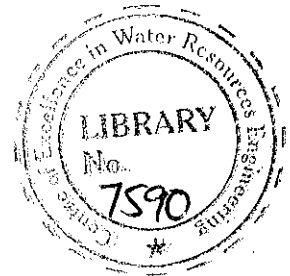# STATISTICAL MODELING OF DROUGHT AND GROUND WATER QUALITY NEXUS IN SARGODHA

by

Engr. Ahsan Siddique
2016-MS-WRE-11
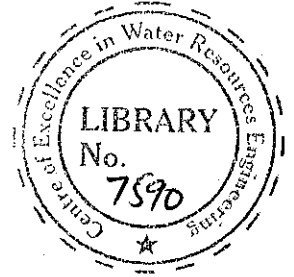
Research Supervisor:
Dr. Muhammad Waseem

2021

Centre of Excellence in Water Resources Engineering

University of Engineering & Technology, Lahore

STATISTICAL MODELING OF DROUGHT AND GROUND WATER QUALITY NEXUS IN SARGODHA

Submitted By

AHSAN SIDDIQUE
(2016-MS-WRE-11)

A THESIS

presented to the university of engineering and technology, Lahore

in partial fulfillment of the requirements for the degree of

Master of Science

in

WATER RESOURCES ENGINEERING

APPROVED BY:

_____
Dr. Muhammad Waseem
Research Advisor/
Internal Examiner

_____
Dr. Naveed Alam
Chief Executive Officer
(CEO), Watersprint, Lhr
External Examiner

_____
DIRECTOR, CEWRE

Approval Date: 06-01-2021

CENTRE OF EXCELLENCE IN WATER RESOURCES ENGINEERING
University of Engineering and Technology, Lahore

ABSTRACT

Drought is generally categorized as metrological drought, hydrological drought, agricultural drought and socio-economic drought. The metrological drought is considered as a deficiency in rainfall over a prolonged period and can cause serious negative impacts on irrigated agriculture, catchment runoff, river flow, lake level, and ultimately the quality of water. In general drought and immediate recovery period could have profound water quality effects and these impacts can vary depending upon the characteristics of a water body and its catchments. Hence, in this study, key water quality parameters i.e. Electrical conductivity (EC), Sodium Adsorption Ratio (SAR), and Residual Sodium Carbonate (RSC) have been selected and Standard Precipitation Index (SPI) was used to compute the metrological drought at two stations i.e. Sargodha and Juharabad. Furthermore, to understand the relationship between drought and water quality, statistical modeling has been carried out based on the estimated drought index and collected water quality parameters data. Based on findings, it resulted that the study area observed 164 drought events with maximum severity of -1.62 and a maximum duration of 8 months. Moreover, a weak correlation was observed between the corresponding time series of SPI and water quality parameters. However, a better correlation ($R^2 \geq 0.45$) was found in the case of lagged series. As disruption of catchment inputs and influence of interposes (i.e. biological uptake of nutrients, denitrification, and settling) can increase during prolonged drought and its recovery period, hence it was expected that the lagged water quality series can have a better relationship with SPI. The overall assessment resulted that the value of EC, SAR and RSC have better agreement with prolonged metrological drought and hence it concluded that prolonged metrological drought has a significant impact on variation in water quality.