Interactive comment on “Shallow Geophysical Techniques to Investigate the Groundwater Table at the Giza Pyramids Area, Giza, Egypt” by Sharafeldin M. Sharafeldin et al.

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Received and published: 4 February 2018

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Shallow Geophysical Techniques to Investigate the Groundwater Table at the Giza Pyramids Area, Giza, Egypt

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ABSTRACT

The near surface groundwater aquifer that threatened the Great Giza Pyramids of Egypt, investigated using integrated geophysical surveys. Ten Electrical Resistivity Imaging, 26 Shallow Seismic Refraction and 19 Ground Penetrating Radar surveys conducted in the Giza Pyramids Plateau. Acquired data of each method subjected to state-of-the-art processing and modeling techniques. A three-layer model depicts the subsurface layers and better delineates the groundwater aquifer and water table elevation. The aquifer layer resistivity ranges between 40-80 Ωm and seismic velocity of 1500-1800 m/s. The average water table elevation is about +15 meters which is safe for Sphinx Statue, and still subjected to potential hazards from Nazlet Elsamman Suburban. Shallower water table in Valley Temple and Tomb of Queen Khentkawes detected to be between 14.5-15m represent a severe hazards. Perched ground water table detected in elevated topography to the west and southwest might be due to runoff and capillary seepage.

Keywords: Groundwater, Electrical Resistivity, Seismic refraction, GPR.

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I. INTRODUCTION

In recent years, the 4500 years old Giza Great Pyramids (GGP) of Egypt; Cheops (Khufu), Chephren (Khafre), Menkaure and Sphinx statue; threatened from the rising groundwater table resulted from the water leakage of the suburban, irrigation canals and mass urbanization surrounding the GGP. This problem prompted the need to use non-destructive near surface geophysical techniques integrated with available borehole hydrogeological data to investigate and characterize the groundwater occurrences in the GGP.

The GGP located in the southwestern part of the Greater Cairo Region (Fig. 1). Geologically, the Giza Pyramids Plateau comprises mainly of white limestone, cretaceous and yellow argillaceous limestone and dark grey dolomitic limestone of Middle-Lower Eocene age. The plateau rocks are commonly interbedded with thin sand layers in their upper part, which dips with about 5-10° to the SE direction. Steep escarpments border the plateau to the north and east directions as shown in Fig. 2 (Yehia, 1985; Mahmoud and Hamdan, 2002). Two regional groundwater aquifers underlie the sphinx (Fig. 3), the Quaternary aquifer of the Nile alluvium, consists of graded sand and gravel with...