Faculty of Graduate Studies and Research

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Assessing the Water Diplomacy towards Resilient Services in Marginalized Palestinian Communities in the Northern Jordan Valley

تقييم دبلوماسية المياه من أجل خدمات صامدة في التجمعات الفلسطينية المهمشة في شمال غور الأردن

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August 2023

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This Thesis was successfully defended on 17-7-2023 and approved by

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Declaration

I, Eng. Raja’ Abu-Zedan, declare that this thesis and the work presented in it are my work and has been generated by me as the result of my original research:

Assessing the Water Diplomacy towards Resilient Services in Marginalized Palestinian Communities in the Northern Jordan Valley.

The work provided in this thesis, unless otherwise referenced, has not been submitted by others elsewhere for any other degree or qualification.

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Signature:

Date: August, 7, 2023.

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Dedication

I dedicate this work to my family, colleagues, classmates, and friends who encouraged me to complete this Thesis. My thanks to my father, mother, brother and sisters for their continued support, and my husband who always supported and advised me.

Abstract

The importance of the study is due to the fact that it measures the resilience of water services in the marginalized communities in Northern Jordan Valley by standing on the efforts of Palestinian water diplomacy in this regard. This study aims to assess of the different aspects concerning the Palestinian water diplomacy to achieve water services resilience and sustainability. To explore the main features of water services situation in Northern Jordan Valley. To understand the interaction of water services stakeholders and their roles in Palestinian water diplomacy. To discuss the impact of water diplomacy on the resilience of water services.

The region is considered to have very complex geographical, social and geopolitical nature, which called for intensified efforts to search and investigate information from its correct and original sources.

In dealing with the issue of the resilience of water services and Palestinian water diplomacy in the Northern Jordan Valley, this research was based on field visits, interviews, questionnaire surveys which were targeted consumers, policy makers, and water service providers. This study was depended on the following two approaches: The descriptive approach was through, studying the nature of the eight clusters by review of relevant previous studies, and analyzing the consumers and water service providers questionnaires. Interpreting the existing situation by identifying the relationships that exist between the different stakeholders, to determine the degree of power, interest and influence. And quantitative approach, by analyzing the data which obtained from water service providers, and the related stakeholders.

The main findings that were reached through this research; identifying the main stakeholders whom have the power, interests, and influence on water services, in addition to determine the degree of resilience by determining the degree of impact of each indicator on water services, and defining the problems that threaten the sustainability of water services in each cluster in Northern Jordan Valley.

Key words: Water diplomacy, resilience, stakeholders, marginalized communities, water services.

ملخص

تم من خلال هذا البحث تقييم دبلوماسية المياه من خلال تقييم صمود خدمات المياه في المناطق المهمشة بالأغوار الشمالية بمحافظة طوباس، وتم عمل الدراسة على ثماني تجمعات (كردلا، بردلا، عين البيضا، العقبة، خربة عاطوف، يرزة، ابزيق، وتجمعات المالح) في الاغوار الشمالية، وتعتبر تلك التجمعات تجمعات مهمشة وهي ذات خصوصية و حساسية جغرافية و سياسية واجتماعية.

من أجل تقييم دبلوماسية المياه في تلك التجمعات؛ تم عمل تحليل أصحاب المصلحة في خدمات المياه، بالإضافة إلى تقييم صمود خدمات المياه من خلال جمع المعلومات (عن طريق الاستبانات، والمقابلات، و الزيارات الميدانية) من مقدمي الخدمات والمجالس المحلية و مجالس الخدمات المشتركة بالإضافة الى الشركاء الاساسين كسلطة المياه الفلسطينية و دائرة مياه الضفة الغربية و مجلس تنظيم قطاع المياه.

وبعد تحليل المعلومات الخاصة بكل تجمع خلصت الدراسة إلى؛ تحديد الشركاء الأساسيين والثانويين في المنطقة، بالإضافة إلى تحديد المشاكل التي تهدد استدامة خدمة المياه في كل تجمع. وأن هناك بعض الخطوات، والاجراءات، و التدخلات التي يجب اتخاذها من قبل صانعي القرار على المستوى المحلي و المستوى الإقليمي من أجل تحسين صمود خدمات المياه باستخدام الأدوات الدبلوماسية.

List of Abbreviation

DOs	Demolition Orders
EQA	Environmental Quality Authority
ICA	Israeli Civil Administration
IDF	Israel Defense Forces
IWA	Israeli Water Authority
JSC's	Joint Service Councils
JWC	Joint Water Committee
LGU's	Local Government Units
MCM	Million Cubic Meter
MoA	Ministry of Agriculture
MoLG	Ministry of Local Government
NGOs	Non-Governmental Organization
NIS	New Israel Shekel
NRW	Non-Revenue Water
OPT	Occupied Palestinian Territory
PCBS	Palestinian Central Bureau of Statistics
PENRA	Palestinian Energy and Natural Resources Authority
PHG	Palestinian Hydrology Group
PWA	Palestinian Water Authority
SWOs	Stop Working Order
WBWD	The West Bank Water Department
WHO	World Health Organization
WSPs	Water Service Providers
WSRC	Water Sector Regulatory Council

List of Terminology

Water service: means the procurement, treatment, and distribution of water for domestic use or any other purpose for which water can be used.

Water Service Providers: the institutions or bodies which have delegated authority to provide water in their area of operation.

Water Diplomacy: it is a dynamic process that uses a diplomatic tool to resolve or minimize current or emerging disagreements and conflicts over shared water resources in the interests of collaboration, regional stability, and peace, which is enable a variety of stakeholders to take the opportunity in contribution to manage and find the solutions for shared water resources issues, (Schmeier, 2018).

Resilience: it is the ability to cope with, and recover from, disruption, and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future, (Cousins, et al. 2017).

Marginalized Communities: are groups within the society, who are exposed to different levels of vulnerability, those communities experience discrimination and rejection (social, political and economic) due to the inequality in economic, political, social and cultural dimensions (Burghal, 2016).

Stakeholders: are people, groups, or organizations, who are likely to be affected (negatively or positively) by a proposed project, or those which can influence the project outcomes, (Kammi, 2000).

Stakeholder Analysis: it is a method of collecting and analyzing qualitative data to determine which interests should be considered when implementing a policy or program, by identifying the key actors, and assessing their interest, attributes, interrelationships, knowledge, and ability to affect the policy process (Khan, 2010).

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Chapter One: Introduction

One of the most significant agricultural regions in the Occupied Palestinian Territory is the Jordan Valley. For Palestinians, it is known as the "food basket" because of its exceptional climatic conditions, which enable year-round food production. Many communities are living there either permanently or in the seasons of the agriculture or animal husbandry, since the most of them are farmers or herders.

Water is very crucial resource for household uses, irrigation, and ranching in the North Jordan Valley areas, since this area classified as arid region and the availability and accessibility is imperative for the local population. The Jordan Valley region has political sensitivity, since the Israeli force put many restrictions on the water resource, e.g.; quantity, accessibility, and drilling new wells, in addition movement restrictions, confiscation of fertile land.

Palestine's water sector has been severely impacted by geo-climatic peculiarities, demographic and urbanization trends, inadequate management and governance methods, as well as the ongoing political scenario. Thus, assuring water security is a priority, so, water service providers (SPs) who offer sustainable, effective, and equitable services are necessary for water security. These WSPs must also have appropriate water resources that are well managed, including risk management.

Active stakeholders, institutions, ministries, and decision makers, must intervene to strengthen the resilience of citizens and water service providers in marginalized communities in the Northern Jordan Valley.

1.1 Diplomacy and Resilience

The geo-climatic peculiarities, demographic and urbanization trends, inadequate management and governance modalities, and the ongoing political crisis have all put significant strain on the water sector in Palestine. Water is and will remain a crucial worldwide issue, affecting the human rights, sustainable development and international peace and security.

To address the growing problems caused by water shortages and water-related issues, both between and within States, we need the international community to take action that is more focused and organized in order to raise awareness, reduce conflict, and foster collaboration.

The wellness, prosperity, and stability of societies around the world depend on the quantity, distribution, and quality of water resources. Different stakeholders are impacted differently by water scarcity, and this can cause tensions amongst them. Giving everyone, especially vulnerable people, access to water will grow more challenging. Also, a variety of traditional and non-traditional players will have a bigger impact on decisions about the accessibility of fresh water.

Water diplomacy will play an increasingly important role in preventing, mitigating and resolving a growing number of water-related conflicts around the world (Bokova, et al., 2016).

The main challenges in water agreements are brought on by strict presumptions about how water must be distributed. There is typically a fixed amount of water to split among nations (or states) when they share boundary waters, despite rising demand and unpredictable unpredictability. These presumptions produce a zero-sum mentality with clear winners and losers. Nonetheless, even countries in conflict can come to agreements that serve the requirements of their citizens for water as well as their own national interests when parties recognize that water is a flexible resource and employ procedures and methods to concentrate on fostering and enhancing trust (Susskind and Islam, 2012).

Resilience of drinking water systems refers to the ability of water service providers to manage water services through the design, maintenance and operation of water services and water facilities in a way that limits the effects of disasters or any urgent status, and their capacity to contain any situations and allow quick return to normal delivery of potable water to customers.

The emergency events which cause damage of water facilities and infrastructure, affect the water service by inundation of facilities, power outage, and exposure and disruption of infrastructures and thus will cause long-term effects on the resilience, sustainability and reliability of water services. Although investment is very important to improve water and sanitation services in developing countries, building resilience of new and existing infrastructure is very significant for sustainable development (World Bank Disaster Risk Management, 2017).

Water scarcity, large population movements, climate change, and unsustainable use of water resources are Some of the factors that posed challenges to water management prior to the current conflicts. The conflict over water resources led to socio- economic, environmental, and political impacts on service providers and have intensified their vulnerability. The accumulation of these impacts, increase the difficulty of setting the level of service, (Diep, 2017).

In areas where there are ongoing violent conflicts and internal water management issues, increased pressure on transboundary water supplies brought on by expanding economic and population needs, intensified by climate change processes, can have disastrous implications. This highlights the urgent need for not just bolstering the institutions of water administration but also for various platforms for dialogue and other water diplomacy tools.

1.2 Research Problem

Water supply services in the Northern Jordan Valley in Tubas are challenged by a number of factors, including diplomacy (Israeli occupation and internal politics), climate change, limited financial resources, poor national economy, and governance. Managing to provide sustainable services to the Palestinian citizens under these challenges is known as resilience. This research aims to assess the different aspects concerning diplomacy and resilience of marginalized Palestinian communities to manage the water services sustainably.

1.3 Research Questions

The main research questions are:

- Are the current water services in the Jordan Valley of the West Bank, Palestine, resilient?
- How could the water diplomacy solve water insecurity in the Jordan Valley?

- What is the role of different stakeholders in providing a sustainable and resilient water sector in the study area?
- What are the major challenges for achieving resilient water services in marginalized communities of the Jordan Valley?
- What is needed by Palestinian Government to empower resilience of marginalized communities?

1.4 Aim and Objectives

The main aim of this research is to assess the different aspects concerning the diplomacy and resilience of local Palestinian service providers for sustainable management of water services in marginalized communities in Northern Jordan Valley. The specific objectives are:

- To assess the current water services that is provided to marginalized communities in the Northern Jordan Valley in Tubas.
- To study the major challenges for achieving sustainable water services for marginalized communities in the Northern Jordan Valley in Tubas.
- To develop guidelines for Palestinian policy makers to use the diplomacy to empower resilience in marginalized communities in northern Valley.

1.5 Hypotheses

The main research hypotheses are:

- The water sector in the marginalized communities of the northern Jordan Valley of the West Bank, Palestine is not resilient to severe climatic and political variations.
- The Israeli occupation is a main stakeholder that affects the resilience of water services in the study area.
- Water diplomacy and integrated management can improve resilience of water services in marginalized communities of the Jordan Valley.

1.6 Thesis Outline

This thesis comprises of five chapters. The first chapter provides an introduction about the water services, diplomacy and resilience in Palestine, research problem, research questions, aims and objective and hypotheses. Chapter Two describes study area, and profiles each community in the study area. Chapter Three presents the theoretical framework and literature review. Chapter Four clarifies the approach and methodology that are followed through this research. And Chapter Five presents and discusses the results. Finally, Chapter Six identifies a set of conclusions and recommendations.

Chapter Two: Study Area

2.1 Jordan Valley

The Jordan Valley is the main source for providing food security to Palestinian communities, as it constitutes the Palestinian food basket. It distinguished by great strategic importance; in all geographic, political, economic, tourism and religious characteristics; its geo-strategic importance formed from the establishment of Palestinian state on the borders of 1967, and its economic value; due to its weather which makes it a warm region that can be used for agriculture throughout the year, and abundance of surface and groundwater sources, as it is located on the eastern basin, that characterized by annual water renewal (Nahas, 2012).

The Jordan Valley and the Dead Sea region are significant from a geopolitical and strategic standpoint, according to Israeli occupation authorities. As a result, they have developed and put into effect organized procedures meant to ensure total control over the area and isolate it from the rest of the West Bank. They have declared it to be a closed military zone, making Palestinian development initiatives impossible there. Additionally, they have taken over vast tracts of productive farmland in the Jordan Valley for Jewish settlements, depriving Palestinian farmers of the right to work their own land (PALTRADE, 2010).

The Jordan Valley represents the eastern strip of the West Bank that was occupied in 1967, and extends from the Ein Gedi area near the Dead Sea in the south, to the Ein Al-Beida area, south of Bisan, in the north. It is extending for about 120 km in length, and 15 km in width and expands over an area of 1.6 million acres, which constitutes approximately 30% of the area of the West Bank. It is inhabited by about 65,000 Palestinians in 49 communities, and 11,000 Israeli settlers. The area of arable land in the Jordan Valley is 280,000 dunums, the Palestinians exploit 50,000 dunums, while the Israeli settlers exploit 27,000 dunums. The occupation has established 90 military sites in the Jordan Valley since its occupation in 1967, while 31 Israeli settlements sit on the Palestinian Jordan Valley lands (EQA, 2019).

The area of the Jordan Valley is 1,155 km^2 distributed geographically over six governorates: Jericho, Nablus, Tubas, Jerusalem, Bethlehem and Ramallah & Al-Bireh, which is equivalent to

19.4 % of the area of Palestine. Israel has expanded the borders of the Jordan Valley to make the total area, according to the Israeli definition, 1,600 km^2, and equivalent to 26.6 % of the area of Palestine (Hellas, 2020).

According to the Oslo Accords 2 in 1995, the Jordan Valley is divided administratively into different areas and different authorities: Areas (A), which are under the control of the Palestinian National Authority, with an area of 85 km^2, and 7.4% of the total area of the Jordan Valley; Areas (B), which is a joint sharing area between the Palestinian Authority and Israel, with an area of 50 km^2 and 4.3% of the total area of the Jordan Valley; And Areas (C), which are under full Israeli control, have an area of 1155 km^2, and constitute the vast majority of the Jordan Valley (88.3%), (Sadek, et al., 2019) as shown in map Figure 2-1 how much of the West Bank is Area C which is controlled by Israel.

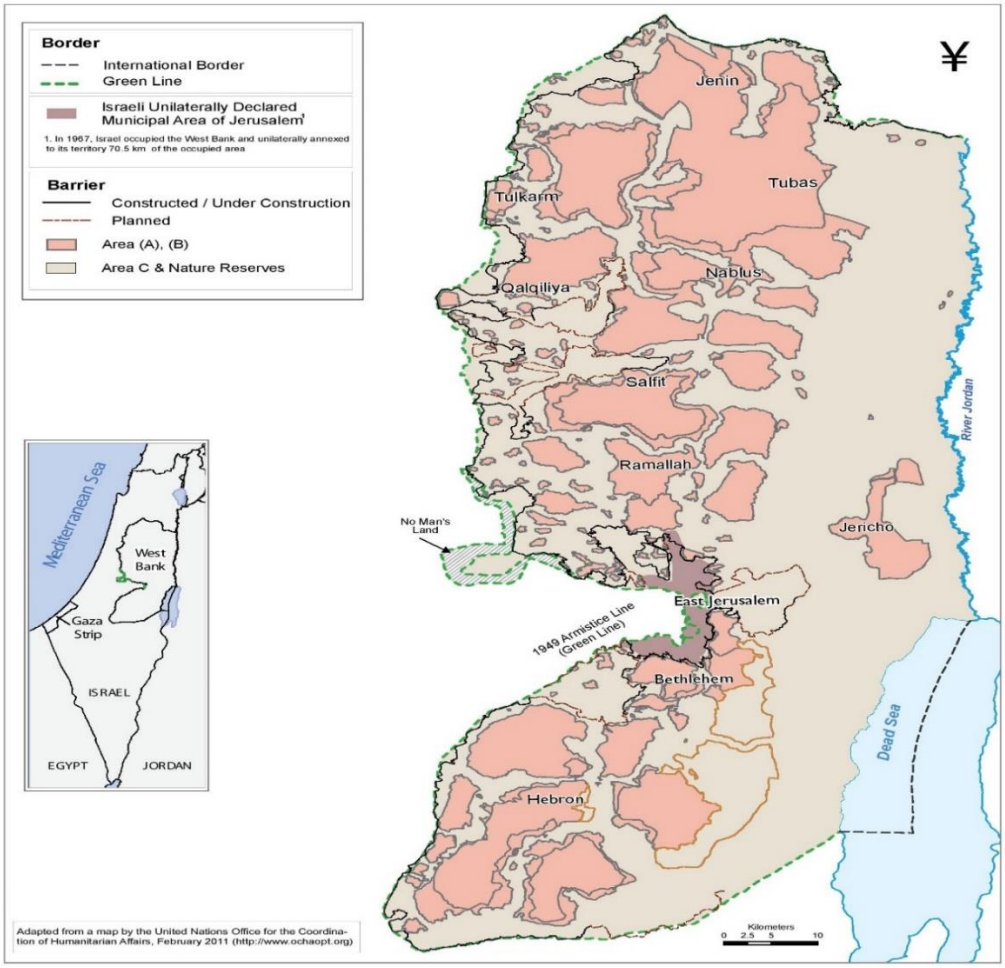

Figure 2-1: Area C in West bank According to the Oslo Accords 2 in 1995.

(Source: PASSIA (The Palestinian Academic Society for the Study of International Affairs), 2023).

The Jordan Valley is divided geographically and agriculturally into three main sections (Ma'ali, 2018):

- **The Northern Jordan Valley**: It belongs to the Tubas Governorate and has 11 localities. It includes the villages of Bardala, Ain al-Bayda, Kardala and al-Maleh, and it contains 10 wells.
- **The Central Jordan Valley**: It belongs to the Nablus Governorate and has 4 localities. It includes the villages of Jiftlik, Marj al-Naja', al-Zubaydat, Marj al-Ghazal and Furush Beit Dajan, and it contains 68 wells.
- **The Southern Jordan Valley** - it belongs to the Jericho Governorate and has 12 population centers. It includes the Al-Fasayel and Al-Auja areas, the city of Jericho, the village of Al-Dyouk, Al-Nuweima, and the area of Khan Al-Ahmar and Al-Nabi Musa. It contains 91 wells.

2.2 Communities Profile

Northern Jordan Valley

The study area is a cluster of eight villages located in the Northern Jordan valley in Tubas governate: Kardala, Bardala, Ein Al-Beida, Al-Aqaba, Khirbt' Atuf, Yarza, Ibzeq, and Al-Maleh communities. The General Information about the eight communities is collected from interviews with chairmen of the councils, consumers, and with the representative person working in related ministries or initiations, in addition to some studies and researches that have been done for these communities.

2.2.1 Kardala Village

Kardala is not recognized as a Palestinian village by the Oslo Accords. It is located in the northern Jordan Valley within the Tubas Governorate. The entire community is located in area C and partially, in an area classified as a military training area, firing region, (GVC, 2022).

Since the community located in area C, it is threatened with confiscation and it's not allowed to build new buildings or rehabilitate existing ones, while most existing structures are subject to stop working orders (SWOs) and demolition orders (DOs). Master plan has been obtained through donor project in partnership with the Ministry of Local Government.

The number of permanent residents in the village according to the Palestinian Central Bureau of Statistics 2022 is 224 capita, and according to the information that was provided by Kardala Municipal Council provided, the total number of residents with the arrival's population the seasons of cultivation and grazing is 380-400 capita.

Most of the citizens work in agriculture, 80% of the community engages in farming as its main source of livelihood while 5% of the community is composed of herders; 7% of the community is employed inside Israel and its settlements; 5% is employed within the West Bank; and 3% are employed in private businesses within the trade and commercial sector, (GVC, 2022).

The energy source of electricity is provided directly by Al-Qutriyya Israeli company, there are no education services in the community and also there is no official health clinic in the community.

Kardala has unlicensed wells that are relied upon for agriculture, and it has recent water networks established in 2021 by PWA, and sanitation network that has not been operated yet, till establishment of waste water treatment plant.

However, water services are provided from WBWD, and these services not paid by the citizens. The village owned a reservoir of 40 cubic meter capacity. Drinking water and agricultural water are supplied through two sources:

- The first source: water connections on WBWD pipelines outlets which is located near the village, and these outlets provide 40 subscriptions to Kardala residents with 5 cups per hour.
- The second source: the agricultural reservoirs that were established in Kardala through MoA projects, that are filling with water through WBDW pipelines and every reservoir has water meter guaranteed from its owner who lives in Tubas for 3000 NIS per year. There are 60 tanks with 100 cubic meter per hour flow.

2.2.2 Bardala Village

Bardala is located in the northern part of the Jordan Valley within the Tubas Governorate. 90% of the community is located in area C and 20% classified as a military training area, firing zone. Residents of the Bardala community are not allowed to build or rehabilitate any of the existing facilities, and all existing facilities that are not included in the master plan are subject to stop-work and demolition orders (all facilities in the community were built after the 1993 Oslo Accords), (GVC, 2022).

The total population of the community according to the PCBS for the year 2022 is 1776 capita, 83% of the community engages in farming as its main source of livelihood while 5% of the community is composed of herders; 3% of the community is employed inside Israel and its settlements; 3% is employed within the West Bank; 3% are unemployed; and 3% are employed in private businesses within the trade and commercial sector), (GVC, 2022).

The energy source of electricity is provided directly by Al-Qutriyya Israeli company, there are three (primary and secondary) schools inside the community and also there is an official health clinic in the community, which provides primary health services for five days per week.

There are two water storage reservoirs in Bardala village, an old tank with a capacity of 40 m^3, established in 1970s, and a second tank with a capacity of 500 m^3, established in 2021 with funding from the PWA, during this project the water network was rehabilitated and expanded.

In 2018, prepaid meters were installed, and the price of a cup per consumer was 0.48 NIS/m^3, and this to guarantee fair water distribution for consumers, but the citizen refused to pay for the service.

In 1970s, the village of Bardala owned a licensed artesian well, the Israelis offered to Bardala's citizen and farmers who owned artesian well to stop using it, in return digging of two wells inside the village and providing the farmers with 140 m^3/hour for various uses such as agriculture and drinking, while the rate of pumping from each well is 1500 m^3/hour.

There are 3 licensed artesian wells in Bardala from the time of the Jordanian government, and there are some unlicensed wells for irrigation uses.

2.2.3 Ein Al-Beda Village

Ein Al-Beida community is located in the northern part of the Jordan valley within the Tubas governorate. 95% of the community is located in area C, and 5% in area B, and 37% of the total area is classified as a buffer zone (GVC, 2022).

A Master Plan of the village only cover 5% of its total area, and it was obtained in 1999. All buildings were constructed after the 1993 OSLO agreement, are exposed most of the village to the risk of SWOs and DOs (GVC, 2022).

The total population of the community in the area according to the PCSB for the year 2022 is 1258 capita, and 80% of the community engages in farming as its main source of livelihood. Of the remaining 20%, 10% are employed inside Israel and its settlements and the other 10% are distributed along the following categories: employed in the Palestinian areas (2%), private business (2%), herding and livestock (3%), and currently unemployed (3%) (GVC, 2022).

The energy source of electricity network is provided directly by the Al-Qutriyya Israeli company. There is no school in the community, so students go to the nearby Tayaseer village to obtain educational services, there is a governmental health clinic.

Ein Al-Beida village has a storage reservoir of 300 m^3 capacity, it supplied by piped water from WBWD, the pipeline networks have been rehabilitated recently. It owns some springs that dried up due to digging nearby wells, and for this reason, farmers and owners of wells and springs were given shares on the network pipelines which are belonging to the Mekorot company, which is operate by the WBWD.

2.2.4 Al-Aqaba Village

Al-Aqaba is located in the northern Jordan Valley within the Tubas Governorate. The entire community is located in area C and it classified as a military training area, firing region. The master plan includes a small part of the village land area, 80% of master plan proposed area is built upon (MAS,2017).

The population of Al-Aqaba village according to the PCBS for the year 2022 is 186 people, and the vast majority of the community working in agriculture and raising livestock, and a few of citizen are employees or workers (MAS,2017).

The energy source of electricity network is provided directly by the Al-Qutriyya Israeli company. /There is a primary school from 1st to 10th grade in Al-Aqaba community, and there is a governmental health clinic.

Al-Aqaba village, receives water service from the JSC for Water and Sanitation in Tubas, and it has a transmission line and an internal network that was established in 2016-2017, of 2500 meters length. It also has a water tank with a capacity of 300 cubic meter, and every citizen in the village owns a rainwater harvesting well.

2.2.5 Khirbt' Atuf Village

Khirbet' Atuf is located in the Jordan Valley within the Tubas Governorate. 80% of the community is located in area C and 20% in area B. It is partially (72%) classified as a military training area, firing zone and 4% of it is classified as a buffer zone. The community's lands in area C (80% of total land) are all under access restrictions (GVC, 2022).

The total population of the community in the service area according to the PCSB for the year is 239 capita. It is considered an agricultural area, 40% of the community engages in farming and 35% in herding as their main sources of livelihood, while 17% of the community is employed inside Israel and its settlements; 3% is employed within Palestinian areas in the West Bank; and the remaining 5% are unemployed (GVC, 2022).

There is a functioning electricity network in the community governed by the (PENRA). There is an official health clinic in the community supervised by the Ministry of Health (MoH). There is a mixed primary school from 1st to 10th grade inside the community.

Khirbet' Atuf has a water network that was established in 2016-2017, with a length of 7 km. The village has 11 artesian wells that are used to irrigate agricultural areas. Before digging these wells, water was transported through tanks from Al-Fara'a and Ein Shibli.

2.2.6 Yarza Village

Yarza is located in the Jordan Valley area of Tubas Governorate, and it is considered a military area used as a military training zone for the Israeli army.

The population of Yarza village, according to the municipal council is 110 capita, as it is not included in the PSCB reports. There are a number of citizens, 40 capita who temporarily live in the village of Yarza during the agricultural and grazing seasons. All residents work in agriculture and livestock breeding.

The energy source of electricity in the community is solar panels. There is no school in the village, and there is no public transportation to transport students to the school in nearby villages. In addition, to the absence of a medical service center or clinic in the village.

The water network was established in 2017 with a length of 10 km. Before that, Yarza residents mainly used rainwater harvesting wells.

2.2.7 Ibziq Village

Ibziq is located in the Jordan Valley area of Tubas Governorate, it is 7 km to the northwest of Tubas. The entire village located within Area C and it is considered a military training area, firing zone.

The population of the village of Ibziq, according to the PCBS for the year 2022, is 143 capita, and the population increases during the agricultural and grazing seasons to 210 capita.

The energy source of electricity in the community is solar panels and it covers 70% of the total population. There a primary school from 1st to 10th grade in the village, but there is no medical service center or clinic in the village.

The water network was established in 2013 with a length of 6 km, 42 families are living in Ibziq village, 25 of them not connected to water network, due to the weak of capabilities, and the difficulty of working in the region as it is Area C. Ibziq residents are working in raising livestock and rain-fed agriculture.

2.2.8 Al-Maleh Communities

Al-Maleh communities are located in the northern Jordan Valley, inside the community there are a number of settlements and training camps for the Israeli army, and it considered a closed military training area, residents live in a group of scattered population centers.

The population of Bedouin communities in Al-Maleh according to the PCBS for the year 2022 is 391 capita, distributed over ten communities.

There are 240 families live in the community, and each one of these communities has (5-10) of burlap and hair houses. The residents of these communities working in raising livestock, grazing, and agriculture.

The energy source of electricity is supplied by solar panels, all citizens living in the community own solar panels, as the IDF destroyed a number of solar panels, PENRA will support these communities through providing the affected citizen with solar panels. No education services in the communities and students going to schools in neighboring villages, also no health clinic or centers in these dispersed communities.

The water sources that are used in Al-Maleh is springs, such as Ein Al-Hilweh and Al-Ein Al-Mitah, many of the springs in the area were seized by the IDF and settlers. Also, the residents use the water openings on WBWD networks, which are used illegally for drinking and livestock by filling tanks with a capacity of 6 or12 cubic meters.

There is a modest water network that reaches every house in Tell Al-Hamma, but it is not connected to a water source. Hammamat Al-Maleh (Al-Mayta and Al-Burj), served by water network from Yarza village council.

Al-Maleh consists of tens communities (Mas, 2017):

1. Al-Farsiyya, which includes: Khirbt Himyar, Tallet Khader, Al-Za'bah, Nabe' Al-Ghazal, and Al-Jubiyah.

2. Ein al-Hilweh, which includes: Ein al-Hilweh, Umm al-Jimal, Al-Faw, and Al-Nabaa.

3. Al-Deir, which includes Khirbt Al-Deir.

4. Hammamat Al-Maleh: Al-Mayta and Al-Burj.

5. Tell Al-Hamma: Khallet Hamad,

6. Al-Qafqaf.

7. Samra.

8. Al-Hadidiya.

9. Khallet Makhol.

10. Jabaris.

Chapter Three: Theoretical Framework and Literature Review

3.1 Theoretical Framework

3.1.1 Water Diplomacy

Water diplomacy can be defined as the use of diplomatic tools to resolve or minimize current or emerging disagreements and conflicts over shared water resources in the interests of collaboration, regional stability, and peace (Schmeier, 2018).

Water diplomacy is also defined as an approach that enables a variety of stakeholders to take the opportunity in contribution to manage and find the solutions for shared water resources issues.

It is also known as a dynamic process that aims to create fair, peaceful, and long-term water management solutions while encouraging or informing cooperation and collaboration among riparian stakeholders (Klimes, 2019).

It is important to have a contextual awareness of the requirements and values of the various cultures and communities that share watersheds and groundwater reserves in order to find solutions to water conflicts and transboundary challenges with water quality, quantity, and allocation (Hefny, 2011).

Future water conflicts may be anticipated, avoided, and settled through diplomacy based on technical and scientific input. Local decision-makers, water managers, and other stakeholders can use water diplomacy to collaborate with national and international partners to find and negotiate fresh, flexible approaches to transboundary water management that will maximize the advantages from these shared resources for all (Hefny, 2011).

Water Diplomacy Tracks

Conventionally water diplomacy is considering as high-level interaction and dialogue mechanisms between nation-states. Diplomacy is now defined according to various tracks which vary in terms of technical experts and foreign policy actors and interdisciplinary frameworks, (Klimes, and Yaari, 2019):

- Formal Diplomacy: Official or formal communication between state actors who have the power and responsibility to speak and act on behalf of their institutions or governments.

- Informal Diplomacy: Conversations between non-officials that are based on roles and obligations that have been established in order to foster relationships, settle disputes, handle crises, or foster trust. It can include of retired civil workers, academics, NGOs, faith-based organizations, business partners, media, and other "insiders" in addition to informal officials.

The Main Challenges for Water Diplomacy

Variety of state and non-state actors are applying the diplomacy as a comparable tool to facilitate such cooperation. The factors that affect cooperation at various levels must be identified in order to increase diplomatic effectiveness. Although practitioners are fully aware of the obstacles preventing and resolving water conflicts face, solutions are not always available. The main challenges for water diplomacy in the hydro-political landscape are (Huntjens, and de Man, 2017):

1. The ability to build trust among competing stakeholders: Stakeholders have different claims with regards to water, and poor communication between many parties involved, led to rigid attitudes.

2. The ability to organize multi-sector and multi-level interactions: Water is inextricably linked to food, energy, and the environment; therefore, if it is dealt independently of these other sectors the solutions to our water problems will be ignorant and almost surely have unfavorable effects.

3. The effectiveness of decision-making can easily be diminished as various interests and worldviews clash at the negotiating table as a result of the complexity of the water challenges, which increasingly necessitates the involvement of stakeholders from many sectors and levels.

4. The ability to manage a growing multi-actor policy environment:

By bringing in a larger range of viewpoints on requirements, implications, and solutions and allowing them to be openly discussed, dialogues can educate and assist shape more formal negotiating and decision-making processes.

5. The ability to deal with uncertainties: Uncertainties plague collaboration and conflict over water resources, including the unpredictability of developments, a lack of information, and divergent viewpoints about the gravity of an issue, its root causes, and viable solutions. Finding practical solutions to this in the practice of water management is vital. These ambiguities are fuelling conflicting accounts of the same events and (politically exacerbated) mistrust. Hence, overcoming uncertainty is a crucial step in developing trust.

6. Sustainable financing: Transboundary water cooperation is often underfinanced; many national governments and donors are reluctant to provide funding for initiatives without defined goals and timetables. Nonetheless, it is less expensive to prevent conflicts and environmental deterioration than it is to respond after the fact.

7. Sustainable legacy: how to help all parties involved prevent and handle issues in the future. Sustainable water cooperation requires the development of water diplomacy, governance, and management capabilities through focused training, experiential learning, expert guidance, and consulting.

Key Aspects of Water Diplomacy

There are five key aspects of water diplomacy, together with examples of related key approaches and mechanisms, and this categorisation provides a simple and relatively comprehensive view, as shown in Table 3-1 below (Keskinen, et al., 2020):

Table 3-1: The five key aspects of water diplomacy

Water diplomacy aspects	Examples of related key approaches, frameworks and mechanisms
Political: Inherently political process that affects much more than just water; a component of larger diplomatic context and geopolitics.	Critical hydro politics, geopolitics, foreign policy, and regional cooperation comprise the most heavily political segment.
Preventive: Conflict resolution through mediation	Preventative diplomacy, conflict resolution, and development of peace
Integrative: Integrating various institutional forms, levels, stakeholder groups, and knowledge sources.	Integrated Water Resources Management, multi-track diplomacy, integrative diplomacy, and knowledge co-production
Cooperative: Cooperation and effective governance to encourage rational and fair water use.	Sustainability, cooperative relationships, benefit-sharing strategies, and international agreements on shared waterways.
Technical: Providing knowledge about water, related resources, and the environment to support diplomatic efforts	Track with the most intense technicality: Water quantity, quality, and time information; knowledge creation and products including impact evaluations and hydrological models.

Water Diplomacy Features

Although there are several definitions of water diplomacy in the literature, three fundamental and related features are generally recognized (Hefny, 2011):

- The requirement to incorporate various viewpoints. According to the theory of water diplomacy, it is necessary for hydrologists, engineers, politicians, economists, sociologists, and all other interested parties to collaborate in order to acquire a nuanced knowledge of the complex nature of water needs and disputes.

- The significance of mediation, negotiation, and cross-cultural communication. In order to help solve issues with water allocation, quality, and conflicting water needs, water diplomacy looks for negotiated solutions informed by science and technology.

- Support for the international diplomatic effort. Water diplomacy can be a bilateral or multinational endeavour that plays a significant role in determining regional and global foreign policy. It provides a chance to establish worldwide alliances and reciprocal relationships. Collaboration on scientific matters and capacity building can provide doors to additional political discussion channels.

Palestinian – Israeli Conflict Over Water

Water availability issues in the West Bank are attributed mostly to Israeli control over the majority of the region's natural water sources, extremely unequal access to water, and Israel's power to veto water infrastructure projects. According to Palestinian opinion, Israel's control over a sizable portion of the region's water resources is perceived as an existential danger to Palestinian society, and the observed water scarcity is thus primarily seen as a political phenomenon (Kronich, and Maghen, 2020).

Water diplomacy is the practice of establishing bilateral and multilateral discourse on water issues between peoples and nations as well as the beginning of political processes at many levels to improve water governance, and collaboration, as well as regional integration, security, and stability. Water diplomacy is built on problem-solving rather than scarcity of water, and it is at the heart of water security. Military directives were issued when Israel occupied the West Bank and Gaza Strip in 1967, imposing meters on Palestinian wells and imposing an extraction limit on irrigation wells. Because the military directives also needed permission for the digging of wells, the overall amount of water that Palestinians could withdraw was limited (Eran et al., 2018).

Several agreements between the Israeli and Palestinian conflicts parties have been signed, the most important one is the Oslo II Accords signed in 1995 included a short-term agreement on water allocation between Israel and Palestine, both sides' commitment to water management, and the establishment of a joint body to ensure cooperation and coordination of water management, the Joint Water Committee (JWC). However, Water resources are disproportionately allocated, reflecting significant inequalities, including Israel's control over 80% of the West Bank's water reserves, due to the fixed water quantity and allocation determined during the Oslo Accords, as

well as the lack of attention given to demographic, natural, social, and economic developments that have affected the supply and demand of water (Duleux, 2020).

The water agreements between Palestinian and Israeli side determined the water quantities that would be supplied to the Palestinians; It was agreed in 1995 agreement that Palestinian would be supplied with 118 MCM/Y, and agreed water quantity for the Interim Period was 141.6 MCM/Y, where the actual water consumption in 2006 was 180 MCM/Y, and according to agreement the Palestinian future needs is between 188-198 MCM/Y, since the total quantity of water available for the Palestinians in 2007 is 200 MCM/Y, (IWA, 2009), as shown the following Figure 3-1:

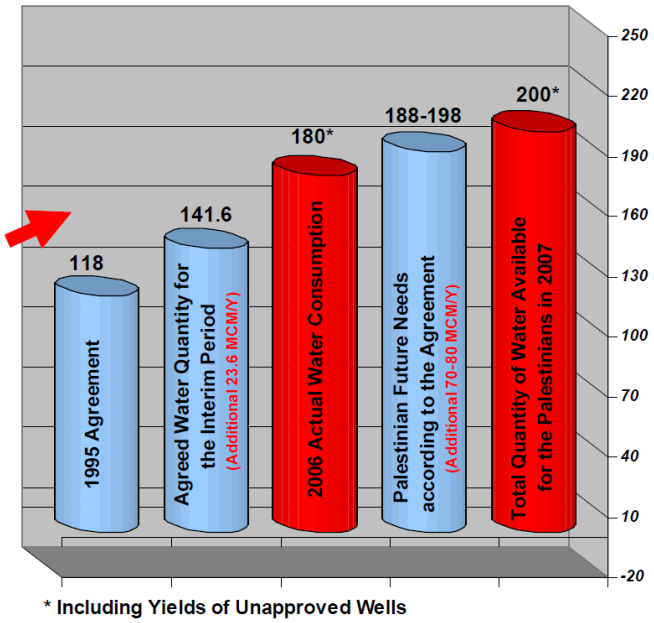

Figure 3-1: Water Supply to the Palestinians in the West Bank – According to the Water Agreement and in Practice (MCM/Y).

Source: (IWA, 2009).

As the Ecopeace study, 2018, based on the information from Israel water Authority 2014, shows the difference in mountain aquifer's water quantities between the Palestinian and Israeli, since in the total pumping from the north eastern aquifer for Palestinian is 45.5 MCM where for Israeli 62.7 MCM, and the total pumping from the western aquifer for Palestinian is 39 MCM where for Israeli 297 MCM, and for eastern aquifer the total pumping for Palestinian is 39 MCM where for Israeli 29.9 MCM, (Eran et al., 2018), so the total difference in quantities for the benefit of Israeli side by 266.1 MCM higher than Palestinian share, as the Figure 3-2 below shown:

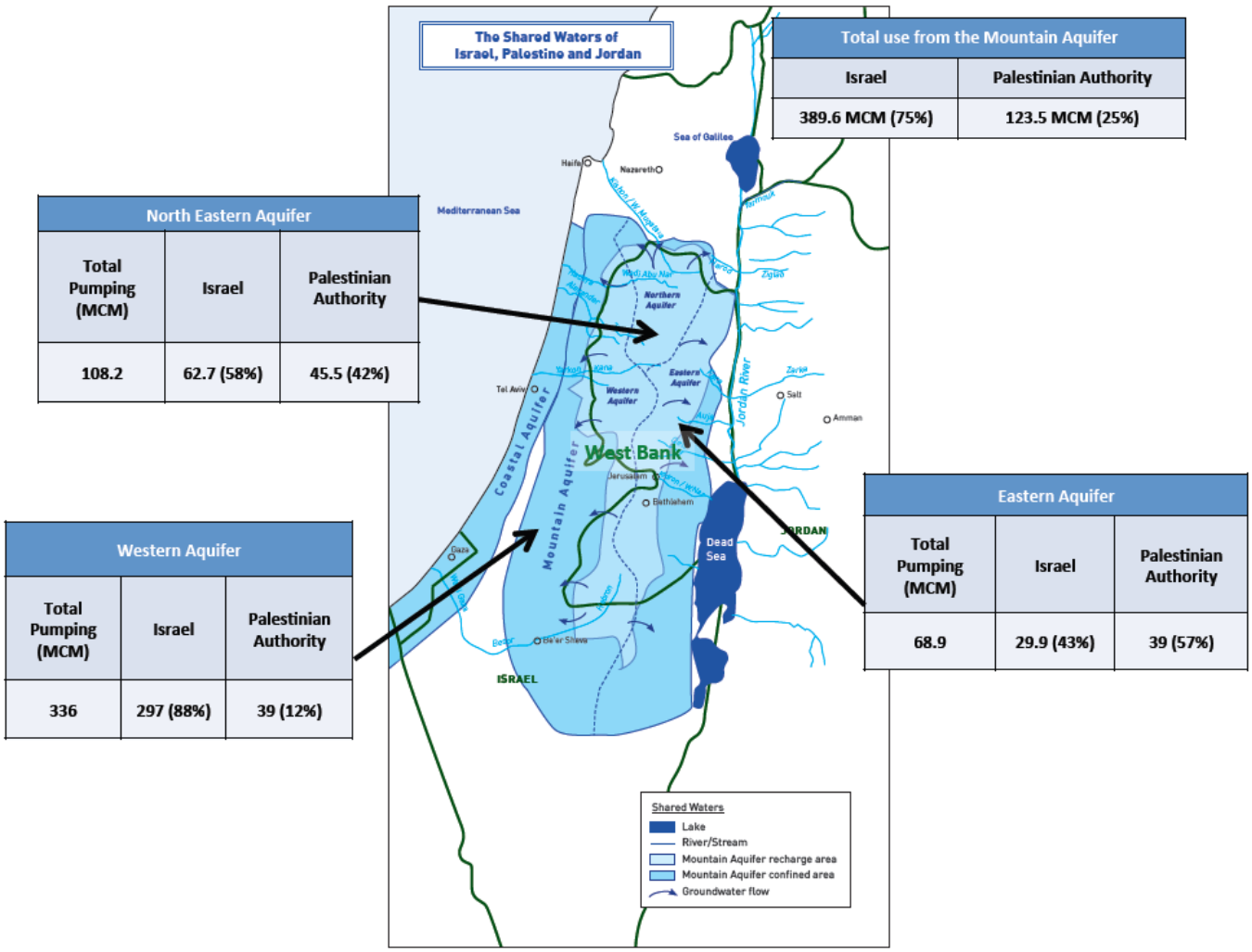

Figure 3-2: Israel and the PA's use of Mountain Aquifer's water.
Source:(IWA, 2014)

Stakeholders in The Jordan Valley

Stakeholders can also be determined based on a variety of factors, including power, support, impact, and importance. The stakeholders' interest in the consultation issue and their support or opposition to the project initiative are related. During the consultation process, a stakeholder's interest in the consultation subject may fluctuate, and they may show more or less support for the .project. The process of balancing many stakeholders' economic and environmental interests is delicate, (Kool, 2016).

Consequently, a crucial phase that affects the constituents of the Master Plan's development is the identification and selection of the stakeholders. The Jordan Valley's primary economic activity is irrigated agriculture; hence stakeholders are divided into the agricultural, water, and environmental sectors, (Kool, 2016).

Government Roles

In order to improve the delivery of water services to all citizens, the government launched a water reform process in 2010 (which was implemented in 2014). This process included concrete legislative actions for the management of its resources through the application of integrated and sustainable water resources management principles. The new Water Law includes a clause indicating the Government's willingness to improve the governance structure required to attract private investment into the sector. The Government, committed to effectively reforming the service subsector, established the independent regulatory body in 2014 as an independent regulatory entity, since the Water Law 2014 has consolidated responsibility and clarified the roles of the entities within it; e.g; (PWA, WBWD, municipalities, MoA), (GWP-Med, 2015).

The Study of GWP-Med in 2015, identifies recommendations pertinent to the three governance challenges that face the water sector, other than problems with access to water and political-related restrictions, Palestine encounters similar challenges to other nations in implementing water projects involving the private sector, which are represented in budgetary, regulatory, and stakeholder oriented, so the recommendations were:

- Improving the budget process: this can be accomplished by working in conjunction with the corporate sector to raise operational efficiency while taking social justice and the budgetary governance component into account.

- Developing the regulatory framework: suggested checklist for action related were prepared to regulatory issues through; periodic consultation with regulated entities and the public on new regulations, promote service provider consolidation and increase their independence.

- Promoting and ensuring stakeholder engagement: the stakeholders' engagement will be through:

- Raise the awareness to empower the public by strengthening the information base on critical issues,

- Identify and engage with groups of stakeholders to discuss and gain support on several issues,

- Prepare a communication strategy, with the dual purpose of raising awareness and show responsiveness to consumers' needs and interests,

- Support the implementation of the Action Plan evolving from the 2012 "Gender Strategy for the Environment Sector with emphasis on water and solid waste".

3.1.2 Resilience

What is Resilience?

Resilience is known as the ability of an individual, institutions or system to respond to shocks and stresses and survive in spite of the effects of a disruptive event (Chapagain, et al., 2019).

Resilience is considering a new concept, focusing on making decisions with little future knowledge in a developing environment as opposed to a stable one. It can be considered across multiple scales, which have impacts on the resilience of stakeholders and systems. Special effort should be made to engage main stakeholder who have the most influence on the water system and the consumers who are most dependent on these resources, as well as the most vulnerable and commonly disregarded communities and stakeholders, should be given special attention (Chapagain, et al., 2019).

A Road Map was set by World Bank 2018, to build the Resilience of Water Supply and Sanitation Utilities to respond for all possible threats by urged the water utilities take a proactive strategy to potential disruption. The Road Map proposes a three-phase procedure in light of the uncertainty surrounding future circumstances, such as climate change, population expansion, and economic conditions: Phase 1: Knowing the system, Phase 2: Identifying vulnerabilities, and Phase 3: Choosing actions (World Bank 2020).

The AWWA association define the Utility Resilience Index (URI) as a tool measures how well a water utility and the community it serves are able to withstand and recover from the effects of a

natural disaster and external factors, for measuring the URI, many factors must be taken into consideration; the operational and financial capacity, outlines comprehensive strategies for business continuity and disaster response; and takes into account social vulnerability elements in the community (AWWA 2021).

The Dimensions of Resilience

Four drivers of resilience, identified by the OECD Ministerial Council's statement, serve as the foundational structure for this framework (Figueiredo, 2018):

- **The economic dimension**: demands for space for innovation and industry diversity.
- **The social dimension**: ensuring that opportunities are available, citizen networks are active, and society is inclusive and cohesive.
- **The environmental dimension**: if sufficient natural resources are available, if solid infrastructure is there, and if urban expansion is sustainable.
- **The institutional dimension**: Aspects demand strong public support, an open and participatory government, adequate public resources, and collaboration with other levels of government.

Shocks and Stresses on The Water System

Water systems face multiple challenges on a daily basis. Water systems must be planed and prepared for terrorist attacks, cyber-attacks, hazardous materials release, climate change and natural disasters; e.g., (drought, earthquakes, floods, hurricanes, tornados, tsunamis, wildfires, winter Storms). In addition to aging infrastructure of water utilities which affect the water quality by increasing the leakage, and pipes breakage (Cousins, et al. 2017).

The above-mentioned challenges and hazardous will leave several impacts on the water system, which represented in pipe break, infrastructure damage and failure, power outage service, water service disruption, loss of access to facilities or supplies, loss of pressure/Leaks, change in water quality, environmental impacts, financial impacts (e.g., loss of revenue, repair costs), and social Impacts (e.g., loss of public confidence) (EPA 2015).

Water Resilience Analysis

The world bank recommended to use the road map as guiding document for performing the systems level resilience analysis. The goal of this analysis is to determine which infrastructure investments should be prioritized in order to maintain system performance and boost resilience. To that end, a three-phase iterative analytical exercise will be conducted to examine the systems level resilience of the larger water network within which operates. This analysis requires the consultant to work with (team of the task, local government ministries, and other stakeholders) (World Bank 2020):

Phase 1: Knowing the system

By determining the dimensions required for the system to carry out a sufficient analysis. During this phase the key system components, potential risks to the system, available analytical tools, failure scenarios, and performance goals for success should all be identified.

Phase 2: Identifying vulnerabilities

The expert will put the water system through a variety of realistic stress tests and evaluate how it performs in various circumstances. Determine options that will lessen vulnerability and enhance the performance of the system as a whole as well as the important components inside the system.

Phase 3: Choosing actions

The consultant would next talk about the tradeoffs between the various solutions in consultation with stakeholders to offer more context. The alternatives should be able to increase a system's robustness, flexibility, or both through improving the system's important components (or the system as a whole).

Resilience Strategies

Resilience strategy is A systematic approach to enhance resilience by understanding and addressing shocks and stresses. There are three categories of resilience strategies: persistence, adaptation and transformation. The resilience strategy is tested by stress based on resilience indictors to evaluate the effectiveness of the expected actions in the structure long-term system resilience (Chapagain, et al., 2019).

To build continuous resilience cycle to natural disasters and other hazards implies planning and preparedness activities, response and recovery actions following an adverse event, and adapting and changing to be better prepared for future events based on lessons learned (EPA, 2015) as Figure 3-3 shows:

Figure 3-3: Continuous cycle of building resilience.
Source: (EPA, 2015)

Preparedness is also essential component of resilience, to build resilient system with minimal loss of functionality. Communities can be prepared with emergency response plans, and mitigation strategies and this is required effective implementation of response and recovery actions, with flexibility, agility, and rapidity, in order to reduce vulnerabilities and the potential impacts of hazards, benefit from previous events, risk management, and adaption of future events (EPA, 2015).

Strategies for Improving Access to Water

The International Institute of Social Studies have been identified 18 strategies to respond in different ways for water insecurities, which is shown in the following Table 3-2 (Rudolph, 2020).

Table 3-2: Indicative assessment of positive effects of identified strategies on different dimensions of access

Strategies	Dimensions of Access					
	Quantity	Quality	Distance and Collection Time	Price and Affordability	Availability and Reliability	Safety
1. Storing water in tanks or ponds	•		•	•	•	•
2. Using pumps to increase the pressure of the water from a network	•				•	•
3. Using filters to improve the water quality		•				
4. Buying water from additional sources (e.g., wells, springs, supermarket)	•	•			•	
5. Sharing water sources or services				•		
6. Collecting water from other people's surpluses	•	•	•	•		
7. Asking for permission to deepen or rehabilitate wells	•	•	•	•	•	•
8. Tapping pipes	•	•	•	•	•	
9. Refusing to pay for water				•		
10. Using different types of water for different purposes	•			•		•
11. Being careful with handling water	•		•	•	•	•
12. Reducing domestic water consumption	•		•	•	•	•
13. Changing crop or livestock production (e.g., growing dates, reducing area)	•		•	•	•	•
14. Having additional jobs (e.g., one family member working in a settlement)				•		
15. Having special arrangements with land and well owners	•	•	•	•	•	•
16. Moving within the Jordan Valley or leaving the area	•	•	•	•	•	•
17. Protesting on the streets	•	•	•	•	•	
18. Raising awareness internally, nationally and internationally	•	•	•	•	•	•

Source: (The International Institute of Social Studies, 2020).

Building Resilience of Utilities Through Efficient Resource Management

To help build resilience of water service facilities by supporting the short-, medium- and long-term structure emergency response for humanitarian organizations, by applying the key lessons learned from previous events (Diep, 2017):

- Good contingency planning: Emergency and contingency plans enable utilities to, reduce risks of service disruptions during a crisis, respond quickly to emergency situations with safe failure, and maintain services with spare parts.

- Improving human resources and internal capacity: enhancing human resources and internal capacity by practical workshops, visits to established emergency programs, and staff training on emergency situations and program implementation will speed up and improves the quality of response.

- Reducing non-revenue water (NRW): non-revenue water considering as losses, and reducing it will lead to increase both the amount of water distributed to customers and increase a utilities' revenue.

- Efficient use of water and energy resources: for efficient water-management several practices can be applied; e.g. More extensive treatment of wastewater and aquifer recharge, reducing physical losses by reducing leaks, water conservation, rainfall harvesting, and efficient use of greywater.

- Up-to-date data for decision making: updating data to help decision making to determine the essential needs.

3.1.3 Water Services in the Jordan Valley

Water Sources and Situation in Palestine and Jordan Valley

The Jordan River, the coastal aquifer, and the mountain aquifer are the three main natural freshwater sources in the Occupied Palestinian Territories. Israel took control of all water resources in the Occupied Palestinian Territories once the occupation began in 1967 (Military order No. 92, 1967), and Palestinians were not allowed to build new water systems or maintain existing ones without a military permit. These directives are still in effect, and they only apply to Palestinians—not to Israeli settlers, who are subject to Israeli law (Human Rights Council, 2021).

In 1982, all water supply systems in the West Bank were purchased by Mekorot, a government-owned corporation that is a part of the Israeli Ministry of Energy and the Water Authority. Many wells, trunk lines, and reservoirs in area C that extract water from Palestinian territory and deliver

it to Israeli settlements in the West Bank are still in operation, according to information provided by the State of Palestine (Human Rights Council, 2021).

One of the West Bank's most abundant natural water sources is thought to be the Jordan Valley region. It contains underground water from the eastern portion of the Mountain Aquifer, the most significant and highest quality water reserve of Israel and the Palestinians, as well as surface water from the Jordan River Basin, flooding, and waters flowing into the Jordan River from West Bank streams (Hareuveni, 2011).

According to international law, some of these water sources belong to both Israelis and Palestinians, while others are exclusive to Palestinians living in certain areas. Despite this prohibition, Israel has gained control of most of the water sources in the area and has earmarked the usage of most of the resources exclusively for the settlers in the area, while disregarding Palestinian villages and the chronic water shortage in the rest of the West Bank (Hareuveni, 2011).

Although the Jordan Valley is home to a third of the West Bank's subsurface water supplies, Israelis were given four times more access to the shared mountain aquifer than Palestinians due to an unfair allocation of water under the Oslo Interim Accord (commonly known as "Oslo II"). Because Palestinian farmers and villages are mostly dependent on tankered water, which they must pay for, Israeli settlement crops are well watered and lush as a result of this unequal access to wate, (Oxfam, 2012).

Most of springs in the Jordan Valley area are severely impacted by Israeli meddling through excessive pumpage for surrounding illegal Jewish communities, which undermines existing wells. These agricultural colonies, despite having a small population, have an insatiable desire for water since they engage in intense farming in lushly irrigated fields, depleting the natural water supplies of their neighbors. With dropping water levels, most of springs have dried and ceased to exist as natural groundwater outflow points (HWE, 2017).

Water Services in Palestine

According to the valuation, some 60% of the Area C residents in the Jordan valley surveyed rely entirely or partially on water trucking, receiving water either from neighboring wells, springs, or from filling stations in other villages. Less than half of the population (41%) can rely only on water

networks. In addition, due to the restricted amount of water available through water networks, around 40% rely on water trucking. The price of the water varies significantly from 4 NIS/m^3 from networks to 40 NIS/m^3 from the wells, influenced by transport costs for water trucking (OCHA 2021).

World Bank Group prepared a study about water service in Palestine, and it discussed operational performance of service provision and water service quality in the Palestinian territories (World Bank, 2018):

- High investment levels have guaranteed high connection rates. As a result, practically every home has access to the water network. In Gaza and the West Bank, 93 percent of people have access to piped water.
- For a region with limited water and financial resources, NRW levels are high. On the West Bank, the average NRW is 29 percent at the SPs' level and 15 percent at the level of the bulk water supply; in Gaza, it is 40 percent, with certain municipalities losing 53 percent of their water.
- Despite high network coverage, service delivery is intermittent, with significant differences in per capita supply between communities. Quality of service is highly dependent on the availability of bulk water, which is varies significantly among West Bank communities, particularly varying from 26 lcd in Yatta and Dura to over about 250 lcd in Jericho.
- The provision of effective and adequate water services in Gaza is hampered by the absence of a sufficient and dependable energy supply to the water and wastewater sector. Up to 2030, the Gaza water industry will require about 127 Megawatts.

Water Service Providers in Palestine

The number of water service providers in the West Bank reached 300, in addition to 25 service providers in the Gaza Strip. There is a discrepancy in the way of providing water service in the West Bank, as there are 193 service providers under classification of a village council, and this is a relatively large number. On the other hand, there are 87 service providers operating under the umbrella of the municipality, there is also one water undertaking, the Jerusalem Water undertaking, which provides services to more than 100 communities in Ramallah and Jerusalem, as illustrated in Figure 3-4 below (WRSC, 2021).

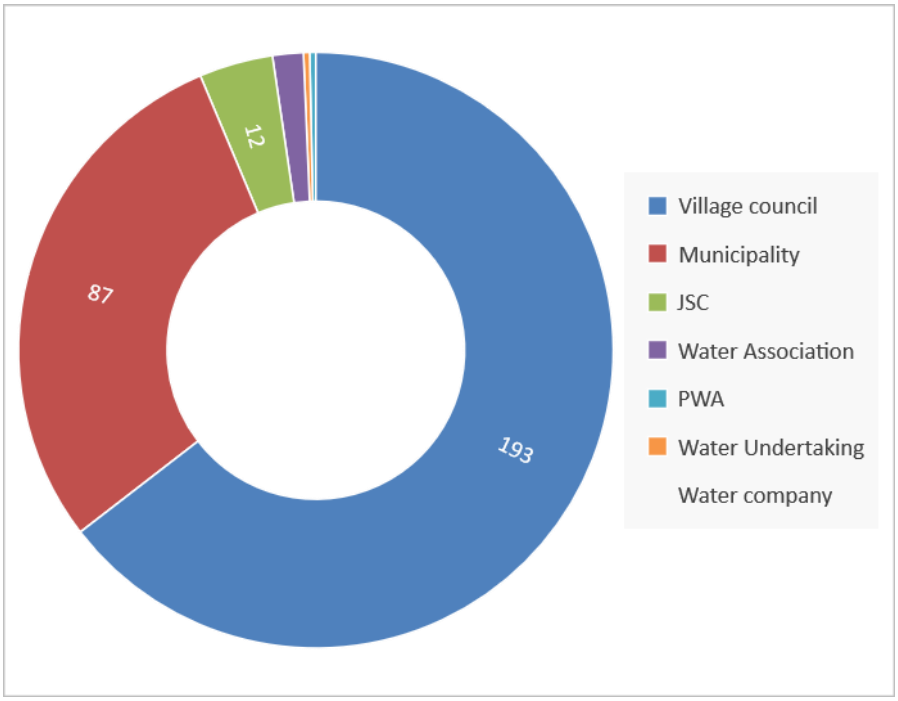

Figure 3-4: The administrative structure of the service provider in West Bank.
Source: (WRSC, 2022)

While in the Gaza Strip, there is a relative similarity in the method of providing the service through 24 municipalities and water authorities One is the Coastal Water Authority – Rafah, as illustrated in Figure 3-5 below (WRSC, 2022):

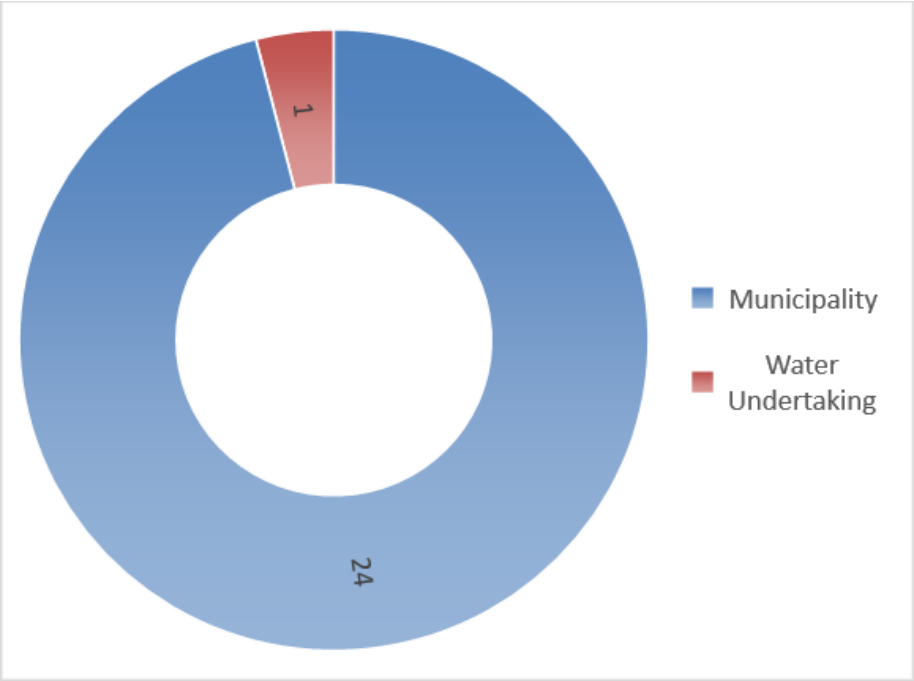

Figure 3-5: The administrative structure of the service provider in Gaza.
Source: (WRSC, 2022)

The sources of drinking water for water service providers are as follows (WRSC, 2022):

- 62.7% of the drinking water is purchased water.
- 33.3% of the drinking water is groundwater wells.
- 3.9% of the drinking water is spring water.
- 0.1% Rainwater harvesting tanks.

Water Service Providers in Palestine

Water and wastewater services are provided by over 280 water service providers in Palestine. These water service providers differ substantially in terms of institutional structures, which include (WSRC 2023):

- **Water Utilities Local Authorities,**
- **Municipalities and village councils,**
- **Joint Services Councils,**
- **Private Sector Water Associations.**

The West Bank Water Department (WBWD) is the sole bulk water provider in the West Bank, distributing to the majority of water service providers in the West Bank. In addition, there are about 24 municipal departments serving the Gaza Strip and the Coastal Municipal Water Utility (CMWU), which serves as both a regional service provider and a bulk supplier to other municipal sub-providers in Gaza (WSRC 2023).

Water service providers in Palestine operate under varying institutional, administrative, operational and financial conditions. Major differences are found in terms of service areas, availability and nature of water resources, operational costs, financial resources, etc (WSRC 2023).

Water Service Providers (WSPs) in Northern Jorden Valley

There are two water service providers supplying the piped water services through water network to the residents of the Northern Jordan Valley area in Tuba's governorate:

- **The West Bank Water Department (WBWD)**

WBWD supplies Kardala, Bardala, and Ein Al-Beida Villages with piped water, and the village councils manage the water networks and communicate with the WBWD, and carry out maintenance works for the network in the case of malfunctions.

The villages meters are read from the Israeli side and the bill is sent to the WBWD, in order to deduct the cost of the water consumed by these communities from the clearing.

The three villages have agreements with Israeli side, which is determined the amount of water for each farmer, since 1970s the settlers digging deeper water wells than the existing Palestinian wells, which caused the complete drying off of the Palestinian wells in Kardala, Bardala, and Ein Al-Beda. Following that, the ICA trying to compensate these communities with the same amount of water for domestic and agricultural purposes, but these amounts were fixed and never upgraded to take into account the community's subsequent natural demographic growth.

- **Joint Services Council for Water and Sanitation in Tubas**

JSC for Water and Sanitation in Tubas supplying the purchased water from WBWD, to Al-Aqaba, Khirbt' Atuf, directly and to Yarza and Ibzeq villages indirectly; Yarza through Tubas Municipality and Ibzeq through Tubas Cooperative Association, and it is also, managing the water networks and water services by carrying out maintenance works in the case of pipes breakdown.

All consumers in these four communities own prepaid water meters. The selling price of water is according to the category of consumption, so the higher the consumption, the higher the price.

Water Network Losses

An interview was conducted with Mr. Mohammad Abd al-Aal, the manager of central district in the WBWD, which supplies water to the communities of Kardala, Bardala and Ein Al-Beida: the water losses in network was discussed with him, and he mentioned that it is difficult to measure or limit the losses in network pipelines, due to many reasons:

- The citizen in three communities didn't have meters to count actual consumption of water, thus it is difficult to limit the difference in quantities between the actual consumptions and the total amount of supplied water to the communities.

- Determining the number of outlets and the amount of water for each outlet according to the agreement with the Israeli side, made the new farmers resort to make new openings in the main lines, and therefore these quantities are calculated as losses.

- The fragility of infrastructure, given that communities near or in Area C and close to the military training zones, thus the army prevents any maintenance works on the network pipelines.

And all the amount of waste in the networks is calculated from the main meters located after the reservoirs which are supplying water to the communities' pipelines, and all cost of the losses amount are deducted by the Israeli side through clearing.

It is not possible to quantify the amount of the network losses, because the main existing meters are meters belonging to the Mekorot company, and it read, billed and sent to WBDW, as the quantities allocated to the three communities is approximately equal to 3.8 MCM, while the total billed consumption is about 7 MCM, meaning that there are 3.2 MCM of water consider as losses.

3.1.4 Marginalized Communities

Marginalized Communities' Definition

Marginalized populations are groups within the Palestinian society, who are likely to be exposed to different levels of vulnerability, those communities experience discrimination and rejection (social, political and economic) due to the inequality in economic, political, social and cultural dimensions. Marginalization occurs because of unequal power relationships between social groups (Burghal, 2016).

Marginalized communities those who are excluded from mainstream social, economic, educational, and/or cultural life. They are also characterized as vulnerable, oppressed, underrepresented, or undercounted groups in community indicator initiatives. Groups excluded because of ethnicity, gender identity, sexual orientation, age, physical ability, language, and/or

immigration status are examples of marginalized populations. Furthermore, the predicament of Palestinian youth in the face of occupation and bad economic conditions may inspire new groups and expose a bigger number of young people to vulnerability (Brutschy, et al. 2014).

The citizens in the North Jordan Valley considered geographically marginalized, Bedouins whom live in areas which are frequently inaccessible by road and separated from one another by checkpoints, which prevents them from accessing markets and other necessities and hinders their ability to generate income and feed their cattle (UNDP 2013).

Classification of Marginalized Groups

The UNFPA study 2016, determined number of criteria and indicators for the classification of vulnerable and marginalized groups: Poverty, unemployment, inequality at work, low wages, poor working conditions, school absenteeism, school dropout, lack of qualifications, orphanhood, separation of parents, divorce, verbal violence, sexual violence, occupation-related violence, early marriage for girls, all types of disability, chronic diseases among youth, HIV/AIDS, negative and risky behaviors (drugs, alcohol, smoking, etc.), conflict with the law (crimes, misdemeanors, violent behavior, etc.), refugee status, displacement, exposure to armed conflicts, and desire to emigrate abroad (Burghal, 2016).

The citizens in the North Jordan Valley considered geographically marginalized, Bedouins whom live in areas which are frequently inaccessible by road and separated from one another by checkpoints, which prevents them from accessing markets and other necessities and hinders their ability to generate income and feed their cattle (UNDP 2013).

3.2 Literature Review

Study: Gruppo di Volontariato Civile in Italian (GVC), (2022). "Protection Community Profile, Ein Al-Beida, Tubas Governorate."

This study aimed to increase capacities of communities and individuals to make informed decisions and support the coordinated mobilization of comprehensive multi-sector, multi-actor, and multi-scale efforts. It includes an analysis of collected information about the communities in the Jordan Valley, using multi-sectoral assessment addressed at community level through structured interviews with community representatives covering 12 sectors across the humanitarian-

development nexus (demography & displacement, location, protection, legal framework, livelihood, roads & transportation, health, energy, WASH, stakeholders).

This study and similar studies for (Kardala, Bardala, Khirbt' Atuf, and Hammamat Al Maleh) were used in this research in the community profiling and describe the services situation in these communities.

Study: Palestine Economic Policy Research Institute-MAS, (2017). "East Tubas Communities - Diagnosis of Local Economic Resources."

Drawing an economic map for the communities east of Tubas, including the economic, social and cultural potentials, and highlighting the available potentials and prospects for investment and economic and social development. In addition to a preliminary identification of the needs for the development of the local economy, in preparation for completing the process of analysis, studying the reality, and developing work strategies that seek to stimulate the investment environment and develop the local economy and enable it to achieve the planned economic goals and results.

The study also identifying the relevant parties and the regulatory framework that will be responsible for following up the implementation of the local development plan.

This study includes information about Al-Aqaba, Al-Maleh, Bardala, Ein Al-Beida, Kardala, and Yarza, and this information was helpful in communities profiling.

Study: House of Water and Environment (HWE), (2017). ("Detailed Assessment/Mapping for Agriculture Water Resources in Bardalah Watershed (Kardalah, Bardalah and Ein Al-Beida)."

This research study the sustainability of the agricultural water resources to achieve food security activities through protecting and using the available water resources efficiently, by assessment/mapping for agriculture water resources, the cropping patterns, irrigation needs, water supply and demand in the project area. This study described the water situation in Bardala, Kardala, and Ein Al-Beida by assessing the current agricultural water system in these communities, in terms of available water resources, water supplies, water consumptions and identification of the components of water needs.

Study: The Global Water Partnership Mediterranean (GWP-Med), (2015). "Water Governance in Palestine. Sector reform to include private sector participation."

This research aimed to analysis of the governance challenges that faces private sector participation in the Palestinian water sector, and it overcome the main governance challenges faced by Palestine in its effort to reform the water sector, including the involvement of the private sector in the water and wastewater development plans. This study was useful in stakeholder analysis, by determining the main the institutions involved in Palestinian water services and allocation the roles and responsibility of water sector entities.

Study: Rudolph M., (2020). "Water Governance under Occupation: A Contemporary Analysis of the Water Insecurities of Palestinians in the Jordan Valley, West Bank." The International Institute of Social Studies.

This study discusses the problems that Palestinians face regarding to access to water service in acceptable quantity in terms of quality, distance and collection time, price and affordability, availability and reliability as well as safety. Palestinians' access to water in the Jordan Valley largely relies on private efforts. They include strategies like storing water in tanks or reducing domestic water consumption, which often improve several dimensions of access, and this is consider as resilience of water service. This study also analyzes the undertaken strategies to improve access to water, and how people have responded in different ways to water insecurities, through this research these indicators (quantity, quality, distance and collection time, price and affordability, availability, reliability, and safety) have been studied and analyzed for the population of marginalized communities in the Northern Jordan Valley.

Study: IWA (Israel Water Authority) (2009). "The Issue of Water between Israel and the Palestinians."

This study examines the issue of water between Israel and the Palestinians by presenting the existing water agreements and modes for implementing them, as well as stating the principles of both sides for coping with the shortage of water, currently and in the future. For this research, this study showed the water Agreements with the Palestinians and the Implementation of the

Agreements during the Period 1995-2008, and the difference in the quantities of water between those consumed by the Israelis and the Palestinians in accordance with these agreements.

Study: Hefny, M., (2011). "Water Diplomacy: A Tool for Enhancing Water Peace and Sustainability in the Arab Region"

The main purpose of the research paper is to put water diplomacy in action, focusing on International Waters in the Arab Region, and to use water diplomacy as a strategic tool, and not merely as a discipline or a pedagogic material for capacity building of water planners or decision makers and other stakeholders. The main assumption is that management problems rather than scarcity of water resources is the reason why water diplomacy is needed as a strategic tool for enhancing peace and sustainability in the Arab region.

Study: Duleux, A. (2020). "Water diplomacy and water security in the Israeli-Palestinian conflict."

This paper investigates the role of water diplomacy in ensuring water security in Israel and Palestine. The analysis begins by defining water security from Israel's and Palestine's perspectives. It then explores potential water diplomacy strategies and examines water management systems, including the roles of international organizations and international law. This paper concluded a primary finding, is that Israel and Palestine are interdependent within the context of transboundary water sources, and that according to strategic realism, Israel and Palestine will achieve greater water security by using water diplomacy.

Study: Eran, O.; INSS; Bromberg, G.; Giordano, G. (2018). "Israeli Water Diplomacy and National Security Concerns."

This paper reflects on the concepts of water security and water diplomacy, describes the state of water security in Israel, Jordan and the Palestinian Territories, and presents a set of recommendations to decision makers designed to advance Israeli Palestinian water security and shared national security concerns. This paper provides a general overview of Israeli-Jordanian and Israeli-Palestinian water relations and makes the case that Israeli water diplomacy with Jordan has resulted in fruitful cooperation because both nations share the belief that advancing a common agenda for water security serves their respective national interests.

The article then makes the case that too frequently, Israeli water policy following 1967 and following the Oslo Accords with the Palestinian Authority, have neglected to take broader national security objectives into account.

Study: WRSC (2022). "Performance Monitoring Report of Water &Wastewater Service Providers."

This report covers most of service providers in Palestine, whose number exceeds three-hundred in the West Bank and Gaza Strip. It provides operational information about service providers of water and wastewater services, and gives a detailed review of WSP's performance based on indicators, e.g.; (technical indicators, financial Indicators, water quality indicators, and other indicators). This report was used during the analysis process of resilience indicators, since some indicators values were determined based on the numbers collected and analyzed for water service provider in Tubas governorate in WRSC report.

Study: WRSC (2020). "The comparative data of Water &Wastewater service Providers in Palestine."

This report compares the data of water service providers in Palestine with respect to several indicators, in terms of; technical indicators, financial indicators, water quality indicators, in addition to other indicators, and it was used in this research in determining resilience indicators of water services in Tubas, during the process of preparing the WSPs questionnaires.

Since this report was prepared by WRSC as an incentive to do more to improve services provision wherever is possible, and to present the performance indicator data disclosed by service providers and reviewed by the Council.

3.3 Knowledge Gap

This research assessed the water service situation in Northern Jordan Valley in terms of diplomacy and resilience, and the study area focused on marginalized communities. The Northern Jordan Valley area is known as complex region and has its own specificity in terms of geography, politics and social aspects. Thus, the water service there also complicated; where the eight communities in this area are considered marginalized, there is more than one water service

provider, and the water service prices vary from one village to another, despite of the geographical proximity.

The reviewed studies discuss the situation of services and the population in general, without analyzes the water services in the Northern Jordan Valley in terms of diplomacy and resilience. During data collection process, it was noticed that the data of water service of Northern Jordan Valley in WRSC reports were not existed. So, the added value of this research is created a database of water service for Northern Jordan Valley communities, in addition to analyzing the performance indicators of water service providers in these communities and measuring the degree of resilience of water services, and determine the roles of the active stakeholders in water service diplomacy.

Chapter Four: Approach and Methodology

The processes of identification the role of diplomatic to enhance the resilience of water services in marginalized communities in the Northern Jordan Valley were include a number of activities:

- This research used qualitative and quantitative analysis, which allowed for a more comprehensive understanding of performance drivers related to diplomacy, level of service, resilience of service.
- Collection of information about water services and WSPs in marginalized communities in the Northern Jordan Valley was made based on different sources of data; field visits, questioners, stakeholders' interviews, statistics, reports, books, and researches.
- Conducted a number of individual interviews with relevant ministries and government institutions, service providers, local council, and local residents.
- Stakeholders' analysis was done, based on the interviews with all related parties with diplomacy and water services in Northern Jordan Valley.
- Ten interviews were made with different stakeholder in different ministries and institutions to achieve stakeholder analysis.
- The primary and secondary stakeholders were determined based their power, interests, and influences, as a result of stakeholder's interviews.
- To collect data about water service in eight communities, nine interviews were made with the head of the LGU's in Kardala, Bardala, Ein Al-Beida, Al-Aqaba, Khirbt' Atuf, Yarza, Ibzeq, and Al-Maleh communities.
- In addition to five interviews with the WSP's in Tubas Governate (Head of JSC for Water and Sanitation in Tubas, Water department in Tubas Municipality, Head of Tubas Cooperative Association, WBWD representative, PWA representative)
- Two focus groups were conducted with the heads of the LGUs and the Directorate of Local Government in Tubas, in order to assess the water service and the challenges faced by the residents in marginalized communities.
- Two types of questioners were made for data collection, one for LGU's and water service providers, and it contains seven parts shown in Table 7-1 Annex A:

- First part: Quantity of consumed water by inhabitants, e.g.; amount of water consumed for different uses, households use, livestock, and agriculture,

  Second part: The availability and reliability of water sources (i.e., How frequent and how certain is the access to the water?),
- Third part: The affordability and the price of the water (i.e., selling price, purchasing cost, and collection efficiency),
- Fourth part: safety (i.e., How safe is the access?),
- Fifth part: Reliability of alternative sources of piped water, (e.g.; quality of tanked water),
- Sixth part: Accessibility to alternative resource (e.g.; distance to alternative source),
- Seventh part: Satisfaction of consumers; numbers of complaints per year.

And different questioner was made for the consumers, and it divided for six parts as shown in Table 7-2 Annex A:

- First part: sample properties to identify if the community is marginalized,
- Second part: the source of consumed water for household use, irrigation, and raising livestock,
- Third part: the quantity of consumed water and monthly cost for household use, irrigation, and raising livestock,
- Forth part: Satisfaction about the level of piped water services,
- Fifth part: Satisfaction about the quality of piped water services,
- Sixth part: Suggestions for improving water service.

- Eight questioners were filled with the head of LGU's in Eight communities, Kardala, Bardala, Ein Al-Beida, Al-Aqaba, Khirbt' Atuf, Yarza, Ibzeq, and Al-Maleh communities.
- Two hundred of consumer questioners were distributed in the LGU's in eight communities, six communities (Kardala, Bardala, Ein Al-Beida, Al-Aqaba, Yarza, and Al-Maleh communities), filled one hundred and twenty-five questioners, but residents or the village council in (Khirbt' Atuf, and Ibzeq villages) were not cooperative to fill the questioners.
- The consumer questioners were distributed over eight LGU's, because most population works in agriculture in their farms which are far from the village center.
- The collected data from the questioners and interviews with LGU's and WSP's were analyzed based on score-card analysis, and some criteria have been set based on the water

service situation in Palestine and the standards adopted by the WSRC in addition to international standards.

- The questioners that were distributed for the consumer can't be analyzed correctly because the missing data in the questioners, especially in water quantity and monthly cost part, since the residents, in (Kardala, Bardala, Ein Al-Beida) the residents didn't pay for the water services, so they have no idea about the water price or consumed quantities, and in Al-Maleh communities they didn't have water networks, and they own large numbers of cattle, so it hard to know the consumed amount of water for household, so the consumer questioners were excluded from the analysis, despite the difficulties we encountered in collecting data, especially the distance from the study area, the dispersal of communities, and the widening of the geographical area.
- Analysis of water diplomacy and the Israel-Palestinian agreements impacts on the water quantities provided to each party and how this influences the shortage in water quantities in marginalized communities in Jordan valley within the context of international humanitarian law.
- Analysis of undertaken strategies to improve access to water, and how they have been supported and promoted by resilience and resistance.

Through this research different tools were used to collect data form different resources:

- Interviews with ministries, chairmen of village councils, water service providers representatives, and community representatives,
- Questionnaires and surveys, one for water service providers, and for LGUs' and the other for consumers,
- Focus groups, were held with persons related to the water service of the northern Jordan Valley from various ministries and institutions,
- Oral histories, were record through the interviews with residents and people who worked in these areas.
- Documents and records, collected from different ministers, institutions, and research and studies centers.

4.1 Stakeholders Analysis Procedure

Stakeholders are people, groups, or organizations, who are likely to be affected (negatively or positively) by a proposed project, or those which can influence the project outcomes. These interested parties, can be classified into the different groups: international and national agencies, governmental institutions e.g., (Ministry of Health, Ministry of Agriculture, Environment Quality Authority), nongovernmental organizations [NGOs], labors, private for-profit, nonprofit, civil society, and users or consumers (Kammi, 2000).

Stakeholders have significant impact on decision-making process. Therefore, it is important to understand the role of each party and the interrelationships between them, and recognize the multiple roles of stakeholders in the same situation, and the different roles in different situations (Khan, 2010).

Stakeholder analysis is a method of collecting and analyzing qualitative data to determine which interests should be considered when implementing a policy or program, by identifying the key actors, and assessing their interest, attributes, interrelationships, knowledge, and ability to affect the policy process (Khan, 2010).

Objectives of a stakeholder analysis:

- To identify groups, authorities or institutions that might affect or be affected by water services in marginalized communities in northern Jordan valley.
- To provide a foundation and strategy for key stakeholders' participation.
- To understand the needs and interests of the key stakeholders.

Stakeholder analysis Procedure

The following steps are followed in carrying out the analysis of water services stakeholder in marginalized Palestinian communities in the northern Jordan Valley (DRFN, 2013):

Step 1: Clearly understanding the purpose of conducting a stakeholder analysis by identifying the stakeholders who will contribute to improve the resilience of water services in the study area in northern Jordan valley through diplomacy.

Step 2: Identifying and lists all stakeholders who have an influence, power or interests on water services in marginalized Palestinian communities in the northern Jordan Valley.

Step 3: Categories stakeholders into primary or secondary stakeholders based on their influence, power and interests.

Step 4: Analyzing each stakeholders' interests and potential influence on water service in Jordan Valley. This was done for both primary and secondary stakeholders by conducting interviews and questioners with targeted stakeholders. Not all stakeholders are equally important throughout the whole systems.

Step 5: Stakeholders were classified into four main groups as shown on Figure 4-1 below.

- Stakeholders with high influence but low interest.
- Stakeholders with both high influence and interest.
- Stakeholders with both low influence and interest.
- Stakeholders with low influence, but high interest.

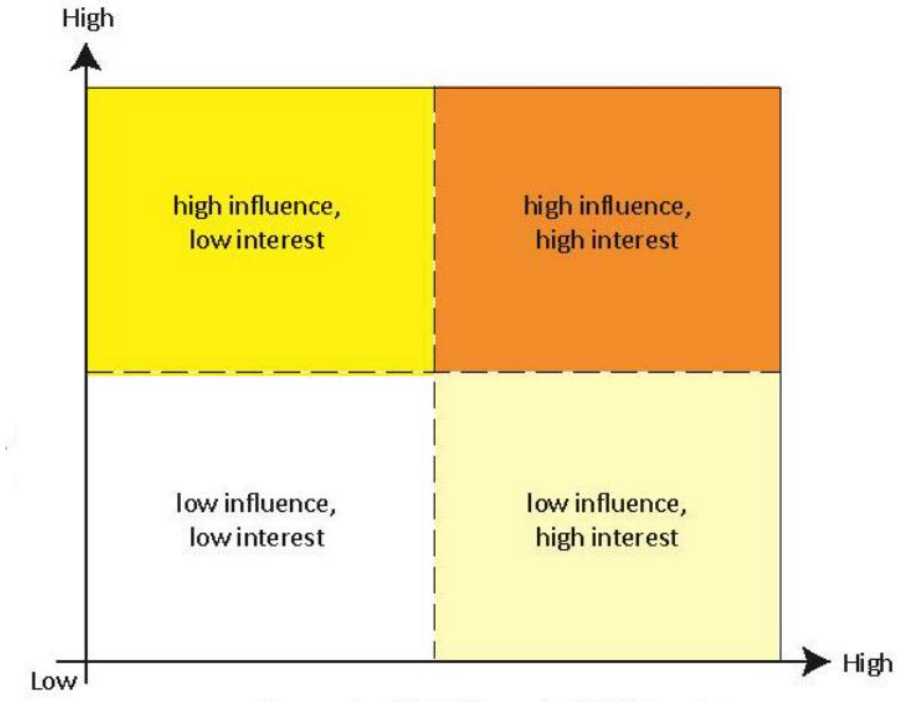

Figure 4-1: Stakeholder matrix with four main categories.
Source: (IWRM, 2013).

4.2 Data Analysis Method

Score-card Analysis

To analyze the resilience for water service, in the eight communities; Kardala, Bardala, Ein Al-Beida, Al-Aqaba, Khirbt' Atuf, Ibzeq, and Al-Maleh. The equitable access Scorecard technic is used for the analysis it was designed and produced by PHG, it lists policy options, and it summarizes the degree to which a number of specified policy options are valid to used. The scorecard also calls for quantitative information to contextualize the results and describe the level of access to safe drinking water (PHG, 2016).

The scorecard can be used by any country, or region in the world to carry out a self-evolution. It has been created to compare the various outcomes over time. It is highly recommended to use the scorecard to gain a baseline analysis of the equity of access to water; to identify related priorities, to set targets to bridge the identified gaps and to evaluate progress (PHG, 2016).

The scorecard can be used to identify current policies and ongoing actions and highlight any discrepancies between legislative texts and actual conditions (PHG, 2016).

The analysis will be done based on seven categorize:

- Quantity,
- Availability and reliability,
- Affordability,
- Financial situation of the WSPs,
- Quality/safety,
- Reliability and Accessibility of alternative source, and
- Consumer satisfactions,

The analysis will be done based on scorecards method, the tables were modified to fit the collected information, the purposes and targets of the research.
The scoring will be from 1 to 5, as score one is the lowest value and score five is the highest value, the following Table 4-1 illustrates the summary of water service resilience indicators measurements, and each of the indicators will be analyzed and measured according to the criteria adopted in the following tables:

Table 4-1: The resilience indicators assessment

Score	Quantity	Availability and reliability of water service	Affordability	Financial situation of WSPs	Quality	Reliability and Accessibility of Alternative source	Consumer satisfaction
5	Very sufficient	Very reliable	High	Good	Good	Very reliable	Very Satisfied
4	sufficient	Reliable/Secure			Acceptable	Reliable/Secure	Satisfied
3	Acceptable		Moderate	Moderate			
2	Insufficient	Problematic	Low	Not good	Problematic	Problematic	Partly Satisfied,
1	Unacceptable	Unreliable/ insecure			unacceptable	Unreliable/ insecure	Not at all Satisfied,

4.2.1 Quantity Analysis

It is Quantity of water used per capita per day; this indicator includes all water collected by or distributed to the household and used for drinking, cooking, personal and household hygiene by the consumers. It does not include water used for irrigation or for raising animals (Billig, et al., 1999). It is proposed five different quantity levels; A minimum of 20 liters per day is generally required for basic needs. A higher standard that gives scope for some productive use of water is 40 liters. At 60 liters, it is assumed that users enjoy more options for water use (Moriarty, et al, 2011), 85 liters is the average daily consumption per capita of JSC for water and sanitation in Tubas governorate (WRSC, 2022), and the average daily of water consumption per capita should be (100-150) liter according to WHO standards.

The water network should use only for domestic purposes by permanent residents, but it used for livestock breeding or agricultural, and this would unavoidably lead to misleading results on the consumption per capita and cannot be compared with the WHO water consumption standards, the following Table 4-2 shows the standards of quantity indicators assessment. The permanent population: are the residents who live in the village permanently in all seasons of the year.

Expatriate population: are the people who come to the village during the grazing and agricultural seasons.

Table 4-2: The standards of quantity indicators Assessment

Score	Quantity Indicators Assessment		
	Indication	**Quantity** (l/c/d)	**Uses**
5	Very sufficient	Greater than 100	For domestic use only
4	Sufficient	Greater than 85	For domestic use only
3	Acceptable	Greater than 60	For multi-purposes uses
2	Insufficient	Greater than 40	For multi-purposes uses
1	Unacceptable	Greater than 20	

4.2.2 Availability and Reliability of Water Service Analysis

Availability: The amount of water provided for each person must be adequate and continuous for personal and domestic purposes. According to the WHO, between (50 - 100) liter of water per capita per day are needed to guarantee basic needs and few health concerns (Kayser, et al., 2013). The availability of water service will be measured by the percentage of the coverage residents by water network services, and five coverage levels were put to classify the availability of water service based on the area situation.

Reliability: is refer to the time which piped system is free from unplanned interruption due to breakdown or other causes, the reliability was classified in to four categories, the highest category is very reliable when the system works all the time, it will be reliable or secure when the water is provided through networks most of the time, but it will be considered problematic when it suffers from breakdowns and slow response time to repairs, and if it is completely broken down it will considered unreliable and in secure (Kayser, et al., 2013). The periodic inspections for water networks should be done twice a year, as chairman of JSC of Water and Sanitation in Tubas mentioned, and the Table 4-3 below shows the degree of availability and reliability of water service.

Table 4-3: The degree of the availability and reliability of water service

Score	Availability and reliability			
	Indication	**Number of service days per week**	**Periodic inspection per year**	**Coverage of permanent residents** (%)
5	Very reliable "Works all of the time"	7	2	100%
4	Reliable/Secure "Works most of the time"	3	1	Greater than 90%
3		2		Greater than 80%
2	Problematic "Suffers breakdowns and slow response time to repairs"	1	In case of malfunctions	Greater than 60%
1	Unreliable/ insecure "Completely broken down"	0	0	Less than 50%

4.2.3 Affordability Analysis

Affordability: it's not just willingness to pay for water service, it is also influenced by a variety of factors beyond costs; including: water quality, the service continuity, acceptability, and location. It's evaluated based on; household expenditure and household income. (Moriarty, et al, 2011). The price of water is subsidized by the Palestinian Authority, and the government bears part of the bulk purchase cost. Whereas, the service provider purchases water through the WBWD at a price of 2.6 NIS/m^3, while the selling price from Mekorot is 3.2 NIS/m^3, (WRSC, 2022). The "average selling price per cubic meter of water" indicator does not mean the tariff applied by the service provider, but rather it is a general indicator of the average selling price per cubic meter of water to be compared with the operating costs of the service provider.

The average selling price for cubic meter of water in the Tubas by JSC for water and sanitation is 5 NIS, according to WSRC report for 2022. Thus, the affordability classified into three levels as shown in the following Table 4-4.

Table 4-4: The affordability degree for water services

score	Affordability	
	Indication	**Selling price** (NIS/m^3)
5	High	SP ≤ 5
4	Moderate	SP ≤ 6
3		SP ≤ 7
2	Low	SP ≤ 8
1		SP ≥ 9

4.2.4 Financial Situation of WSPs

Collection Efficiency: the ratio reflects the level of efficiency of the service provider's staff in performing their duties and the level of consumers' willingness to pay. This indicator measures the percentage of collected bills issued in this year and overdue bills from past years. Ideally, collection rates should be 100% if all the bills issued in the year collected with zero outstanding bills from previous years, for this research five levels of collection efficiency were set based on the average collection efficiency for JSC of Water and Sanitation in Tubas was 80% for 2022 (WRSC,2022).

Non-Revenue Water (NRW): It is the difference between water supplied through the water distribution networks and water for which bills have been issued for consumers. These losses including water leakage in the network, illicit connections, and inaccurate water meters, etc., WSRC classified the losses into three types (WRSC,2022). There are three types of losses in the water distribution networks:

- **Apparent Losses:** it is consisting of all losses like meter deficiencies (customer meters), data entry, thefts, etc.
- **Physical Losses:** All losses caused by leakage from the water network facilities.
- **Unbilled Authorized Consumption**: is the amount of water provided by WSPs for free through water meters or without meters e.g (Kardala, Bardala, and Ein Al-Beida).

The Non-revenue water for JSC for Water and Sanitation in Tubas is 36%, so the classification of the NRW was set for five categories, 0% is consider the best situation of the network, and whenever it becomes less than 36%, means that network doesn't work probably.

Working ratio: The working ratio of total expenses, excluding depreciation, to the gross billed revenues. If the percentage were more than 1, it means deficit would be detected in the operational cycle. If working ratio less than 1, thus, the service provider would generate a surplus and cover part or all the depreciation and capital expenses, (WRSC, 2022). For this research the working ratio divided over five categories. Financial situation of WSPs will be determined based on working ratio, collection efficiency and percentage of non-revenue water, as shown in the following Table 4-5.

Table 4-5: Financial situation for WSPs

Score	Financial situation of WSPs			
	Indication	**Work ratio** (%)	**Collection efficiency** (%)	**NRW (non-revenue water %)**
5	Good	Less than 60%	100%	0%
4		Less than 80%	Greater than 90%	Less than 10%
3	Moderate	Less than 100%	Greater than 80%	Less than 20%
2	Not good	Less than 120 %	Greater than 70%	Less than 40%
1		Less than 140%	Less than 70%	Greater than 50%

4.2.5 Quality Analysis

The Ministry of Health periodically takes and examines water samples from resources, transmission pipelines, networks, in addition to specific points from homes and institutions within a specific sampling program, while water service providers are not party of this program. The drinking water standard (MF 41-2005), remains the primary reference in determining the drinking water characteristics:

- **Biological characteristics**:
  - The total number of total coliform bacteria should not exceed 3 per 100 mm of the tested water.
  - The total number of fecal coliform bacteria should not be more than zero per 100 mm of the tested water.

- The sterilization quality must be checked by examining the total bacterial number, and it must be less than 500 cells per 1 mm.

- When fecal coliform bacteria are present, additional laboratory tests should be determined by looking for other indicators.

- The recommended minimum sample numbers for fecal indicators testing in distributions systems, for piped water for communities of population less than 5,000 capita, it recommended 12 tests per year.

- The number of samples matching biological characteristics from the same source over a period of 12 months must not be less than 95%.

- Drinking water must be free of protozoa, worm eggs, fungi, algae, and any pathogens.

- **Physical properties:**

  The taste and smell should be palatable to most citizens, according to the approved methods.

- **Chemical properties:**

  The water must be disinfected so that the amount of disinfectant and the time of contact with the water is sufficient, and in the case of using chlorine with water as a disinfectant, the following must be done:

  - The mixing time of chlorine with water should not be less than 15-30 minutes before the water reaches the consumer.

  - The residual free chlorine should not be less than 0.2 mg/L and not more than 0.8 mg/L when the water reaches the consumer.

  - The number of samples required daily from the service provider is two samples for every 5,000 citizens who are provided with water service daily.

The Table 4-6 below shows the degree of the water quality which provided by WSPs and based on the tests were performed by MoH:

Table 4-6: The quality of water provided from WSPs

Water quality				
Score	**Quality**	**Percentage contaminated samples with total coliform**	**Percentage contaminated samples with fecal coliform**	**Percentage of water samples containing free chlorine residual** (CR)
5	Good	0%	0%	100%
4	Acceptable	Less than 2%		
3				
2	Problematic	More than 3%	More than 1%	97%
1	Unacceptable	More than 5%	More than 5%	Less than 95%

4.2.6 Reliability of Alternative Source Analysis

The alternative source will consider very reliable if the cost for cubic meter of water is equal or less than 7 NIS, which is very close to the selling price of water network in some communities, the quality of the alternative source for most of groundwater sources, especially wells, meet high quality specifications, but for collection wells and springs considered as acceptable quality since the rainwater it is the source of these resources. So, the reliability of the alternative source was classified into four categories, based on the price of cubic meter of alternative source and the water quality of alternative source, and this classification was set on based observation from the field visits and research readings as shown in the Table 4-7 below:

Table 4-7: The degree of reliability of alternative source

Reliability of alternative source			
Score	**Reliability of Alternative source**	**The price of cubic meter of water** (NIS/m^3)	**Water quality of alternative source**
5	Very reliable	Less than 7	Good
4	Reliable/Secure	Less than 10	Acceptable
3			
2	Problematic	Greater than 15	Problematic
1	Unreliable/ insecure	Greater than 20	Unacceptable

4.2.7 Accessibility of Alternative Source Analysis

The accessibility will be based on the average time and distance to alternative resource, and it classified into four classes, it considers to be high access if the average travel time less than 10 min and the average travel distance less than 2 km to find the alternative source, and the classification was based on what has been observed by field visits and research questionnaires, as shown in the following Table 4-8:

Table 4-8: The degree of accessibility of alternative source

Score	Accessibility of alternative source		
	Accessibility	**The average time (min)**	**The average distance (km)**
5	High access	Less than 10	Less than 2
4	Intermediate access	Less than 30	Less than 5
3			
2	Low access	Less than 60	Less than 10
1	Very low access	Greater than 60	Greater than 10

4.2.8 Consumer Satisfaction Analysis

The consumer satisfaction in the study area was measured through percentage of the written complaints to the WSPs from the total connections, and the degree of satisfaction classified into four levels as the following Table 4-9 shows:

Table 4-9: The degree of consumer satisfaction

Score	Consumer satisfaction	
	Satisfaction measurements	**% Of written complaints**
5	Very Satisfied	Less than 5%
4	Satisfied	Less than 10%
3		
2	Partly Satisfied,	Less than 20%
1	Not at all Satisfied	Greater than 30%

4.2.9 Resilience of Water Service Degree

To determine the degree of resilience of water service in each community, the overall coverage of all indicators scores will be calculated, and based on the Table 4-10 below will be classified:

Table 4-10: The Degree of resilience

#	**Degree of resilience**	**The overall coverage**
1	Very Resilient	80-100%
2	Resilient	60-80 %
3	Somehow Resilient and need support	40-60 %
4	Not Resilient (Need support)	40-20%

Chapter Five: Results and Discussion

This chapter describes the main data collected during the research period and presents a set of results based on the analyzed data.

5.1 Diplomacy and Stakeholder Analysis

5.1.1 Collected Data for Stakeholder Analysis

Data collection process was done with a great deal of force, due to many reasons; the distance from the study area, and the specificity and complexity of this region due to it's economic, social and geopolitical situation. and the local residents were working in their farms that located far away from the village's centers, and this make data collection harder.

Stakeholder Classifications

Based on the resources available and after some research the possible stakeholders were identified and divided into two Categories, primary and secondary stakeholders:

Primary stakeholders

A primary stakeholder constitutes of a water user or group of water users within the cluster, and water service suppliers who are responsible for providing water to, or managing it, and those stakeholders are directly affected, either positively or negatively by the project. (DRFN, et al., 2013) and it includes:

- **LGU's, and JSC's:** are multi-purpose bodies responsible for delivering a broad range of services, in relation to roads; traffic; planning; housing; economic, community development, and environment. Regarding to water services some of LGU's and JSC's are providing the population with drinking water, working on monitoring and organizing the service, maintaining the water network, installing new pipelines, and preventing pollution of the springs, canals, basins and wells in the area.

- **Household, Farmers, Livestock Breeder, and local institutions e.g. (health centers and educational institutions):** the beneficiaries of water services, for household, ranching, agriculture, and institutional use.

- **The West Bank Water Department (WBWD):** is the sole bulk water provider in the West Bank, distributing to the majority of water service providers in the West Bank, it also manages wells and purchases bulk water from Israel (Mekorot) which it sells to water service providers (WSPs), and it operates some wells owned by the PWA, and responsible of Bulk water provision in West Bank (The World Bank, 2018).

- **Israeli National Water Company** (Mekorot, illegal stakeholder): 90% of the water used for drinking in Israel is provided by a public national water company Mekorot. Both inside the Green Line and in the OPT, the Israeli state is in charge of water management and supply. Mekorot controls water taken from Palestinians in the occupied territories and provides infrastructure for water supplies in the settlements, (PENGON, et al., 2014).

  Violations of the Mekorot against the Palestinians (PENGON, et al., 2014):

  - Since 1950s, Mekorot has been responsible for violation of Palestinian water rights, by redirecting the Jordan River to serve Israeli residents and areas, while forbids the Palestinian community from having any access to water resources.
  - The main wells in Jordan valley were operated by Mekorot, which mostly supply the Israeli settlements.
  - Mekorot exclusively benefit from Palestinian wells which is located in behind the apartheid Wall, as it prevents the Palestinian access to their own wells.
  - Discrimination against Palestinians, since the daily water per capita consumption for Palestinian is less than 100, which is the minimum value recommended by the World Health Organization (WHO), while Israeli daily per capita consumption is about four times as much of Palestinian consumption.
  - Discrimination against Palestinian farmers in the Jordan Valley, through the lack of access to agricultural land and the lack of access and share of water for irrigation compared to settlers in the same area.

- **Settlers (illegal stakeholder):** Israeli government gives high incentives for potential settlers to move to Jordan Valley to be involved in agricultural works; also, Jordan Valley settlers receive significant discounts for basic services such as water and electricity. Since settlers' families receive a 75% discount in their monthly water bills, whereas Palestinians in the same area are paying up to 50% of their monthly income for far less water.

  The water statistics clearly show the enormous differences in the quantity of water that Palestinians and Israeli settlers receive and the agricultural figures are also far exceeding the domestic figures (ARIJ, 2013).

Secondary stakeholder

Secondary stakeholders play intermediary role and may have significant impact on the water services outcome through policy or decision-making, include:

- **Ministry of Local Government (MoLG):** With regard to water, sanitation and environmental services, the Ministry of Local Government undertakes, (Molg,2022):
  - Working with local authorities in order to provide better services in the fields of water, sanitation, electricity and solid waste.
  - Preparing draft laws, regulations, and instructions calling for the development and improvement of public services.
  - Providing local authorities with all necessary information related to their work.
  - Monitoring the work of local authorities and ensuring their compliance with the applicable regulations, instructions and laws.
  - Assisting local authorities in developing designs and specifications for their projects and supervising their proper implementation.
  - Helping to provide sources of funding for vital projects that local authority's need and whose budgets cannot bear its costs.

- **Ministry of Agriculture (MoA):** aims to develop the agricultural sector in the Tubas and Jordan Valley region through (MoA,2022):
  - Support farmer's access to agricultural land, water, natural resources, and markets.
  - Increasing the efficiency and sustainability of natural resources (land and water).
  - Increasing investment in the agricultural sector and strengthening the partnership between the public and private sectors.

- Activating the role of agricultural institutions, especially those concerned the small farmers.

- **Environmental Quality Authority** (**EQA):** Aims to preserve the environment, water sources and wells by regular inspection.

- **Palestinian Water Authority (PWA):** Pursue to achieve integrated and sustainable management of limited water resources, and to protect and preserve them within organizational tools that help them reach a healthy environment, by ensuring a balance between the available water quantity and quality and the Palestinian people's need to achieve sustainable development through water resources (PWA,2017).

- **Water Sector Regulatory Council (WSRC):** Monitoring the operational activity of water service providers, including production, transmission, distribution, consumption, and wastewater management, in order to ensure the quality and efficiency of the services of the water provision and wastewater services sector in Palestine, which are provided to consumers at reasonable prices (WSRC, 2022).

- **Donors, Local NGOs, and Unions:** supporting water projects of all sizes while pursuing reform of the water sector in West Bank and Gaza, capacity building and awareness rising on water and environment prevention.

- **Israeli Water Authority (IWA, illegal stakeholder):** was created as an alternative to the Water Commission, motivated by the need to centralize the powers in managing the water sector to a single government agency. The authority is responsible for the management, operation and development of the water sector. The Water Authority supervises the maintenance and rehabilitation of natural water sources. It also supervises the development of new water sources, water consumers and water extractors. The Authority is composed of several units, including: water quality, water security, spokesperson and media, water desalination, research, the West Bank Water Directorate, sanitation, water supply promotion, and hydrological services (IWA, 2022).

- **Israeli Civil Administration (ICA, illegal stakeholder):** Must grant a permit for any kind of structure will be built located in C area, including homes and basic infrastructure projects, such as schools, health centers, water and sanitation networks, and access to agricultural area, although of the applying for the permission, most of applications are denied. As well as forbidding drilling and construction of agricultural or artesian wells, which are required to support the Palestinians socio-economic development (EWASH, et al., 2011).

- **Joint Water Committee (JWC, illegal stakeholder):** was established in 1995 as part of the Oslo II Accord. is mandated to approve all water and sanitation projects in the West Bank, including; joint management of water sources and sewage system, water sources protection, Collaboration to solve conflicts, water supply regulation (Tal-Spiro, O., 2011).

5.1.2 Stakeholder Analysis

Analysis of primary stakeholders

The primary stakeholders are grouped according to their interests and effects on water service in marginalized Palestinian communities in the Jordan Valley as shown in Table 5-1 below, the validation of information was based on consultation with people representing the institutions active on the field:

- **LGU's and JSC's**: a meeting was conducting with Mr. Suleiman Abu Mufarreh, the general director of the general directorate of Joint Services Councils in MoLG, and with Mrs. Nisreen Hammad, the water and environmental engineer in MoLG; to discuss the responsibilities and the effect of LGU's and JSC's on water services in Northern Jordan Valley in Tubas. The main tasks of the JSC's and LGU's are financing and implementing water projects, seeking for water projects fundraising, supervising, coordinating and providing periodic reports to MoLG.

  The LGU's and JSC's will affect the water services by execution of water projects, management of water services (e.g.; water distribution, information and evaluation of water services, and O&M of water facilities).

  The degree of stakeholder influence on decisions related to water services, and the importance of stakeholders for sustainable water services, was determined based on the

discussion with Mr. Abu Mufarreh to find; LGU's and JSC's are high importance and moderate influence.

The interests of MoLG in water services, represented in providing sustainable water services, water services revenues to create a good balance between cost & benefit, and satisfaction of citizen.

- **Household, Farmers, Livestock Breeder, and local institutions e.g. (health centers and educational institutions):** the roles of these stakeholders have been discussed with several parties during the interviews; they are the main users of water service and they could share their opinion about water projects and services in the area.

  By defining their needs, priorities, and their commitment of water rules and paying bills; the consumer effects appear through; providing information and evaluation of the services, rational water consumption, and social support and acceptance for water projects.

  The water service users are high importance, but little or no influence on the service, since the information is one-way flow. The interest of water consumers can be summarized in sustainability, affordability, and the good quality of supplied water.

- **Israeli National Water Company (Mekorot):** Based on meeting with Eng. Mohammad Abdel-Aal, the manager of north and central districts in WBWD, Mekorot is the bulk water supplier that providing bulk water to WBWD which sells water to WSP's in Northern Jordan Valley in Tubas.

  Mekorot is a critical player and very influential on water services in marginalized communities in northern Valley, its effect manifest by controlling and managing the water resources, and the unfair water quantities supplied to Palestinian.

  Mr. Omar Zayed the director of Studies & Hydrological, in PWA mentioned that Mekorot supplies the West Bank and Gaza with over 80 million cubic meters of water per year, it sells the water to WBWD, which redistribute the water to JSC's, LGU's and private sector.

The Israeli National Water Company (Makerot) interests can be seen through; the benefit from the profit of providing water services to the Palestinians, Makerot also serving settlements plan, and forcing Palestinians to purchase Israeli desalinated water.

- **The West Bank Water Department (WBWD):** based on dissection with Mr. Omar Zayed this department is part of PWA it is responsible to; sell and re-distribute water to West Bank water service providers, approving water prices, as well operation and maintenance of wells, reservoirs, and main pipelines. So, WBWD interests can be seen through management of water resources and water services facilities. Thus, it has high importance and high influence on water services in marginalized communities in Northern Valley.

- **Settlers (illegal stakeholder):** The effect of setllers on water services was discussed with Mr. Abu Mufarreh, and Mr. Zayed. Settlers have power and influenced Palestinians water services; they preventing Palestinian to access to their water resources, destroying the water facilities and seizing the Palestinians water share.

  Settlers are some importance and have some influence on water services in marginalized communities in Northern Valley.

  The Settlers of Nothern Valley intrests appear through the expansion of settlements, and creation new agricultural and industrial settlements in Jordan Valley area.

  The following Table 5-1 show the primary stakeholder groups according to their roles, responsibilities, and interests then locate the degree of influence on water services and degree of importance for sustainable water services in marginalized Palestinian communities in the Jordan Valley:

Table 5-1: Primary stakeholder according to their interests and effects on water service in marginalized Palestinian communities in the Jordan Valley

Stakeholders Group	Roles, and responsibilities	Effect on level water services sustainability and quality	Interest	Importance of stakeholders for success of sustainable water services	Degree of stakeholder influence on decisions relating water services
LGU's, and JSC's	- Financing (partially or fully) and projects implementation, - Working on fundraising, - Preparing plans and related studies for water projects, - Supervising the implementation and participating in handing over, - Coordinating and providing a periodic reports to MoLG about water service.	-Projects execution quality, -Water service management (Information and evaluation, Water distribution), - Periodic operation and maintenance.	-Sustainable water supply, -Revenue to create a good balance between cost & benefit, -Citizen satisfaction.	High importance.	Moderate influence.

Householders, Farmers, Livestock Breeder, local institutions e.g. (health centers and educational institutions)	-Beneficiaries of water services could share their opinion, -Committing to water regulations and paying water bills, -Determine needs and priorities.	-Information and evaluation, -Rational consumptions of water, -Social support and acceptance for water projects.	-Sustainable water supply, -Affordable water supply, -Good quality water supply.	High importance.	Little or no influence.
Israeli National Water Company (Mekorot, illegal stakeholder)	Sells water to Palestinians.	-Controlling the service delivery amounts and days, -Own and manager of water resources, - Unfair water distribution quantities to Palestinian inhabitant, - Shortage in water quantities in peak seasons,	-Profit, -Serving settlements plan, -Forcing Palestinians to purchase Israeli desalinated water.	Critical player.	Very influential.

The West Bank Water Department (WBWD)	- Selling and distributing water to West Bank service providers and private users.	- Bulk water supply.	- Water service delivery, -Operation and maintenance.	High importance.	High influence.
Settlers (illegal stakeholder)	-Discrimination in availability of and access to water, - Settler Consume approximately four times the water consumed by Palestinians. -Seizing the Palestinians water quota.	- Destruction the water facilities, - Decrease the water share of Palestinian inhabitants, - Prevent the Palestinian to access the Water resources.	-Settlement expansion, -Creation new agricultural and industrial settlements.	Some importance.	Some influence.

Analysis of secondary stakeholders

The secondary stakeholders are all stakeholders other than the primary of internal stakeholders, whom may have an important effect on the project outcomes, as shown in the Table 5-2 The secondary stakeholder's analysis was done based on meetings with the representative persons working in the targeted institutions; which include the following bodies:

- **Ministry of Local Government (MoLG):** a meeting was conducting with Dr. Tawfiq Al-Budairi, the deputy minister in MoLG, to discuss MoLG roles and impacts on water services, he mentioned that the Palestinian Water Law No. (14) of 2014, is based on four pillars, which are the basis for regulating the water sector:
    - The Water Authority: It is the regulator and policy-maker for the water sector, and it manages and protects water resources, it also has many other tasks as indicated by the law.
    - Water Sector Regulatory Council (WSRC): It is the regulating and licensing body for water and wastewater service providers.
    - Regional water interests: It provides water and wastewater services directly to the consumer e.g., Jerusalem water undertaking.
    - The National Water Company: A committee was formed to establish the National Water Company, according to the law.

  Dr. Al-Budairi confirmed that the tasks of MoLG in water services, are implementation of projects in coordination with the PWA, capacity building programs and plans, and participation in the formation of the regional water services and the national water company, in addition to water services supervision which are provided by LGUs.

  MoLG affect the water service in the Northern Jordan Valley by monitoring and managing of water services, and involvement of stakeholders and citizen in awareness programs.
  MoLG interests in water service in Northern Jordan Valley appear through integration of national plan and service delivery.

  Throughout the roles and impacts of MoLG on water services in Northern Valley, MoLG considered to be some important and has some influence.

- **Ministry of Agriculture (MoA):** Discussion has been raised with Mr. Nihad Al-Amleh, the director of control and licensing department in the general administration of agricultural water and irrigation, about the water services in Northern Valley in tubas, he mentioned that the water resources in this area are old, as the occupation authorities refused to approve the construction of new wells, he added some communities are supplied with water through pipes that deliver water to neighboring settlements, and farmers can obtain water as long as water is available in the pipes, to improve the resilience of farmers in this area; number of water tanks were established near to the main pipelines, and some operating wells were rehabilitated.

  The roles of MoA in water services are implementation of some water and agricultural projects in coordination with PWA, water resources prevention which is located near agricultural projects, strategies and policies development for agricultural project, improving water management and exploitation of water resources.

  The influence of MoA on water services; engagement of stakeholders, participate in citizen's awareness, resource uses allocation, and setting the quality standards of irrigation water.

  The interests of MoA in water service in marginalized communities in Northern Jordan Valley can be seen through allocation of enough water for agriculture, ensuring food security, and full utilization for treated wastewater. Based on MoA concerns, it considered to be high important and has high influence.

- **Environmental Quality Authority (EQA):** the responsilbeties and effects of EQA on water services were defined through meeting with Dr. Essa Muosa the general director of water resources directorate in EQA, he calrifiied that EQA is responsible for; granting environmental approvals for some projects which are need environmental impacts assessment, preparation of environmental regulations and qualifications, stakeholders' engagement, and raising citizen's awareness, water quality monitoring, evaluation, and follow up and reporting complaints received in case of water sources contamination.

  The EQA interests in water services appear through monitoring the quality of water and wastewater, environmental protection of water resources, and monitoring of Israeli violation.

The importance of EQA is some and it has some influence on water service in marginalized communities in Jordan Valley.

- **Palestinian Water Authority (PWA):** The roles and effects of PWA on water services were evaluated with Mr. Omar Zayed, the director of studies & hydrological in PWA. PWA is considered one of the main stakeholders and it is resposible for; water resources management and preservation, policies and strategies preparation, plans and projects implementation and following up with all parties, involve the private sector in managing the water services and resources, obtain water projects funding by contacting with donors, institutional capacity building, following up for water sector institutions and setting specifications for water projects and quality control processes for outlets, in addition, it is responsible of development of water resources, and it provides monthly monitoring reports of wells and springs.

  So, the effect of PWA on water services shown through, setting priorities, making policy, stakeholder's engagement and citizen's awareness, providing information, monitoring and evaluation of water services, guarantee customer satisfaction, and water resources allocation of uses and this is done in cooperation with MoA, since the agriculture irrigation source could be converted to drinking source, if there is a need for that.

  Based on PWA impacts and roles, it represents a critical player and has high influence on water services in marginalized communities in northern Valley.

- **Water Sector Regulatory Council (WSRC):** Based on the interview with Mr. Mohammad Al-Hamidi, the CEO of WSRC, referring to Palestinian Water Law No. (14) of 2014, the WSRC working on:
  - Recommending the Cabinet for licensing water providers and approving water prices,
  - Issuing licenses for regional water utilities and any operator suppling, desalinating or treating water,
  - Implementation of cabinet projects,
  - Monitoring and following-up of water production, transportation, and distribution operations,
  - Monitoring and following-up of sewage operations, and water supply agreements,

- Establishing a database with technical, financial and statistical information,
- Setting standards to ensure the quality of technical and administrative services provided by service providers to consumers.

WSRC effects are shown through, licenses & regulations for water service providers, tariffs of water prices, providing annual reports and information, monitoring and evaluation of water services, making data available to all stakeholders, respond to consumers and service providers complaints, and recommendation to key stakeholders including donors on specific needs. The interests of WSRC in water services are improving water services efficiency, and achieve financial and technical sustainability of water.

Based on WRSC roles, responsibilities and effects on services, it has moderate importance and moderate influence.

- **Donors:** after the conversation with Dr. Abd Al-Rahman Al-Tamimi, the general manager of Palestinian Hydrology Group, the donors are providing financial support for some projects in cooperation with PWA and relevant authorities and support the policy formulation.

  Mrs. Majedah Alawnih, the director of the water quality department, in PWA, clarified that donors have some concerns in financing and implementing the water project in the Northern Jordan Valley, since the Israeli military force destroyed the water facilities that were implemented through donor-funded projects.

  Their interests shown through financing and Socio-economic development to create stability, this stakeholder plays high importance and moderate influential roles in water services in marginalized communities.

- **International and national NGOs:** based on a meeting with Mrs. Alawnih, the role of international and Local NGOs is participation in planing and implamentation of water projects funded by donors in coordination with PWA, and supporting water networks installation and finding new water resource in order to enhance the resilience of citizens in C areas.

Dr. Al-Tamimi illustrated the role of the International and national NGOs, by supporting the marginalized group, monitoring and evaluation of the governmental bodies' performance and implementing small scale projects.

The interests of NGOs in water services in marginalized communities in Northern Jordan Valley appears through supporting these communities and developing services. This stakeholder plays high importance and moderate influential roles in water services in marginalized communities.

- **Israeli Water Authority (IWA, illegal stakeholder):** Mr. Omar Zayed, confirmed the roles of Isreal Water Authority in water services in Northern Jordan Valley, it oversees all civil matters for Jewish Israeli settlers and Palestinian residents in Area C of the West Bank, it controlling the drilling of new Palestinian wells, and management of aquifers. This authority affects the water service in Northern Jordan Valley in form of regulations, and permission for using water resources, and impeding the construction and rehabilitation of water sources and networks, the coordination with PWA as Palestinian side is one of IWA interests.
  Israeli Water Authority has high influence and play some important role in water service in Palestinian marginalized communities, in Northern Jordan Valley.

- **Israeli Civil Administration (ICA, illegal stakeholder):** Based on the talk with Mr.Omar Zayed, the ICA considered to be very influential and play high important role in water service in Palestinian marginalized communities; since it supervises all civil matters for Jewish Israeli settlers and Palestinian residents in Northern Valley in Area C, controlling the drilling of new Palestinian wells, controlling the use of agricultural artesian wells, demolition of harvesting cisterns, prevents Palestinians from accessing to water resources and benefit of Jordan river water, and destruction of unlicensed water facilities.

  ICA influenced water services in marginalized communities in Northern Valley by controlling; the permission for using water resources, constructing new wells and new networks, and access to water resources, and obstruction the construction and rehabilitation water resources and facilities, destruction water facilities. ICA interest appears through approval on projects in Area C.

- **Joint Water committee (JWC, illegal stakeholder):** it's a Body created by Osla agreement in 1995, which is a mechanism to manage joint project. Mr. Omar Zayed confirmed the role of JWC in managing water and sewage related infrastructure in the West Bank, is one of the major roles of JWC, and it also controlling the development of water resources and water facilities infrastructure. JWC effects on water services in marginalized communities in Northern Jordan Valley shown clearly through water resources management, monitoring of water services, and approvals on water projects.

  JWC is moderate importance and has high influence on water service as its interests in preparing the technical file for approvals, and conflict resolution.

Table 5-2: Secondary stakeholder according to their interests and effects on water service in marginalized Palestinian communities in the Jordan Valley

Stakeholders Group	Roles & Responsibilities	Effect on level water services sustainability and quality	Interests	Importance of stakeholders for success of sustainable water supply	Degree of influence stakeholder on decisions relating water supply
Ministry of Local Government (MoLG)	- Coordination with the PWA in implementing water projects for LGU's, - Participate in implement capacity building programs and plans, - Participation in the establishment of the regional water services and the national water company, - Supervising the services provided by LGU's.	- Stakeholders' engagement, -Citizen's awareness, -Monitoring, -Management, - Support service providers to collect revenues and managing the debt.	- Integration of national plane and services. -Service delivery.	Some importance.	Some influence.

Ministry of Agriculture (MoA)	- Coordination with PWA in the implementation of some projects of common interest, - Participation in community awareness through workshops, - Managing and protecting water resources related to agricultural projects, - Develop policies and strategies related to agricultural project, - improve water management and exploitation of water resources.	- Stakeholders' engagement, - citizen's awareness, - Allocation of uses, - Quality standards of irrigation water, - Water use efficiency.	- Allocation of enough water for agriculture, - A food security, -Full utilization for treated wastewater.	High importance.	High influence.
Environmental Quality Authority (EQA)	Issuing environmental approvals for some projects.	- Environmental regulation, -Stakeholders' engagement, citizen's awareness, - Water Quality monitoring and evaluation, - Production water quality data.	- Monitoring the quality of water and wastewater, - Environmental protection of water resources, - Monitoring of Israeli violation.	Some importance.	Some influence.

Palestinian Water Authority (PWA)	- Management and protection of water sources, - Preparing the policies and strategies that support the implementation of the plan, - Implementation of some projects through the projects unit, - Follow up the implementation of the plan with all parties, - Create an appropriate investment environment to involve the private sector in managing the water sector, - Mobilizing the necessary funding through contact with donors, - Follow-up of institutional building and capacity building for water sector institutions, - Setting specifications for water projects and quality control processes for outlets, - Development of water resources. - Monthly monitoring of wells and springs.	- Strategy, priority setting and planning, -Policy Making, -Allocation of uses, -Stakeholders' engagement, citizen's awareness, -Information, monitoring and evaluation and reporting, - Guarantee customer satisfaction.	- Service delivery, -Water service polices, -Water resource management, -Planning and financing.	Critical player.	High influence.

Water Sector Regulatory Council (WSRC)	-To recommend to the Cabinet for licensing water providers and approving water prices, - Implementation of Cabinet projects, - Monitoring and follow-up of water production, transportation, and distribution operations, - Monitoring and follow-up of sewage operations, - Monitor and follow up on water supply agreements.	- Licenses & Regulations, - Tariffs, - Information, monitoring and evaluation, - Making data available to all stakeholders, - Respond to consumers and service providers complaints, -Recommendation to key stakeholders including donors on specific needs.	- Improved water efficiency, - Financial and technical sustainability of water services.	Moderate importance.	Moderate influence.
Donors	- Financing some projects in coordination with PWA and other relevant authorities, -Support in policy formulation.	- Financing, - Support strategies.	- Financing, - Socio-economic development to create stability.	High importance.	Moderate influence.
International and national NGOs,	- Partipciation in planing and implamentation of water projects in coordination with PWA. - Support the marginalized group,	- Enhance the resilience of citizens in C areas. - Monitoring and evaluation,	- Supporting marginalized groups, -Developing services.	High importance.	Moderate influence.

	- Monitoring and evaluation of the governmental bodies' performance. -Implementing small scale projects.	-Filling the gap of services not covered by government for marginalized communities.			
Israeli Water Authority (IWA, illegal stakeholder)	- Oversees all civil matters for Jewish Israeli settlers and Palestinian residents in Area C of the West Bank, - Controlling the drilling of new Palestinian wells, and management of aquifers.	- Permission, - Regulator.	- Coordination with PWA.	some importance.	high influence.
Israeli Civil Administration (ICA, illegal stakeholder)	- Oversees all civil matters for Jewish Israeli settlers and Palestinian residents in Area C of the West Bank, - Controlling the drilling of new Palestinian well, - Restricting the use of agricultural artesian wells, - Demolition of harvesting cisterns, - Prevents Palestinians from accessing water resources and using the waters of the Jordan River,	- Permission, - Obstructive, - Destruction.	- Approval for projects in Area C,	High importance.	Very Influential.

	- Destruction of unlicensed water facilities,				
Joint Water committee (JWC, illegal stakeholder)	- Manage water and sewage related infrastructure in the West Bank, - Controlling the development of water resources and water facilities infrastructure.	- Monitoring, Management, - Project approval.	-Preparing the technical file for approvals, - Conflict resolution.	Moderate importance.	High influence.

After analysis of primary and secondary stakeholders, the degree of the influence and the importance of stakeholder on water service in marginalized Palestinian communities in the Northern Jordan Valley was summarized in Table 5-3 below.

Table 5-3: The influence and the importance of the primary and secondary stakeholder on water service in marginalized Palestinian communities in the Jordan Valley

Influence	Importance or interests					
	Unknown	**Little or no**	**some**	**Moderate**	**High**	**Critical Player**
Unknown						
Little or no					Beneficiaries	
some			MoLG, Settlers, EQA			
Moderate				WSRC	LGU's, and JSC's, Donors, NGOs	
High			IWA	JWC	WBWD, MoA	PWA
Very Influential					ICA	Mekorot

The matrix of primary and secondary stakeholders, classify the stakeholders into the following four main groups as shown on Figure 5.1-1 below:

- Stakeholders with high influence but low interest: IWA, JWC, WSRC and EQA.
- Stakeholders with both high influence and interest: Mekorot, PWA, WBWD, MoA, LGU's, and JSC's, Donors, NGOs, ICA.
- Stakeholders with both low influence and interest: MoLG, Settlers.
- Stakeholders with low influence, but high interest: Beneficiaries or consumers.

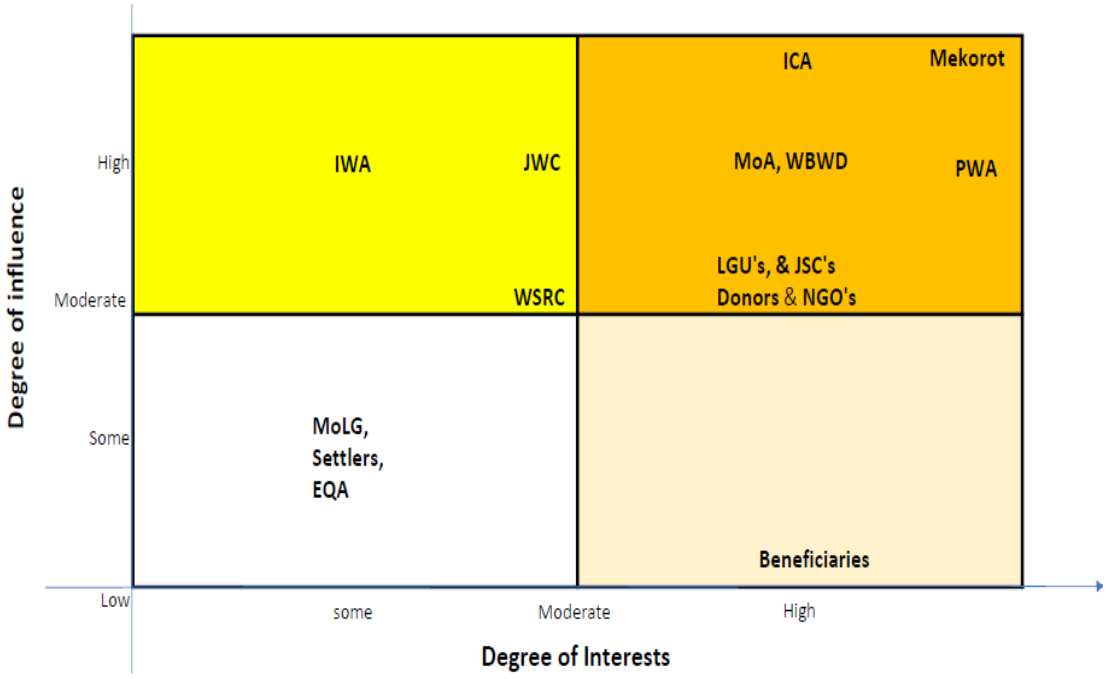

Figure 5-1: Matrix of primary and secondary stakeholders.

After analyzing roles, responsibilities, effects and interests of each stakeholder, the stage of intervention and the nature of intervention for each stakeholder in water service projects were determined as shown in the Table 5-4 below:

Table 5-4: Stages of water service projects in marginalized Palestinian communities in the Jordan Valley

Stages	Information Sharing (One-way flow)	Consultation (two- way flow)	Collaboration (Increasing control over decision making)	Empowerment (transfer of control of decisions and resources)
Identification	Beneficiaries			
Preparation and Appraisal	Beneficiaries	MoLG,		
Decision Making, Permissions & Approvals		MoA, EQA	PWA	JWC, ICA, IWA
Implementation Supervision and Monitoring		LGU's, and JSC's	Mekorot, Donors, Local NGOs, and Unions	WBWD
Evaluation of water Services			WSRC	

Stakeholder mapping and diagramming

All stakeholders have power, whether it is social power derived from supporting or opposing the project or it is formal power invested in a position of authority. Since, the stakeholder analysis helps to focus and priortize the main stakeholders, with high powers which are most benifial supporters or mostacute opponents (Khan, 2010).

Stakeholder mapping is a significant tool for understanding this power relation and dynamics. The following Table 5-5 shows the power of stakeholder in order in opposition and support the water service in marginalized Palestinian communities in the Jordan Valley.

Table 5-5: The power of stakeholder in order in opposition and support the water service in marginalized Palestinian communities in the Jordan Valley

		Opposition			**Support**	
		Active Opposition	**Passive Opposition**	**Fence sitter**	**Active Support**	**Passive Support**
Stakeholder Power	**High**	Mekorot, ICA	JWC, Israeli Water Authority		PWA	WSRC, WBWD
	Medium	Settlers			MoLG, MoA, EQA, LGU's, PSI, and JSC's	Donors, Local NGOs, and Unions
	Low				Public, Farmers, Livestock Breeder, health centers and educational institutions	

We can conclude from the above Table 5-5; the water active supporters are:

- PWA is active supporter with high power,
- MoLG, MoA, EQA, LGU's, PSI, and JSC's are active supporters with medium power,
- Public, Farmers, Livestock Breeder, health centers and educational institutions are active supporters with low power.

The water passive supporters are:

- WSRC, WBWD are passive supporters with high power,
- Donors, Local NGOs, and Unions are passive supporters with meduim power,

The water active oppositions are:

- Mekorot, ICA are active oppositions with high power,
- Settlers are active oppositions with medium power.

The water passive oppositions are:

- JWC, Israeli Water Authority are passive oppositions with high power.

5.1.3 Results and discussion

Achieving the sustainability and resilience of water services in Palestine, especially in the marginalized areas in the northern Jordan Valley, is a shared responsibility among all institutions within the framework of the water sector system, in addition to the contribution of many other relevant partners from outside the water sector. Referring to stakeholder analysis, as Table 5-6 below illustrate the influence and the importance of the primary and secondary stakeholder on water service in marginalized Palestinian communities in the Jordan Valley.

Table 5-6: Summery of the influence and the importance of the primary and secondary stakeholder on water service

Influence	Interest	Stakeholder
High influence	High interest	Mekorot, PWA, WBWD, MoA, LGU's, and JSC's, Donors, NGOs, ICA.
High influence	Low interest	IWA, JWC, and WSRC.
Low influence	High interest	Beneficiaries or consumers.
Low influence	Low interest	MoLG, Settlers, EQA.

The main stakeholders, which have effect on water service in the eight studied communities, will be classified into three categories:

1- Palestinian side: PWA, WBWD, MoA, LGU's, and JSC's, and WSRC.
2- Israeli side (illegal stakeholder): Mekorot, ICA, IWA.

3- Intermediate side: Donors, NGOs, JWC.

The level of intervention was suggested based on the responsibility and importance of each stakeholder as Table 5-7 below shows:

Table 5-7: The level of intervention of stakeholders

#	Intervention level of stakeholders	Stakeholder responsibility
1	Water service management	LGU's, JSC's, MoLG
2	Strategy, priority setting and planning	PWA, MoA, Donor's
3	Policy Making	PWA, IWA, JWC
4	Information, monitoring and evaluation	PWA, WSRC, EQA, MoH
5	Allocation of uses	PWA, MoA, Mekorot
6	Quality standards	PWA, MoH, EQA
7	Compliance of service delivery	WBWD
8	Economic regulations (tariff)	WSRC
9	Environmental regulation	PWA, EQA
10	Financial support	Donors, NGOs, MoLG
11	Citizen's awareness	LGU's, JSC's, NGOs, MoLG, and EQA

The discrepancy in the amount of water between the Palestinian and Israeli citizens who live in the same geographical area, was discussed in section 3.1.1. Table 5-8 below shows the amount of water which was determined in 1995 agreement for Palestinian and Table 5-9 shows the difference in mountain aquifer's water quantities between the Palestinian and Israeli:

Table 5-8: Water Supply to the Palestinians in the West Bank – According to the Water Agreement and in Practice (MCM/Y) (*(IWA, 2009).*

Agreements	Palestinian (MCM/Y)
1995 Agreement	118
the Interim Period	141.6
2006 Actual water consumption	180
Palestinian future needs according to the agreement	188-198
Total quantity of water available for the Palestinian in 2007	200

Table 5-9: The difference in mountain aquifer's water quantities between the Palestinian and Israeli (Eran et al., 2018):

Aquifer	Palestinian (MCM)	Israeli (MCM)
The north eastern aquifer	45.5	62.7
The western aquifer	39	297
Eastern aquifer	39	29.9
Total difference in quantities		266.1

The Palestinians must get JWC approvals for drilling new wells in the Mountain Aquifer, since the JWC refuse to allow drilling of new wells, the Palestinians are violating the Water agreement by drilling water new wells in the Mountain Aquifer, and they are also making unauthorized connections to the Mekorot water supply pipelines; and this is due to the water shortage in the Jordan Valley area, and unfair and the unfair quantities of water that were determined by the agreements.

The Palestinian water allocation according to the Oslo Agreement is 118 MCM. 51 MCM out of 100 MCM is annually consumed in irrigating 115,000 dunums, while 49 MCM is annually consumed for domestic and industrial uses; knowing that the Unaccounted-for Water (UfW) is more than 35% and that there is about 51 MCM of purchased water from the Israeli water company Mekorot (4 MCM for agricultural purposes and 47 MCM for drinking). This brings the total Palestinian consumption of water to 151 MCM (PWA 2016).

The quantity of water purchased from the Israeli side effects the sustainability of water services supplied to the Palestinians by determining these quantities in agreements without taking into account the real future need.

With regard to water services in the Jordan Valley areas, agreements have been signed with the Israeli side specifying the quantities that are supplied to communities in these areas, the consumed water quantities through illegal openings that are made on the network lines is considered lost and its price is deducted from the clearing house, in addition to the agreed consumed water price.

Strategies to improve access to water

The Palestinian Water Authority prepared the strategic development plan, which aims to develop a strategy for the development of the water and wastewater sector during the six years (2017-2022), in order to reach a strategic development vision for the sector. And the most important objectives that have been identified are:

- Integrated management and sustainable development of the water resources (quantitatively and qualitatively) by:
  - Increasing the quantity of water delivered to customers,
  - Maximizing the volume of water made available for irrigation,
  - Providing all citizen with a good access to a reliable source of water,

- Improving the quality and authenticity of water supply services as well as ensuring fair water distribution, by:
  - Reducing inequalities among regions and localities,
  - Improving the quality of the water delivered to customers,
  - Improving the quality and reliability of the service,

- Development of water sector institutions to reinforce good governance foundations within an integrated legal and institutional framework, by:
  - Strengthening the foundations of good governance and the legal and institutional framework.

- Ensuring the financial sustainability of water utilities and water service providers, by:
  - Ensuring financial sustainability of water operators.

5.2 Resilience of Water Services in the Study Area

5.2.1 Collected Data from Communities

The Current Situation in each Village

This study includes eight clusters, and these were chosen based on their vulnerabilities, since they have a higher risk for population immigration as a result of the barriers they experience to social, economic, political and environmental resources, as well as limitations on social services[1]. Based on the collected data from the eight clusters in the Northern Jordan Valley, through questioners, field visits, and interviews with chairmen of village councils, community representatives, water service providers representatives, and consumers, the situation of each village will be shown and discussed separately; in terms of the water services status there.

The eight clusters which considered as marginalized communities are Kardala, Bardala, Ein Al-Beida, Al-Aqaba, Khirbet' Atuf, Ibziq, Yarzah, and Al-Maleh as shown in the Figure 5-1 below, and the data collected from these communities shown in the following sections.

Figure 5-2: Marginalized communities, in Northern Jordan Valley, Tubas Governorate.
(Source: B'TSELEM interactive map)

[1] social services: is often substituted with other terms such as social welfare, social protection, social assistance, social care and social work, with many of the terms overlapping in characteristics and features.

Kardala Village

Field visits were made to Kardala village, the data was collected through questioner and interviews with the representative water service provider of WDWB and with the chairman of Kardala council.

Quantity of consumed water in Kardala Village

The water networks are mainly used for domestic uses and livestock farming, and the number of water connections in the community is 40 subscriptions connected to WBWD outlets, which provides the citizens who are permanently present in the village of Kardala with water at a rate of 5 m^3/hour.

The percentage of water service coverage is 59% of the total permanent and expatriate population of Kardala, where the number of the population is increased during the agricultural seasons, and the incoming residents are provided with agricultural water through the agricultural reservoirs for farming and livestock raising uses.

The West Bank Water Department was contacted in order to obtain information about the reading of the main meters that supply the village with water. The reading of Kardala and Bardala meters were given as one reading, and the amount of consumed water is shown as follows in Table 5-9:

Table 5-10: Amount of consumed water for Multipurpose in Kardala and Bardala Village

Community	**Population in service** (capita)	**Total amount of water consumed during 2022** (m^3/year)
Kardala	224	4,405,889
Bardala	1,776	

Source: (WBWD,2022).

The MoA and the Directorate of AgriculDeclarationture in Tubas were contacted in order to determine the quantities used in agriculture and livestock raising, and the quantities are shown as following in Table 5-10, and for more detail about the number of livestock and amount of water consumed per head per day refer to Table 7-3 in Annex A.

Table 5-11: Amount of consumed water for each use in Kardala and Bardala Villages

Types of use	**Amount of water consumed during 2022** (m^3/year)
Consumed amount from WSP	4,405,889
Agricultural use	3,600,000
Livestock use	21,623

Source: (MoA & Directorate of Agriculture,2022)

The average daily consumption at domestic level for Kardal and Bardala can't be calculated since it is difficult to separate water consumption for domestic purposes from other types, because there are many water sources that are used for agriculture and livestock breeding, such as artesian wells, and therefore the amount of consumed water for multi-purposes is greater than the amount supplied by the service provider.

The availability and reliability of water service in Kardala Village

Number of service days of piped water is 7 days a week, and there is no periodic maintenance for water pipelines networks, and maintenance is done when a breakdown, breakage, or clear leakage occurs. The local authority carries out maintenance on the pipe line, although it is a modest village council that does not have maintenance team, and the water losses can't be measured.

The affordability and the price of the water in Kardala Village

The three villages of Kardala, Bardala, and Ein Al-Beida supplied by piped water from the same source WBWD, so the financial situation is the same in the three villages. The piped water is supplied from the WBWD networks, and the water price was set in agreement with the Israeli water company Mekorot considering the water as agricultural water. The cost of purchasing water from Mekorot in 1970's was 0.15 NIS/m^3, and then it raised to 0.30 NIS/m^3, and it raised again to become the current purchasing cost of 0.51NIS/m^3.

Despite the low average selling price of cubic meter of water which equal 0.48 NIS, compared to nearby communities, citizens do not pay for water services, and this is shown from the zero percent of the collection efficiency.

The West Bank Water Department installed meters for consumers in Kardala community in order to support the sustainability of water services in this area, but citizens removed the meters and refused to pay the price of water, since they had a historical right of this water, as they consider the wells and springs private properties.

It was agreed with the Israeli side to allocate shares of water for the residents of the community in return of stopping using the private springs and wells that they own. The price of the consumed water is paid to the Israeli side by deducting it from the clearance funds. In addition, the price of the amount of consumed water that exceeds the agreed quantity is deducted and considered as loses.

Quality of piped water in Kardala Village

Periodic checks of the water networks are carried out through the MoH, three tests are made for each sample that is taken from point source, citizens' tanks or the council's tanks.

Chlorine residue test, the total contamination with coliform bacteria test, and the examination of the contamination with the fecal coliform bacteria test, were made for each sample, and through the report of MoH that was reviewed, it shows that samples were taken from different places of the Kardala piped water networks during the period between January and August, as Table 5-11 shows:

Table 5-12: Microbiological tests of piped water in Kardala Village

Area	**Kardala**	
Test	**Number Of Samples**	**Results**
Number of microbiological tests carried out	7	
Number of water samples for chlorine residual (CR)	1	0
	2	0.1
	4	0.2
Number of water samples for total coliform contamination	5	NIL
	2	90, 50
Number of water samples for fecal coliform contamination	7	NIL

The concentration of "free residual chlorine" in drinking water should be between 0.2 to 0.8 mg/l according to the drinking water standard (MF 41-2005), and it's noted that three samples in Kardala, were less than the recommended concentration and two sample were contaminated with total coliform bacteria.

The reliability of the alternative sources of piped water in Kardala Village

The alternative sources of water networks that are used in the village are the openings on the network of the WBWD, which are filling the reservoirs that were established through the projects of the MoA with 100 m^3/hour. The quality of the water from the alternative sources is very good and is tested by the MoH, as it is from the same source as the water pipelines network.

Accessibility to alternative resource

Opening outlets considered as alternative water source but they connected to agricultural reservoirs, and water distributed through pipes, so farmers didn't spend more time or money than they do with piped water.

Satisfaction of consumers in Kardala Village

The village council didn't receive written complaints from residents.

Bardala Village

Field visits were made to Bardala village, the data was collected through questioner and interviews with the representative water service provider of WDWB and with the chairman of Bardala council.

Quantity of consumed water in Bardala Village

The total number of piped water connection according to Bardala Village Council is 200 subscriptions. All residents of Bardala village are served by water service through networks, so the percentage of water service coverage is 100%.

The water consumed quantities of Kardala and Bardala are provided from WBWD as one main meter reading is shown in the Table 5-12 below:

Table 5-13: Amount of consumed water for Multipurpose in Kardala and Bardala Villages

Community	**Population in service** (capita)	**Total amount of water consumed during 2022** (m^3/year)
Kardala	224	4,405,889
Bardala	1,776	

Source: (WBDW,2022)

The MoA and the Directorate of Agriculture in Tubas were contacted in order to determine the quantities of water which are used in agriculture and livestock, as shown in following Table 5-13, and for more detail about the numbers of livestock and amount of water consumed per head per day refer to Table 7-3 in Annex A.

Table 5-14: Amount of consumed water for each use in Kardala and Bardala Villages

Types of use	**Amount of water consumed during 2022** (m^3/year)
Consumed amount from WSP	4,405,889
Agricultural use	3,600,000
Livestock use	21,623

Source: (MoA & the Directorate of Agriculture in Tubas,2022)

The average daily consumption at domestic level for Kardal and Bardala can't be calculated since it is difficult to separate water consumption for domestic purposes from other uses, because there are many water sources that are used for agriculture and livestock breeding, such as artesian wells, and therefore the amount of consumed water for multi-purposes is greater than the amount supplied by the service provider.

The availability and reliability of water service in Bardala Village

The number of service days of piped water is 7dyas/week, there is no interruption in the service. The network water is mainly used for domestic uses and livestock breeding, as there are 50 families who raise livestock used tanked water in case of shortage of piped water supplied through the network.

The local village council implements the maintenance on network pipeline, in case of breakdown, breakage, or clear leakage occurs, despite it is a modest village council that does not have maintenance team, and the water losses can't be measured for the mentioned reasons.

The affordability and the price of the water in Bardala Village

Bardala has the same financial situation of Kardala village, the WBWD Provide the community with the piped water, and the cost of purchasing of 1 m^3 of water from Mekorot is 0.51 NIS, and the supposed average selling price of 1.0 m^3 of water is 0.48 NIS, but in spite of the low selling price, the citizens of Bardala community do not pay for these services, and this obvious from the zero percent of the collection efficiency.

Quality of piped water in Bardala Village

The water pipeline network in Bardala village is subjected to periodic tests that are carried out by the MoH. The results of these checks which were carried out during the period between January and August are shown in the following Table 5-14:

Table 5-15: Microbiological tests of piped water in Bardala Village

Area	Bardala	
Test	**Number Of Samples**	**Results**
Number of microbiological tests carried out	14	
Number of water samples for chlorine residual (CR)	6	0.1
	7	0.2
	1	0.3
Number of water samples for total coliform contamination	13	NIL
	1	9
Number of water samples for fecal coliform contamination	14	NIL

It's noted that 6 samples in Bardala, were less than the recommended concentration of free residual by drinking water standard (MF 41-2005).

The reliability of the alternative sources of piped water in Bardala Village

The alternative sources of piped water that are used in the Bardala village is tanked water, which is filled from the network openings, and it used instead of the piped water in case of shortage.

The quality of the water from the alternative sources is very good and is tested by the MoH, as it is taken from water pipelines network, and the cost range between (10-15) NIS/m^3.

Accessibility to alternative water resource in Bardala Village

Alternative source is used as compensation for the lack of water quantities, when there are an interruption of service or shortage in the amount of piped water. Tanked water is used as alternative source in Bardala village, it filled from the opening of WBWD networks, since the meter owned by a farmer, he must allow for the consumer to fill the tank, and the time and distance varies.

Satisfaction of consumers in Bardala Village

The village council didn't receive written complaints from residents, and the amount of water supplied to the community is more than sufficient.

Ein Al-Beida Village

Field visits were made to Ein Al-Beida village, all data has been collected through questioners and interviews with the representative of water service provider WBWD and with the chairman of Ein Al-Beida village council.

Quantity of consumed water in Ein Al-Beida Village

The total number of piped water connection is 170 subscriptions. 90% of the residents of Ein Al-Beida village are served by water service through networks, water networks are used for domestic, agricultural and livestock use.

The readings of the main meters that supply the Ein Al-Beida with water, were obtained from WBWD. The amount of consumed water during 2022 is shown in Table 5-15 below:

Table 5-16: Amount of consumed water for Multipurpose in Ein Al-Beida Village

Community	**Population in service** (capita)	**Total amount of water consumed during 2022** (m3/year)
Ein Al-Beda	1,258	2,703,193

Source: (WBDW,2022)

The MoA and the Directorate of Agriculture in Tubas were contacted in order to determine the quantities used in agriculture and livestock, and the quantities are shown as following in Table 5-16, and for more detail about the numbers of livestock and amount of water consumed per head per day refer to Table 7-3 in Annex A.

Table 5-17: Amount of consumed water for each use in Ein Al Beda Village

Types of use	**Amount of water consumed during 2022** (m^3/year)
Consumed amount from WSP	2,703,193
Agricultural use	3,600,000
Livestock use	9,563

Source: (MoA & the Directorate of Agriculture in Tubas,2022)

There are many water sources that are used for agriculture and livestock breeding, such as artesian wells, and therefore the amount of consumed water form multi-purposes is greater than the amount supplied by the service provider, therefore the average daily consumption at domestic level for Ein Al-Beida can't be calculated.

The availability and reliability of water service in Ein Al-Beida **Village**

The water service is supplied for Ein Al-Beida village for 7d/week. The maintenance works for water networks are done in case of a breakdown, breakage, or clear leakage by local authority, but there is no periodic maintenance for water pipelines networks, and the water losses can't be quantified for the reasons mentioned above.

The affordability and the price of the water in Ein Al-Beida Village

The piped water is supplied from the WBWD networks, the cost of purchasing of a cubic meter of water from the Mekorot is 0.51NIS, and the average selling price of cubic meter of water is 0.48 NIS.

The selling price of cubic meter is very low comparing to nearby villages, but the consumer in Ein Al-Beida don't pay for the water service. So, the percentage of the collection efficiency is zero.

Quality of piped water in Ein Al-Beida Village

Periodic tests on water network are carried out by the MoH. Chlorine residua test, the total contamination with coliform bacteria test, and the examination of the contamination with the fecal coliform bacteria test, were made for each sample, and Table 5-17 below shows results of the tested samples during the period between January and August:

Table 5-18: Microbiological tests of piped water in Ein Al-Beida Village

Area	Ein Al-Beda	
Test	**Number Of Samples**	**Results**
Number of microbiological tests carried out	16	
Number of water samples for chlorine residual (CR)	1	0
	4	0.1
	11	0.2
Number of water samples for total coliform contamination	16	NIL
Number of water samples for fecal coliform contamination	16	NIL

The total number of tested samples is 16, five of them were less than the recommended concentration of free residual chlorine by drinking water standard (MF 41-2005).

The reliability of the alternative sources of piped water in Ein Al-Beida Village

The alternative sources of piped water that used in the Ein Al-Beida is the tanked water which are filling from the opening on the network of the WBWD. The quality of the tanked water is very good and is tested by the MoH, as it is from the same source as the water network. There are 10% of homes in Ein-Al Beida are using tanked water as an alternative source of network water. The cost ranges from (10-15) NIS/m^3.

Accessibility to alternative water resource in Ein Al-Beida **Village**

In cases of interruption of service or shortage in the amount of water, alternative sources are relied upon to compensate the lack of water quantities. In Ein al-Beida, tanked water is used as alternative source, and the time required to collect water varies according to the distance to the water opening on the network that owned by farmer, in case he allowed of filling the tank.

Satisfaction of consumers in Ein Al-Beida Village

There are no written complaints received the village council from consumers.

Al-Aqaba Village

Field visits were made to Al-Aqaba village, the data was collected through questioner and interviews with the representative water service provider of JSC for Water and Sanitation in Tubas and with the chairman of Al-Aqaba council.

Quantity of consumed water in Al-Aqaba Village

The water service is provided through the JSC for Water and Sanitation in Tubas through water network lines, as the number of connections in the community is 67 subscriptions (63 prepaid meters and 4 subscriptions monthly billed meters), the total number of citizens served by water service through the network is 167 individuals, and thus the service covers 90% of the residents of the village, and 10% live on the outskirts and are not connected to water networks and are supplied with water through tanks.

Based on the information from the JSC for Water and Sanitation in Tubas, the total consumption of the Al-Aqaba village during January to November of 2022 is **8475** m^3, as shown in the Table 5-18 below:

Table 5-19: Amount of consumed water for Multipurpose in Al-Aqaba Village

Community	**Population in service** (capita)	**Total amount of water consumed during 2022** (m^3/11month)
Al-Aqaba	186	8,475

Source: (the JSC for Water and Sanitation in Tubas,2022)

The amount of consumed for livestock raising was provided from the MoA and the Directorate of Agriculture in Tubas, as shown in the Table 5-19 below, and for more detail about the numbers of livestock and amount of water consumed per head per day refer to Table 7-3 in Annex A.

Table 5-20: Amount of consumed water for each use in Al-Aqaba Village

Types of use	**Amount of water consumed during 2022** (m^3/11month)
Consumed amount from WSP	8,475
Livestock use	5,238

Source: (MoA & the Directorate of Agriculture in Tubas,2022)

Residents work in rain-fed agriculture, so the sources of consumed amount of water for the livestock breeding, are water networks and other sources, thus the exact quantities for each use can't be calculated.

The availability and reliability of water service in Al-Aqaba Village

Water services are delivered to citizens by gravity flow without the need to use water pumps. The village is supplied with water 7 days a week, and there is no interruption in service except in the event of a breakdowns or malfunctions, and the water losses due to JSC is 36%. No periodic maintenance is done for the network pipelines, and the JSC performs the maintenance works when a breakdown, breakage, or clear leakage occurs.

The affordability and the price of the water in Al-Aqaba Village

The Joint Services Council for Water and Sanitation in Tubas supplies water to the village through water network pipelines. The selling price of purchased water from WBWD to the consumer has been divided into four categories according to the amount of consumption, as shown in the Table 5-20 below:

Table 5-21: The price of cubic meter of water based on the amount of consumption

Category	Consumption (rate m^3)	Price (NIS/m^3)
1	10-1	4
2	20-11	5
3	30-21	7
4	More than 30	10

Based on information from the JSC, the JSC manages the water service in the village, and the water price is paid through prepaid meters, as the cost of purchasing a cubic meter of water from the WBWD is 2.6 NIS, the average selling price is 4.69 NIS, and the total costs of water service delivery is 6.55 NIS/m^3, which means that the selling price per cubic meter does not cover the cost price, in addition to the losses, which estimated 36% of the total amount supplied to the village, and that will cause financial repercussions affecting the financial sustainability of the water service, as prepaid meters are used in this community, the collection efficiency is100%. The following Table 5-21 summarizes the costs of water service delivery:

Table 5-22: The costs of delivering water service to Al-Aqaba village, based on data collected from the JSC of Water and Sanitation

#	The costs of delivering water service to Al-Aqaba village	The cost (NIS/m^3)
1	The cost of purchasing water from the WBWD (NIS/m^3)	2.6
2	The average of selling price a cubic meter of water to residents of Aqaba village (NIS/m^3)	4.69
3	Average total costs of delivering water service to the user (NIS/m^3)	6.55

Quality of piped water in Al-Aqaba Village

Periodic tests of the water networks are carried out through the MoH, three tests are made for each sample that is taken from point source, citizens' tanks or the council's tanks.

The reviewed report of MoA, shows that samples were taken from different places of the Al-Aqaba piped water networks during the period between January and August, as Table 5-22 shows:

Table 5-23: Microbiological tests of piped water in Al-Aqaba Village

Area	Al-Aqaba	
Test	**Number Of Samples**	**Results**
Number of microbiological tests carried out	27	
Number of water samples for chlorine residual (CR)	19	0.1
	7	0.2
	1	0.3
Number of water samples for total coliform contamination	25	NIL
	1	TNTC
	1	5
Number of water samples for fecal coliform contamination	27	NIL

The percentage of free chlorine residue recommended according to the guidelines of the drinking water standard (MF 41-2005), which ranges from 0.2-0.8 mg / liter, and 19 of the samples that were examined are less than the recommended percentage.

The reliability of the alternative sources of piped water in Al-Aqaba Village

The alternative sources that used in the village are cisterns, rainwater harvesting wells and artesian wells. There are six houses using the alternative water resources, which represent 10% of village's population, these houses not connected to the water network and located on the outskirts, in areas far from the center of the village, and the price of a cubic meter of tanked water is (15-20) NIS/m^3, it is a relatively high cost comparing to the income of citizens in those areas, and the daily need for water for domestic use and for raising livestock.

Due to the high price of tanked water, users' resort to rationing water consumption to a rate much lower than the minimum, as the rate of use of these homes reaches from 6 -9 m^3/m, and according to the SPCB, the average number of Palestinian households is 5.3 individuals, so, the daily per capita consumption ranges from 38-58 liters, which is much less than the per capita ration recommended by the World Health Organization (WHO), (100- 120) l/c/d.

The quality of alternative water resource is very good because it comes from rain water, network water, or the artesian well located in Aqaba. and the water loss according to the Joint Services Council is 36%.

Accessibility to alternative water resource in Al-Aqaba

Access to tanked water is easy, without many obstacles, as the distance required to the water source for consumer who do not connect to a water network is 5 km and a time it takes to collect the water ranging from (10-15) minutes.

Satisfaction of consumers in Al-Aqaba Village

The JSC didn't receive any written complaints from residents.

Khirbt' Atuf Village

Field visits were made to Khirbt' Atuf village, the data was collected through questioner and interviews with the representative water service provider of JSC for Water and Sanitation in Tubas and with the chairman of Khirbt' Atuf council.

Quantity of consumed water in Khirbt Atuf Village

Water services are provided through the JSC of Water and Sanitation in Tubas, as the number of the water connection is 78 subscriptions (74 prepaid meters and 4 subscriptions monthly billed meters). The total number of populations served through water supply network is 191 individuals, and the service covers 80% of the population residing in the village.

Based on the information from the JSC for Water and Sanitation, the total consumption of Khirbet' Atuf village during the period of January to November of the year 2022 is **7,348** m^3, as Table 5-23 shows below:

Table 5-24: Amount of consumed water for Multipurpose in Khirbt' Atuf Village

Community	**Population in service** (capita)	**Total amount of water consumed during 2022** (m^3/11month)
Khirbet Atuf	239	7,348

Source: (the JSC for Water and Sanitation in Tubas,2022)

The quantity of water consumed for livestock, which was provided from MoA and the Directorate of Agriculture in Tubas, as shown in the following Table 5-24, and for more detail about the numbers of livestock and amount of water consumed per head per day refer to Table 7-3 in Annex A.

Table 5-25: Amount of consumed water for each use in Khirbt' Atuf Village

Types of use	**Amount of water consumed during 2022** (m^3/11month)
Consumed amount from WSP	7,348
Livestock use	6,388

Source: (MoA & the Directorate of Agriculture in Tubas,2022)

The type of agriculture uses in Khirbt' Atuf is rain-fed agriculture, so the sources of consumed amount of water for the livestock breeding are water networks and other sources, thus the exact quantities for each use can't be calculated.

The availability and reliability of water service in Khirb't Atuf Village

Water services are delivered to citizens by gravity flow without the need to use water pumps. The JSC supplying the village with water at a rate of 24 h/d, 7 days per week, and there is no interruption in service unless there is a breakage or malfunction in the network.

No periodic maintenance is done for the pipelines, and JSC is performed the maintenance works in case of breakdown, breakage, or clear leakage, and due to the condition of water network, the losses reach 36% of total percentage of supplied water.

The affordability and the price of the water in Khirbt' Atuf Village

The JSC for Water and Sanitation in Tubas, supplies water to the village through water network lines. The selling price of purchased water from WBWD to the consumer has been divided into four categories according to the amount of consumption, as shown in the Table 5-25 below:

Table 5-26: The price of cubic meter of water based on the amount of consumption

Category	**Consumption rate (m^3)**	**Price (NIS/m^3)**
1	10-1	4
2	20-11	5
3	30-21	7
4	More than 30	10

Based on information from the JSC, the JSC manages the water service in the village, and the water price is paid through prepaid meters, as the cost of purchasing a cubic meter of water from the WBWD is 2.6 NIS, the average selling price is 4.69 NIS, and the total costs of water service delivery is 6.55 NIS/m^3, which means that the selling price per cubic meter does not cover the cost price, in addition to the losses, which estimated 36% of the total amount supplied to the village, and that will cause financial consequences affecting the financial sustainability of the water service. The following Table 5-26 summarizes the costs of water service delivery:

Table 5-27: The costs of delivering water service to Khirbt' Atuf village, based on data collected from the JSC of Water and Sanitation

#	The costs of delivering water service to Khirbt' Atuf village	The cost (NIS/m^3)
1	The cost of purchasing water from the WBWD (NIS/m^3)	2.6
2	The average of selling price a cubic meter of water to residents of Khirbt' Atuf village (NIS/m^3)	4.69
3	Average total costs of delivering water service to the user (NIS/m^3)	6.55

The JSC is using prepaid meter in Khirbat' Atuf village, so the collection efficiency is 100.

Quality of piped water in Khirbt' Atuf Village

Periodic checks of the water networks are carried out through the MoH, three tests are made for each sample that is taken from the point source, citizens' tanks or the council's tanks.

Chlorine residue test, the total contamination with coliform bacteria test, and the examination of the contamination with the fecal coliform bacteria test, were made for each sample, and through the report of MoH that was reviewed, it shows that samples were taken from different places of the Khirbt' Atuf piped water networks during the period between January and August, as Table 5-27 shows:

Table 5-28: Microbiological tests of piped water in Khirbt' Atuf Village

Area	Khirbt' Atuf	
Test	**Number Of Samples**	**Results**
Number of microbiological tests carried out	26	
Number of water samples for chlorine residual (CR)	1	0.0
	17	0.1
	8	0.2
Number of water samples for total coliform contamination	26	NIL
Number of water samples for fecal coliform contamination	26	NIL

18 of the samples of 26 samples that were examined are less than the recommended concentration of free residual chlorine in drinking water, which it should be between 0.2 to 0.8 mg/l according to the guidelines of the drinking water standard (MF 41-2005).

The reliability of the alternative sources of piped water in Khirbt' Atuf Village

Nine houses in Khirbt' Atuf village are not connected to water network and using alternative resources, which represent 20% of the total population. The alternative sources that are used in the village by these houses that are not connected to the water network, are cisterns, rainwater harvesting wells, and agricultural wells. Based on alternative resources origin, the quality of its water very good, and the selling price of a cubic meter of tanked water reaches (15-20) NIS/m^3, which is a relatively high cost in relation to the citizens income, and the daily need for water.

Amount of tanked water consumed by citizen who are not connected to water network is ranging (9-12) m^3, and using 5.3 as the average number of Palestinian households, the daily water consumption per capita for these residents is between (58-75) litters, which is much less than (100-120) l/c/d, the recommended consumption by the (WHO).

Accessibility to alternative water resource in Khirbt' Atuf Village

The possibility of accessing the alternative resources is good, without many difficulties, as the distance required to the alternative water source, is ranges between (3-5) km, which takes a time ranging from (10-15) minutes.

Satisfaction of consumers in Khirbt Atuf Village

The Joint Services Council for Water and Wastewater did not receive any written complaints from citizens regarding the water service provided by the JSC.

Yarza Village

Field visits were made to Yarza village, the data was collected through questioner and interviews with the representative water service provider of Tubas Municipality and with the chairman of Yarza council.

Quantity of consumed water in Yarza Village

The municipality of Tubas provides water service to the village through the water network pipelines, and Yarza Council is treated as a bulk user with one meter.

Based on the information that was provided by Yarza Village Council, the number of water connections in the community is 15, and the total number of populations served through supply network is 80 capita, thus, the water service coverage is 75% of Yarza residents.

There are a number of citizens who temporarily live in the village of Yarza during the agricultural and grazing seasons. They are estimated at 40 capita, and they own 2000 sheep, they used to get water from the Yarza water network during the years 2019, 2020 and 2021, but during the year 2022 they began to supply tanked water from the Majali Water Company.

According to the information from the Tubas municipality, the total consumption of Yarza village during January to November of the year 2022 is 11,579 m^3, and based on the information from Yarza village council the village council is supplied Hamamat Al-Maleh (Al-Meitah and Al-Burj) of 4,246 m^3 during January to November of the year 2022, and the citizens of Yarza village consume 700-800 m^3 per month from rain harvesting wells, thus the amount of consumed water is shown in the Table 5-28 below:

Table 5-29: Amount of consumed water for Multipurpose in Yarza Village

Community	**Population in service (**capita)	**Total amount of water consumed during 2022** (m^3/11month)
Yarza & Al-Malah	290	11,579
Hamamat Al-Malah (Al-Meitah & Al-Burj)	180	4,246
Yarza	110	7,333

Source: (The Tubas Municipality and Yarza Village Council,2022)

The consumed quantities of water for raising livestock, which were provided from MoA and the Directorate of Agriculture in Tubas, as shown in the following Table 5-29, and for more detail about the numbers of livestock and amount of water consumed per head per day refer to Table 7-3 in Annex A.

Table 5-30: Amount of consumed water for each use in Yarza Village

Types of use	**Amount of water consumed during 2022** (m^3/11month)
Consumed amount from WSP	7,333
Consumed water from rain harvesting wells	8,250
Livestock use	10,512

Source: (MoA & the Directorate of Agriculture in Tubas,2022)

The type of agriculture uses in Yarza is rain-fed agriculture, so the sources of consumed amount of water for the livestock breeding, are water networks and rain harvesting wells and other resources, therefor the exact quantities for each use can't be calculated.

The availability and reliability of water service in Yarza Village

Water services are delivered to the citizens by gravity flow without the need to use water pumps. The village is supplied with water at a rate of 24 h/d, 7 days a week, and there is no interruption in service except in the event of a breakdown in the network.

There is no periodic maintenance for the network pipelines, the maintenance is done when a breakdown, breakage, or clear leakage occurs in one of the lines by Yarzeh Village Council although the council has modest capabilities and does not have any staff or employees.

The water loss according to the Water Sector Regality Council in general in the networks in Palestine is 36%.

The affordability and the price of the water in Yarza Village

The municipality of Tubas provides the village council of Yarza with piped water at a price of 3.0 NIS/m^3, and the village council of Yarza is selling a cubic meter of water for 5.0 NIS to the Yarza citizens and to some of the neighboring communities of Al-Maleh (Al-Meitah and Al-Burj) as shown in the following Table 5-30. The cost of delivering water to the consumer is unknown to the village council. Therefore, it is not possible to know whether the price per cubic meter of water covers the costs.

Table 5-31: The costs of delivering water service to Yarza village, based on data collected from the Tubas Municipality

#	**The costs of delivering water service to Yarza village**	**The cost** (NIS/m^3)
1	The cost of purchasing water from the Tubas municipality (NIS/m^3)	3
2	The average of selling price a cubic meter of water to residents of Yarza village (NIS/m^3)	5
3	Average total costs of delivering water service to the user (NIS/m^3)	5

The price of water consumed by citizens is paid monthly billed meters, according to the village council, and the percentage of collection efficiency is 95%.

Quality of piped water in Yarza Village

Periodic checks of the network water are carried out through the MoH for Water, but Yarza Council is treated as one bulk user with one main meter, so there are no tests dedicated to the village in the reports of the MoH, but the water quality is very good for all uses.

The reliability of the alternative sources of piped water in Yarza Village

The alternative sources that are used by homes that are not connected to the water network, which are 4 houses and they represent 25% of the village's population. Cisterns and water harvesting wells are used as alternative water sources. The quality of these resources water is very good as it comes from rain water, water network or underground wells.

Since the water network established recently, every house has tanks and a tanker car. The consumer who relies upon alternative resource, the consumed quantities range from (6-9) m^3/month, and this is for domestic use only. The amount of water required for livestock consumption may reach 3 m^3/day.

Accessibility to alternative water resource in Yarza Village

There is a difficulty in finding a water source in order to fill the tanks, as the distance required to reach the water source for users who are not connected to water networks is up to 7 km and a

time ranging from (20-30) minutes, and this rise the cost of a cubic meter of tanked water is 20 NIS/m^3.

Satisfaction of consumers in Yarza Village

Tubas Municipality did not receive any written complaints from citizens regarding the water service provided to them, but the village council received many complaints about the amount of supplied water.

Ibziq Village

Field visits were made to Ibziq village, the data was collected through questioner and interviews with the representative water service provider of Tubas Cooperative Association and with the chairman of Ibziq council.

Quantity of consumed water in Ibziq Village

The Water service is provided by the Tubas Cooperative Association through water network lines, as the number of water connection is 26, and the total number of citizens those served by water service through the network is 143 capita, and the service covers 70% of the total population residing in the village.

Based on the information provided from the Tubas Cooperative Association, the total consumption of piped water by Ibziq village during January to November of the year 2022 is 8,182 m^3, as shown in the following Table 5-31:

Table 5-32: Amount of consumed water for Multipurpose in Ibziq Village

Community	**Population in service** (capita)	**Total amount of water consumed during 2022** (m^3/11month)
Ibziq	143	8,182

Source: (Tubas Cooperative Association,2022)

The consumed quantities of water for raising livestock, which were provided from MoA and the Directorate of Agriculture in Tubas, as shown in the following Table 5-32, and for more detail about the numbers of livestock and amount of water consumed per head per day refer to Table 7-3 in Annex A.

Table 5-33: Amount of consumed water for each use in Ibzeq Villages

Types of use	Amount of water consumed during 2022 (m^3/11month)
Consumed amount from WSP	8,182
Livestock use	14,016

Source: (MoA & the Directorate of Agriculture in Tubas,2022)

The type of agriculture uses in Ibzeq is rain-fed agriculture, so the sources of consumed water for the livestock raising, are water networks and other resources, therefor the exact quantities for each use can't be calculated.

The availability and reliability of water service in Ibziq Village

Water services are delivered to the citizens by gravity flow without the need to use water pumps, The village is supplied with water at a rate of 24 h/day, 7 days a week, and there is no interruption in service except in the event of network breakdown. The water losses through the network are counted by the association 1,970 m3, which represent 23% of the total supplied water amount.

No periodic maintenance is done for network pipelines, and maintenance is done only when a breakdown, breakage, or clear leakage occurs by Tubas Cooperative Association.

The affordability and the price of the water in Ibziq Village

The Tubas Cooperative Association manages the water service in Ibziq village, as the cost of purchasing a cubic meter of water from the Joint Services Council for Water and Sanitation is 4.69 NIS, and the average selling price of water cubic meter is 7.5 NIS, and the total delivery costs of water service is 8.5 NIS/m^3, which means that the selling price per cubic meter does not cover the cost price, in addition to the losses in the network that estimates by the association is 23% of the total amount supplied water amount to the village, which will have financial repercussions affecting the financial sustainability of the water service. The following Table 5-33 summarizes the costs of water service delivery:

Table 5-34: The costs of delivering water service to Ibziq village, based on data collected from the Tubas Cooperative Association

#	The costs of delivering water service to Ibziq village	The cost (NIS/m^3)
1	The cost of purchasing water from the JSC for water and sanitation (NIS/m^3)	4.69
2	The average of selling price a cubic meter of water to residents of Ibziq village (NIS/m^3)	7.5
3	Average total costs of delivering water service to the user (NIS/m^3)	8.5

The Tubas Cooperative Association is using prepaid meter in Ibzeq village, so the collection efficiency is 100%.

Quality of piped water in Ibziq Village

Periodic checks of the network water are carried out through the MoH for piped water, but Ibziq village is considered as one bulk user with one main meter managed by the Tubas Cooperative Association, supplied with piped water through the JSC for Water and sanitation, so there are no tests dedicated to the village in the reports of the MoH. However, the water quality is very good for all uses.

The reliability of the alternative sources of piped water in Ibziq Village

Alternative sources that are used for the houses that are not connected to water network or in the case of a decrease in the amount of water used for agriculture or livestock breeding are tanked water, rain harvesting wells, and agricultural wells. Six houses using tanked water as alternative source of piped water. The quality of these alternative sources is good, and the selling price of cubic meter of tanked water is between (20-25) NIS.

Accessibility to Alternative Water Resource in Ibziq Village

The possibility of accessing to alternative water source is good, without many obstacles, as the distance required to reach the water source, for users who do not have water networks, is (5-8) km, with a time ranging from (20-30) minutes.

Satisfaction of consumers in Ibziq Village

Tubas Cooperative Association did not receive any written complaints from citizens regarding the water service, but the village council received many complaints about high price per cubic meter of water, and the slow maintenance work.

Al-Maleh Communities

Field visits were made to Al-Maleh clusters, the data was collected through questioner and interviews with the representative persons and with the chairman of Al- Maleh council.

Quantity of consumed water in Al-Maleh Communities

Al-Maleh includes ten communities, two of them are supplied with water through networks from villages or neighboring areas, and the rest of the communities do not have water networks:

- Localities connected to the water network: Hammamat Al-Maleh (Al-Mayta, Al-Burj), have a water network that are supplied with water from Yarza Village Council.
- Localities not connected to a water network: Al-Farsiyya, Ein al-Hilweh, Al-Deir, Tell Al-Hamma, Al-Qafqaf, Samra, Al-Hadidiya, Khallet Makhol, Jabaris.
- A water tank with a capacity of 120 m^3 was constructed in Al-Farsiyeh in order to supply the community with water, but it was demolished by the occupation authorities.
- Al-Himma community has an internal water network, but there is no water source supplied to the network.
- Al-Deir community is supplied with water from private wells.

The amount of consumed water in these communities can't be determined, since 95% of these communities don't have water networks, and they use the nearby resources, like springs, and tanked water. The amount of consumed water for livestock breeding, as provided from MoA and the Directorate of Agriculture in Tubas, as the following Table 5-34 shows, and for more detail about the numbers of livestock and amount of water consumed per head per day refer to Table 7-3 in Annex A.

Table 5-35: Amount of consumed water for each use in Al- Maleh communities

Types of use	Amount of water consumed during 2022 (m^3/11month)
Livestock use	71,540

Source: (MoA & the Directorate of Agriculture in Tubas,2022)

Hammat Al-Maleh (Al-Mayta & Al-Burj)

According to the information from Yarza Village Council, the amount of water supplied to Hammat Al-Maleh (Al-Mayta & Al-Burj) communities during the month January to November was 4,246 m^3, and based on the information from Local communities, the population of these communities is 180 capita, as the following Table 5-35 illustrates:

Table 5-36: Amount of consumed water for Multipurpose in Hammat Al-Maleh community

Community	Population in service (capita)	Total amount of water consumed during 2022 (m^3/11month)
Hamamat Al-Malah (Al-Meitah & Al-Burj)	180	4,246

Source: (Yarza Village Council ,2022)

The consumed quantities of water for raising livestock, which were provided from MoA and the Directorate of Agriculture in Tubas, as shown in the following Table 5-36, and for more detail about the numbers of livestock and amount of water consumed per head per day refer to Table 7-3 in Annex A.

Table 5-37: Amount of consumed water for each use in Hamamat Al-Malah community

Types of use	Amount of water consumed during 2022
Consumed amount from WSP	4,246
Livestock use	10,220

Source: (MoA & the Directorate of Agriculture in Tubas,2022)

The type of agriculture uses in Hamamat Al-Malah is rain-fed agriculture, so the sources of consumed amount of water for the livestock breeding, are water networks and rain harvesting wells and other resources, therefor the exact quantities for each use can’t be calculated.

The availability and reliability of water service in Al-Maleh Communities

Water services are delivered to the citizens by gravity flow without the need to use water pumps, The Hamamat Al-Malah communities are supplied with water at a rate of one or two days a week.

The water losses through the network can't be counted. And no periodic maintenance is done for network pipelines, and maintenance is done only when a breakdown, breakage, or clear leakage occurs by Yarza Village Council.

The affordability and the price of the water in Al-Maleh Communities

The communities that receive water from the water networks of the neighboring villages are Al-Mayta, and Al-Burj are supplied with piped water from Yazra water network, and the cost of delivering water service based on the data collected from Tubas Municipality as shown in the following Table 5-37:

Table 5-38: The costs of delivering water service to Hammat Al-Maleh communities, based on data collected from the Tubas Municipality

#	**The costs of delivering water service to Hammat Al-Maleh community**	**The cost** (NIS/m^3)
1	The cost of purchasing water from the Tubas municipality (NIS/m^3)	3
2	The average of selling price a cubic meter of water to residents of to Hammat Al-Maleh community village (NIS/m^3)	5
3	Average total costs of delivering water service to the user (NIS/m^3)	5

The price of water consumed by citizens is paid through monthly billed meters, according to Yarza village council, and the percentage of collection efficiency is 85%.

Quality of piped water in Al-Maleh Clusters

Whether the water networks supplied to some communities or the alternative water sources that are used instead of or as sources supporting the water network, all of them are subject to examinations from the Ministry of Health, since the water is subject to the management of the

West Bank Water Department, so the quality of the water supplied to the communities is very good for all uses.

The reliability of the alternative sources of piped water in Al-Maleh Communities

The alternative sources that are used in communities that do not have water networks, or that are supplied with insufficient amount of water from neighboring villages, are rainwater harvesting wells, tanked water, and springs adjacent to the communities such as; Ein Al-Hilweh, which were confiscated by the army, and neighboring residents can no longer benefit from it, and the spring of Al-Mayta, which is used by the residents of the Al-Mayta community.

Accessibility to alternative water resource in Al-Maleh Communities

Access to water in these communities is not easy and requires time and effort, since there is no fixed and permanent source for drinking water or livestock. To reach a source of water from tankers, it takes (20-30) minutes, depending on the location of the water opening on the water network or agricultural wells that supplied water to tankers, at a cost of (10-15) NIS/m^3, the quantities of water consumed vary according to the number of family members and the livestock owned by each family.

The communities not connected to water networks, are supplied by tanked water, the average cost ranges between (10-15) NIS/m^3, which is a high cost per cubic meter of water, for multiple uses such as drinking and livestock breeding, especially for the residents who owned large numbers of livestock, so the amount of water they need for raising livestock is very large, and there is an urgent need for a stable source of water supply at a reasonable price.

Satisfaction of consumers in Al-Maleh Communities

Residents of Al-Maleh communities face many difficulties due to the lack of water networks and the distance from alternative sources of water and the difficulty of accessing them.

5.2.2 Data Analysis

Kardala Village

Table 5-39: Profile of Kardala Village

#	Item	Year of data 2022	Source of data
1	Permanent Residents (inhabitants)	224	PCBS
2	Permanent and Expatriate Residents (inhabitants)	380-400	Kardala LGU
3	Governorate	Tubas.	
4	The village's location according to the Oslo division	The entire community located in area C.	GVC,2022
5	Masterplan	The village has a master plan.	MoLG
6	Main livelihood	80% engages in farming.	GVC,2022
7	Health	No official health clinic.	Kardala LGU
8	Education	No education services.	Kardala LGU
9	Energy source	Al-Qutriyya Israeli company.	Kardala LGU
10	Water network	Existed.	Kardala LGU

Water Quantity

Table 5-40: Analysis the indicators of consumed water quantity of Kardala village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Is piped water used for agriculture and livestock raising	Yes	3	Kardala LGU
2	Average amount of daily water per capita for domestic use	Higher than 85 l/c/d	4	Estimated based on the supplied water quantity
	Score		7/10	

The supplied water quantity to Kardala village is very good, since the WBWD consider verified WSP, and the residents use the piped water for agriculture and livestock raising, and referring the quantity of consumed water for multi-purpose for 2000 capita in Kardala and Bardala villages which is equal to 4.4 MCM per year [2], (WBWD, 2022), we can conclude that the average daily consumption per capita is higher than 85 litter, since it is difficult to separate water consumption for domestic purposes from other uses.

The quantity of the water supplied to Kardala Village is **sufficient.**

The availability and reliability of water service

Table 5-41: Analysis the indicators of the availability and reliability of water network service in Kardala village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Number of service days per week	7	5	WBWD
2	Periodic inspections	In case of malfunctions	2	Kardala LGU
3	Piped water supply coverage of permanent residents (%)	100%	5	Kardala LGU
	Score		12/15	

The water service in Kardala village is reliable and works most of the time, as the number of service days is 7 days per week, which means there is no interruption in service, but there are no periodic inspections but in case of malfunctions, and the coverage of the piped water service is 100%.

The affordability

Table 5-42: Analysis the indicators of the affordability of water price in Kardala village

#	Indictor	Indication	Scour (1-5)	Data Source
1	The average selling price per m^3 of water (NIS/m^3)	0.48	5	PWA
	Score		5/5	

[2] WBWD, 2022. The consumed water quantities by Kardala provided by WBWD.

The selling price of water in Kardala village is very low comparing to the selling price of cubic meter of water in nearby villages. And this term used to express the affordability of water service since the average total costs of delivering water service to the user not calculated due to the lack of information, since the bills sent to WBWD just include the selling price.

So, we can say the affordability of water service for the consumers is very high.

Financial situation of WSP

Table 5-43: Analysis the indicators of financial situation of WSP in Kardala village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Working ratio (%)	106%	2	Calculated
2	Collection efficiency (%)	0%	1	WBWD
3	NRW (%)	53%	1	Based on the supplied quantities and determined quantities in agreement with Israeli side
	Score		5/15	

The purchasing price of water in Kardala village including of O&M costs is very low, comparing to the purchasing cost of cubic meter of water in nearby villages which is 2.6 NIS/m^3.

Here, to calculate the percentage of working ratio; the ratio of the purchasing cost to selling cost of cubic meter of water; for Kardal village the selling price is 0.48 NIS/m^3, and the purchasing price is 0.51NIS/m^3, so the working ratio is 106%.

The selling price is subsidized by 0.3 NIS/m^3, but citizen don't pay for water services so the percentage of collection efficiency is zero, and this is not good indicator comparing to 80% of collection efficiency [3].

The water losses very high since the amount of water that was determined for Kardal, Bardala and Ein Al-Beida from the Israeli side based on the agreement with farmers and owners of

[3] Collection efficiency of JSC for water and sanitation in Tubas Governorate according to the performance of water and sanitation service providers report of WRSC, 2022.

agricultural and underground wells in 1970s was 3.8 MCM per year and the total consumed quantity was 7.1 MCM per year [4], so the losses are higher than 36% [5].

So, we can say the financial situation of water service is not good, note that the purchasing cost not include any cost but purchasing price, and serious action should be taken form the Palestinian Authority to push the consumers to pay for the low price of water service.

Water Quality

Table 5-44: Analysis the indicators of the water network quality in Kardala village

#	Indictor	Quantity	Scour (1-5)	Data Source
1	Percentage of water samples containing free chlorine residual (CR), which complying with standards.	57%	1	MoH
2	Percentage of water samples free from total coliform contamination, which complying with standards.	71%	1	MoH
3	Percentage of water samples free from fecal coliform contamination, which complying with standards.	100%	5	MoH
	Score		7/15	

The quality of network water is problematic, thus 57% of the tested water samples were matching the recommended chlorine residual concentration [6],71% of the tested samples are free from total coliform contamination, and 100% are free from fecal coliform contamination, so more efforts must be spent on monitoring and improving the water quality.

The reliability of the alternative sources

Table 5-45: Analysis the indicators of the reliability of the alternative water sources in Kardala village

#	Indictor	Indication	Scour (1-5)	Data Source
2	The price of cubic meter of water from alternative source (NIS/m^3)	0.48	5	Kardala LGU
5	The quality of the alternative source	Good	5	WRSC [7]
	Score		10/10	

The accessibility of the alternative sources

Table 5-46: Analysis the indicators of the accessibility of the alternative water sources in Kardala village

#	Indictor	Indication	Scour (1-5)	Data Source
3	The Average time to the alternative water source (min)	0	5	Kardala LGU
4	The Average distance to the alternative water source (Km)	0	5	Kardala LGU
	Score		10/10	

The accessibility of alternative resource is high, since the outlets connected to agricultural reservoirs, the farmers didn't make any efforts to bring water from alternative resource.

Satisfaction of consumers

Table 5-47: Analysis the indicators consumers satisfaction in Kardala village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Numbers of written complaints per year	0	5	Kardala LGU
	Score		5/5	

The consumers of water services in Kardala are very satisfied.

Resilience of water service in Kardala Village

Table 5-48: Summary of resilience indicators of water service in Kardala village

#	Indictor	Scour	The Indication
1	Water quantity	7	Very good
2	The availability and reliability of water service	12	Reliable and works most of the time
3	The Affordability	5	Very high
4	Financial situation of WSP	5	Not good
5	Water Quality	7	Problematic
6	The reliability of alternative source	10	Very reliable
7	The accessibility of alternative source	10	High
8	consumers satisfaction	5	Very satisfied
	sum	61	
	Over Average	**72%**	

Based on the above, as the table shows the water service in Kardala Village is resilient. However, work needs to be done to improve the areas where weaknesses appear that affect the sustainability and resilience of water services, as the above table shows the financial situation and water quality in the village of Kardala in need of support.

Bardala

Table 5-49: Profile of Bardala Village

#	Item	Data for year 2022	Source of data
1	Permanent Residents (inhabitants)	1776	PCBS
2	Permanent and Expatriate Residents (inhabitants)	1776	Bardala LGU
3	Governorate	Tubas	
4	The village's location according to the Oslo division	90% community located in area C.	GVC,2022
5	Masterplan	The village has a master plan.	MoLG
6	Main livelihood	83% engages in farming.	GVC,2022
7	Health	Existed official health clinic.	Bardala LGU
8	Education	There are three (primary and secondary) schools inside the community.	Bardala LGU
9	Energy source	Al-Qutriyya Israeli company.	Bardala LGU
10	Water network	Existed	Bardala LGU

Water Quantity

Table 5-50: Analysis the indicators of consumed water quantity of Bardala village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Is piped water used for agriculture and livestock raising	Yes	3	Bardala LGU
2	Average amount of daily water per capita for domestic use	Higher than 85 l/c/d	4	Estimated based on the supplied water quantity
	Score		7/10	

The supplied water quantity to Bardala village is very good, since the WBWD consider verified WSP, and the coverage of the piped water service is 100%, and the residents use the piped water for agriculture and livestock raising, and referring the consumed quantity of water for multi-purpose for 2000 capita in Kardala and Bardala villages which is equal to 4.4 MCM per year [8], we can conclude that the average daily consumption per capita is higher than 85 litter, since it is difficult to separate water consumption for domestic purposes from other uses.

The quantity of the water supplied to Bardala Village is **sufficient.**

The availability and reliability of water service

Table 5-51: Analysis the indicators of the availability and reliability of water network service in Bardala village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Number of service days per week	7	5	WBWD
2	Periodic inspections	In case of malfunctions	2	Bardala LGU
3	Piped water supply coverage of permanent residents (%)	100%	5	Bardala LGU
	Score		12/15	

The water network service is reliable and works most of the time in Bardala village, as the number of service days is 7 days per week, which means there is no interruption in service, but

[8] WBWD, 2022. The consumed water quantities by Kardala, Bardala, and Ein-Al-Beida provided by WBWD.

there are no periodic inspections but in case of malfunctions and the coverage of the piped water service is 100%.

The affordability

Table 5-52: Analysis the indicators of the affordability of water price in Bardala village

#	Indictor	Indication	Scour (1-5)	Data Source
1	The average selling price per m^3 of water (NIS/m^3)	0.48	5	PWA
	Score		5/5	

The selling price of water in Bardala village is very low comparing to the selling price of cubic meter of water in nearby villages. And this term used to express the affordability of water service since the average total costs of delivering water service to the user not calculated due to the lack of information, since the bills sent to WBWD just include the selling price.

So, we can say the affordability of water service for the consumers is very high.

Financial situation of WSP

Table 5-53: Analysis the indicators of financial situation of WSP in Bardala village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Working ratio (%)	106%	3	Calculated
2	Collection efficiency (%)	0	1	WBWD
3	NRW (%)	53%	1	Based on the supplied quantities and determined quantities in agreement with Israeli side
	Score		5/15	

The purchasing price of water in Bardala village including of O&M costs is very low, comparing to the purchasing cost of cubic meter of water in nearby villages which is 2.6 NIS/m^3.

Here, to calculate the percentage of working ratio, the ratio of the purchasing cost to selling cost of cubic meter of water; for Bardal village the selling price is 0.48 NIS/m^3, and the purchasing price is 0.51NIS/m^3, so the working ratio is 106%.

The selling price is subsidized by 0.3 NIS/m^3, but citizen don't pay for water services so the percentage of collection efficiency is zero, and this is not good indicator comparing to 80% of collection efficiency.

The water losses very high since the amount of water that was determined for Kardal, Bardala and Ein Al-Beida from the Israeli side based on the agreement with farmers and owners of agricultural and underground wells in 1970s was 3.8 MCM per year and the total consumed quantity was 7.1 MCM per year [9][10], so the losses are higher than 36% [11].

So, we can say the financial situation of water service is not good, note that the purchasing cost not include any cost but purchasing price, and serious action should be taken form the Palestinian Authority to push the consumers to pay for the low price of water service.

Water Quality

Table 5-54: Analysis the indicators of the water network quality in Bardala village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Percentage of water samples containing free chlorine residual (CR), which complying with standards.	57%	1	MoH
2	Percentage of water samples free from total coliform contamination, which complying with standards.	92%	1	MoH
3	Percentage of water samples free from fecal coliform contamination, which complying with standards.	100%	5	MoH
	Score		7/15	

More efforts should be taken on monitoring and improving the water quality. The quality of network water is problematic, thus 57% of the tested water samples were matching the

[9] Collection efficiency of JSC for water and sanitation in Tubas Governorate according to the performance of water and sanitation service providers report of WRSC, 2022.
[10] WBWD, 2022. The consumed water quantities by Kardala, Bardala, and Ein-Al-Beida provided by WBWD.
[11] WRSC, 2022.Water losses of JSC for water and sanitation in Tubas Governorate is 36% according to Performance Monitoring Report of Water &Wastewater Service Providers

recommended chlorine residual concentration [12],92% of the tested samples are free from total coliform contamination, and 100% are free from fecal coliform contamination.

The reliability of the alternative sources

Table 5-55: Analysis the indicators of the reliability of the alternative water sources in Bardala village

#	Indictor	Indication	Scour (1-5)	Data Source
1	The price of cubic meter of water from alternative source (NIS/m^3)	10	3.5	Bardala LGU
2	The quality of the alternative source	Good	5	WRSC
	Score		8.5/10	

The alternative source of water in Bardala village is reliable, since the opening outlets on the WBWD network are considered as alternative water source for tanked water, and the cost (10-15) NIS/m^3.

The accessibility of the alternative sources

Table 5-56: Analysis the indicators of the accessibility of the alternative water sources in Bardala village

#	Indictor	Indication	Scour (1-5)	Data Source
1	The Average time to the alternative water source (min)	(10-15)	4	Bardala LGU
2	The Average distance to the alternative water source (Km)	(2-5)	4	Bardala LGU
	Score		8/10	

The accessibility of alternative resource is intermediate, since the Average time is (10-15) min, and the average distance is (2-5) km to the alternative water source.

[12] "Free residual chlorine" in drinking water should be between 0.2 to 0.8 mg/l, and 95 %of samples should match biological characteristics according the drinking water standard (MF 41-2005).

Satisfaction of consumers

Table 5-57: Analysis the indicators consumers satisfaction in Bardala village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Numbers of written complaints per year	0	5	Bardala LGU
	Score		5/5	

The consumers of water services in Bardala are very satisfied.

Resilience of water service in Bardala Village

Table 5-58: Summary of resilience indicators of water service in Bardala village

#	Indictor	Scour	The Indication
1	Water quantity	7	Very good
2	The availability and reliability of water service	12	Reliable and works most of the time
3	The Affordability	5	Very high
4	Financial situation of WSP	5	Not good
5	Water Quality	7	Problematic
6	The reliability of alternative source	8.5	Reliable
7	The accessibility of alternative source	8	Intermediate
8	consumers satisfaction	5	Very satisfied
	sum	57.5	
	Over Average	**68%**	

Based on the above, as the table shows the water service in Bardala Village is Resilient.

However, work needs to be done to improve the areas where weaknesses appear that affect the sustainability and resilience of water services, as the above table shows the financial situation and water quality in the village of Bardala in need of support.

Ein Al-Beida

Table 5-59: Profile of Ein Al-Beida Village

#	Item	Data for year 2022	Source of data
1	Permanent Residents (inhabitants)	1258	PCBS
2	Permanent and Expatriate Residents (inhabitants)	1258	Ein Al-Beida LGU
3	Governorate	Tubas.	
4	The village's location according to the Oslo division	95% community located in area C.	GVC,2022
5	Masterplan	cover 5% of the total area	MoLG
6	Main livelihood	80% engages in farming.	GVC,2022
7	Health	Existed governmental health clinic.	Ein Al-Beida LGU
8	Education	No education services.	Ein Al-Beida LGU
9	Energy source	Al-Qutriyya Israeli company.	Ein Al-Beida LGU
10	Water network	Existed.	Ein Al-Beida LGU

Water Quantity

Table 5-60: Analysis the indicators of consumed water quantity of Ein Al-Beida village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Is piped water used for agriculture and livestock raising	Yes	3	Ein Al-Beida LGU
2	Average amount of daily water per capita for domestic use	Higher than 85 l/c/d	4	Estimated based on the supplied water quantity
	Score		7/10	

The supplied water quantity to Ein Al-Beida village is very good, since the WBWD consider the WSP, and the residents use the water networks for agriculture and livestock raising, and referring the consumed quantity of water for multi-purpose for 1,258 capita in Ein Al-Beda village which is equal to 2.7 MCM per year [13], we can conclude that the average daily consumption per capita is higher than 85 litter , since it is difficult to separate water consumption for domestic purposes from other uses.

The quantity of the water supplied to Ein Al-Beida Village is **sufficient.**

The availability and reliability of water service

Table 5-61: Analysis the indicators of the availability and reliability of water network service in Ein Al-Beida village

#	Indictor	Quantity	Scour (1-5)	Data Source
1	Number of service days per week	7	5	WBWD
2	Periodic inspections	In case of malfunctions	2	Ein Al-Beida LGU
3	Piped water supply coverage of permanent residents (%)	90%	4	Ein Al-Beida LGU
	Score		11/15	

The water service in Ein Al-Beida is reliable it works most of the time.

The availability and reliability of water network service is good, as there is no interruption in service, but there are no periodic inspections, and the coverage of the piped water service is 90%.

The affordability

Table 5-62: Analysis the affordability indicators of water price in Ein Al-Beida village

#	Indictor	Indication	Scour (1-5)	Data Source
1	The average selling price per m^3 of water (NIS/m^3)	0.48	5	PWA
	Score		5/5	

The selling price of water in Ein Al-Beida village is very low comparing to the selling price of cubic meter of water in nearby villages. And this term used to express the affordability of water

[13] WBWD, 2022. The consumed water quantities by Kardala, Bardala, and Ein-Al-Beida provided by WBWD.

service since the average total costs of delivering water service to the user not calculated due to the lack of information, since the bills sent to WBWD just include the selling price.
So, we can say the affordability of water service for the consumers is **very high.**

Financial situation of WSP

Table 5-63: Analysis the indicators of financial situation of WSP in Ein Al Beida village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Working ratio (%)	106%	2	Calculated
2	Collection efficiency (%)	0	1	WBWD
3	NRW (%)	53%	1	Based on the supplied quantities and determined quantities in agreement with Israeli side
	Score		5/15	

The purchasing price of water in Ein Al Beida village including of O&M costs is very low, comparing to the purchasing cost of cubic meter of water in nearby villages which is 2.6 NIS/m^3.

Here, to calculate the percentage of working ratio, the ratio of the purchasing cost to selling cost of cubic meter of water; for Ein Al Beida village the selling price is 0.48 NIS/m^3, and the purchasing price is 0.51NIS/m^3, so the working ratio is 106%.

The selling price is subsidized by 0.3 NIS/m^3, but citizen don't pay for water services so the percentage of collection efficiency is zero, and this is not good indicator comparing to 80% of collection efficiency [14].

The water losses very high since the amount of water that was determined for Kardal, Bardala and Ein Al-Beida from the Israeli side based on the agreement with farmers and owners of agricultural

[14] Collection efficiency of JSC for water and sanitation in Tubas Governorate according to the performance of water and sanitation service providers report of WRSC, 2022.

and underground wells in 1970s was 3.8 MCM per year and the total consumed quantity was 7.1 MCM per year [15], so the losses are higher than 36% [16].

So, we can say the financial situation of water service is not good, note that the purchasing cost not include any cost but purchasing price, and serious action should be taken form the Palestinian Authority to push the consumers to pay for the low price of water service.

Water Quality

Table 5-64: Analysis the indicators of the water network quality in Ein Al-Beida village

#	Indictor	Quantity	Scour (1-5)	Data Source
1	Percentage of water samples containing free chlorine residual (CR), which complying with standards.	69%	1	MoH
2	Percentage of water samples free from total coliform contamination, which complying with standards.	100%	5	MoH
3	Percentage of water samples free from fecal coliform contamination, which complying with standards.	100%	5	MoH
	Score		11/15	

The quality of network water is acceptable, thus 69% of the tested water samples were matching the recommended chlorine residual concentration [17], 100% of the tested samples are free from total coliform contamination, and from fecal coliform contamination.

[15] WBWD, 2022. The consumed water quantities by Kardala, Bardala, and Ein-Al-Beida provided by WBWD.
[16] WRSC, 2022.Water losses of JSC for water and sanitation in Tubas Governorate is 36% according to Performance Monitoring Report of Water &Wastewater Service Providers
[17] "Free residual chlorine" in drinking water should be between 0.2 to 0.8 mg/l, and 95 %of samples should match biological characteristics according the drinking water standard (MF 41-2005).

The reliability of the alternative sources

Table 5-65: Analysis the indicators of the reliability of the alternative water sources in Ein Al-Beida village

#	Indictor	Indication	Scour (1-5)	Data Source
1	The price of cubic meter of water from alternative source (NIS/m^3)	10	3.5	Ein Al-Beida LGU
2	The quality of the alternative source	Good	5	WRSC
	Score		8.5/10	

The alternative source of water in Ein Al-Beida village is reliable, since the opening outlets on the WBWD network are considered as alternative water source for tanked water, it is tested by the MoH, as it is from the same source as the water network and the cost (10-15) NIS/m^3.

The accessibility of the alternative sources

Table 5-66: Analysis the indicators of the accessibility to the alternative water sources in Ein Al-Beida village

#	Indictor	Indication	Scour (1-5)	Data Source
1	The Average time to the alternative water source (min)	(10-15)	4	Ein Al-Beida LGU
2	The Average distance to the alternative water source (Km)	(2-5)	4	Ein Al-Beida LGU
	Score		8/10	

The accessibility of alternative resource is intermediate, since the Average time is (10-15) min, and the average distance is (2-5) km to the alternative water source.

Satisfaction of consumers

Table 5-67: Analysis the indicators consumers satisfaction in Ein Al-Beida village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Numbers of written complaints per year	0	5	Ein Al-Beida LGU
	Score		5/5	

The consumers of water services in Ein Al-Beida are very satisfied.

Resilience of water service in Ein Al-Beida Village

Table 5-68: Summary of resilience indicators of water service in Ein Al-Beida village

#	Indictor	Scour	The Indication
1	Water quantity	7	Very good
2	The availability and reliability of water service	11	Reliable and works most of the time
3	The Affordability	5	Very high
4	Financial situation of WSP	5	Not good
5	Water Quality	11	Acceptable
6	The reliability of alternative source	8.5	Reliable
7	The accessibility of alternative source	8	intermediate
8	consumers satisfaction	5	Very satisfied
	sum	60.5	
	Over Average	**71%**	

Based on the above, as the table shows the water service in Ein Al-Beida Village is Resilient.

However, work needs to be done to improve the areas where weaknesses appear that affect the sustainability and resilience of water services, as the above table shows the financial situation in the village of Ein Al-Beida in need of support.

Al-Aqaba

Table 5-69: Profile of Al-Aqaba Village

#	Item	Data for year 2022	Source of data
1	Permanent Residents (inhabitants)	186	PCBS
2	Permanent and Expatriate Residents (inhabitants)	186	Al-Aqaba LGU
3	Governorate	Tubas.	
4	The village's location according to the Oslo division	The entire community is located in area C.	GVC,2022
5	Masterplan	cover small part of the village.	MoLG
6	Main livelihood	90% engages in farming.	GVC,2022
7	Health	Existed governmental health clinic.	Al-Aqaba LGU
8	Education	Primary school from 1st -10th grade.	Al-Aqaba LGU
9	Energy source	Al-Qutriyya Israeli company.	Al-Aqaba LGU
10	Water network	Existed.	Al-Aqaba LGU

Water Quantity

Table 5-70: Analysis the indicators of consumed water quantity of Al-Aqaba village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Is piped water used for agriculture and livestock raising	Yes	3	Al-Aqaba LGU
2	Average amount of daily water per capita for domestic use	Greater than 60 l/c/d	3	Estimated based on the supplied water quantity
	Score		6/10	

The supplied water quantity to Al-Aqaba village is acceptable, since the JSC for water and Sanitation verified WSP, and referring the consumed quantity of water for multi-purpose for 186 capita in Al-Aqaba village which is equal to 8,475 m^3 per year [18], and this water network used also for livestock raising, it can be concluded that the average daily consumption per capita is greater than 60 litter [19], since it is difficult to separate water consumption for domestic purposes from other uses.

The availability and reliability of water service

Table 5-71: Analysis the indicators of the availability and reliability of water network service in Al-Aqaba village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Number of service days per week	7	5	JSC for water and Sanitation
2	Periodic inspections	In case of malfunctions	2	Al-Aqaba LGU
3	Piped water supply coverage of permanent residents (%)	90%	4	Al-Aqaba LGU
	Score		11/15	

The water service in Al-Aqaba village is reliable and works most of the time, as the number of service days is 7 days per week, which means there is no interruption in service, but there are no periodic inspections but in case of malfunctions and the coverage of the piped water service is 90%.

The affordability

Table 5-72: Analysis the indicators of the affordability of water price in Al-Aqaba village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Average total costs of delivering water service to the user (NIS/m^3)	6.55	3	PWA
	Score		3/5	

[18] JSC for water and Sanitation in Tubas Governate, 2022. The consumed water quantities by Al-Aqaba village provided by JSC for water and Sanitation in Tubas Governate.
[19] average daily consumption per capita of JSC for water and sanitation in Tubas Governorate is 85 liter according to the performance of water and sanitation service providers report of WRSC, 2022.

Average total costs of delivering water service to the user in Al-Aqaba village is moderate comparing to the delivering cost of cubic meter of water in nearby villages. So, we can say the affordability of water service for the consumers is also moderate.

Financial situation of WSP

Table 5-73: Analysis the indicators of financial situation of WSP in Al-Aqaba village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Working ratio (%)	139%	3	Calculated
2	Collection efficiency (%)	100%	5	JSC for water and Sanitation
3	NRW (%)	36%	2	WSRC
	Score		10/15	

The purchasing price of water in Al-Aqaba village including of all costs is 6.55 NIS/m^3, while the purchasing cost of cubic meter of water from WBWD is 2.6 NIS/m^3, and the average of selling price a cubic meter of water to residents of Aqaba village is 4.69 NIS/m^3 [20].

Thus, the working ratio for WSP in Al-Aqaba village is 139%. Water losses for the water network not calculated exactly form WSP, so water losses of JSC for water and sanitation in Tubas Governorate will be used as 36% [21].

So, we can say the financial situation of water service is moderate.

[20] The average selling and purchasing price of water service in Al-Aqaba village provided by JSC for water and Sanitation in Tubas Governate.
[21] WRSC, 2022.Water losses of JSC for water and sanitation in Tubas Governorate is 36% according to Performance Monitoring Report of Water &Wastewater Service Providers

Water Quality

Table 5-74: Analysis the indicators of the water network quality in Al-Aqaba village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Percentage of water samples containing free chlorine residual (CR), which complying with standards.	30%	1	MoH
2	Percentage of water samples free from total coliform contamination, which complying with standards.	92%	1	MoH
3	Percentage of water samples free from fecal coliform contamination, which complying with standards.	100%	5	MoH
	Score		7/15	

More efforts should be taken on monitoring and improving the water quality, since, the quality of network water is problematic, thus 30% of the tested water samples were matching the recommended chlorine residual concentration [22],92% of the tested samples are free from total coliform contamination, and 100% are free from fecal coliform contamination.

The reliability of the alternative sources

Table 5-75: Analysis the indicators of the reliability of the alternative water sources in Al-Aqaba village

#	Indictor	Indications	Scour (1-5)	Data Source
1	The price of cubic meter of water from alternative source (NIS/m^3)	(15- 20)	2	Al-Aqaba LGU
2	The quality of the alternative source	Acceptable	4	WRSC
	Score		6/10	

[22] "Free residual chlorine" in drinking water should be between 0.2 to 0.8 mg/l, and 95 %of samples should match biological characteristics according the drinking water standard (MF 41-2005).

The cisterns, rainwater harvesting wells, artesian wells and tanked water are the alternative water sources, with acceptable quality, but the cost for the tanked water is high, which is one source of the alternative resources. So, the alternative source of water in Al-Aqaba village is reliable.

The accessibility of the alternative sources

Table 5-76: Analysis the indicators of accessibility to the alternative water sources in Al-Aqaba village

#	Indictor	Indications	Scour (1-5)	Data Source
1	The Average time to the alternative water source (min)	(10-15)	4	Al-Aqaba LGU
2	The Average distance to the alternative water source (Km)	(2-5)	4	Al-Aqaba LGU
	Score		8/10	

The accessibility of alternative resource is intermediate, since the Average time is (10-15) min, and the average distance is (2-5) km to the alternative water source of tanked water, and the rest of alternative sources needs no efforts.

Satisfaction of consumers

Table 5-77: Analysis the indicators consumers satisfaction in Ein Al-Aqaba village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Numbers of written complaints per year	0	5	Al-Aqaba LGU
	Score		5/5	

The consumers of water services in Al-Aqaba are very satisfied.

Resilience of water service in Al-Aqaba Village

Table 5-78: Summary of resilience indicators of water service in Al-Aqaba village

#	**Indictor**	**Scour**	**The Indication**
1	Water quantity	6	Acceptable
2	The availability and reliability of water service	11	Reliable and works most of the time
3	The Affordability	3	Moderate
4	Financial situation of WSP	10	Moderate
5	Water Quality	7	Problematic
6	The reliability of alternative source	6	Reliable
7	The accessibility of alternative source	8	Intermediate
8	consumers satisfaction	5	Very satisfied
	sum	56	
	Over Average	**65%**	

Based on the above, as the table shows the water service in Al-Aqaba Resilient.

However, work needs to be done to improve the areas where weaknesses appear that affect the sustainability and resilience of water services, as the above table shows the affordability and water quality in the village of Al-Aqaba in need of support.

Khirbt' Atuf

Table 5-79: Profile of Khirbt' Atuf Village

#	Item	Data for year 2022	Source of data
1	Permanent Residents (inhabitants)	239	PCBS
2	Permanent and Expatriate Residents (inhabitants)	239	Khirbt' Atuf LGU
3	Governorate	Tubas.	
4	The village's location according to the Oslo division	% 80 of community located in area C.	GVC,2022
5	Masterplan exiting	The community has a Master plan on B areas, but not approved yet.	MoLG
6	Main livelihood	40% engages in farming, 35% in herding.	GVC,2022
7	Health	Existed governmental health clinic.	Khirbt' Atuf LGU
8	Education	Primary school from 1st to 10th grade.	Khirbt' Atuf LGU
9	Energy source	PENRA.	Khirbt' Atuf LGU
10	Water network	Existed.	Khirbt' Atuf LGU

Water Quantity

Table 5-80: Analysis the indicators of consumed water quantity of Khirbt' Atuf village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Is piped water used for agriculture and livestock raising	Yes	3	Khirbt' Atuf LGU
2	Average amount of daily water per capita for domestic use	Greater than 60 l/c/d	3	Estimated based on the supplied water quantity
	Score		6/10	

The supplied water quantity to Khirbt' Atuf is acceptable, since the JSC for water and Sanitation verified WSP, and referring the consumed quantity of water for multi-purpose for 239 capita in Khirbt' Atuf village which is equal to 7,348 m^3 per year [23], and this water network used also for livestock raising, it can be concluded that the average daily consumption per capita is greater than 60 litter [24], since it is difficult to separate water consumption for domestic purposes from other types.

The availability and reliability of water service

Table 5-81: Analysis the indicators of the availability and reliability of water network service in Khirbt' Atuf village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Number of service days per week	7	5	JSC for water and Sanitation
2	Periodic inspections	In case of malfunctions	2	Khirbt' Atuf LGU
3	Piped water supply coverage of permanent residents (%)	80%	3	Khirbt' Atuf LGU
	Score		10/15	

The water service in Khirbt' Atuf village is reliable and works most of the time, as the number of service days is 7 days per week, which means there is no interruption in service, but there are no periodic inspections but in case of malfunctions and the coverage of the piped water service is 80%.

[23] JSC for water and Sanitation in Tubas Governate, 2022. The consumed water quantities by Khirbt' Atuf village provided by JSC for water and Sanitation in Tubas Governate.

[24] average daily consumption per capita of JSC for water and sanitation in Tubas Governorate is 85 liter according to the performance of water and sanitation service providers report of WRSC, 2022.

The affordability

Table 5-82: Analysis the indicators of the affordability of water price in Khirbt' Atuf village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Average total costs of delivering water service to the user (NIS/m^3)	6.55	3	PWA
	Score		3/5	

Average total costs of delivering water service to the user in Khirbt' Atuf village is moderate comparing to the delivering cost of cubic meter of water in nearby villages. So, we can say the affordability of water service for the consumers is also moderate.

Financial situation of WSP

Table 5-83: Analysis the indicators of financial situation of WSP in Khirbt' Atuf village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Working ratio (%)	139%	3	Calculated
2	Collection efficiency (%)	100%	5	JSC for water and Sanitation
3	NRW (%)	36%	2	WSRC
	Score		10/15	

The purchasing price of water in Khirbt' Atuf village including of all costs is 6.55 NIS/m^3, while the purchasing cost of cubic meter of water from WBWD is 2.6 NIS/m^3, and the average of selling price a cubic meter of water to residents of Khirbt' Atuf village is 4.69 NIS/m^3 [25].

Thus, the working ratio for WSP in Khirbt' Atuf village is 139%. Water losses for the water network not calculated exactly form WSP, so water losses of JSC for water and sanitation in Tubas Governorate will be used as 36% [26]. So, we can say the financial situation of water service is moderate.

[25] The average selling and purchasing price of water service in Khibt' Atuf village provided by JSC for water and Sanitation in Tubas Governate.

[26] WRSC, 2022.Water losses of JSC for water and sanitation in Tubas Governorate is 36% according to Performance Monitoring Report of Water &Wastewater Service Providers

Water Quality

Table 5-84: Analysis the indicators of the water network quality in Khirbt' Atuf village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Percentage of water samples containing free chlorine residual (CR), which complying with standards.	31%	1	MoH
2	Percentage of water samples free from total coliform contamination, which complying with standards.	100%	5	MoH
3	Percentage of water samples free from fecal coliform contamination, which complying with standards.	100%	5	MoH
	Score		11/15	

The quality of network water is acceptable, thus 31% of the tested water samples were matching the recommended chlorine residual concentration [27],100% of the tested samples are free from total coliform contamination, and from fecal coliform contamination.

The reliability of the alternative sources

Table 5-85: Analysis the indicators of the reliability of the alternative water sources in Khirbt' Atuf village

#	Indictor	Indications	Scour (1-5)	Data Source
1	The price of cubic meter of water from alternative source (NIS/m^3)	(15- 20)	2	Khirbt' Atuf LGU
2	The quality of the alternative source	Acceptable	4	WRSC
	Score		6/10	

Cisterns, rainwater harvesting wells, agricultural wells, and tanked water are the alternative water sources, with acceptable quality, but the cost for the tanked water is high, which is one source of the alternative resources. So, the alternative source of water in Khirbt' Atuf village is reliable.

[27] "Free residual chlorine" in drinking water should be between 0.2 to 0.8 mg/l, and 95 %of samples should match biological characteristics according the drinking water standard (MF 41-2005).

The accessibility of the alternative sources

Table 5-86: Analysis the indicators of accessibility to the alternative water sources in Khirbt' Atuf village

#	Indictor	Indications	Scour (1-5)	Data Source
1	The Average time to the alternative water source (min)	(10-15)	4	Khirbt' Atuf LGU
2	The Average distance to the alternative water source (Km)	(3-5)	4	Khirbt' Atuf LGU
	Score		8/10	

The accessibility of tanked water resource is intermediate, since the Average time is (10-15) min, and the average distance is (3-5) km to the source of tanked water, and the rest of alternative sources need no efforts to reach.

Satisfaction of consumers

Table 5-87: Analysis the indicators consumers satisfaction in Khirbt' Atuf village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Numbers of written complaints per year	0	5	Khirbt' Atuf LGU
	Score		5/5	

The consumers of water services in Khirbt' Atuf are very satisfied.

Resilience of water service in Khirbt' Atuf Village

Table 5-88: Summary of resilience indicators of water service in Khirbt' Atuf village

#	**Indictor**	**Scour**	**The Indication**
1	Water quantity	6	Acceptable
2	The availability and reliability of water service	10	Reliable and works most of the time
3	The Affordability	3	Moderate
4	Financial situation of WSP	10	Moderate
5	Water Quality	11	Acceptable
6	The reliability of alternative source	6	Reliable
7	The accessibility of alternative source	8	Intermediate
8	consumers satisfaction	5	Very satisfied
	sum	59	
	Over Average	**69%**	

Based on the above, as the tables show the water service in Khirbt' Atuf Village is Resilient.

However, work needs to be done to improve the areas where weaknesses appear that affect the sustainability and resilience of water services, as the above table shows the affordability and water quality in the village of Khirbt' Atuf in need of support.

Yarza

Table 5-89: Profile of Yarza Village

#	Item	Data for year 2022	Source of data
1	Permanent Residents (inhabitants)	110	Yazra LGU
2	Permanent and Expatriate Residents (inhabitants)	150	Yazra LGU
3	Governorate	Tubas.	
4	The village's location according to the Oslo division	Entire community located in area C.	GVC,2022
5	Masterplan	The community has no master plan	MoLG
6	Main livelihood	All residents raising livestock and rain-fed agriculture.	GVC,2022
7	Health	Existed governmental health clinic.	Yazra LGU
8	Education	No education services.	Yazra LGU
9	Energy source	Solar panels.	Yazra LGU
10	Water network	Existed.	Yazra LGU

Water Quantity

Table 5-90: Analysis the indicators of consumed water quantity of Yarza village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Is piped water used for agriculture and livestock raising	Yes	3	Yarza LGU
2	Average amount of daily water per capita for domestic use	Greater than 60 l/c/d	3	Estimated based on the supplied water quantity
	Score		6/10	

The supplied water quantity to Yarza village is acceptable, since the municipality of Tubas is verified WSP, and referring the consumed quantity of water for multi-purpose for 110 capita in Yarza village which is equal to 7,333 m^3 per year [28], and the resident consumed 8,250 from rain water harvesting [29] and this water network used also for livestock raising, it can be concluded that the average daily consumption per capita is greater than 60 litter[30], since it is difficult to separate water consumption for domestic purposes from other uses.

The availability and reliability of water service

Table 5-91: Analysis the indicators of the availability and reliability of water network service in Yarza village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Number of service days per week	7	5	Yarza LGU
2	Periodic inspections	In case of malfunctions	2	Yarza LGU
3	Piped water supply coverage of permanent residents	75%	2	Yarza LGU
	Score		9/15	

[28] The municipality of Tubas, 2022. The consumed water quantities by Yarza village provided by Tubas municipality.
[29] Yarza LGU, 2022. The consumed water quantities by Yarza village from collection wells.
[30] average daily consumption per capita of JSC for water and sanitation in Tubas Governorate is 85 liter according to the performance of water and sanitation service providers report of WRSC, 2022.

The water service in Yarza village is reliable and works most of the time, as the number of service days is 7 days per week, which means there is no interruption in service, but there are no periodic inspections but in case of malfunctions and the coverage of the piped water service is 75%.

The affordability

Table 5-92: Analysis the indicators of the affordability of water price in Yarza village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Average total costs of delivering water service to the user (NIS/m^3)	5	5	PWA
	Score		5/5	

Average total costs of delivering water service to the user in Yarza village adequate. So, the affordability of water service for the consumers is also high.

Financial situation of WSP

Table 5-93: Analysis the indicators of financial situation of WSP in Yarza village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Working ratio (%)	100%	3	Calculated
2	Collection efficiency (%)	95%	4	Yarza LGU
3	NRW (%)	36%	2	WSRC
	Score		9/15	

The purchasing price of water in Yarza village including of all costs is 5 NIS/m^3, while the purchasing cost of cubic meter from JSC for Water and Sanitation is 3 NIS/m^3, and the average of selling price a cubic meter of water to residents of Yarza village is 5 NIS/m^3 [31].

[31] The average selling and purchasing price of water service in Yarza village provided by Yarza LUG and Tubas municipality.

Thus, the working ratio for WSP in Yarza village is 100%. Water losses for the water network not calculated exactly form WSP, so water losses of JSC for water and sanitation in Tubas Governorate will be used as 36% [32]. So, we can say the financial situation of water service is moderate.

Water Quality

Yarza is considered one bulk user, so no water quality tests are performed for the water networks or for point source in the village.

The reliability of the alternative sources

Table 5-94: Analysis the indicators of the reliability of the alternative water sources in Yarza village

#	Indictor	Indications	Scour (1-5)	Data Source
1	The price of cubic meter of water from alternative source (NIS/m^3)	20	1	Yarza LGU
2	The quality of the alternative source	Acceptable	4	WRSC
	Score		5/10	

Cisterns, water harvesting wells, and tanked water are the alternative water sources, with acceptable quality, but the cost for the tanked water is high, so, the alternative source of tanked water in Yarza village is consider problematic.

The accessibility of the alternative sources

Table 5-95: Analysis the indicators of the accessibility to the alternative water sources in Yarza village

#	Indictor	Indications	Scour (1-5)	Data Source
1	The Average time to the alternative water source (min)	20-30	3	Yarza LGU
2	The Average distance to the alternative water source (Km)	7	2	Yarza LGU
	Score		5/10	

[32] WRSC, 2022.Water losses of JSC for water and sanitation in Tubas Governorate is 36% according to Performance Monitoring Report of Water &Wastewater Service Providers.

The accessibility of alternative resource of tanked water is low, since the Average time is (20-30) min, and the average distance is 7 km to the tanked water source, and the rest of alternative sources need no efforts to reach.

Satisfaction of consumers

Table 5-96: Analysis the indicators consumers satisfaction in Yarza village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Numbers of written complaints per year	0	5	Yarza LGU
	Score		5/5	

The consumers of water services in Yarza are very satisfied.

Resilience of water service in Yarza Village

Table 5-97: Summary of resilience indicators of water service in Yarza village

#	Indictor	Scour	The Indication
1	Water quantity	6	Acceptable
2	The availability and reliability of water service	9	Reliable and works most of the time
3	The Affordability	5	High
4	Financial situation of WSP	9	Moderate
5	Water Quality	0	Not applicable
6	The reliability of alternative source	5	Problematic
7	The accessibility of alternative source	5	Low
8	consumers satisfaction	5	Very satisfied
	sum	44	
	Over Average	**51%**	

Based on the above, as the tables show the water service in Yarza Village is somehow resilient but need some support.

However, work needs to be done to improve the areas where weaknesses appear that affect the sustainability and resilience of water services, as the above table shows the water quality and the reliability and accessibility of alternative source in the village of Yarza in need of support.

Ibzeq

Table 5-98: Profile of Ibzeq Village

#	Item	Data for year 2022	Source of data
1	Permanent Residents (inhabitants)	143	PCBS
2	Permanent and Expatriate Residents (inhabitants)	210	Ibzeq LGU
3	Governorate	Tubas.	
4	The village's location according to the Oslo division	Entire community located in area C.	GVC,2022
5	Masterplan	The community has a master plan.	MoLG
6	Main livelihood	All residents raising livestock and rain-fed agriculture.	GVC,2022
7	Health	No official health clinic.	Ibzeq LGU
8	Education	Primary school from 1st -6th grade.	Ibzeq LGU
9	Energy source	Solar panels cover 70% of the population.	Ibzeq LGU
10	Water network	Existed.	Ibzeq LGU

Water Quantity

Table 5-99: Analysis the indicators of consumed water quantity of Ibzeq village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Is piped water used for agriculture and livestock raising	Yes	3	Ibzeq LGU
2	Average amount of daily water per capita for domestic use	Greater than 60 l/c/d	3	Estimated based on the supplied water quantity
	Score		6/10	

The supplied water quantity to Ibzeq village is acceptable, since Tubas Cooperative Association is verified WSP, and referring the consumed quantity of water for multi-purpose for 143 capita in Ibzeq village which is equal to 8,182 m^3 per year [33]and this water network used also for livestock raising, it can be concluded that the average daily consumption per capita is greater than 60 litter[34], since it is difficult to separate water consumption for domestic purposes from other types.

The availability and reliability of water service

Table 5-100: Analysis the indicators of the availability and reliability of water network service in Ibzeq village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Number of service days per week	7	5	Ibzeq LGU
2	Periodic inspections	In case of malfunctions	2	Ibzeq LGU
3	Piped water supply coverage of permanent residents	70%	2	Ibzeq LGU
	Score		9/15	

The water service in Ibzeq village is reliable and works most of the time, as the number of service days is 7 days per week, which means there is no interruption in service, but there are no periodic inspections but in case of malfunctions and the coverage of the piped water service is 70%.

The affordability

Table 5-101: Analysis the indicators of the affordability of water price in Ibzeq village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Average total costs of delivering water service to the user (NIS/m^3)	8.5	1	PWA
	Score		1/5	

[33] Tubas Cooperative Association, 2022. The consumed water quantities by Ibzeq village provided by Tubas Cooperative Association.
[34] average daily consumption per capita of JSC for water and sanitation in Tubas Governorate is 85 liter according to the performance of water and sanitation service providers report of WRSC, 2022.

Average total costs of delivering water service to the user in Ibzeq village is low. So, the affordability of water service for the consumers is also low.

Financial situation of WSP

Table 5-102: Analysis the indicators of financial situation of WSP in Ibzeq village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Working ratio (%)	113%	2	Calculated
2	Collection efficiency (%)	100%	5	Tubas Cooperative Association
3	NRW (%)	23%	2	Tubas Cooperative Association
	Score		9/15	

The purchasing price of water in Ibzeq village including of all costs is 8.5 NIS/m^3, while the purchasing cost of cubic meter of water from JSC for Water and Sanitation is 4.69 NIS/m^3, and the average of selling price a cubic meter of water to residents of Ibzeq village is 7.5 NIS/m^3. [35]

Thus, the working ratio for WSP in Ibzeq village is 113%. The water losses through the network are counted by the association 1,970 m^3, which represent 23% of the total supplied water amount. So, we can say the financial situation of water service is moderate.

Water Quality

Ibzeq is considered one bulk user, so no water quality tests are performed for the water networks or for point source in the village.

[35] The average selling and purchasing price of water service in Ibzeq village provided by Tubas Cooperative Association.

The reliability of the alternative sources

Table 5-103: Analysis the indicators of the reliability of the alternative water sources in Ibzeq village

#	Indictor	Indications	Scour (1-5)	Data Source
1	The price of cubic meter of water from alternative source (NIS/m^3)	(20 -25)	1	Ibzeq LGU
2	The quality of the alternative source	Acceptable	4	WRSC
	Score		5/10	

Rainwater harvesting wells, agricultural wells, and tanked water are the alternative water sources, with acceptable quality, but the cost for the tanked water is high, which is one source of the alternative resources. So, the alternative source of tanked water in Ibzeq village is consider problematic.

The accessibility of the alternative sources

Table 5-104: Analysis the indicators of the reliability and accessibility to the alternative water sources in Ibzeq village

#	Indictor	Indications	Scour (1-5)	Data Source
1	The Average time to the alternative water source (min)	(20-30)	3	Ibzeq LGU
2	The Average distance to the alternative water source (Km)	(5-8)	2	Ibzeq LGU
	Score		5/10	

The accessibility of alternative resource of tanked water is low, since the Average time is (20-30) min, and the average distance is (5-8) km to the tanked water source, and the rest of alternative sources need no efforts to reach.

Satisfaction of consumers

Table 5-105: Analysis the indicators consumers satisfaction in Ibzeq village

#	Indictor	Indication	Scour (1-5)	Data Source
1	Numbers of written complaints per year	0	5	Ibzeq LGU
	Score		5/5	

The consumers of water services in Ibzeq are very satisfied.

Resilience of water service in Ibzeq Village

Table 5-106: Summary of resilience indicators of water service in Ibzeq village

#	Indictor	Scour	The Indication
1	Water quantity	6	Acceptable
2	The availability and reliability of water service	9	Reliable and works most of the time
3	The Affordability	1	low
4	Financial situation of WSP	9	Moderate
5	Water Quality	0	Not applicable
6	The reliability of alternative source	5	Problematic
7	The accessibility of alternative source	5	Low
8	consumers satisfaction	5	Very satisfied
	sum	40	
	Over Average	**47%**	

Based on the above, as the table shows the water service in Ibzeq Village is somehow resilient but need support.

However, work needs to be done to improve the areas where weaknesses appear that affect the sustainability and resilience of water services, as the above table shows the affordability, the water quality, the reliability and accessibility of alternative source in the village of Ibzeq in need of support.

Al-Maleh Communities

Table 5-107: Profile of Al-Maleh communities

#	Item	Data for year 2022	Source of data
1	Permanent Residents (inhabitants)	391	PCBS
2	Permanent and Expatriate Residents (inhabitants)	391	Ibzeq LGU
3	Governorate	Tubas	
4	The village's location according to the Oslo division	Entire community located in area C	GVC,2022
5	Masterplan	No master plan	MoLG
6	Main livelihood	All residents raising livestock and rain-fed agriculture	GVC,2022
7	Health	No official health clinic	Al-Maleh LGU
8	Education	No education services	Al-Maleh LGU
9	Energy source	Solar panels cover 95% of the population	Al-Maleh LGU
10	Water network	No water networks	Al-Maleh LGU

Water Quantity

Table 5-108: Analysis the indicators of consumed water quantity for Al-Maleh communities

#	Indictor	Indications	Scour (1-5)	Data Source
1	Is piped water used for agriculture and livestock raising	No network	1	Al-Maleh LGU
2	Average amount of daily water per capita for domestic use	Greater than 40 l/c/d	2	Estimated based on the supplied water quantity
	Score		3/10	

The supplied water quantity Al-Maleh community is insufficient, since Al-Maleh communities don't have water pipe networks, so the average daily consumption per capita is greater than 40 litter [36], which is in adequate for household use.

The availability and reliability of water service

Table 5-109: Analysis the indicators of the availability and reliability of water network service in Al-Maleh communities' village

#	Indictor	Indications	Scour (1-5)	Data Source
1	Number of service days per week	0	1	Al-Maleh LGU
2	Periodic inspections	No water network	1	Al-Maleh LGU
3	Piped water supply coverage of permanent residents	0	1	Al-Maleh LGU
	Score		3/15	

The water service in Al-Maleh communities is unreliable and insecure, as there is no water network for the nine communities.

The affordability

Table 5-110: Analysis the indicators of the affordability of water price in Al-Maleh communities

#	Indictor	Indication	Scour (1-5)	Data Source
1	Average total costs of delivering water service to the user (NIS/m^3)	0	NA	
	Score		NA	

There is no water network for the nine communities of Al-Maleh.

[36] average daily consumption per capita of JSC for water and sanitation in Tubas Governorate is 85 liter according to the performance of water and sanitation service providers report of WRSC, 2022.

Financial situation of WSP

Table 5-111: Analysis the indicators of financial situation of WSP in Al-Maleh communities

#	Indictor	Indications	Scour (1-5)	Data Source
1	Working ratio (%)	0	NA	
2	Collection efficiency (%)	0	NA	
3	NRW (%)	0	NA	
	Score		NA	

There is no water network for nine communities of Al-Maleh.

Water Quality

There is no water network for the nine communities of Al-Maleh.

The reliability of the alternative sources

Table 5-112: Analysis the indicators of the reliability of the alternative water source in Al-Maleh communities

#	Indictor	Indications	Scour (1-5)	Data Source
1	The price of cubic meter of water from alternative source (NIS/m^3)	(10 -15)	3	Al-Maleh LGU
2	The quality of the alternative source	Acceptable	4	WSRC
	Score		7/10	

Tanked water are the alternative water sources, with acceptable quality, but the cost per cubic meter of water is high, since it used for household and livestock breeding, thus large amount of water is needed for the residents who owned large numbers of livestock. The tanked water as alternative source considers to be reliable but as major source of water it's high price and unreliable.

The accessibility of the alternative sources

Table 5-113: Analysis the indicators of the accessibility to the alternative water sources in Al-Maleh communities

#	Indictor	Indications	Scour (1-5)	Data Source
1	The Average time to the alternative water source (min)	(20-30)	3	Al-Maleh LGU
2	The Average distance to the alternative water source (Km)	(10-15)	1	Al-Maleh LGU
	Score		5/10	

The accessibility of alternative resource of tanked water is very low access, since the Average time (20-30) min, and the average distance is (10-15) km to the tanked water source, and the rest of alternative sources need no efforts to reach.

Satisfaction of consumers

Table 5-114: Analysis the indicators consumers satisfaction in Al-Maleh communities:

#	Indictor	Indication	Scour (1-5)	Data Source
1	Numbers of written complaints per year	Not Applicable	1	Ein Al-Beida LGU
	Score		1/5	

No water network in the nine communities, and the residents not satisfied at all.

Resilience of water service in Al-Maleh Communities

Table 5-115: Summary of resilience indicators of water service in Al-Maleh communities' village

#	Indictor	Scour	The Indication
1	Water quantity	3	Insufficient
2	The availability and reliability of water service	3	Unreliable and insecure
3	The Affordability	0	Not applicable
4	Financial situation of WSP	0	Not applicable
5	Water Quality	0	Not applicable
6	The reliability of alternative source	7	Unreliable
7	The accessibility of alternative source	5	Very low
8	consumers satisfaction	1	Not satisfied at all
	sum	19	
	Over Average	**22%**	

Based on the above, as the tables show the water service in Al-Maleh Village is Not Resilient and need support.

However, work needs to be done to improve the water service in Al-Maleh communities, as the above table shows the water service not resilient and in need for immediate support.

5.2.3 Results & Discussions

Table 5-116: The summary of resilience indicators of water service in marginalized communities in Northern Jordan Valley**:**

ndicators								
Community	**Water quantity**	**The availability and reliability of water service**	**The Affordability**	**Financial situation of WSP**	**Water Quality**	**The reliability of alternative source**	**The accessibility of alternative source**	**Consumers satisfaction**
Kardala	Very good	Reliable and works most of the time	Very high	Not good	Problematic	Very reliable	High	Very satisfied
Bardala	Very good	Reliable and works most of the time	Very high	Not good	Problematic	Reliable	Intermediate	Very satisfied
Ein Al-Beida	Very good	Reliable and works most of the time	Very high	Not good	Acceptable	Reliable	Intermediate	Very satisfied
Al-Aqaba	Acceptable	Reliable and works most of the time	Moderate	Moderate	Problematic	Reliable	Intermediate	Very satisfied
Khirbt' Atuf	Acceptable	Reliable and works most of the time	Moderate	Moderate	Acceptable	Reliable	Intermediate	Very satisfied
Yarza	Acceptable	Reliable and works most of the time	High	Moderate	Not applicable	Problematic	Low	Very satisfied
Ibzeq	Acceptable	Reliable and works most of the time	Low	Moderate	Not applicable	Problematic	Low	Very satisfied
Al-Maleh	Insufficient	Unreliable and insecure	Not applicable	Not applicable	Not applicable	Unreliable	Very low	Not satisfied at all

Seven indicators were analyzed to assess the resilience of water service in marginalized communities in north Jordan valley, and the results of analysis were summarized in the above-mentioned Table 7-1, the following main conclusion based on data analysis can be summarized:

- Water quantities in (Kardala, Bardala, and Ein Al-Beida) are very good, since the average daily consumption per capita is higher than 85 litter, and water quantities in (Al-Aqaba, Khirbt' Atuf, and Yarza) are acceptable, since the average daily consumption per capita is greater than 60 litter, and the water quantity in Al-Maleh community is insufficient, since the average daily consumption per capita is greater than 40 litter.

- The availability and reliability of water service is reliable and works most of the time in all communities expect Al-Maleh communities, it is Unreliable and insecure, since there is no water network for these communities.

- The affordability of water service in (Kardala, Bardala, and Ein Al-Beida) is very high, and its high in Yarza, as the selling price of water in is very low less than 5 NIS/m^3, and in (Al-Aqaba, Khirbt' Atuf) is moderate as the selling price of water in is higher than 6 NIS/m^3, and the affordability of water service in Ibzeq is Low as the selling price is higher than 8 NIS/m^3, and this indicator not applicable to Al-Maleh communities, since there is no water network for these communities.

- Financial situation of WSPs in (Kardala, Bardala, and Ein Al-Beida) is not good, since the citizen don't pay for water services there and the collection efficiency is zero, and it is moderate in (Al-Aqaba, Khirbt' Atuf, Yarza, and Ibzeq), as the collection efficiency is greater than 80%, and this indicator not applicable to Al-Maleh communities, since there is no water network for these communities.

- Water quality were classified between good, acceptable, problematic, and unacceptable; the water quality is acceptable (Ein Al-Beida, and Khrbit' Atuf), and problematic in (Kardala, Bardala, and Al Aqaba) communities, referring to the MoH and WRSC standards that were set and discussed in section 4.3.5, and this indicator was not applicable in (Yarza and Ibzeq) since the tests results were not found in MoH reports, considering these two villages as one

user, and it is also not applicable in Al-Maleh communities, , since there is no water network for these communities.

- The alternative source is very reliable in Kardala, and reliable in (Bardala, Ein Al-Beida, Al-Aqaba, and Khrbit' Atuf) and it is problematic in (Yarza and Ibzeq) due to the high cost, but the alternative source in Al-Maleh communities is unreliable due the high cost for multiple uses.

- The accessibility of alternative source is high in Kardala, and intermediate in (Bardala, Ein Al-Beida, Al-Aqaba, and Khrbit' Atuf) and it is low in (Yarza and Ibzeq) due to long the average time and distance to alternative water source, and the accessibility to alternative source in Al-Maleh communities is very low since the average time and distance to alternative water source is longest.

- The consumers are very satisfied in all communities since no complaints were written to WSPs, except in Al-Maleh communities the citizen no satisfied at all, since there is no water network for these communities.

Indebtedness of WSP's to the Palestinian Authority

The indebtedness of LGUs and WSPs in the West Bank and the Gaza Strip is about 1.8 billion shekels owed to the PWA. The reason for the accumulation of these debts is the inability of local authorities and WSPs to fulfill their obligations; as a result of the poor collection process, and high percentage of NRW, in addition, in addition to the absence of a deterrent law that compels local authorities and WSPs to fulfill their financial obligations.

The PWA is working on following up the debt problem by developing the necessary solutions, as the fulfillment of the financial obligations incurred by local authorities and WSPs contributes greatly in sustainability and improvement of water service level.

Palestinian Water Law No. (14) of 2014 and National Water Company

The Palestinian Water Law No. 14 of 2014 approved the establishment and development of the National Water Company and regional water utilities, it will be responsible for supplying the bulk water at the national level, and will be the replacement of WBWD and will carry out all of it

tasks, which is currently in its transitional period. The difficulties and challenges that will face the National Water Company, the indebtedness of LGUs and WSPs, due to several things; failure of LGUs and WSPs to pay the monthly bills or parts of them, because of the political and economic conditions, and as a result of a defect in the management, in addition to non-compliance of citizens to pay.

In areas where citizens do not pay for water services, such as Kardala, Bardala, and Ein Al-Beida in Northen Jordan Valley, the prices of consumed water are deducted by the Israeli side through clearing, but remain registered as debts on the LGUs in these areas.

Through this research, it was found that one of the most important factors for the resilience and sustainability of water services in those areas is maintaining a stable financial situation of WSPs, by creating a mechanism and policy which will force citizen to pay for water services that consumed for multiple uses (such as; drinking, irrigation, livestock), and this must be done in cooperation and coordination with LGUs in Kardala, Bardala, and Ein Al-Beida, as 90% of these areas fall in C area, which is outside the control of the Palestinian Authority, so to solve this issue:

- Provide citizens with water services through the LGUs, under the supervision of the National Water Company and the competent authorities,
- Installing prepaid counters which belonging to the LGUs, since charging and paying at the council body or approved sale points,
- Training specialized work crew in water networks, including installation and maintenance works, in the targeted areas,
- The LGUs that will provide water services receive a percentage of the water price (e.g; 30%), which will be used to develop the infrastructure services in these communities and support the steadfastness of citizens,
- Reducing the price of cubic meter of water for farmers to 0.30 shekels/cup for example, since large quantities of water are consumed for agriculture.

Chapter Six: Conclusion and Recommendations

6.1 Conclusion

Through this research, water diplomacy was evaluated by assessing the resilience of water services in the marginalized communities in the Northern Jordan Valley in Tubas Governorate. The study included eight communities (Kardala, Bardala, Ein Al-Beida, Al-Aqaba, Khirbit' Atuf, Yarza, Ibzeq, and Al- Maleh communities), which have geographical, socio-political specificity and sensitivity.

In order to assess the water diplomacy in these communities; an analysis of water services stakeholders was carried out, in addition to evaluate the resilience of water services by collecting information (through questioners, meeting and field visits) from water service providers, local councils, joint services councils, in addition to the main stakeholders such as the PWA, WBWD, and WSRC.

After analyzing the information for each community, this research identified main stakeholders in study area, and they were classified into three categories; Palestinian (PWA, WBWD, MoA, LGU's, and JSC's, and WSRC), Israeli (Mekorot, ICA, IWA), and Intermediate side (Donors, NGOs, and JWC), and the level of intervention of each stakeholder to improve the resilience of water services was suggested as section 5.1.3 illustrated.

The current water services in the Jordan Valley not resilient, and the degree of resilience of water services differ from one community to another, this is due to many reasons (political agreement with Israeli side, social, economic, and geographical). The problems that are threaten the resilience of water service in marginalized communities were determined through water services resilience degree analysis in each community as shown in section 5.2.2:

- The water services in (Kardala, Bardala, and Ein Al-Beida) suffer from poor management affected by the residents' failure to pay the cost of water service, which is considered low compared to other communities, so the financial situation and water quality need of support.

- The degree of resilience of water services in Al-Aqaba and Khirbit' Atuf communities affected by the affordability and water quality.

- In Yarza village, the water quality, and the reliability and accessibility of alternative source need of support to enhance water service resilience.

- Water services resilience in Ibzeq village affected by the affordability, the water quality, the reliability and accessibility of alternative source.

- The water services in Al- Maleh communities not resilient at all and need immediate support and intervention by main stakeholders.

Hence, there are some steps, actions, and interventions must be taken by decision makers at the local and regional levels in order to improve the resilience of water services using diplomatic tools; (such as cooperation between main stakeholders, strategies development, and reconsideration of water quotas and agreements with Israeli side).

6.2 Recommendations

To improve water service situation in eight communities, some actions, interventions, and negotiations must be done between main stakeholders:

1- Developing the management of water services in the eight communities, through activating the role of local councils, under the supervision of the Palestinian Water Authority and the Joint Services Councils,
2- Finding a mechanism to collect water fees in the communities that do not pay for the service (Kardala, Bardala, and Ein al-Beida), especially the water used for agricultural purposes, where the price of this water must be paid as part of product cost by farmer, although the price of water is very low, but it affects the supporting of water services in the region.
3- Reform the water service providers situation through improving a mechanism to enhance the financing, management, and administrative systems to ensure resilient efficient water service delivery,

4- Supporting the steadfastness of Bedouin communities (Al-Maleh communities), by increasing access to improved drinking water by connecting them to water networks from the neighboring serviced areas, or finding nearby and reliable water supply points,
5- Improving water quality by Increasing coordination and cooperation between the PWA, MoH and WSRC to control the water quality, by examining the main supplying source and conducting regular checks according to the recommendations of the WHO.
6- Encouraging farmers to use new agricultural technologies, techniques, and methods which support using less water in agriculture.

References

ARIJ (Applied Research Institute) 2013. *"Trading your Neighbours Water. Israeli appropriation of Palestinian water resources for export products: compiling existing data of water consumption of settlement exports."* Rosa Luxemburg stifung, regional office Palestine. htpp: www.rosaluxemburg.ps

AWWA (The American Water Works Association) (2021). *"Improving System Resilience".* J-100 standard: ANSI/AWWA J100-10 (R13). Risk and Resilience Management of Water and Wastewater Systems. 2013. Appendix H.

Billig, P., Bendahmane D., Swindale, A., (1999*). "Water and Sanitation Indicators Measurement Guide".* Food and Nutrition technical assistance.

Bokova, I., & Ovink, H., (2016). *"The Multi-track Water Diplomacy Framework. A Legal and Political Economy Analysis for Advancing Cooperation over Shared Waters"* The Hague Institute for Global Justice.

Brutschy, S.; Zachary, D. (2014). *"Marginalized Communities."* Encyclopedia of Quality of Life and Well-Being Research.

Burghal, W. (2016). *"Analytical Study: Status of Vulnerable and Marginalized Youth Groups in Palestine."* United Nations Population Fund, (UNFPA).

Chapagain, A., Shimabuku M., and Morrison, J., (2019). *"Water Resilience Assessment Framework".* CEO Water Mandate; Pacific Institute.

Cousins, A., Ellis, L., England, S., Gray, I., Hay, H., Johnson, S., and Wenger C., (2017). "*Resilience in Water, Agenda Setting Scoping Studies Summary Report".* The resilience shift.

Diep, L., Hayward, T., Walnycki, A., Husseiki, M., and Karlsson, L., (2017). *"Water, crises and conflict in MENA: how can water service providers improve their resilience?"* Water & Sanitation for the Urban Poor (WSUP), United Nations Children's Fund (UNICEF).

DRFN (Desert Research Foundation of Namibia), Heyns International Water Consultancy (HIWAC) (2013). *"Training Module on Stakeholder participation and engagement for Basin Support Officers and Basin Management Committee members."* IWRM in the Cuvelai-Etosha Basin Project.

Duleux, A. (2020). *"Water diplomacy and water security in the Israeli-Palestinian conflict."*

EPA (The United States Environmental Protection Agency) (2015). *"Systems Measures of Water Distribution System Resilience",* Office of Research and Development, National Homeland Security Research Center.

Eran, O.; INSS; Bromberg, G.; Giordano, G. (2018). *"Israeli Water Diplomacy and National Security Concerns."* EcoPeace Middle East.

EWASH (The Emergency Water, Sanitation and Hygiene group), Al-Haq (2011). *"Israel's violations of the International Covenant on Economic, Social and Cultural Rights with regard to the human rights to water and sanitation in the Occupied Palestinian Territory."* The Committee on Economic, Social and Cultural Rights.

Figueiredo, L., Honiden, T., Schumann, A., (2018). *"Indicators for Resilient Cities."* OECD Regional Development Working Papers.

GVC (Gruppo di Volontariato Civile in Italian) (2022). "Protection Community *Profile, Kardala, Tubas Governorate."* Community Protection Approach, West Bank Protection Consortium.

GVC (Gruppo di Volontariato Civile in Italian) (2022). *"Protection Community Profile, Bardala, Tubas Governorate."* Community Protection Approach, West Bank Protection Consortium.

GVC (Gruppo di Volontariato Civile in Italian) (2022). *"Protection Community Profile, Ein Al-Beida, Tubas Governorate."* Community Protection Approach, West Bank Protection Consortium.

GVC (Gruppo di Volontariato Civile in Italian) (2022). *"Protection Community Profile, Khirbt Atuf Tubas Governorate"*. Community Protection Approach, West Bank Protection Consortium.

GWP-Med (The Global Water Partnership Mediterranean) (2015). *"Water Governance in Palestine. Sector reform to include private sector participation."* National Report, Governance & Financing for the Mediterranean Water Sector.

Hareuveni, E., (2011). *"Dispossession & Exploitation Israel's policy in the Jordan Valley & northern Dead Sea."* B'Tselem.

Hefny, M., (2011). *"Water Diplomacy: A Tool for Enhancing Water Peace and Sustainability in the Arab Region"*

Human Rights Council (2021). "*The allocation of water resources in the Occupied Palestinian Territory, including East Jerusalem."* Report of the United Nations High Commissioner for Human Rights.

Huntjens, P., de Man, R., (2017). *"Water diplomacy: Making water cooperation work"*. Policy Brief, Planetary Security Initiative, The Hague Institute for Global Justice.

HWE (House of Water and Environment) (2017). *"Detailed Assessment/Mapping for Agriculture Water Resources in Bardalah Watershed (Kardalah, Bardalah and Ein Al-Beida)."* The Ministry of Agriculture.

IWA (Israel Water Authority) (2009). *"The Issue of Water between Israel and the Palestinians."*

IWA (Israel Water Authority) (2022). *"The Water Authority"*. https://www.gov.il/he/departments/water_authority.

Kammi, S., (2000). *"Stakeholder Analysis Guidelines".* The Ohio State University, 40 publications,836 citations.

Kayser, G., Moriarty, P., Fonseca, C., Bartram, J., (2013). *"Domestic Water Service Delivery Indicators and Frameworks for Monitoring, Evaluation, Policy and Planning: A Review. Int J Environ Res Public Health"*. International Journal of Environmental Research and Public Health.

Keskinen, M., Salminen, E., Haapala, J., (2020). *"Water diplomacy paths – An approach to recognize water diplomacy actions in shared waters."* Water & Development Research Group, Aalto University, Journal of Hydrology, 602.

Khan, S., (2010). *"Module 8: Stakeholder Analysis. Training of Trainers (ToT) in Interdisciplinary Field Research Methodology."* IWFM, BUET and SaciWATERs. Cox's Bazar, Bangladesh.

Klimes, M. and Yaari, E. A. (2019). *"Water Security in the Middle East – Opportunities and Challenges for Water Diplomacy"*. Routledge Handbook on Middle East Security. Routledge, London.

Klimes, M., Yaari, E., Michel, D., Restiani, PH., (2019). *"Water diplomacy: Facilitating dialogues".* Stockholm International Water Institute (SIWI), the Journal of Hydrology.

Kool, J., (2016). *"Sustainable Development in the Jordan Valley"*, Final Report of the Regional NGO Master Plan, Hexagon Series on Human and Environmental, Security and Peace VOL 13, EcoPeace Middle East.

Kronich, Sh., Maghen, L., (2020). *"Ensuring Water Security in the Middle East: Policy Implications."* European Institute of the Mediterranean, (IEMed.), Joint policy study.

MoA (2022). "*The Ministry of Agriculture roles".* https://www.moa.pna.ps

MoLG (2022). *"Brief about Ministry of Local Government".* https://www.molg.pna.ps

Moriarty, P., Batchelor, C., Fonseca, C., Kluthe, A., Naafs, A., Nyarko, k., Pezon, C., Potter, A., Reddy R., Snehalatha, M., (2011). *"Ladders for assessing and costing water service delivery"*, Second edition. IRC International Water and Sanitation Centre.

OCHA (2021). *"Palestinians strive to access water in the Jordan Valley."* The Humanitarian Bulletin.

Oxfam (2012). "On The Brink, Israeli settlements and their impact on Palestinians in the Jordan Valley." Oxfam Briefing Paper.

PALTRADE, (2010). “The Jordan Valley: Challenges and the Lost Potential.” Norwegian consultation trust fund, the World Bank.

PENGON (Friends of the Earth Palestine, the Palestinian BDS National Committee and the Land Defence Coalition) (2014). *“International Week Against Mekorot”*

PHG (Palestinian Hydrology Group) (2016). *“The Equitable Access Score-card, National Self-Assessment Report, Supporting Policy Processes to Achieve the Human Right to Water and Sanitation”*, Funded by European Union.

Pinker, A., (2022). "*Social Service". Encyclopedia Britannica”*, https://www.britannica.com/topic/social-service.

PWA (2016). *“National Water Sector Strategic Plan and Action Plan (2017-2022) Part I: Strategic Development Plan (SDP)”*

PWA (2017). *“About Palestinian Water Authority”*. http://www.pwa.ps

Rudolph M., (2020). *“Water Governance under Occupation: A Contemporary Analysis of the Water Insecurities of Palestinians in the Jordan Valley, West Bank.”* The International Institute of Social Studies. Working Paper No. 655.

Schmeier, S. (2018*). “What is water diplomacy and why should you care?”* IHE Delft, The Netherland.

Susskind, L., and Islam, Sh., (2012). *“Water Diplomacy: Creating Value and Building Trust in Transboundary Water Negotiations”* Science & Diplomacy, Vol. 1, No. 3. http://www.sciencediplomacy.org/perspective/2012/water-diplomacy.

Tal-Spiro, O., (2011). *“Israeli-Palestinian Cooperation on Water Issues.”* The Internal Affairs and Environment Committee, Center for Research and Information Kiryat Ben Gurion, Jerusalem.

The World Bank (2018). “*Securing Water for Development in West Bank and Gaza”*. Water Global Practice. Sector Note.

UNDP (2013). *“FOCUS: Bedouins in the occupied Palestinian territory.”* Empowered lives. Resilient nations.

World Bank Disaster Risk Management Hub, Tokyo. (2017). *“Resilient Water Supply and Sanitation Services, The Case of Japan”.* Solutions Brief.

World Bank Group (2020). *“Resilient Water Infrastructure Design Brief”*. International Bank for Reconstruction and Development.

WRSC (2022). *“Performance Monitoring Report of Water &Wastewater Service Providers.”*

WSRC (2022). *"Mission of Water Sector Regulatory Council"*. https://www.wsrc.ps

WSRC (2023). *"Regulated Sector, Service Providores"* https://www.wsrc.ps/providers/sector

Bokova, I., & Ovink, H., (2016). *"The Multi-track Water Diplomacy Framework. A Legal and Political Economy Analysis for Advancing Cooperation over Shared Waters"* The Hague Institute for Global Justice

المراجع العربية:

رائد حلس، (2020). "مشروع الضم الإسرائيلي لمنطقة الأغوار الفلسطينية: السياق والتداعيات وخيارات المواجهة الاقتصادية."

زهران معالي، (2018). *"الأغوار الفلسطينية: حقائق وأرقام."* (رام الله: وكالة الأنباء والمعلومات الفلسطينية – وفا)، نشر بتاريخ كانون ثاني 2020، في.https://bit.ly/2UHbDiJ

سلطة جودة البيئة، (2019). *" تطوير مصادر المياه في الاغوار."* دائرة جودة المياه، سلطة جودة البيئة، فلسطين.

فادي نحاس، (2012). *" إسرائيل والأغوار: بين المفهوم الأمني واستراتيجيات الضم"* ، مدار المركز الفلسلسطيني للدراسات الاسرائيلية.

مجلس تنظيم قطاع المياه (WRSC)، (2022). واقع تقديم خدمة المياه والصرف الصحي في فلسطين للعام 2021.

معهد أبحاث السياسات الاقتصادية الفلسطيني- ماس،2017." تجمعات شرق طوباس – تشخيص الموارد الاقتصادية المحلية."

ميرفت صادق، أيمن فضيلات، (2019). *" الأغوار المهددة بالضم الإسرائيلي، حدود الفلسطينيين وسلّة غذائهم"*، الجزيرة نت. نشر بتاريخ 11 سبتمبر 2019. bit.ly/2EKumVR

Annex A

Table 7-1: Questioner for water service providers and LGU's

Quantity of consumed water				
#	**Indicator**	**Unit**	**quantity**	**Not Quantified**
1	Total population in service	capita		
2	Number of the water connections	No.		
3	Number of the population served through water supply network.	No.		
4	Water supply coverage	%		
5	Average daily per capita water consumption at domestic level (water supplied by pipelines network for domestic use)	l/c/d		
6	Average daily water sold per capita based on total population	l/c/d		
7	Average daily water sold for irrigation	m^3/d		
8	Average daily water sold for raising livestock	m^3/d		
The availability and reliability of water service				
9	Using pumps to improve the transport of the network water.	Yes	No.	Not applicable
#	**Indicator**	**Unit**	**quantity**	**Not Quantified**
10	Number of service days of piped water per month	d/month		
11	Periodic inspection and maintenance of physical assets	No./month		
12	Non-Revenue Water (NRW, water losses)	%		
The affordability and the price of the water				
13	The water categories	Domestic	Agriculture	Not applicable
14	Ownership of water resources	.....		
#	**Indicator**	**Unit**	**quantity**	**Not Quantified**
15	The cost of purchasing of m^3 of water from the source	NIS/m^3		
16	The average selling price per m^3 of water	NIS/m^3		
17	Operating costs per m^3 of water sold	NIS/m^3		

18	Collection efficiency	%			
safety					
#	**Indicator**	**Unit**	**quantity**	**Not Quantified**	
19	Number of microbiological tests carried out	No.			
20	Number of water samples containing free chlorine residual (CR)	No.			
21	Number of water samples free from total coliform contamination	No.			
22	Number of water samples free from fecal coliform contamination	No.			
The reliability of the alternative sources of piped water					
23	Using alternative source of water	Yes	No	Not applicable	
24	The alternative source of water	Springs	Household wells	Tanked water	other resources ……..
25	Source of tanked water	Springs	Groundwater wells	other resources ……..	
26	Quality of tanked water/ Is source of tanked water checked periodically?	Yes	No	Not applicable	
27	Number of houses use water tanks due to lack of water networks or insufficient of supplied water quantities	No.			
28	Amount of tanked water due to lack of water networks or insufficient of supplied water quantities	m^3			
Accessibility to alternative resource					
#	**Indicator**	**Unit**	**quantity**	**Not Quantified**	
29	The time it takes to collect the water, for water users whose households are not connected to a network as well as for connected households.	m			
30	The Average distance to the alternative water source for domestic and agricultural use.	km			
31	The price of the alternative water for domestic use.	NIS/m^3			
32	The price of the alternative water for agricultural use.	NIS/m^3			
Satisfaction of consumers					
33	Complaints on	Water quantity	Water quality	Number of service days	Duration of service)
#	**Indicator**	**Unit**	**quantity**	**Not Quantified**	

34	The complaints from citizens due to dissatisfaction with the water service	No.		
35	Numbers of written complaints per year	No.		

Table 7-2: Questioner for water service consumers

sample properties							
1	Age	30-20	40-31	50-41	60-51	Older than 60	
2	Gender	Male	Female				
3	Marital status	Single	Married	Divorced	Widowed		
4	Number of family members	4--2	6--4	8—6	10--8	More than 10	
5	Field of work of the head of the family	An employee	Farmer	Trader	Worker	Owner of a facility	Non-working
6	Accommodation type	House	Apartment	Tent	Removable unit		
7	Electricity Availability	Yes	No				
8	Education level	Less than high school	High school	Diploma	Bachelor	Master	PhD
9	Income level (NIS)	1000-1500	2000-2500	3500-3000	4000-4500	5000 - 6000	more than 7000
Water Sources							
10	Main source of drinking water	Water network	Household well	Agricultural well	Tanked water	Other resources ……	
11	Agricultural water source	Water network	Groundwater well	Tanked water	Other resources		
12	Livestock water source	Water network	Groundwater well	Tanked water	Other resources		
13	Number of service days of piped water per week	Daily	Three days	Two days	one day		
Water quantity and monthly cost							

#	Indicator	Unit	quantity	Not Quantified
14	The amount of drinking water consumed per month from the service provider	m^3		
15	The amount of water consumed for agriculture per month from the wells or the service provider	m^3		
16	The amount of water consumed for livestock per month from the wells and service provider	m^3		
17	The amount of purchased tanked water for drinking	m^3		
18	The amount of purchased tanked water for livestock	m3		
19	The monthly cost of consumed m^3 of drinking water from wells using pumps or service provider	NIS/m^3		
20	The monthly cost of consumed m^3 of water for agricultural from wells using pumps or service provider	NIS/m^3		
21	The monthly cost of consumed m^3 of water for livestock from wells using pumps or service provider	NIS/m^3		
22	The monthly cost of consumed m^3 of drinking water from tanked	NIS/m^3		
23	The monthly cost of consumed m^3 of water for livestock from tanked	NIS/m^3		
Satisfaction about the level of piped water services				
24	The extent of satisfaction with the amount of water supplied through the water networks	Satisfied	Neutral	Dissatisfied
25	The extent of satisfaction with the uninterrupted water service through water networks from the WSP	Satisfied	Neutral	Dissatisfied
26	The extent of satisfaction with the suppling water days program for the area via the network from the WSP	Satisfied	Neutral	Dissatisfied

27	The extent of satisfaction with the response of the authority responsible for repairing any faults in meters, networks or water facilities	Satisfied	Neutral	Dissatisfied
28	The extent of satisfaction with the price of m3 of water	Satisfied	Neutral	Dissatisfied
Satisfaction about the quality of piped water services				
29	The extent of satisfaction with the quality of drinking water	Satisfied	Neutral	Dissatisfied
30	The extent of satisfaction with the clarity of the water and its absence of plankton	Satisfied	Neutral	Dissatisfied
31	The extent of satisfaction with the color of the drinking water supplied through the networks	Satisfied	Neutral	Dissatisfied
32	The extent of satisfaction with the taste of drinking water supplied through networks	Satisfied	Neutral	Dissatisfied
33	Satisfaction with the aroma of drinking water supplied through the networks.	Satisfied	Neutral	Dissatisfied
Suggestions for improving the water service				
34	Increasing the number of days of supplying drinking water from the WSP	Yes	No	Not applicable
35	Maintenance of lines and pipes of drinking water networks	Yes	No	Not applicable
36	Reducing the price purchased cubic meter of water from the WSP	Yes	No	Not applicable
37	Finding an auxiliary water source with drinking water supplied through networks	Yes	No	Not applicable
38	Establishing rainwater harvesting wells in agricultural lands	Yes	No	Not applicable
39	Use irrigation technology, which depends on small amounts of water	Yes	No	Not applicable
40	Change the types of crops that depend on larger amounts of water for drought-tolerant crops that require less water	Yes	No	Not applicable

Table 7-3: Amount of consumed water for each use in Northern Valleys communities

#	Community	WSP	Population (Capita)	Amount of consumed water from WSP (m^3/year)	Amount of consumed water for livestock raising (m^3/year)	Amount of consumed water for irrigation(m^3/year)
1	Kardala	WDWB	224	4,405,889	21,444	3,000,000
2	Bardala	WDWB	1,776		179	600,000
3	Ein Al-Beda	WDWB	1,258	2,703,193	9,563	3,600,000
4	Al-Aqaba	JSC	186	8475	5,238	0
5	Khirbet' Atuf	JSC	239	7348	6,388	0
6	Yarza	Tubas Municipality	110	7333	14,016	0
7	Ibziq	Tubas Cooperative Association	143	8182	10,512	0
8	Hammat Al-Maleh	Yarza village council	180	4246	10,220	0
9	Al-Maleh	No water net work	391	NA	71,540	0

Source: Amount of consumed water for livestock raising (m^3/year), and amount of consumed water for irrigation(m^3/year), this information was provided from directorate of agriculture in Tubas and the Northern Jordan Valley