Exploring the Natural Limits of the Northern Guam Lens Aquifer: A Step Toward Optimum Sustainable Management, Phase 3 – Model Implementation: Determining Ultimate Yield

Funded by:
US Geological Survey, Water Institute Program

Principal Investigators:
Nathan Habana & John Jenson

The Northern Guam Lens Aquifer (NGLA) provides 80% of Guam's drinking water. The anticipated addition of US Marine Corps activities will require additional production, while ongoing economic growth will increase demand as well. Policy-makers and water managers have begun asking "what is the absolute *maximum* volume of water that could be sustainably withdrawn from the aquifer?" Answering such a question requires identifying (1) the *natural limits* on aquifer recharge, storage, and water quality imposed by climatic and geologic conditions, (2) but doing it *for an ideal production system*, i.e., one that is constructed and operated so as to achieve the maximum possible production for a given standard of quality. This study is therefore directed at estimating the *maximum potential capacity* of the NGLA, i.e., the capacity that ultimately *could* be achieved by an ideal production system, given what we currently know or must assume about the natural limiting conditions. Recent modeling has incorporated the current state of knowledge regarding natural conditions and constraints. In the this third phase, estimates of maximum potential capacity can now be made by exploring scenarios in which hypothetical well depths, expansion by addition of basal wells, and pumping rates are distributed so as to maximize the capacity for given upper limits of chloride. This study will thus help provide some estimates of the absolute upper limits of production that could, in principle, be achieved by an optimum system. These will provide ultimate baselines against which to make economic evaluations of future options for holistic sustainable management of the aquifer.

The principal investigators will lead a research team composed of themselves, a WERI research associate trained in modeling, and WERI-based graduate and undergraduate research assistants (UOG environmental science MS candidate), working in collaboration with colleagues at the USGS Pacific Islands Water Science Center (PIWSC) to assemble and prepare the data sets; identify climatic phenomena and geologic features that are most likely to exert significant control on rainfall amount and intensity, infiltration rates, aquifer storage, groundwater flow, and groundwater salinity on northern Guam; and apply statistical, geospatial, and other analytical tools to identify, characterize, and interpret past and present spatial patterns in rainfall, groundwater levels, specific conductivity, chloride concentrations, and production rates from existing wells within the NGLA. The team will develop scenarios to identify ideal configurations (i.e., configurations not limited by economic, social, legal, or other non-natural factors) of well distribution and spacing, depth, and pumping rates that could thus in principle maximize production from the aquifer for specified limits on saltwater content. Scenarios will also examine how the ideal configuration might also respond to different long term climatic conditions.

WERI researchers with the drilling crew for an exploratory well in the NGLA.