



Impacts of Land Cover Change on Groundwater Quality in Guam



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Guam has one of the finest limestone aquifers in the world. Located in the northern half of the island, this vital underground resource supplies island residents with about 80% of their drinking water needs. The population of Guam has gradually increased since WWII and currently stands at ~180,000. The majority of island inhabitants live in the northern half of the island where significant economic growth and urban development has occurred over the last two decades. The US military has also occupied large tracts of land in this region for the past 60 years. The risks of groundwater contamination are, therefore, very real considering the population density in northern Guam and the rapid recharge rates to the underlying aquifer. Since April 1996, Guam Waterworks Authority (GWA) has monitored the island's drinking water resources annually for all contaminants listed under the US Safe Drinking Water Act. Over 100 wells and two surface water sources are analyzed on a quarterly basis, and approximately 10,000 water samples have been tested to date. Data obtained to date are used only to determine which wells are out of compliance with no further statistical analysis to determine spatial or temporal trends. The proposed project described herein will incorporate all the data collections into GIS map coverages for each contaminant that has so far been detected. By so doing, the impacts of land cover change on groundwater quality in Guam can be evaluated; time-dependant changes in the distribution profiles of commonly occurring contaminants, e.g. fecal coliforms, chlordane, tetrachloroethylene (PCE) and trichloroethylene (TCE) can be easily visualized, and areas of maximum concentration identified and delineated for the implementation of appropriate remediation strategies as necessary.

The water quality data are available on file from GWA. Land cover changes will be determined using Landsat images of 1993, historical aerial photos, and one scene of Landsat TM or ETM + image at the end of 2006, or early 2007 if available. However, QuickBird image of 2006 may be harnessed as an alternative data if necessary. These satellite images will be applied to extract land cover information. How land cover change affects groundwater quality will be the main concern for this research project.

The main objectives of this project are listed as follows:

1. Preprocessing of Landsat images for derivation of land cover information;
2. Classification of land cover information from available images and/or aerial photos;
3. Evaluation of the relationship between land cover change and groundwater quality
4. Temporal and spatial changes in the distribution and abundance of frequently occurring chemical and biological contaminants

The project outcome will be of tremendous benefit GWA and the Guam Environmental protection Agency whose collective responsibility is to maintain the chemical and biological integrity of the island's water resources and provide a reliable and continuous supply of safe drinking water for the people of Guam.

