



Comprehensive Analysis of Salinity Trends In the Northern Guam Lens Aquifer



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The Northern Guam Lens Aquifer (NGLA) provides 80% of Guam's drinking water. Total withdrawal by all producers is currently about 45 million gallons per day (mgd), against a currently estimated sustainable yield of about 80 mgd. The anticipated military buildup during the next decade is expected to require an additional 5-6 mgd of drinking water to support the new military activities alone, and additional economic growth on the island will certainly further increase demand for municipal and private production as well. It has now been a full decade since the most recent comprehensive survey of the incidence and trends of chloride concentrations in Guam's water production wells. Moreover, the past decade has been relatively dry; some of the reported recent upward trends in chloride in production wells may therefore be driven by natural processes, but no study has yet been undertaken to ascertain how much of the observed increases, if any, may be due to the recent natural decline in recharge. There is thus a compelling need for a new survey, incorporating historical knowledge, to (1) precisely determine the current salinity trends in the freshwater lens and in particular drinking water production wells, (2) investigate the possible causes of the trends, and (3) recommend appropriate responses to the trends to promote sustainable development of additional capacity.

The proposed project will compile and evaluate historical and current data from existing sources to support statistical and graphical analyses. Spatial relationships and trends will be identified by using GIS applications to display them on 2-D and 3-D maps of the aquifer and Guam's groundwater production infrastructure. The data will thus be evaluated to determine not only the current distribution of relatively low- and high-chloride zones in the aquifer, but also the historical spatial and temporal trends in the relationships between chloride concentrations in Guam's freshwater lens and production wells on

the one hand, and spatial and historical trends in production rates and recharge on the other hand. The resulting graphics, maps, and analyses will be published as a WERI technical report, which will be placed on WERI's website. The work will be done primarily in WERI's meteorology and hydrology laboratories, by a WERI-sponsored graduate research assistant under the supervision of WERI hydrologists. If separate funding can be obtained from other local and federal sources, this project will be augmented by piloting a new methodology to the determination of chloride profiles in existing and perhaps additional new deep penetrating observation wells.

The objectives of this project are to (1) update the analyses of historical trends in *chloride profiles* observed in the CWMP *observation wells*, (2) update the analyses of historical trends in *water levels* and *chloride concentrations* documented in Guam's *production wells*, alongside the record of *production rates*, (3) compile the *rainfall and evaporation* histories for the applicable portions of the aquifer, (4) *compare the patterns and trends* of the data sets, and statistically evaluate how (a) the *chloride profiles in the observation wells* and (b) the *chloride concentrations in production wells* may be responding to changes in (c) drinking water *production rates* and/or (d) natural aquifer *recharge*.