



POLITECNICO DI MILANO- DIIAR
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# Carried out activities in Nauru

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From the 29th of September to the 13th of October 2011 Politecnico di Milano, represented by Dr. L. Alberti, Dr. M. Cantone and Dr. G. Oberto, visited for the second time the Nauru island. The objectives of this journey were:

- to meet Nauru's Public Authorities dealing with the island water resources
- to collect a series of hydrogeological missing data that had turned to be necessary for a full hydrogeological comprehension and the model implementation.

## 1. Meeting with local public authorities

The second travel to Nauru island was organized in order to present the obtained results during the first year of work to Nauru Rehabilitation Corporation (NRC), to collect data useful to project development and to plan future activities. During the journey it was scheduled a meeting in Brisbane with the hydrogeologist Tony Falkland, advisor of Pacific Islands Applied Geoscience Commission (SOPAC) and expert of the island, to discuss about some issues on Nauru hydrogeology and to evaluate the best solution for groundwater use. That meeting was the start for a scientific collaboration which will be useful in the project final steps. In Nauru was held a meeting with the CEO of NRC, Vinci Clodumar, and with the Project Manager of the Department of Commerce, Industry and Enviroment (CIE), Haseldon Buraman. This meeting was useful in order to show the hydrogeological elaborations made and the early results of numerical modelling; it was also possible to discuss and plan the future project steps that will concern the drilling of new 4 boreholes in the north zone of the island in order to evaluate the presence and the extent of the freshwater lens. At last, an infiltration gallery should be designed and implemented in order to enhance water supply access while avoiding saltwater intrusion from the sea. During the return trip it was scheduled a meeting in Fiji islands with David Duncan, environmental engineer of SOPAC. This meeting was to discuss some issues regarding groundwater resources and to organize the final conference which should take place in cooperation with SOPAC and where Politecnico di Milano will show the final results of the project carried out in Nauru.

## 2. Field activities

Field activities were carried out with the cooperation of NRC experts, precisely with Benedict and Peter Abouke.

Activities were divided in three phases:

- Borehole elevation survey;
- Piezometric and hydrochemical survey;
- Pumping tests.

The borehole elevation survey was planned accurately as the elevations previously obtained in the starting phase of Nauru project were sometimes very uncertain. The accuracy of topographic survey is very important in order to better understand collected data and to develop future hydrogeologic elaborations and the calibration of the numerical model. So it was assessed the elevation of 44 boreholes or wells, of which 33 are NRC property and 11 of privates. Topographic survey was performed by Ing. Gabriele Oberto with GNSS instruments of Politecnico di Milano.

About the piezometric survey, the first few days two data-loggers were set up to record continuously the groundwater level in the boreholes S18 and S3 in order to evaluate also the tidal lag in groundwater fluctuations respect the sea level variations. Loggers were be kept in boreholes for two days so as to have a relevant number of data to be elaborated. In addition to data-logger records, there were performed two piezometric and hydrochemical surveys ; the first one was realized in the North zone of the island, while the other one in the South zone. Surveys were performed in two days in order to have borehole groundwater levels which are comparable with tide levels. The survey was carried out in the same boreholes used in November 2010 survey and in other 11 private wells along the coast. In the last few days 4 pumping tests were performed in order to get some basic hydrogeological parameters which will be used in the numerical model. The first pumping test was carried out in Anetan district, extracting water from O32 well, monitoring continuosly groundwater response in the borehole S1, 28 m far. Unfortunately, after about two hours from the beginning of the test, the well O32 dried up because the extraction rate exceeded well recharge from groundwater because of the short screened sector of the well. At the beginning also the pumping test at Anabar 2 Degia well failed, due to a calibration error of the logger which had to record the drawdowns in the control borehole; however test was repeated the following day giving values of the hydrogeological parameters similar to expected ones. The third pumping test was performed in Anetan 1 (Deukro) well, in Anetan district, near the coast line, while the last test was carried out in the borehole S3, situated in Ewa depression. All the pumping tests were performed in the North zone of the island, which is the modeled area.

## 3. Current work progress

Hydrogeological data collected in Nauru island were elaborated and inserted in the previously developed geodatabase in order to have a more accurate outline of salt concentrations and hydraulic heads distribution of the island, particularly in the North zone, target of the numerical modelling. The topographic survey allowed to have more accurate data about hydraulic heads distribution, which was used to elaborate piezometric maps, for November 2011 and December 2010, in order to underline drainage area and zones where high hydraulic heads persist over time. In the first months of 2012 there were processed data about groundwater response to tidal sea level variability; these data were used as calibration target of the numerical flow model. Currently the model is able to simulate groundwater response to tidal fluctuations with a good accuracy, while it has some difficulties in simulate drainage area and zones where high hydraulic heads persist over time, near the coast line. Therefore the transport model will be calibrated once a good flow calibration has been achieved.