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**Al-Quds University**



**Water Quality Index (WQI) for Water Resources in  
Jenin District**

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**Water quality index (WQI) for water resources in Jenin district**

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## *Dedication*

*To the heart I love my husband Sakher*

*To my soul Malaak and Kareem*

*To my father Sami and my mother Nuha*

*To my beloved family for their support*

*Lubna Ibrahim*

## **Declaration**

I certify that this thesis submitted for the degree of Master is the result of my own research, except where otherwise acknowledged and that this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

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## **Abstract**

The water quality index is a key, and useful tool for determining the quality and suitability of drinking water for the end consumers. The study of water quality index has been carried on the ground water of Jenin governorate, by collecting 36 samples from 9 deep wells covering more than 97% of the study area. The water quality index was developed by subjecting the samples to a comprehensive physicochemical analysis to the major 12 parameters that directly affect the quality of drinking water such as: pH, fecal coliform, total hardness, total dissolved solids, magnesium, sodium, calcium, potassium, sulphate, chloride, nitrate, and fluorides. The WQI has been calculated, and the values ranged from 25.6 to 71.6 which means good to excellent water quality level for the total of 36 samples. The water quality index in water distribution networks was also calculated for Jenin city by adding free chlorine as an additional parameter to detect the quality of water at the point of consumption and compare it with its original source. The WQI in the water distribution networks decreased and the level of water quality was ranged from good to excellent for the study area. This present study reveals that the groundwater in Jenin governorate is suitable for drinking and human consumption.

## مؤشر جودة المياه (WQI) لموارد المياه في منطقة جنين

إعداد: لبنى سامي مجيد إبراهيم

المشرف: د. عامر مرعي.

### الملخص

يعد مؤشر جودة المياه أداة رئيسية ومفيدة لتحديد جودة ومدى ملاءمة مياه الشرب للمستهلك النهائي. تم إجراء دراسة لمؤشر جودة المياه على المياه الجوفية في محافظة جنين من خلال جمع 36 عينة من 9 آبار عميقة تغطي أكثر من 97% من مساحة الدراسة. تم تطوير مؤشر جودة المياه عن طريق إخضاع العينات لتحليل كيميائي و فيزيائي يشمل أهم اثني عشر من العناصر الكيميائية والفيزيائية التي تؤثر بشكل مباشر على جودة مياه الشرب وهي: الأس الهيدروجيني، القلونيات البرازية، عسر الماء الكلي، اجمالي المواد الصلبة الذائبة، المغنيسيوم، الصوديوم، الكالسيوم، البوتاسيوم، الكبريتات، الكلوريد، النترات، الفلورايد. تم حساب مؤشر جودة المياه لمحافظة جنين وتراوحت القيم من 25.6 - 71.6 اذ تشير هذه النتائج أن مستوى جودة المياه يتراوح بين الحالة الجيده الى الممتازه. كما تم حساب مؤشر جودة المياه في شبكات توزيع المياه لمدينة جنين عن طريق إضافة الكلور الحركمؤشر اضافي للعناصر الفيزيائية والكيميائية الأخرى للكشف عن نوعية المياه عند



نقطة الاستهلاك ومقارنتها بمصدرها الأصلي. انخفض مؤشر جودة المياه في شبكات توزيع المياه

وكان مستوى جودة المياه يتراوح من جيد إلى ممتاز في شبكات المياه التي تغطي مدينة جنين. تشير

نتائج هذه الدراسة أن المياه الجوفية في محافظة جنينصالحة للشرب والاستهلاك الادمي.

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## List of abbreviations

Abbreviation	Title
MCM/Y	Million cubic meters per year
NEAB	North-Eastern Aquifer Basin
Km <sup>2</sup>	Square kilometers
WHO	World Health Organization
PCBS	Palestinian Central Bureau of Statistics
WQI	Water Quality Index
PWA	Palestinian Water Authority
PCBS	Palestinian Central Bureau Statistics
ARIJ	Applied Research Institute –Jerusalem
TDS	Total Dissolved Solids
WDS	Water Distribution Networks
Mm	millimeters
ppm	Parts per Million
WBWD	West Bank Water Department
MoH	Ministry of Health
TH	Total Hardness
ICP-OES	Inductively Coupled Plasma Optical Emission Spectroscopy
PSI	Palestinian Standard institution
l/c/d	Liter per capita per day

# Chapter One:

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## Introduction

### 1.1 Background

Water is the basis of life for all beings; the world suffers from the lack of fresh water, as a result of excessive human consumption, it is an important issue in every community in world not only in the Middle East (Daghray, 2010). Palestine is not far from this, it suffers from scarcity of water resources due to natural, and man-made practices, mainly as a result from the Israeli occupation (ARIJ, 2015).

Over a period of time the shortage of water will increase in Palestine and become a real problem because of population growth, expected climate change, higher standards of living, and mainly, Israeli restrictions and practices imposed on the water resources (ARIJ, 2015).

Palestine has three main sources of freshwater including; the West Bank's Aquifer, the Jordan River, and the Coastal Aquifer (ARIJ, 2015). Israel controls nearly all shared water resources (surface and ground water) therefore, water resources are inadequate to meet the demands of the present population (Al-Khatib et al., 2003).

Groundwater is the main source of fresh water in the West Bank for the Palestinians, and provides over than 90% of all water supplies (PWA, 2012).

Three main groundwater basins are dominant in the West Bank located according to regional groundwater flow directions these are: the eastern, western and northeastern aquifers, all are shared with Israel. The annual sustainable yield of the aquifers are shown in Table 1.1.

Table 1.1: Reported aquifer basin recharge (PWA, 2012).

<b>Basin</b>	<b>Recharge (MCM/Y)</b>
Eastern	145-185
North Eastern	100-145
Western	362-400
Total	607-730

The North Eastern Aquifer Basin (NEAB) extends from the area south of Nablus to the north beyond the borders of the West Bank(see figure 1.1). This basin is the smallest of the three groundwater basins, its area is about 1424 km<sup>2</sup>, and has the smallest portion of recharge (PWA, 2012).