater protection policy actually dates back to the 1920s when any development in the groundwater recharge areas—high rainfall mountain regions—was prohibited. The water and forest conservation zones are marked by a circumisland "no-pass" line. More recently, a second line was added for each island, the UIC (underground injection control) line that delineates the areas in which no waste injection into groundwater is permitted. The current policy debate appears to be wavering somewhere between antidegradation and differential protection rather than the outright nondegradation.

By request, the University of Hawaii Water Resources Research Center is immersed in research to develop options for policy and regulations. For instance, a two year modeling project now nearing completion deals with potential groundwater contamination by urban use of pesticides. In a long-term project, all aquifers in Hawaii are being mapped and classified by their vulnerability to pollution. In progress is an interagency planning effort of large-scale use of primary effluent for replenishment of nonpotable groundwater source by wastewater irrigation. The scientific basis for planning is a recently completed three year demonstration project by UH-WRRC. The innovativeness of this facility is the use of primary, rather than secondary, effluent and the consequent result in tremendous savings from constructing and operating a secondaiy wastewater treatment plant.

In looking to the year 2001 concerning Hawaii's groundwater resources and quality management, extraordinary measures will be required to supplement conventional strategies. Above all is education in the broadest sense to enable formulation of rational policies. This means education of the public and the policy makers. As the only publicly funded university in the state, the University of Hawaii must assume principal responsibility for this special education. Close coordination with action agencies will pinpoint the selection of this particular audience to ensure every chance of success. Educating the public about relative health risks is especially important because an informed public is less prone to emotional reaction and more apt to be able to sift truth from untruths. Hawaii's experience may benefit other Pacific island countries because of similarities in environment and Hawaii's scoreboard of successes in economic development. Technology transfer is one key to this ball game of special education; social acceptance is the other key.