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To cite this article: Syed Mobasher Aftab *et al* 2018 *IOP Conf. Ser.: Mater. Sci. Eng.* **414** 012023

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Strategies to Manage Aquifer Recharge in Balochistan, Pakistan: An Overview.

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Abstract. Balochistan plateau is dominated by the drainage system of eighteen river basins, where precipitation recharges both consolidated and unconsolidated aquifers. In eleven river basins, the groundwater levels are steadily depleting for the last three decades due to indefensible long-term groundwater extraction. The cumulative decline of water-table ranges from 2 to 3 meters/y. The most significant decrease of 60m in the last 12 years has been recorded in parts of Quetta Valley. The estimated total groundwater recharge in an average year of all river basins is 2,200 Mm³, the withdrawal is 2,657 Mm³. The groundwater overdraft in eleven river basins is 886 Mm³, whereas 429 Mm³ is available for sustainable development only in seven river basins. To enhance the groundwater recharge, many proposals have been advanced, and several studies have been carried out by different public and private sector organizations for the protection of natural resources. However, implementation of the recommendations of these studies remained limited with little progress causing severe shortages of groundwater resources. Assorted strategies have been developed by the concerned government departments for the protection of natural resources under their jurisdiction. A comprehensive provincial policy and subsequent strategy for the protection and sustainable development of natural resources in Balochistan is yet to be formed. In this paper the natural resource protection policies and strategies that are directly or indirectly associated with the surface and groundwater resources have been assessed. In addition, the federal and provincial policies, including water, biodiversity, climate change, environment, agriculture, forest, and rangeland management have been reviewed and summarized. In some of the previous strategies, certain measures have been proposed for the improvement of water resources. The measures include a ban on agriculture tube wells in urban areas, construction of storage, supply and delay action dams (DADs). As a consequence, 326 DADs with a storage capacity of 332 Mm³ were constructed in different river basins. The studies represent that in current circumstances, the DADs are the appropriate means to recharge aquifers if supported by design modifications and catchment area specific watershed management plans. For the sustainable management of natural resources of the province a comprehensive, integrated watershed management strategy and a model are presented in this paper.

Keywords: Groundwater, recharge, strategies, Delay Action Dams, Balochistan

1. Introduction

Balochistan plateau is comprised of four distinct zones, the Upper-Highlands, the Lower-Highlands, the Kachi-Nasirabad-Makran Plain and the deserts. The Upper-Highlands where altitude ranges from 1,500 to 3,700 meters above sea level (masl), has warm summer and very cold winters. The precipitation ranges from 200-250 mm/y and characterized as a semi-arid zone. The Lower-Highlands, where altitude ranges from 600 to 1,200 masl, is the zone of hot and dry summers, but the winters are extremely cold to mild. This zone is characterized as arid where precipitation varies from 100-150 mm/y. The Kachi and small plains stretch from, Nasirabad to Dera Bugti and extends from Mekran coast to Iran border, where the summer temperature reaches up to 50 °C but winters are mild. The desert zone is located in western Balochistan mostly covered with sand-dunes where the summer is hot

