The Kingdom of Jordan's Water Scarcity: Understanding Water Demand Management

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Abstract

The Kingdom of Jordan is one of the world's most water poor countries suffering from physical water scarcity, a growing population, regional instability, poor water infrastructure, inefficient water sector management and high water misuse. Through conducting a content analysis of 73 USAID reports, focusing on water demand management, this paper aims to understand how water demand is managed in the Kingdom, in addition to understanding the role of international aid in transforming Jordan's water sector. A greater understanding of the crisis and actions taken to mitigate the impacts were revealed by examining specific water polices and laws, the role of government structures and water sectors, and implemented projects. It was found that Jordan has taken significant efforts to sustainably manage water resources and to address growing water demand. Reallocating water among various sectors, reducing non-revenue water, and decentralizing water provision are key priorities outlined in the Kingdom's water strategy.

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Acronyms

WAJ	Water Authority of Jordan
JVA	Jordan Valley Association
MWI	Ministry of Water and Irrigation
JVC	Jordan Valley Commission
YWC	Yarmouk Water Company
AWC	Aqaba Water Company
WUA	Water Users Association
USAID	United States Agency for International Development
NWMP	National Water Master Plan
WDMU	Water Demand Management Unit
WDM	Water Demand Management
LEMA	Lyonnaise des Eaux- Montgomery Watson Arabtech Jardaneh
ICA	International Cooperation Agency
NRA	Natural Resource Authority
CWA	Central Water Authority
NWC	National Water Council
WURC	Water Utility Regulatory Commission
DWSC	Domestic Water Supply Cooperation
AWSA	Amman Water Sewage Authority
ISSP	Institutional Strengthening and Support Program
WEPIA	Water Efficiency and Public Information For Action
UNHCR	United Nations High Commissioner for Refugees
NWMP	National Water Master Plan

The Kingdom of Jordan's Water Scarcity: Understanding Water Demand Management

Chapter 1: Introduction

Water Scarcity

Water is the single most essential requirement to sustain life. It has no substitutes, and its scarcity remains a national threat to many countries of today's world. This valuable resource has and continues to serve as an indicator of countries' political, social, environmental and economic status. According to the 2006 United Nations Human Development Report, water scarcity is a matter of concern in every continent, directly affecting over 1.2 billion people and placing an additional 500 million at risk. In addition, more than 1.6 billion individuals face economic water scarcity, which is defined as the lack of technical and human capacity and infrastructure to make water available and acceptable for consumption (UNDP, 2006). Water use has grown more than twice the rate of population increase and as such, water scarcity classifies as a top priority threat of the twenty first century. Figure 1 Projected Water Scarcity in 2025 illustrates the global impact of this crisis.

One of the most crucial areas suffering from water scarcity is the Middle East. The researcher will be performing a detailed literature review of the background of the Middle East and Northern Africa (MENA) region and further focusing on the Kingdom of Jordan's water scarcity crisis. This will further include a descriptive analysis of the key drivers for water scarcity and how these issues have exacerbated the current situation. In addition, a comprehensive analysis and review of the water profile in Jordan will be conducted in order to further emphasize how water policies and laws have evolved over time. This

research will also focus on the most recent water strategies and policies currently in place in the Kingdom of Jordan. By drawing upon secondary data sources from government sources, peer reviewed articles, published documents, water strategies, books, government policies, and international sources and reports, this will allow for deeper examination of the trends that have precipitated the current water crisis, and any subsequent actions that have been taken to mitigate the impacts of water scarcity. In addition, the former documents will be used to determine the extent to which Jordan has made progress towards more environmentally and sustainable management of their scarce water resources. Using the available background literature on water demand management (WDM) will allow the researcher to focus on water management in Jordan, how mechanisms have evolved and improved to highlight water demand management in Jordan.

Middle East and Northern Africa Region

The MENA region is home to approximately six percent of the world's population and yet its people have access to less than two percent of the available water resources (Michel et al. 2008). This is illustrated in Figure 2. In the Middle East, the average renewable water supply is approximately 219 billion cubic meters (bcm), whereas Africa stands at 4,180 bcm, Asia at 10,485 bcm, and the world total 40,670 bcm (Michel et al. 2012). Furthermore, some of the more affluent Middle Eastern Gulf States embody the greatest global per capita water consumption rates ranging between 300 and 750 liters per day, and this has been attributed to the lack of sound water policy and law enforcement (Tolba & Saab, 2008). The magnitude of excessive consumption is realized when the numbers are

compared to the 10-20 liters per day in Sub-Saharan Africa, 200 liters in Europe and 350 in the United States (Tolba & Saab, 2008). For most countries of the Middle East, the population demands cannot be satisfied by relying on renewable water resources, and therefore countries must resort to other means like desalination for securing their water needs (Tolba & Saab, 2008). The regional water demand is only growing; total water consumption for the agriculture sector in the MENA region rose by 16 billion cubic meters from 1990 to 2000 (Tolba & Saab, 2008).

Furthermore, the MENA region is classified by instability, water scarcity, and rapid population growth and the majority of the world's most water deprived countries lie within its' borders (Haddadin, 2006; World Bank, 2007; Tolba & Saab, 2008; Kubursi et al. 2011; Michel et al. 2012). Countries of this region also suffer from the lack of effective water governance and water management, as water use efficiency levels range between 37-53 percent (Tolba & Saab, 2008). The battle to secure water has existed for centuries, and as populations grow, supply dwindles and the climate changes, the demand for water continues to rise. Access to water has interdisciplinary roots because it directly affects a vast array of interests including but not limited to agriculture, industry, politics, economic development, public health, and livelihood. Countries of the Middle East are plagued by water scarcity and it is predicted that in thirty-five years, all countries of this region with the exception of Iraq will be threatened by water scarcity (Michel et al. 2012). Due to this and several additional factors, effective water

governance and water management remains crucial for the countries of this region.

Jordan Background

Reasons For Water Scarcity

Jordan is among the most water-deprived countries of the world. The current freshwater availability per capita is 145 cubic meters (m^3); this is among the lowest per capita availability worldwide (Haddadin, 2006; Kubursi et al. 2011; World Bank, 2015). According to the Ministry of Water and Irrigation (MWI), water availability in Jordan has significantly declined over the past few decades; water supply went from 3,600 m^3/year in 1946 to 145 m^3/year in 2009 (MWI "Water For Life Strategy", 2009).[1] See figure 3 for visual reference of the Jordan River and riparians. When soil moisture is accounted for the average water per citizen is 212 m^3. To further emphasize, 145 m^3 is less than one third of the acceptable international poverty benchmark of 500 cubic meters, rendering Jordan a water crisis zone (Tolba & Saab, 2008; Shridhar & ECODIT, 2012). Figure 4 Total Water Withdrawal as a Percentage of Total Renewable Water Resources, presents water consumption rates as a percent of available renewable water resources by each country in the Middle East. Countries with high values indicate their reliance on alternative forms of water supply to meet demand. According to the graphic, Jordan is represented at the 100 percent mark indicating the country withdraws almost all of its renewable water supply.

[1] 3,600 m^3 is approximately equal to the volume of water that fills two standard Olympic size pools

According the Jordanian Department of Statistics, the population is currently 6.5 million; this figure is more than double the population in 1990 of 3.17 million, and is further expected to reach nine million by 2020 and 12 million by 2050 (MWI "Water For Life Strategy", 2009, *Water Valuation Study* ISSP, 2012). Jordan is among the 10 most vulnerable and poor in terms of water resources, according to Jordan's National Water Master Plan, from 1998 – 2002, the population growth rate was 2.9 percent (2004). Jordan has been and still remains saturated with Palestinian, Iraqi and more recently, Syrian refugees. As of December 2015, the United Nations High Commissioner for Refugees (UNHCR) estimated the total number of refugees currently residing in Jordan at 1,000,630 (UNHCR, 2015). Many refugees are unregistered and are therefore not included in these counts, as such as the number is likely significantly higher than stated. Undoubtedly, the former serves as a driver for water demand, a demand Jordan is struggling to satisfy.

In addition to the population burden and physical scarcity of freshwater supplies, water conditions are further exacerbated by several additional factors. Jordan's topography is predominantly desert constituting approximately 80 percent of total land cover, the climate is arid, and the annual rainfall is estimated at 111 mm per year of which 80-90 percent is lost to evaporation (Haddadin, 2006; Denny et al. 2008; Grover et al. 2010; Kubursi et al. 2011, Food and Agricultural Organization of the UN, 2008; Albiac and Dinar, 2012). In addition, unaccounted for water loss in the municipal system results from aging infrastructure and domestic misuse (Grover et al 2010, Haddadin, 2006; Kubursi

et al., 2011). Moreover, the agriculture and largest consuming sector has been known to overuse and mismanage these sources (Haddadin, 2006; Grover et. al 2010, MWI "Water For Life Strategy", 2009).

Overview of Jordan Basin

Many of the streams and rivers that run through Jordan are transboundary, and thus shared between neighboring countries. Of the water bodies, the most critical and highly contested is the Jordan River. The Jordan River Basin has a total area of 18,500 square kilometers and spans across five countries (Food and Agricultural Organization of the UN, 2008). Forty percent of the basin lies within Jordan's borders, thirty seven percent in Israel, ten percent in Syria, nine percent in the occupied West Bank, and four percent in Lebanon (Food and Agricultural Organization of the UN, 2008). This transboundary water source begins at Mount Heron in Syria and rises at the confluence of three main rivers: the Hasbani River of Lebanon, Banias River of Syria, and Dan River of Israel (Haddadin, 2006; Frenken, 2009). It continues into the Sea of Galilee and eventually empties into the Dead Sea. There are numerous headwaters of the Jordan River which include: the Hasbani River (Lebanon), Baniyas River (Syria), Dan River (Israel), Ayoum River (Lebanon), Yarmouk River (Syria), Haroud River (Israel), and Yabis River (Israel) (Food and Agricultural Organization of the UN 2008). The Jordan River runs along international borders thus separating the Kingdom of Jordan from Israel and from the West Bank. The hydro-geopolitics of this shared river remains one of the greatest perpetuators for a long history of wars and conflict in the area (Wolf, 1995; Haddadin, 2006; Food and Agricultural Organization of the UN, 2008; Denny et al. 2008).

Water Resources

Groundwater Resources

There are twelve groundwater aquifers in Jordan, ten of which are renewable and two that are non-renewable (Haddadin, 2006, FAO, 2009a). According to the Food and Agriculture Organization, the sustainable yield of all groundwater aquifers amounts to 450 m^3/year and the safe yield is 275.5 m^3/year, however approximately 253 m^3/year runs off to establish river base flow (2009b). It must be clarified that each of the groundwater aquifers has independent safe yields, thus limiting the rate and amount of water that can be withdrawn without adversely affecting the aquifer (National Water Master Plan, 2004). Figure 5 shows the groundwater basins in the Kingdom. Of the twelve-groundwater aquifers, six are extracted at rates faster than they are replenished, four are used at capacity and two on the other hand are not sufficiently used (Haddadin, 2006; Food and Agricultural Organization of the UN, 2008; Denny et al. 2008). Furthermore, one third of the groundwater basins are transboundary basins between Jordan and Syria. The location of these aquifers plays a significant role in determining the water flow, as water projects and dams in Syria decreased flow rates reaching Jordan (Haddadin, 2006).

Excessive exploitation of groundwater aquifers has not only affected water availability, but quality as well. In addition, concerns over water quality have exacerbated the water deficit in Jordan further contributing to the imbalance between water supply and water demand (Haddadin 2006; Frenken 2009; Grover et al. 2011; Kubursi et al. 2012). Groundwater recharge occurs through various pathways, which are represented in Table 1. This comprehensive water balance

table represents the recharge characteristics and groundwater profile of the aquifers in Jordan. Further, according to the MWI, the over abstraction of groundwater aquifers has severely impacted the baseline levels and rate of recharge overall indicating ineffective water resource management (National Water Master Plan, 2004). In order to alleviate water stress and meet the growing demand for water, Jordan launched the Disi Water Conveyance Project in 2013, in partnership with a Turkish company. The project consisted of a 320-kilometer pipeline that extended from the Disi Aquifer located on the Jordan-Saudi Arabia border to Amman. It was designed to ensure 100 million m^3 of water per year to the residents of Amman (equivalent to ten percent of the total water available in 2005) (Haddadin, 2006; Denny et al. 2008).

Surface water Resources

There are a total of fifteen surface water drainage basins, which are further classified into seven main drainage areas. The most important is the Dead Sea Basin which consists of seven individual basins: Yarmouk, Jordan River and Rift Side Wadis, Zarqa, Dead Sea Side Wadis, Wadi Mujib, Wadi Hasa, and Wadi Araba North (Haddadin, 2006). The catchment area and average annual rainfall in each basin and drainage area is represented in Table 2. Approximately thirty percent of water supply originates from surface water taken from the Yarmouk and Jordan River (ISSP Intuitional Assessment Report, 2011). Overall, the average renewable surface water resources average to 554 mcm per year; of this Syria contributes to 184 mcm and Israel 100 mcm leaving the internal surface water yield at 270-mcm/ year (Haddadin 2006; FAO, 2009b.) Figure 6 outlines the surface water basins. Surface water supply contributes to 37 percent of

Jordan's total water supply whereas groundwater is 54 percent of water supply (MWI "Water For Life Strategy", 2009). In addition, Jordan is experiencing diminishing surface water flow due to dams and projects that are constructed in neighboring countries and climate change driven impacts of reduced rainfall (Haddadin, 2006; Denny et al. 2008; Albiac and Dinar 2012).

Water Demand

By Sector: Agriculture, Municipal and Industrial

Water consumption and withdrawal rates are not consistent and vary yearly. In the Kingdom, water is distributed unevenly across three main sectors: municipal, industrial, and agriculture. As indicated in Jordan's Water For Life Strategy, water consumption statistics were dispersed as follows: agriculture (64 percent), domestic (30 percent), and industrial (5 percent) and tourism (1 percent) (FAO, 2009b; National Water Master Plan, 2004). Considering these numbers, municipal sectors consume less than half agriculture users. As defined by the National Water Master Plan, municipal water consumers are domestic, commercial, small industries and pastoral sectors. Touristic water consumers are mainly hotels and rented apartments (2004). The municipal sector relies on public-private water utilities for their water. Furthermore, there are approximately 18,400 industries in the Kingdom, yet only a mere fraction consumes significant amounts of water (NWMP, 2004). Most of the small industries rely on private wells, which is essentially groundwater. Of the four larger industries in the Kingdom, the thermal power plant and fertilizer industries are supplied through the public network, whereas the tomato paste and potash industry rely on surface and groundwater (NWMP, 2005). Finally, the agriculture sector which accounts

for the greatest water use, has three main irrigation areas: the Jordan Rift Valley, Northeastern Desert and Azraq region, and the Southern desert in the Disi Area. Farmers in the Rift Valley mainly draw on surface and treated wastewater for irrigation purposes, however, farmers in the uplands have been cited for over exploiting groundwater for irrigation, resorting to flooding techniques, and drawing from both licensed and unlicensed wells (NWMP, 2004; FAO, 2009b). The projected water demand shown in table 3 provides a breakdown of the demand and losses by sector in Jordan. To address the ever-growing imbalance between water supply and demand, several policy recommendations have been introduced into the national water strategies and laws.

Towards Sustainable Water Management and Water Efficiency

Despite efforts to manage the resource, water scarcity continues to plague the Kingdom and its people. A multitude of factors frame the water situation in Jordan as nothing short of a crisis. Experts and scholars have written extensively on the inefficient and ineffective water governance in Jordan and suggested areas of improvement. In his work, Dr. Atif Kubursi draws on the importance of using economic instruments to establish a more efficient and equitable water system for Jordan through using economic incentives to drive efficient water use mainly in the agriculture sector (Kubursi et al. 2011). Further, Dr. Munther Haddadin, former Minister of Water and Irrigation of Jordan has written extensively on the anatomy of water scarcity in Jordan, describing the foundation and historical context of water affairs and policies in the kingdom and providing recommendations for effective water governance and management (Haddadin, 2006). A working paper coauthored by Velma Grover, Abdel Raouf Darwish and

Eliza Deutsch entitled “Integrated Water Resource Management for Jordan” provides an argument for integration given the increasing disparity between water demand and water supply (2010). As defined by the Global Water Partnership, Integrated Water Resource Management (IWRM) is an interdisciplinary approach that “Promotes coordinated development and management of water, land and related resources to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems” (Pandya et al., 2012 p. 249). To improve water management in Jordan, significant attention must focus on the importance of water resources and the potential for adopting sustainable practices (Pandya et al. 2012). Only if this is effectively addressed, can a sustainable path for Jordan to mitigate the consequences of its’ water scarcity crisis be created. Further, increasing water efficiency and conservation, redistributing resources between users and sectors, instilling effective water governance, and involving local communities in a participatory approach is essential for Jordan to move forward sustainably and satisfy its water needs (Grover et al., 2010). In conclusion the contributors offer policy recommendations that may foster a more suitable environment for IWRM.

Since the publication this article, Jordan has taken significant strides in improving their water management. With the help of international agencies like the World Bank, USAID, Mercy Corps and others, several programs within the realm of water management were identified, developed, and implemented.

Chapter 2: Water Policy and Management

History of Hydropolitics and Water Policy Development

From 1921 to 1923, the present Kingdom of Jordan was known as the Emirate of the Arab East and later from 1923 to 1946 as the Emirate of Transjordan. During this time, the Emirate was run by an executive council which later evolved into one that was elected (Haddadin, 2006). The area was also considered British territory and as such, financial, technical, and military resources were provided by Britain (Haddadin, 2006). Laws were based on the Ottoman Empire rulings, in addition to those enforced in Palestine, which at the time was also under British mandate (Haddadin, 2006).

Much like the prominence today, regulation, management, and administration of water resources was a principal matter. The main emphasis of water management from 1921 – 1935 was directed towards ensuring adequate municipal supply mainly in the larger cities; local councils within towns were responsible for managing these resources (Haddadin, 2006). Nonetheless, government officials were tasked with overseeing and ensuring the availability of financial resources for projects. (Haddadin, 2006). However, in rural areas and villages that lacked councils, locals depended on the natural availability of rainwater to satisfy their needs (Haddadin, 2006).

Foreign consultants were instrumental in forming the water policies for the Jordan Basin, which later laid the foundation for water governance in the Kingdom. The early twentieth century marked the commencement of developing water policies, treaties, and laws for distributing water among Jordan, Syria, and Israel (Haddain, 2006). After all, this strategic highly demanded agricultural basin

is considered among the most fertile due to the rich soil deposits and sediments from the Jordan River flow (Haddadin 2006; FAO, 2009b). Upon the establishment of Israel in 1948, regional tensions escalated among neighboring Arab countries marking the beginning of the historical battle to secure national water supply (Haddadin 2006; FAO, 2009b; Kubursi et al. 2011).

Water conflicts in the area date back to the early twentieth century (1936-1937); surface waters of the Jordan River and groundwater supplies were the main source of a long rooted history of violence and contention. In addition to the profitable fertile land of the Jordan River Basin, these water resources accounted for much of the dispute between Jewish immigrants and native Palestinians (Haddadin, 2006). Given Jewish immigrants were particularly interested in groundwater access; law reforms emphasized irrigation and groundwater to alleviate tension amongst Arabs and Jews (Haddadin, 2006).

One of the chief founders of water policy in Jordan was of British origin, Michael Iondies. He took part in feasibility studies to assess the potential of water resources in the Jordan Basin in order to satisfy a two state solution (Haddadin, 2006). Furthermore, the Iondies study of 1946 recommended dividing the area into two states, one for the Arab Palestinians and one for Jewish Palestinians. This became the Emirate's first involvement in international water policies, a novice field that was not yet well established (Haddadin, 2006). The Ionides 1946 was the first legal attempt to formulate a law of water governance and distributing of water resources within the Kingdom. The law specifically looked at ways for distributing the Jordan Basin's water between Palestine and Israel. Although the

law was not enforced until sixteen years after it was drafted, it served as a foundation for Jordanian and Arab policies regarding the waters of the Jordan Basin (Haddadin, 2006).

In 1946, Jordan earned its independence and became the Hashemite Kingdom of Jordan and two years later, the state of Israel was formed. The Jordan River Basin instantly became a critical water resource as it now lay at the heart of both Jordanian and Israeli water politics. In fear of having to compromise access to the river's water, the Kingdom called on foreign specialists to conduct water studies in order to comprehensively understand the basin capacity (Haddadin, 2006). The British consultancy firm Sir Murdoch MacDonald and Partners produced a report that highlighted the importance of Jordan's reliance on the river, specifically outlining Jordan's vulnerability to the basin. This report along with the Ionides study became the first two written documents to contour a master plan for the Jordan Valley (Haddadin, 2006). The 1947-1956 decade was a crucial period for formulating, expanding, and refining water policies of the Jordan River Valley. During this period, water rights for irrigation purposes were in accordance with land ownership rights and the foundation of water laws was based on Islamic Sharia (Haddadin, 2006).

Continuous tension and turmoil between Palestinians and Israelis drove many Palestinian refugees into Jordan. This immigration pattern fueled the demand for jobs and need for national stability (Haddadin, 2006). At the time, the socio-economic status in the Kingdom was weak and foreign investment was dire for development, as was the availability, access, and security of water resources

(Haddadin, 2006). To mitigate the situation, American and Jordanian experts joined to develop water resources (Haddadin, 2006). One of the American influences was an American engineer, Mills Bunger. His ideas for water apportionment and policy differed from than those who predated him, because he recommended regulating the Yarmouk River by a dam located at Maqarin, known as the Bunger dam and later as Wehda Dam, whereas former recommendations called for dams along Lake Tiberais (can be seen in Figure 3). Lake Tiberais was a water body under Israeli authority (Haddadin, 2001, 2006). Delighted by his recommendation, the Jordanian government authorized Bunger's plan without consulting Syria (the upper riparian of the Yarmouk River) or Israel (lower riparian). Although the United Nations Relief and Works Agency (UNRWA) for Palestine and the United States Technical Cooperation Agency (TCA) were on board with Bunger Plan, the Israeli government's objection instantly halted the project (Haddadin, 2006). Nonetheless, Jordan launched a bilateral agreement with Syria regarding the use of the Yarmouk River: Jordan would access the river in order to supply refugees with water and Syria would rely on the Bunger Dam at Maqarin for hydropower (Haddadin, 2006). During the early 1950's, negotiations with Israel were nonexistent; political tension and opposition surfaced between Israelis and Arabs once again (Haddadin, 2006).

During this time period there were several unregulated and undocumented water bodies, rivers, and streams within and passing through Jordanian territory. To legalize the entities and reassign landownership rights, the Jordanian government established the Law of Settlement of Land and Water Rights in 1952.

The law also highlighted procedures for settlement of water rights and emphasized irrigation as the primary user of water (Haddadin, 2006). In 1953, UNRWA asked the Tennessee Valley Authority to carry out a study accounting for all riparians of the Jordan Basin, in hopes of developing a unified plan, nonetheless water rights remained a major concern and conflict persisted between riparians. To alleviate the tension, international efforts stepped in. The period between 1953 and 1955 was defined as one of 'shuttle diplomacy' because United States President Eisenhower designated Ambassador Eric Johnston to negotiate a water deal between Israel and the Arab League (Haddadin, 2001 2006). Despite four trips and several negotiations building off of the Unified Development of the Water Resources of the Jordan Valley Region, a consensus was never reached. The fourth and final Johnston Plan indicated that waters would be divided in the following manner: 55 percent for Jordan, 36 percent for Israel, 9 percent for Syria and Lebanon (Food and Agricultural Organization of the UN, 2008). The Arab League rejected the Johnston Plan in fear, fearing ulterior motives behind striking an eventual peace treaty that would acknowledge the state of Israel. Table 4 represents the water allocations between riparains of the Jordan River throughout Johnston's shuttle diplomacy.

In 1957, water projects in Jordan became the responsibility of the Ministry of Public Works. In abiding efforts to conform to the Johnston Plan, Jordan called for the East Gohr Canal Project; diverting a portion of the Yarmouk River in order to irrigate 10,000 hectares of land. The Kingdom's economic standing was weak and Jordan had to rely on foreign aid for assistance. The International

Cooperation Agency (ICA) and the United States Agency for International Development (USAID) stepped in to assist. Once Israel was aware that the United States was funding Jordanian projects they too began developing their own. In turn, in 1964, Israel called on the United States to fund the National Water Carrier, which called for transferring 425 mcm of Jordan water from Lake Tiberias to the Negev Desert as opposed to the 320 mcm presented in the Johnston Plan. As a result of this, the Arab League called for a Summit where they planned to divert the Jordan River waters to Syria and Jordan. Immediately thereafter Israel ceased all projects and launched a six day war from June 5th to June 10th of 1967, seizing the Syrian Golan Heights, West Bank, and Gaza Strip, and demolishing all water diversion plans (Food and Agricultural Organization of the UN, 2008).

The 1967 Israel- West Bank war lasted four years, significantly impacting and destabilizing Jordan's infrastructure and economy (Haddadin, 2006). After the war, reviving the economy was crucial; several water policy shifts took place mainly concerning the development of these resources. One of the major transformations was the central government's role in providing municipal water and wastewater services (Haddadin, 2006).

The early nineties were dedicated to pushing forward peace negotiations in the Middle East. In 1994, Jordan and Israel came together in forming a mutual water covenant known as the 1994 Jordan- Israel Peace Treaty. It emphasized the importance of adopting bilateral cooperation strategies to alleviate the water shortage in each country. The Israel Jordan Joint Water Commission was formed

with three officials from each country. Jordan and Israel signed The Washington Declaration and agreed on a Peace Treaty that designated specific water flows from the Yarmouk to both countries in addition to measures for preventing water contamination and securing water supply to each other during periods of shortage (Haddadin, 2006) In addition the bilateral treaty emphasized development of water resources, sustainable withdrawal, and sharing of information to promote cooperation (Haddadin, 2006, Food and Agricultural Organization of the UN, 2008).

History of Administrative Structures in the Water Sector

In 1959, the Central Water Authority (CWA) was established to provide a centralized approach to managing water resources in the kingdom. Under the CWA was the Department of Irrigation, Drilling Department at the Ministry of Public Works, Department of Water Resources Development at the Office of Consolidated Services, and the Development Board (Haddadin, 2006). The CWA was responsible for public water resources in the Kingdom but had no jurisdiction regarding irrigation water, the East Ghor Canal, and municipal water provision (Haddadin, 2006). Because the of the highly contested status of the Jordan river, the Natural Resource Authority (NRA) was established in 1966 as a consolidated department tasked with developing and constructing distribution networks across the Kingdom, with exception of the capital, Amman (Haddadin, 2006). The NRA essentially took over the CWA's responsibilities in addition to management of the East Gohr Canal (Haddadin, 2006).

In attempt to improve municipal water provision in Jordan's capital, Amman Water and Sewerage Authority (AWSA) was formed in 1973. The former

entity was responsible for cooperating with the NRA to allocate water to residents of Amman in addition to managing water and wastewater services in the capital (Haddadin, 2006). As for the rest of the country, water projects, and water provision were under the jurisdiction of the Domestic Water Supply Corporation (DWSC). Wastewater services were separately the responsibility of the Ministry of Municipal and Rural Affairs. Nonetheless, the fragmentation of water provision created nothing short of a disaster for management.

The same year, Jordanian citizens formed the Jordan Valley Commission (JVC) to rehabilitate and develop the Jordan Valley, which was essentially destroyed by the war. More than half of the villages and homes were demolished and the basin's population dropped to less than 10 percent of its prewar size Haddadin, 2006). Because agricultural value of this land was of primary concern, irrigation was a chief priority. Four years later in 1977, the Jordan Valley Authority (JVA) succeeded the JVC, the Jordan River Tributaries Regional Corporation, and the parts of the NRA and DWSC operating in the Jordan Valley. The JVA was responsible for providing water supply and managing wastewater in the Jordan Valley (NWMP, 2004).

The urgency of understanding future water needs was not understood until 1978, when the National Planning Council and a British firm assessed and surveyed Jordan's future water resource capacity. Specifically, the study focused on the northwest area of Jordan where 90 percent of the population resided, and they concluded that the water resources would come nowhere close to sufficiently meeting demands in the year 2000 without tapping into supplies set aside for

agriculture/irrigation expansion along the Jordan Valley (Haddadin, 2006). Little did they know, the situation would be far worse than expected.

In 1983, Water Authority of Jordan (WAJ) took over responsibilities of Jordan's distribution networks. WAJ inherited the roles of the AWSA, DWSC, and divisions of the NRA that worked on water resources (Haddadin, 2006). The JVA and WAJ authorities were the sole power forces in the water sector until 1988 when the Ministry of Water and Irrigation was formed. The MWI became the central power body for water affairs in the Kingdom (Ministry of Water and Irrigation; Haddadin, 2006). The MWI objective was to sustainably manage Jordan's water resources to promote economic and social sustainability and national security (Haddadin, 2006).

Water Strategy Development

Later in the 1990s, in recognition of the water crisis and future challenges of water management, the Jordanian government shifted its policy focus away from supply-oriented management to demand. The first National Water Strategy was formed in 1997 and it called for establishing comprehensive water databanks, monitoring programs, a system for data collection, and overall policy implementation in the water sector (Jordan Ministry of Water and Irrigation, 2009). The National Water Strategy was Jordan's first national effort to address the water shortage and future implications for the Kingdom. Coupled with this strategy were four policies: Irrigation Water Policy, Wastewater Policy, Groundwater Policy and Water Policy. As indicated by the MWI, the main emphasis of these documents revolved around strengthening public education through awareness campaigns that promoted water conservation and natural

resource protection, in addition to continuous dedication in the research and development of current water standards (National Water Strategy, 2004). Together the strategy along with its supplementary water policies stressed the need for Jordan to include more environmentally sound practices, regulation, structural improvements, citizen attentiveness, and a system of financial incentives. This was an innovative step, however challenges remained predominant when it came to applying and implementing the strategy to the entire kingdom (Haddadin, 2006). Moreover, effective implementation was limited by the lack of sufficient human, financial, and technical capacity. The government called for updating the policies and water strategies on a five-year basis.

The current Water For Life Strategy 2008-2022 addresses Jordan's future challenge of balancing water needs across the municipal, industrial and agricultural sectors. Future strategies outline the importance of granting priority to drinking water quality and capping agriculture water consumption. As indicated in the strategy, in 2007 the Kingdom's annual water demand exceeded water availability by 638 mcm (2009). Thus given the heightened awareness and consolidated understanding of the water crisis in Jordan, the MWI took the lead in drafting the Water for Life Strategy of 2008-2022, which outlines a vision of what the country hopes to achieve by 2022 through addressing water demand, water supply, institutional reform, water for irrigation, wastewater, and alternative water resources. According to the strategy in 2022, the annual deficit is expected to be 284 mcm (2009). The remainder of this research focuses on assessing international efforts invested in reforming Jordan's water sector.

Chapter 3: Methodology

For the purpose of this research, content analysis will be used to uncover the progress and transformation of WDM in Jordan's water sector. For the following sections, the researcher will continue relying on the literature and in addition will incorporate results of a content analysis of USAID reports. Content analysis is a scientific and systematic, low cost, qualitative research tool used to extensively explore the undertone of various data sources (Krippendorff, 2004). As defined by Klaus Krippendorff in the book *Content Analysis An Introduction to Its Methodology*, content analysis is a method that allows one to extrapolate information, document trends over time, narrow down large documents into manageable units, and draw conclusions from available texts in order to deepen understanding of a particular subject matter (2004).

Previous Content Analyses

Content analysis remains a methodology used by several scholars of interdisciplinary backgrounds to reveal different meanings within water management. In Plummer et al.'s article "A Systematic Review of Water Vulnerability Assessment Tools", the researchers drew on literature to define correlations between access to water resources, and effects on health (2012). The research intended to better understand the extensiveness of water vulnerability assessment tools. Results indicated that an all-encompassing water resource management approach does very little to account for overall vulnerability (Plummer et al., 2012).

In addition, the objective of Jasper et al.'s research, "Water Sanitation in Schools: A systematic review of the health and educational outcomes", was to

identify the degree to which insufficient and ineffective water and sanitation provision in schools corresponded with children's involvement and attendance (2012). Research results validated that lack of sanitation and water provision was associated with higher absentee rates, further begging the greater question of the role of water and sanitation in overall academic performance and achievement (Jasper et al., 2012).

Further, In Drieschova's paper "Governance Mechanisms to address flow variability in water treaties", the researchers used content analysis to understand various international water treaties and to detect implemented strategies that address water variability among different countries (2008). Research results highlighted the mechanisms within treaties that permitted transboundary water countries to adapt and use water resources cooperatively and sustainably (Drieschova et al., 2008).

Pahl- Wostl et al.'s paper "The importance of social learning and culture for sustainable water management" used two previously conducted content analyses for Spain and Holland's national water master plans (2008). The researchers argue the definition of integrated water resource management is evolving to encompass value to cultural awareness, behavior change, and adaptation (Pahl-Wostl et al., 2008). The content analyses were used to determine how the role of culture and institutions has changed in light of evolving water resources management (Pahl- Wostl et al., 2008).

Content Analysis for Jordan

For purposes of researching how water demand is managed in Jordan, and further exploring how the country has responded to the water crisis, conducting a

content analysis offers several beneficial purposes. Although previous review articles recommended solutions and proposals for integrated and sustainable water management, the role of international agencies in implementing reform in Jordan has yet to be studied using this methodology. Third party efforts were essential to carrying out water projects and implementing programs in line with the water conservation priorities dictated by the Jordanian Government (WEPIA, 2005). For the past 16 years, United States Agency for International Development (USAID, n.d.) has teamed with the MWI to rehabilitate and improve overall water management and provision in Jordan. No previous attempts have been made to conduct a consolidated systematic review of the role of USAID in promoting water demand management (WDM) in Jordan. Thus the content analysis of this research will be limited to USAID reports. The first part of this research will draw on definitions of WDM, which will be used to define search terms in the analysis. USAID has published numerous reports relating to water demand management in Jordan, thus content analysis can identify key portions of text where governance, implemented projects, and targeted sectors are highlighted.

Through relying on content analysis, the researcher can more effectively understand, categorize, and code the information related to WDM in Jordan, which will then provide an indication to how the crisis is managed. Through identifying keywords, their frequency, and themes related to water demand management and conservation across various policy documents and assessments, project reports, and evaluations this may reveal an understanding of how the water crisis in Jordan is currently framed and approached.

Content Analysis Steps

1. Formulate Research Questions

Question 1: How is water demand being managed in Jordan? How has Jordan responded to this water crisis?

Question 2: How do the USIAD Reports focus on WDM? More specifically, how have these reports focused on the water crisis; what was USAID's role in water demand management?

Question 3: What programs (if any) have been implemented to operationalize water demand management in Jordan? Have there been successful outcomes of these programs?

Question 4: To what extent has community based social marketing played a role in water demand management in Jordan? To what extent is the public aware of water scarcity and water demand management?

Question 5: How is each sector (Agriculture, Municipal, Industrial, Touristic) responding?

- Agriculture: what has been done about misuse, high water allocations, water overuse, pollution of surface and groundwater, and traditional flood irrigation methods?
- Municipal: what has been done about leaking water, nonrevenue water, water theft, illegal extraction, absence of effective metering, poor law enforcement (weak penalty systems)?

2. Define Water Demand Management

In attempting to understand the development and existing nature of water demand management in Jordan through relying on USAID reports, defining

WDM remains crucial. As defined by Butler & Fayyaz, WDM calls for drawing on preventive strategies to tackle water demand rather than relying on unconventional reactive ways to increase supply (2006). WDM calls for analyzing the drivers of water demand in addition to shifting towards conservative water consumption and use patterns (Butler & Fayaz, 2006). Further, unlike the broad concept of demand management, WDM focuses on decentralizing water provision to water utilities. The transfer of tasks to lower levels is thought to provide more efficient and effective water resources and better coverage than centralized approaches (Butler & Fayyaz, 2006).

Brooks defines WDM as any practice that conserves water use while maintaining water quality (Brooks, 2002). Furthermore, in the article "Overview re Public- Private partnerships in the domestic water supply sector," Grover cites several academics that alluded to effective WDM through outlining the transformation of its definition. For example, Tate recommends that individuals act mindfully as they regard social benefits of conserving and reducing their water use and consumption (Grover, 2002 & Tate, 1993). Other researchers such as Savenjie and Van Der Zaag underline the importance of strategy building in addition to enhancing water use (2002).

WDM is a part of an overall water management system and is required for sustainable integrated water resource management. WDM draws on principles of public awareness, governance, community organization, education programs, strategic planning, economic incentives, national and international guidelines, and environmental conservation to collectively manage water demand (Brooks, 2002;

Butler and Fayyaz, 2006). In David Brooks' article "An Operational Definition of Water Demand Management," he consolidates scholarly findings into a five-tiered definition of water demand management. Brooks' definition plays close attention to the discourse and deliberative dialogue surrounding conversations rather than the actual outcome they result in. Further he argues a combination of both efficiency and conservation is needed to effectively manage water demand, as these should both be components of policies that promote behavior change regarding water use (Brooks, 2006). For the purpose of this research, WDM is seen as a preventive approach that manages water proactively rather than reactively. WDM identifies the triggers that exacerbate water demand and identifies ways for managing existing water resources effectively and efficiently.

3. Develop a list of synonyms and related terms to WDM and demand side strategies

Water Demand Management: water demand, water demand management, water management and conservation, and water use efficiency

Sectors: Agriculture, Industrial, Tourism, and Municipal/Domestic and Residential Sectors

Programs: educational programs that have been implemented, evaluations, campaigns, behavior changes, public participation, community based social marketing, capacity building, information sharing, gender roles, community organization/participation/awareness, use of financial incentives, and water/ environmental conservation programs.

Governance and Management Reform: strategic planning, policy and sector reform, planning and management in the water sector, best management practices

Water provision: looking at the main entities responsible for water provision: Ministry of Water and Irrigation, Jordan Valley Authority, Water Authority of Jordan, Water Users Association, Miyahuna, Aqaba Water Company, and Yarmouk Water Company.

4. Data Collection

In effort to closely examine the progress of international development in Jordan, only documents published by USAID were obtained from USAID's Development Experience Clearinghouse (DEC). This was used as the database of choice given the agency's ongoing commitment to improving and reforming the water management structure within the Kingdom of Jordan to create a more secure and democratic, and environmentally stable country (USAID "USAID Jordan", n.d.). The mechanism by which USAID documents were screened and selected for analysis is represented Figure 7.

5. Data Coding

Create and Define Codes: Coding serves as method that allows for effective organization and sorting of the data being used. Five codes were created in order to highlight the research objectives of this study in order to answer questions regarding the status and progress of WDM in Jordan. Table 5 shows the table of codes and definitions.

Atlas.ti is a qualitative data analysis software that can be used to systematically analyze, code, and organize various data resources. The software was selected based on recommendation, its ability to handle large datasets, and the variety of output tools.

Atlas.ti Auto Coding: Auto coding was used to find the keywords specified for each of the following predetermined codes and group them accordingly. For each of the codes, the range of text to include surrounding the specified words was by paragraph. A sample of twenty reports were read in detail prior to the analysis and it was found that selecting codes within paragraphs would provide sufficient text for contextual purposes. To further ensure the extent of search, the researcher ran a sample query and coded the text by paragraph and by document; the latter produced broader results. Because the researcher was interested in closer relationships and more intricate overlaps between categories, paragraphs were selected as the search extension.

For each of the five codes (Water Demand Management, Sectors, Programs, Governance and management reform, and Water Provision) the text was autocoded. In order to carry out Boolean and proximity searches using the predetermined codes, smart codes had to be created. Smart codes were formed to narrow down, filter, and highlight texts of the documents that were needed to answer the questions of interest to the researcher. The quotation cooccurence tool was used to find the overlap between codes. As specified by Atlas.ti this operator is a combination of both Boolean and proximity search tools, designed to locate coded quotations that overlap. Table 6 displays the smart codes were generated

using the quotation cooccurance operator.After smart coding the listed categories, this allowed for the researcher to then extract and prioritize information from the reports to answer the questions presented in this report.

Chapter 4: Data Findings and Discussion

USAID's long-lasting efforts in reforming and managing Jordan's water sector have existed for the past sixteen years. Nonetheless, this research will focus on 73 documents published by USAID, which focus exclusively on water demand management in the Kingdom. In looking at the breakdown of the 73 documents, it is useful to highlight certain characteristics the reports. As a primary step, the reports were categorized by year of publication as show in figure 8. Approximately 60 percent (42 of the 73) of WDM projects were published from 2007 onwards indicating the heightened focus on WDM strategies in the Kingdom. This is not surprising given the official approval of Jordan's National WDM in 2008. Furthermore, report titles were analyzed through observing existence of five main themes: WDM, end use analysis, evaluation, social marketing, and sector (shown in figure 9). The most common phrase found the report titles was 'water demand management' (21 out of 73), it should be noted however, that 17 of these reports were IDARA (Instituting Water Demand Management in Jordan) reports and as such, the program name was in titles all of their reports. Specific programs will be further addressed later in the discussion and analysis.

Question 1: How is water demand being managed in Jordan? How has the Kingdom responded to the water crisis?

Contrary to what one might assume, WDM in Jordan was not the result of a top- down government initiative, instead the concept paved its way into Jordanian institutions and organizations that had the capacity and willingness to mitigate impacts of the crisis through implementing trial projects and drafting

policy recommendations and proposals (DAI *IDARA Final Report,* 2012). In 2008 the Council of Ministers approved the National Water Demand Management Policy that was created by the Water Demand Management Unit (WDMU), a serving body under the MWI (Ministry of Water and Irrigation). Much of the preliminary drive for WDM was initiated through raising awareness and sharing information with society about the advantages of resorting to more water efficient practices and overall water conservation. The success of WDM's impact on the Jordanian water sector and public would have been nearly impossible without international intervention.

Existing Water Governance Structures

To gather a better understanding of the current water management situation in Jordan, the coded paragraphs pertaining to WDM, governance and management reform, and water provision were analyzed. In order to understand how water demand is managed in the Kingdom, it remains essential to first understand the organizational structure. Currently, the three main authorities responsible for management, provision, and regulation of water resources in Jordan are the MWI, WAJ, and JVA, the organizational hierarchy is presented in figure 10. The *MENA Regional Water Governance Benchmarking Project: Country Profile Jordan* assessed the roles of several water management entities in Jordan by rating their organizational institutional capacity, strategic planning potential, adequacy of water provision, handling water resources, and service regulation (De Stefano, Brown et. al 2010). Results indicated that the MWI is the most prominent, instrumental, and influential water resource management agency in the country. The Ministry's role is absolutely essential as the duties within its

jurisdiction cover aspects of drafting water policy and strategies, organizing, planning, supervising the water sector, ensuring water and wastewater services, and managing the finances concerning national projects and water plans (Bakir, 2010).

The WAJ was created by an official law in 1983 as an administratively and financially independent entity tasked with ensuring overall municipal water supply, wastewater services, and regulating and monitoring well licensing (DAI, 2007a; "Improvement of Energy Efficiency of WAJ"n.d.; Haddadin, 2006). The WAJ centrally manages matters pertaining to employees, financial uncertainties, water quality monitoring, and large water project investments. Below WAJ, there are subsidized independent water utilities responsible for water provision within their designated governorates, as such Miyahuna: Amman, Aqaba Water Company (AWC): Aqaba, and Yarmouk Water Company (YWC): northern governorate or Yarmouk. Despite dispersal of water supply to individual companies, the WAJ remains the dominant entity with final and ultimate control. Because WAJ is responsible for rationing water supply and managing financial investments for projects, individual water companies like Miyahuna and AWC have less of an incentive to perform effectively and efficiently (DAI, 2007a). Hence, this explains the high water misuse in municipal sector and excessive water loss.

One of the main drivers of effective WDM involves transferring powers to water utility providers. Through relying on multiple water companies (in the case of municipal supply) or associations (in the case of water for irrigation) to provide

these water services, water delivery and management is more effective and efficient. The Jordanian Government has made significant efforts to decentralize water tasks, which has improved the overall system by reducing unaccounted for water loss, improved water quality, manage government finances more efficiently and increasing the population served (Haddadin, 2006).

Water Provision through Water Utilities and Water User Associations

In 2007, the WAJ created Miyahuna as a separate and private water utility responsible for ensuring water distribution and managing wastewater services for the governorate of Amman. It took over a decade for Miyahuna to transform from a government water company to a private utility (Mendez England & Associates, 2013a).

According to the Project Evaluation of the Institutional Support and Strengthening Program, Miyahuna's coverage extended to two and a half million residents of Amman and there were 532,221 metered customer records in their database (2013a). One of Miyahuna's main challenges Miyahuna is the excessively high level of water lost due to poor and outdated infrastructure, which accounted for greater than 60 percent prior to the year 2000. Nonetheless, the utility has made progress in reducing their total non-revenue water, which now stands at 33 percent (AED *WEPIA Final Report,* 2005; Bakir, 2010). Furthermore, the PAP's assessment of Miyahuna indicated weak communication within the organization and with the locals it served. When the Ministry temporarily changed the billing cycle from quarterly to monthly in 2011 locals were far from pleased. As evident from discussion on lost water and lack of public acceptance of Miyahuna, there is an evident lack of communication between water utilities and locals (Shridhar,

2012a). In addition, another obstacle lies within the realm of water quality. More than half of Amman residents rely on private water distributors for drinking water due to skepticism of public water quality (Shridhar, 2012a). General water quality leaving Miyahuna is considered high by Jordanian Standards, however customers receiving water of compromised quality are unaware that the shift in quality is likely the result of the channels by which water enters their homes (via pipes, faucets, reservoirs, and tanks) (Shridhar, 2012a; 2012; IRG, 201a) The lack of local understanding on this issue has led to high customer complaints condemning Miyahuna for the cause. In addition, Miyahuna's metering system reported 5000 inaccurate monthly readings, indicating clear room for technical improvement (Shridhar, 2012a). Despite these flaws, many government officials view Miyahuna as an example of successful decentralization and reorganization of water provision.

AWC was also established early in twenty first century (2004), and this public water utility is an example of Jordan's first and only quasi-independent water distributor. Unlike Miyahuna which is fully subsidized by WAJ, the WAJ owns the majority of (85 percent) AWC and the co-owner Aqaba Special Economic Zone Authority (ASEZA) owns 15 percent (Mendez England & Associates, 2013a). Because there is more than one entity governing AWC, lack of effective coordination and communication between the two owners hinders AWC's performance. AWC's population coverage surpasses Miyahuna, as they provide uninterrupted water services to all of Aqaba's130, 000 residents and as such is the top performing water utility in Jordan (Shridhar, 2012a; 2012b) Unlike

Miyahuna, Aqaba's residents completely rely on AWC for drinking water (Shridhar, 2012a; 2012b). Aqaba's water services span across 6,888 square kilometers and roughly thirty percent of the water provided is through reclaimed wastewater from agriculture and industrial sectors (Shridhar, 2012a; 2012b). Studies reveal that between 2004 and 2010, AWC reduced their nonrevenue water by 17 percent (Shridhar, 2012b).

The Jordan Valley Authority (JVA) was created in 1977 as a government entity responsible for the socioeconomic improvement, agriculture development, and management of the Jordan River Valley's water resources. The JVA is also tasked with handling the touristic development in the basin (Haddadin, 2006; "Improvement of Energy Efficiency of WAJ"). Recently, attention has been given to farmers and agriculture, as the former sector accounts for 72 percent of water demand and consumes 64 percent of water supply, but contributes to less than 3 percent of the Kingdom's GDP (NWMP, 2005). In Jordan, farmland owners account for an extremely small number of the total population nonetheless they comprise of the largest water users in Jordan. It has been noted that farmers have support from the government (De Stefano & Brown et al., 2010;; Denny et al. 2008). The Water Users Association (WUA) was created in 2001 by the JVA in attempt to devolve water provision duties to local farmers. The JVA's delegation of irrigation water distribution, monitoring and overseeing the network system, and managing local resources, allows for greater representation among the WUA, and for more effective and efficient water management and distribution (*Water Valuation Study*, 2012; National Water Master Plan 2004; Haddadin, 2006). As

indicated by Haddadin, these entities are strengthening the ties between the JVA and local farmers.

Inefficiencies in Management and Communication

The MWI holds the task of coordinating between the MWI, WAJ and JVA. The relationship between these three bodies has been a source of contention and highlighted area of reform and improvement for decades. The secretaries of both the WAJ and JVA report to the Minister of Water and Irrigation, who in turn possess the ultimate power over water related affairs in the country (IRG, 201a). Jordan's water sectors have identified with the looming water shortage through creating institutions and management structures to address their needs on local levels. However, despite the formation of these entities, existing government institutions continued to carry out their mandates, which created significant overlap across the MWI, WAJ, and JVA (IRG, 2011a). Nonetheless, this remains one of the largest inefficiencies of Jordan's water management structures.

The Institutional Support and Strengthening Program (ISSP) was designed and implemented by USAID with the objective of reorganizing and rebuilding the water sector (Mendez England & Associates, 2013a) ISSP evaluations of the current water management indicated significant overlap of tasks between the management structures, lack of accountability and transparency in the management of water resources, and a vague sense of responsibilities among the officials occupying these positions.

Inefficient Legal System

The WDM Policy intended to promote sustainability through maximizing utilization and minimizing waste of water resources in addition to promoting

water conservation (Water Demand Management Policy, 2008). At the heart of the strategy the two largest water users in Jordan are addressed: the Urban Sector and Agriculture Sector. Although this document provided logistical framework for sustainability, various sections and recommendations were ambiguous. To illustrate, in the 'on enforcement' section of Irrigated Agriculture, the policy states "Enforcement mechanisms must be introduced to ensure efficiency and address illegal use of water" (Ministry of Water and Irrigation). It is understood that different water authorities vary in their penalty systems for violators (ISSP, 2013). Nonetheless, the vagueness of this legal document may invite locals to take part in unethical practices, including theft. On October 29th 2014, the headlines of the *Jordan Times* noted that 3,000 cubic meters of water were being stolen per day (the equivalent of 792,500 gallons) by violators who had illegally placed diversion mechanisms on underground water pipes (Namrouqa, 2014).

According ISSP's assessment, MWI identified the current WAJ law as the most significant impediment to developing and managing Jordan's water resources in an integrated and sustainable manner. That is because the same water related functions are assigned to more than one body, the MWI regards the WAJ law as extremely vague and inflexible, thus inhibiting the creation of new laws (Mendez England & Associates, 2013a). The MWI is the fundamental government body accountable for water and irrigation matters in Jordan, however according to legislation there is no clear distinction between MWI functions and WAJ. For example Article (5) of WAJ law states "MWI shall carry the full responsibility for all water and wastewater systems and the related projects and

shall set forth a water policy and submit it to the Council of Ministers for Approval". However Article (10) of the same law notes "The Board of Directors of WAJ shall undertake the following duties and responsibilities: (a) set forth a water policy and (b) approve the water policy of the kingdom" (IDARA Legal Policy Analysis, 2008). Within the same law, the responsibility of preparing a water policy is given to two different water managing entities: WAJ and MWI (DAI, 2008c). The lack of clear coordination among the above mentioned authorities in addition to poorly managed priorities presents a major problem in Jordan's water sector (Haddadin 2006; Denny et al. 2008; Grover et al. 2010). Former water laws focused on creating entities for managing water resources without clearly differentiating between their obligations.

One of ISSP's main recommendations calls for restructuring the water sector in Jordan in order to more effectively provide, distribute, and manage these crucial water resources. In order to enforce sound water policies that draw on water use efficiency and integrated water resource management, laws must exists within the government system that reassert the institutional framework of the proposed policies. It is one thing to recommend institutional reform within Jordan's Water Sector, and another to update and reconstruct the water laws and legal framework essential to their enforcement.

As previously mentioned, one of the main impediments to Jordan's development is the legal system which does not promote adequate water conservation. WAJ laws broadly call for water conservation and discourage waste however there is a lack of specificity regarding water consumption among various

sectors and no word on how to safeguard this precious resource (AED *Assessment of WSD*, 2000). Even the 1995 Environment Protection Law No. 12 summarize consequences for those who impair water quality, but there is no mention of consequences for those who overuse and over pump water (quantity related). Likewise, Jordan's Penalty Law of 1960 fails to specify repercussions for those who waste or misuse water; the doctrine states, "All articles with respect to water issues in this law deal with general crimes relating to the water system in Jordan, such as actions that would negatively affect public sources of water " (AED *Assessment of WSD*, 2000). The vague enforcement and penalty systems outlined in these laws make it difficult to develop and implement specific policies and evaluation plans in the water sector. Although the Water For Life Strategy emphasizes that the government will eventually cap agriculture water use, the degree of enforcement remains unknown.

Although the Water Subscription Law does not explicitly mention water conservation devices, the mandate prohibits residents of domestic households to withdraw more than 75 m^3 per billing cycle, which is four times a year (AED *Assessment of WSD*, 2000). The contract between consumer and WAJ gives the latter the authority to disconnect the residents water supply for overuse, neglecting maintenance, and for abusing the metering network. Because the MWI is the overarching responsible entity for national water affairs, they have the right to end public water subscriptions if they deem any action of the former member a violation (AED *Assessment of WSD*, 2000).

Water Sector Reform

With future water demands rising, effective water governance is crucial for Jordan's development. ISSP recommended granting all administrative management, planning, water policy drafting, large-scale implementation, legal enforcement, and project implementation, to the MWI. In addition, MWI officials were to ensure water withdrawal was in accordance with issued licenses, and enforcing penalty systems for those who violated their permits (IRG, 2011a). The former was a task of the WAJ. In further distributing water sector roles, ISSP suggested the WAJ and JVA be responsible for abstracting, treating, and transferring large water supply to the individual distribution utilities. Individual water unities and WUA would then allocate irrigation and drinking water resources as needed (IRG, 2011a). Finally ISSP called for strengthening WUA's role through expanding their responsibilities to include sewage treatment (a task initially under JVA). With the proposed reform, ISSP sought to eliminate sources of error and redundancy in water provision; the proposed management reform is depicted in figure 11. Furthermore, ISSP believed the reform would strengthen the relationships and communication among these entities forming an interconnected and reliable water management system, shown in figure 12.

Question 2: How are USAID reports tied to water demand management? More specifically, how have these Reports focused on the water crisis; what was USAID's role in WDM?

For several decades, USAID has operated on a broad continuum in Jordan through developing and implementing various programs, which include water and health sanitation, gender equality, resource conservation, and community led initiatives. More notably, for the past seventeen years, their efforts have focused

on introducing and incorporating WDM strategies and principles into community lives and water sectors of Jordan. With approximately two decades of international commitment to remodeling and improving Jordan's technical, social, and economic infrastructure, it remains crucial to analyze the individual programs and evaluations produced. Although 73 documents were used in the data analysis, several of these documents were associated under the larger project headings. Figure 13 provides a timeline that illustrates the span of the six major USAID projects related to WDM in Jordan for the past decade. The breakdown of reports by program is shown in figure 14. The majority of programs took place after the first community based environmental program (WEPIA) ended, which remains significant to understanding the transformative path of WDM in Jordan. Of the 73 reports used in the analysis, figure 15 provides a graphical representation of types of documents produced. As indicated by the graphic, most of the identified reports were community assessments and evaluations. To answer the question of how USAID took part in WDM in Jordan, the six emphasized projects are discussed in order by which they took place in the Kingdom.

Water Efficiency and Public Information For Action (WEPIA) 2000-2005

The Water Efficiency and Public Information for Action Project (WEPIA) was a five-year program established through the Academy for Educational Development, funded by USAID. When WEPIA began in 2000, the MWI and government in Jordan were already in the process of researching water conservation methods. It was not until WEPIA however, that WDM was integrated into policy, society, strategy, and water sector management (WEPIA, 2005). Prior to 2000, WDM was not emphasized or institutionalized in Jordan, but

rather was a topic of conversation among government officials (Bakir, 2010). Nonetheless, WEPIA facilitated the expansion of WDM's definition to include water use and allocation, behavioral attitudes, nonrevenue water, community campaigning, and information exchange. In the PAP Survey Findings report, in 2000 an interviewed water official noted "We do not do water demand management in Jordan because we do not have enough water" (Bakir, 2010 p.5). It was clear through this survey that the concept of WDM was foreign to locals and thus it was statements such as the one described which fueled WEPIA's initiative in Jordan. In attempt to highlight the importance of water conservation and behavior change, WEIPIA stressed the importance of working on all levels of society, in government sectors, local communities, and with the private sector (Bakir, 2010). Their efforts focused on building capacity and sharing knowledge within communities and NGOs, allocating grants towards educational projects that would enhance community awareness regarding conservation efforts, and conducting water audits and building retrofits to implement water saving technologies in homes of residents (AED *WEPIA Final Report*, 2005). WEPIA also prepared several media campaigns, including television programs and pamphlets with a cartoon character named Abu Tawfir who promoted water conservation to appeal to the younger kids in hopes of drawing in public consciousness (AED *WEPIA Final Report*, 2005). Theoretical and skill based training sessions were held to provide participants with the professional proficiencies and techniques needed to effectively understand and promote water conservation.

WEPIA's original retrofit program was a four million dollars incentive-based retrofit plan that would save 10 mcm in 10 years (AED *WEPIA Final Report,* 2005). However, financial limitations forced WEPIA to retrofit large water consuming industries leaving household retrofit and behavior change as a subordinate target (AED *WEPIA Final Report*, 2005). With policy and legislative reform in mind, WEPIA would encourage large commercial buildings to use water saving devices. Building and plumbing codes would then be updated, and households would be incentivized to install WSD based on observed advantages from large commercial areas.

Instituting Water Demand Management in Jordan (IDARA) 2007-2012

The Instituting Water Demand Management (IDARA) project provides one of the most dedicated and important contributions to generating and consolidating water consciousness and awareness among communities and government entities in Jordan. The project was initially set for two years, however it was extended for an additional three; the overall span was 2007 to 2012. IDARA reports contributed to the highest count of program specific documents in this analysis (17). IDARA operated on three main fronts in Jordan: founding the organizational capacity for water demand management, drafting legal water conservation policies, and communicating water demand management strategies to communities (DAI *IDARA Final Report,* 2012). IDARA was designed to begin right after WEPIA ended in 2005, however due to several constraints the program did not begin for another two years (seen in figure 13).

Operations and Maintenance Training Program (OMT) Project 2008-2012

Operations and Maintenance Training Program was a four and a half year USAID program, launched in 2008 as one of the attempts to combat the growing water demand and diminishing water supply dilemma in Jordan. Jordanian organizations and OMT collaborated to create the Jordan Water Operators Certification Program, which allowed members and officials to go through certified training and learning programs that enriched their knowledge, capabilities, and technical skills in water management services. Several workers of private water utilities (Miyahuna and AWC) were trained and certified under the program (Chemonics Internatioanl Inc., 2012; 2010).

Public Action for Water, Energy and Environment Project (PAP) – 2009 2014

Public Action for Water, Energy and Environment Project (PAP) was a community based educational and behavioral program designed to support the various projects formerly implemented by USAID from 2009-2014. The program was broken down into three main phases: data collection and assessment of the current conditions, planning and establishing strategic visions for reform, followed by implementing changes. The nine reports identified in this analysis worked to increase the social, technical, political, and financial capacity of Jordan's water and energy infrastructure whilst focusing on behavior change, community involvement, and reducing barriers to information (PAP, 2011; *PAP Second Annual Progress Report,* 2011). Assessments involved identifying ways to improve the roles of NGOs and CBOs in Jordan.

Institutional Support and Strengthening Program (ISSP) 2010-2014

The ISSP was funded by USAID with the intention of supporting the growth, reform, and development of Jordan's water sectors. ISSP spanned across three years with an additional extension year, from 2010 to 2014. A total of 8 ISSP reports were included in this analysis. Members of the ISSP committee worked in close association with USAID, MWI, WAJ, JVA, water utilities, various ministries, government bodies, and the public and private sector to improve water management in Jordan. In order for the country to manage scarce resources and meet growing population demands, ISSP called for constructing long-term strategies and reforming the current water management organization. ISSP recommended sector reforms and considerations for stakeholders and private water utilities namely WAJ, JVA, and MWI (IRG, 2014; 2012a). Through addressing key factors such as contemporary management, organizational structures, legal policies, laws and bylaws, groundwater and surface water management, and organizational capacity, ISSP aimed to underline key institutional limitations and provide recommendations for creating a more effective, accountable, and efficient water sector.

After evaluating the situation in Jordan, collaborating with government officials and stakeholders, ISSP identified the dire areas where reform was essential. First ISSP called for creation of National Water Council (NWC). The NWC would include stakeholders, government officials, industry representatives and the public and would provide an environment for discussion, deliberation, and dialogue around water related issues (IRG, 2011a). With this democratic approach, sound water strategies developed by the Ministry would encompass the

viewpoints of a much more holistic and representative group of individuals. The council could also lead to more transparency and accountability within Jordan's water sector.

Another key proposal was to privatize Miyahuna, AWC, YWC and the WUA. To ensure the effectiveness of their performance, ISSP suggested that a Water Unit Regulatory Commission (WURC) be formed to serve as a third party who could oversee the effectiveness of service distribution of water utilities (IRG, 2011a). In figure 12, WURC is represented as the "regulator" and as such is also responsible for establishing pricing mechanisms for bulk water supply and facilitating communication between customer and bulk water suppliers.

ISSP really served as a stand-in body for the water management structures in Jordan. It is important to note that ISSP was not intended to achieve and implement long lasting reform, but was intended to initiate the reform process such that the momentum for reform becomes irreversible. It remains difficult to evaluate how much of the proposed ISSP reforms became an integral part of the water sector. The reports display nothing short of success on paper, and several of the recommendations have been incorporated into Jordan's Water for Life Strategy such as: creating a NWC, fully decentralizing water provision, establishing a WURC, and staff training (MWI "Water For Life Strategy", 2009).

Water Reuse and Environmental Conservation Project (WREC) 2010-2015

The Water Reuse and Environmental Conservation Project was funded by USAID in Jordan from 2010 to 2015. The project was implemented by AECOM, a United States based global firm, with the intention of looking at water and energy consumption in Jordan to identify potential reform areas for management

and water conservation. WREC shed light on finding innovative ways of making the industrial water and wastewater programs more resourceful, environmentally sustainable, and cost effective. Overall, WREC concentrated on monitoring water and wastewater facilities to ensure environmental sustainability, efficient process control, and minimization of resource waste (AECOM, 2010; Mendez England & Associates, 2013b). Through relying on a system of performance indicators, WREC evaluated the progress of these operations. The program objectives included organizational and regulatory empowerment, environmental conservation through mitigating industrial contamination, and water conservation programs for locals. WREC goals were to strengthen the institutional, technical, and human capacity of government ministries, affected parties, and workers within their scope of study.

Question 3: What programs (if any) have been implemented to operationalize WDM in Jordan? Have there been successful outcomes?

W E P I A Final Outcomes

1. Education and Training

WEPIA incorporated several water conservation programs into schools across all grade levels with attention tailored towards informing people about the advantages of using water more consciously, and not necessarily about reducing intake (AED *WEPIA Final Report,* 2005). WEPIA stressed the importance of identifying the root causes of water scarcity in Jordan, especially when the overall program objective was to promote water conservation behaviors (AED *WEPIA Final Report,* 2005). Moreover, WEPIA collaborated with several universities in the United States to offer courses on social marketing, xeriscaping, and

campaigning (AED *WEPIA Final Report,* 2005). In addition, WEPIA introduced a master's degree course in Jordan's University of Science and Technology in WDM and funded members of the MWI and Ministry of Agriculture to take it.

WEPIA also trained male and female religious authorities on water conservation techniques, which inspired them to give sermons on the importance of safeguarding water. With this awareness, Islamic scholars located 36 verses from the Quran where water conservation was referenced. This religious awareness further validated the appeal of water conservation in the country (AED *WEPIA Final Report,* 2005). In addition, NGO and Community Based Organization (CBO) staff were provided with on the job training in effective communication strategies, strategic planning mapping, and writing workshops for drafting reports and proposals. Further, NGOs led fundraising workshops, which drew on social marketing principles; effective campaigning resulted in a 30 percent increase in the Jordanians able to correlate population growth and escalating water demand (AED *WEPIA Final Report,* 2005) (shown in figure16).

Further, WEPIA inspired the formation of CBOs such as women and youth groups. Many women CBOs took part in advertisement and selling campaigns for WSD (AED *WEPIA Final Report,* 2005). Approximately 300 CBOs were trained on evaluation and monitoring techniques for assessing water efficiency progress in addition to managing grants. WEPIA provided 90 donations to CBOs for projects related to infrastructure improvement; the former improved the lives of more than four thousand local inhabitants (AED *WEPIA Final Report*, 2005).

2. Media Campaigns and Advertising

WEPIA incorporated and broadcasted informational messages on water conservation and awareness through various media channels including: TV programs, radio, cartoon characters, children's' books, newspaper articles, newsletters, brochures, and on their bilingual website. WEPIPA also created and aired several videos portraying the anatomy of the Jordanian water crisis in both English and Arabic to ensure language was not a barrier. The messages were intended to first explain the context of Jordan's water crisis, followed by how to take water conservation based action to alleviate excessive water demand. WEPIA aired biweekly TV shows on water conservation, however the TV programs were short-lived. Newspapers also added weekly columns addressing water issues, and even the country's national paper, Jordan Times designated a section for water conservation (AED *WEPIA Final Report,* 2005). Table 7 shows how water topics gained coverage as the program progressed; by the time WEPIA ended in 2005, coverage in local newspapers was double when it started.

Several of the promoted household water conservation techniques included water saving devices, rainwater harvesting, storage tanks, and xeriscaping (a landscaping tool used to minimize the amount of additional water needed when constructing outdoor spaces) (IdRC & AED, 2004a; AED *WEPIA Final Report,* 2005). WEPIA drew on xeriscaping and incorporated principles from the technique into national recreational areas, local streets, and recreational parks. Three parks were created using these water landscape conservation techniques in Al-Mansura, Irbid, Zatari, and Mafraq parks (AED *WEPIA Final Report*, 2005; *DAI, 2008a*). The National Gallery model park was chosen as an example of

successful xeriscaping technique as it was saturated with drought resistant plant species. Moreover, WEPIA won the "Best Campaign in Jordan Award for Two Years" in 2002 (AED *WEPIA Final Report*, 2005).

3. Retrofit Program

A portion of WEPIA's initiative involved retrofitting the largest water consuming buildings in Jordan's domestic and commercial areas. WEPIA's initial goal was to retrofit 60 percent of the buildings consuming more than 500 m^3 per billing cycle (AED *WEPIA Final Report*, 2005). Overall, there was an increase in the number of installed WSD and water recovery technologies in buildings throughout the program (AED *WEPIA Final Report,* 2005). Water saving devices varied from faucets, showerheads, toilet flushers, and flow regulators (IdRC &AED, 2004b). WEPIA implemented the Water Audit and Water Fixture Retrofit Policy, as a mechanism designed to promote and yield water and cost savings through resorting to WSD. Table 8 describes the chronological advantages of the policy. Although the retrofit policy was short lived, the end of the program estimated water savings at 18 percent. Observed water savings were proportional to the volume of area occupied by that sector. For example the government sector displayed 46 percent savings and these entities also represented nearly half of the retrofitted areas (AED *WEPIA Final Report,* 2005). Furthermore, hotels exhibited much higher percentages for water saving than their representation in Jordan indicating these facilities were among the highest water consuming areas (AED *WEPIA Final Report,* 2005). In addition water codes were updated under the Ministry of Public Works and Housing to include water

conservation standards. Furthermore, WEPIA also created a system for labeling, promoting, monitoring and evaluating WSD and water efficient products. To create a more representative environment, WEPIA hosted participatory events to include journalists, NGOs, and Ministry officials through a series of luncheons and workshops (AED *WEPIA Final Report,* 2005).

WEPIA also led community initiatives that implemented water conservation pilot programs in rural mosques, schools, and community centers (AED *WEPIA Final Report,* 2005). Because of WEPIA, 18 houses in East Shigera, a local village was improved through fixing plumbing fixtures, incorporating rainwater harvesting and xeriscaping.

5. Campaigns

The most prominent WEPIA held campaigns were: the Clean the Water Tank, Ramadan, Zad Al Kheir, Water Week, and the International WDM conference campaign. Specific results from WEPIA's Water Week Campaign survey displayed 71percent increase in local awareness of WSD (AED *WEPIA Final Report,* 2005). In 2004, WEPIA organized and hosted the first regional conference on WDM where 1000 members attended from 27 countries (AED *WEPIA Final Report,* 2005). One of the most significant contributions of this conference was the creation of 10 doctrines by various regional representatives that highlighted the importance of WDM strategies (AED *WEPIA Final Report,* 2005).

6. WEPIA's impact, a decade later

The WEPIA program terminated approximately a decade ago, thus it remains important to look at how Jordan's water sector has responded to the reforms introduced by the program. Certain learning tools and skills and techniques implemented throughout the WEPIA program remain very much a part of Jordanian society. Information on general water conservation, water saving devices and xeriscaping are available in two languages on the Center for the Study of the Build Environment's website (Bakir, 2010). Brochures, pamphlets, flyers and are scattered across various locations in Jordan. Although informational documents may physically be available, they may not be accessible to the public, and drawing this distinction remains important.

Also, training methods used with religious figures are available on the Jordan Environment Society website. The current secretary general of the MWI represents a model Jordanian figure, an expert in WDM and demand side strategies. According to PAP's Survey Findings of USAID and Other Donor Efforts in Outreach and Communications report, locals remained fond of WEPIA and recollect its success and several large water consumers: hotels and government buildings still use water saving devices (2010). Most importantly, PAP's surveys indicated an increase in public attitudes and value of water conservation and WDM. Overall, WEPIA had a positive influence on Jordan's water management and locals; more than half of current households in Jordan still practice water saving techniques. However, information from the report did not indicate any new organizational reform in Jordan's water sector.

Originally, WEPIA created a cartoon figure to resemble water conservation named Abu Tawfir. The fictional character has disappeared is no longer used in youth education (Bakir, 2010). Although WEPIA prepared websites for several ministries, (namely MWI and MoE), these sites quickly went out of date due to lack of use. The master's degree course that was previously offered at the Jordan University of Science and Technology (JUST) is no longer available. PAP surveys indicated two main reasons for the discontinuation of the course offering: students were less incentivized to pay out of pocket for something USAID was funding for the past two years, and second WDM is considered an new and soft field, a much different concept from established and highly valued medicine, engineering and science degrees (Bakir, 2010).

Final Outcomes of the IDARA Project In Jordan

Throughout the course of the project, IDARA was able to complete and surpass several of their goals. First, IDARA completed water efficiency best management practice brochure guides for hotels, hospitals, office building, landscape, and strategic communications for water and energy utilities. In addition, IDARA collaborated with Miyahuna to promote the use of water saving devices (WSD) in a residential pilot program in Abu Nseir. In addition IDARA launched a pilot metering program for residential end use covering the five largest commercial and institutional water use categories: government buildings, hospitals, hotels, schools, and mosques. Through outreach and community based efforts, IDARA assisted 137 households from low income areas in the Governorate of Zarqa and Mafraq in improving water use efficiency and increasing water availability. IDARA's major outcomes are represented in table 9.

Final Outcomes of OMT

The Operations Maintenance and Training Program surpassed their goals and objectives. Throughout the course of the program, a total of 252 operators, trainees, coaches, developers, and managers were qualified for 324 national certificate programs (Chemonics International Inc.,2012). Participants were trained in various fields including water and wastewater management, water and wastewater treatment, laboratory operations, and water provision and distribution management. OMT's training process was theoretical and practical. Further, because of OMT, "Jordan was the first country in MENA to legalize the licensing of water and wastewater operators" (Chemonics International Inc., 2012 p. 5) The success of this program had much to do with the fact that water distributing companies were looking for ways to improve their overall customer service, distribution efficiency and organizational structure. The OMT program excelled because evaluation and monitoring programs designed to assess formerly trained officials displayed positive results in the facilities (Chemonics International Inc., 2012).

Final Outcomes of PAP

PAP was a five-year project including an extension period from 2009 - 2014; given that PAP just ended, many of the final outcomes have not yet been published. In order to extensively evaluative PAP's progress after the second year, the project hired a United States behavior change and evaluation expert professor to update and evaluate the performance indicators (ECODIT LLC *PAP Second Annual Progress Report,* 2011). Dr. Middlestadt's recommended performance indicators for evaluating behavior change are shown in table 10.

PAP was also responsible for training NGO and CBO members and private company officials in various aspects such as: public speaking, campaigning, social marketing and behavior change principles, and advocacy principles (Chesrown & Dergham, 2010; ECODIT *PAP Second Annual Progress Report,* 2011). The workshops and training sessions were suited to participant needs and completed in Arabic and English. PAP also resorted to media campaigning to spread awareness and broadcast water related messages to Jordanians. This included covering water scarcity and conservation topics through using television, radio, and magazine channels (ECODIT *PAP Second Annual Progress Report,* 2011). PAP's second annual Progress Report indicated an increase in public awareness of water conservation and in residential homes adopting conservation measures (2011). PAP also worked with government ministries and water utilities to improve their communication strategies (Shridhar, 2012a; 2012b) Furthermore, PAP plans to incorporate Arabic and English social marketing training sessions, however this objective is still in the process of implementation.

Final Outcomes of ISSP

ISSP produced several studies: Water valuation Study, Socio Economic Study of Groundwater Uses in Jordan, Groundwater Valuation Study, Wastewater Master Plan, Business Plans for Miyahuna and AWC (IRG *ISSP Year 3 Annual Report*, 2013 Report"; Mendez England & Associates, 2013a). The Water Valuation study focused on the agriculture sector in Jordan as it aimed to evaluate the impact of water prices on food production (*Water Valuation Study*, 2012). The socio economic study of groundwater focused on identifying the various impacts

of groundwater abstraction across all Jordanian sectors and political framework governing groundwater use (*Water Valuation Study*, 2012; Mendez England & Associates, 2013a).

One of ISSP's main recommendations was constructing a Bulk Water Supply unit as part of the WAJ; the report noted that the implementation of this specific aspect is still pending because WAJ has restricted its progress (Mendez England & Associates, 2013a). Reports indicated this may be attributed to the 'don't rock the boat' mentality adopted by numerous government officials (Mendez England & Associates, 2013a). This mentality has imbedded itself in the mindset of major political figures and decision makers in Jordan and according to ISSP it hinders progress on developing the duties of WAJ's Bulk Water Supply Unit.

Policy changes have been slow to take effect in Jordan; this is due to several reasons. As already noted, established laws are often vague and discourage assertive behavior. In addition, the ongoing political and civil unrest in the Middle East has delayed policy reform (Mendez England & Associates, 2013a). An initial assessment report including a list of surveys and financial assessments were completed for WUA, however pilot programs intended to take place in the Jordan Valley were still waiting for JVA consent (Mendez England & Associates, 2013a). In addition, government officials were constantly changing positions throughout the duration of ISSP and this made it difficult to move forward. When surveyed, some MWI officials viewed ISSP's reforms as purely theoretical, others suggested that ISSP would fail to achieve its sector

restructuring objectives due to the short-lived nature of the program and lack of long-term commitment (Mendez England & Associates, 2013a). Ministry officials were skeptical that any transformations within Jordan's management structure would occur in the near future.

ISSP also created a Geographic Information Systems WDM database in order to provide government agencies with technical tools needed to make informed decisions. The database carried information on groundwater well status, distributed licenses. Under ISSP, more than 20 MWI members were trained in department organization, various training aspects, and institutional strengthening (Mendez England & Associates, 2013a). During ISSP's evaluation year, both quantitative and qualitative data were used to determine the transformations and trends that occurred in the water sector. ISSP interviewed USAID project managers, beneficiaries and stakeholders, officials of water utilities and Ministry officials. Group discussions and workshops were held with various groups such as the Water User Associations, to determine what lacking resources were impairing their movement forward. Overall satisfactory readings indicated that groups working with ISSP were content with the project. Miyahuna reported the lowest satisfaction levels whereas the JVA reported the highest (Mendez England & Associates, 2013a). ISSP stressed that MWI reorganization was crucial for obtaining the project's objectives. ISSP submitted a revised MWI bylaw, which included the reform required to enhance the current inefficient management structure. The only way for reform to take place is for the water law to be approved and enacted; the reports provided no further information on the approval

of the bylaw. In a personal communication with the former Minister of Water and Irrigation the legal process for amending and enacting laws was explained. Generally in Jordan, the concerned minister drafts a law and forwards it to the Council of Ministers (Cabinet). The Cabinet then forwards the law to the Legislation Department to ensure it is in accordance with the Constitution. If approved, the law is sent back to the Cabinet for approval and then to the lower House of Parliament where elected deputies debate and review the law. The lower house forwards the law to the legislation committee who call in the concerned minister for discussion. The reviewed law is then sent to the Floor where it is debated and voted on further. If approved, the law is sent to the upper house of Parliament or Senate (these are officials directly appointed by the King and their number is half the number of elected deputies) if not approved it is returned to the Cabinet. The lower and upper house review and amend the law until both Houses vote on it. Once both Houses pass the law, it is forwarded to the King who issues a Royal Decree. The law is then officially published in the Official Gazette with the effective date (M. Haddadin, personal communication, April, 5 2015).

Final Outcomes of WREC

The WREC project is still in the process of implementation because it is expected to carry through until July 2015. WREC's assessment of the Ministry of Environment's (MoE) authority and overall responsibility was weak, and insufficient to ensure Jordan's long-term path towards effective WDM and environmental sustainability (Mendez England & Associates, 2013b). With WREC's intervention and assistance, the MoE created an action guide for improving and strengthening their organizational structure and regulatory

capacity. Further suggestions included requiring industrial projects undergo environmental impact assessments in order to determine the potential socioeconomic and environmental impacts. The WREC study indicated that the industrial sector intends to move towards ensuring environmental compliance and sustainability; as such they are looking into adopting conservation and energy efficient practices as long as long as associated costs are not high (Mendez England & Associates, 2013b). Furthermore, WREC noted that recent industrial areas are managing their waste more efficiently and effectively than older industrial sites (Mendez England & Associates, 2013b).

Question 4: To what extent has community based social marketing and played a role in water demand management in Jordan? To what extent is the public aware of this issue?

Of the total reports, 21 referenced social marketing and 16-referenced behavior change (seen in figure 17). Of those mentioning social marketing, 9 were WEPIA and 7 were PAP. Furthermore, approximately half of the behavior change reports were under the PAP program. This discussion will shed light on the community efforts and social marketing strategies present in these reports.

Public Action for Water Energy and Environment Project

After interviewing the CEO and major department officials of Miyahuna, the assessment revealed an underlying genuine commitment to providing Jordanians with the greatest customer service possible (Shridhar, 2012a). Despite the communications manager's guarantee that social marketing and behavior change were a primary focus of the communications department, PAP's examination of Miyahuna's organizational structure revealed the lack of

importance credited to communications both within the organization and among customers (Shridhar, 2012a). Many of the Miyahuna employees did not understand or value the importance of effective communication; this provides an indication as to why customers' satisfaction of water quality is relatively low. Nonetheless, PAP recommended incorporating communication strategies and individualized communication plans highlighting long term and short-term company goals in every level of the department (Shridhar, 2012a). PAP also urged Miyahuna to conduct social marketing campaigns to inform and educate the public on water scarcity, efficient water use, and misconceptions about water quality (Shridhar, 2012a). Through emphasizing and strengthening communication with customers, this would encourage proactive behaviors more likely to enhance customer service and trust with Miyahuna.

PAP also assessed AWC's communication department to uncover the relationship between customers and the water company and the type of information and services available to them. Further PAP was interested in AWC's goals and objectives, organizational structure, existing communication programs, and transparency and accountability between stakeholder and consumers (Shridhar, 2012b). The interview with AWC's CEO revealed a positive and strong commitment to customer service in Aqaba. However despite AWC's excellent water supply coverage, the importance of communicating the value of water to Jordanians was poor (Shridhar, 2012b). PAP suggested AWC draft a communication strategy that stressed water efficiency, conservation, altering

behaviors, and the general need for adopting a water efficiency program (Shridhar, 2012b).

Among the challenges communicated throughout this assessment, the most prevalent was the lack of awareness regarding IDARA's new plumbing codes, which clearly affected water distribution and management (Shridhar, 2012b). Because AWC is dually owned by WAJ and ASEZA, there was dispute over who was responsible for implementing the codes in Aqaba (Shridhar, 2012b). AWC's public relations manager emphasized the lack of awareness AWC had for the new plumbing system proposed by IDARA. (Shridhar, 2012b). Furthermore, when interviewed, the public relations manager noted that Aqaba had a strong support for developing and integrating communications across all levels of the company. Despite high levels of customer satisfaction for AWC, social marketing and behavior change strategies must become an integral part of the company's long-term action plan.

The degree to which communication is used in these water utilities should be a top priority for several reasons. Although Jordanians are aware of the water shortage, there is limited information on how the public can engage or take action at a local level to address the crisis on a local and residential level. In battling the future water crisis, communication strategies should be concurrent with utility business plans and emphasize transparency and accountability to create an open and participatory organizational structure.

As communicated in the PAP's communication strategy, adopting water efficient and conservation behaviors and attitudes remains one of the key drivers

for effectively implementing WDM policies. The report categorized target institutions into two main groups: soft institutions and technical firms and agencies (Communications Strategy, 2012). Soft institutions were seen as those working closely with younger individuals, educators, women, and organizations, whose work revolved around outreach and campaigning, with less knowledge on social marketing concepts. On the other hand, members of the MWI and water utility companies represented the technical agencies that had scientific and technical backgrounds with little to no emphasis on communication. In Jordan, there is a large gap between these two institutions, which is further contributing to the miscommunication between decision makers, water consumers, and those in power. The PAP study revealed that in Jordanian universities, communication courses were not prioritized and very little was done to keep the curriculums updated on social marketing principles (PAP 2011, p. 4). Again, the fact that science degrees are valued significantly higher than any other social based learning objective, reaffirms the need to inform the public of what WDM really is and how it remains relevant to coping with the water crisis in the country.

PAP's assessment revealed major gaps and miscommunications between ministries, water utilities, and NGOs in addition to the limited public discussion about water management issues (PAP, 2011, Chesrown & Dergham, 2010). The assessment stressed the urgency of strengthening communications, building trust, accountability, and transparency between organizations and the public. In order to do this, the PAP developed a list of purposes and behaviors shown in table 11 that targeted youth, large water consumers, and the agriculture sector. One of the most

important factors to consider is that more half of Jordan's population is considered youth; targeting this group is an investment in the future as they will be the future face of change, political reform, and management (PAP, 2011). Jordan's water crisis is only growing more severe; if the current situation proceeds, the country will likely face a threatening national security crisis. Thus, it remains imperative to strengthen the relationships, transparency, accountability and trust between Jordanians, the water sector, and government officials.

WEPIA

The WEPIA Program, initiated in 2000 was the first of its kind to address WDM in addition to social marketing and behavior change in Jordan (Bakir, 2010). Many of the project outcomes served as a learning experience for NGOs, government officials, water utilities and the general public (WEPIA, 2005). As noted in WEPIA's Final Report, many social marketers lacked sufficient experience with applying CBSM strategies to water sectors, and vice versa. Nonetheless, the success of WEPIA program validates that a holistic and integrated approach is required to develop and sustain environmental based programs (AED *WEPIA Final Report,* 2005). WEPIA worked with communities and various stakeholders to encourage and instill water conservation behaviors. The program's efforts relied extensively on social marketing to drive the pubic in confronting Jordan's water scarcity. WEPIA collaborated with the government and communities to empower and build strong center forces and advocates of environmental sustainability and water conservation to encourage the use of WSD while establishing the pivotal role of communication (WEPIA, 2005).

IDARA

A total of 2 IDARA reports referenced social marketing and only one alluded to behavior change; this was the Work Plan to Implement a Labeling Program for Water Efficient Products (2009). Unlike WEPIA, IDARA did not identify as a social marketing program but rather, as an example of how policy, management, and social reform is more than a result of media advertising and campaigning. Through improving WDM, IDARA targeted social behavior, institutional frameworks and organizations, in addition to promoting technological innovations for monitoring water demand and efficiency. In an attempt to build knowledge of water conservation and demand management, IDARA focused on school education systems and curriculums, promoting learning through media advertising and campaigns, training and communication programs, and demonstration projects (DAI, 2009d).

Community Based Initiative

The Community Based Initiative for WDM was a project designed in 2006 that focused on community rehabilitation and empowerment in rural areas of northern Jordan that remain heavily populated by Syrian refugees from the recent war (Corle et al., 2014). CBI was a seven-year program originally implemented by Mercy Corps in collaboration with the Royal Scientific Society and Jordan River Foundation. However in recognition of the escalating crisis and high influx of Syrian refugees, the project has been extended. The number of registered refugees in the northern governorate alone is approximately 584,600; the approximation is higher when unregistered refugees are accounted for, 1.4 million (UNHCR, 2015). The northern governorate remains highly characterized by

inefficient water and sanitation services, uncoordinated local governance and, limited resource availability. The influx of refugees in this region has only exacerbated the demand for water and water related resources, thus straining the government and service providers.

CBI focused on 135 local communities in the northern governorates that posed greatest demand for water resources: Mafraq and Irbid. A map showing the various governorates of Jordan is provided in figure 18. The purpose of this program was to empower and equip rural communities with the tools they needed to combat water scarcity and maximize water efficiency (Corle et al., 2014). The program objectives involved assessing the current water allocation system, identifying inefficient water practices and existing water conservation methods. CBI also focused on improving YWC's poorly managed network system in order to enhance public water distribution and provision. Perhaps CBI's most crucial objective was to understand the interpersonal relationships between Syrian refugees and the residents of Mafraq and Irbid, and alleviate heightened tensions that exist due to competition over resources (Corle et al., 2014) Theoretically, the program operated on the premise that if water management and provision were improved, competition over water resources would subside. By funding CBOs, households could install water saving devices and water use efficiency techniques to alleviate water intake and promote overall water conservation. Although CBI is still in the early stages of development and implementation, the Mid Cycle Portfolio Review USAID document has drafted an implementation plan based on

pre-established theories of improving service coverage and mitigating conflict among residents of the north (shown in table 12).

Question 5: How is each sector (Agriculture, Municipal, Industrial,) responding?

In looking at the 73 reports included in this analysis, figure 19 provides a representation of how many addressed various sectors. Through examining primary distribution among sectors, most of the reports referenced the municipal sector, which was defined by: residential, domestic, and water utilities. Commercial and industrial sectors were the second highest (10) as this accounted for reports that mentioned educational facilities, restaurants, hotels, and large water consuming buildings. Only 4 documents were specifically related to agriculture and irrigation water in Jordan Valley and Highlands. In the secondary distribution, there were 20 documents that equally referenced all three sectors. Jordan has worked to institutionalize WDM policy recommendations across all sectors. Jordan's national WDM policy provides tailored recommendations that include limiting agriculture water withdrawal while increasing supply for municipal and industrial sectors (Khaleq, 2004). Although the Water For Life Strategy and National Water Master Plan were not included in the 73 reports, the documents signify Jordan's future vision for implementing WDM and conservation across all institutions in Jordan. The vision plans in these documents rely heavily on the recommendations set forth by IDARA, ISSP, and PAP programs.

Municipal Sector

Over the past decades, one third of the Jordan population has gained awareness of the threatening water crisis and water conservation techniques (AED *WEPIA Final Report*, 2005). According to the Communications Strategy for Achieving Behavioral and Policy Changes in the Water, Energy and Environment Sectors, as of 2010, more than half of Jordanians could recite water conservation techniques, almost half still practiced conservation or had water saving devices installed in their homes (2011). Further, according to surveys and assessments, several hotels, commercial buildings and government institutions still have water saving devices within their buildings. The MWI updated building/plumbing codes to require the use of water saving devices and other conservation based measures such as rainwater harvesting and stormwater collection fixtures (MWI "Water For Life Strategy", 2009). The codes call on using more efficient toilet flushers and faucets, as these two accounted for the greatest water use in residential facilities (DAI *IDARA Perform End Use Analysis- Residential Water Use Baseline Survey* 2011). Furthermore, with respect to IDARA's efforts, Jordan's plumbing codes have been updated in the National Jordanian Codes and Standards of Construction document. Overall, the degree of enforcement and compliance remains questionable because levels of implementation have not been reported.

Improvement in Water Utilities

Water utilities have technologically advanced through incorporating water demand tracking devices that forecast future water demands. It remains noteworthy that Miyahuna, AWC, and YWC were the 6th, 7th and 8th water utilities to incorporate the Water Use Efficiency tool, in the world (DAI *IDARA*

Final Report, 2012). Miyahuna has reduced their non-revenue water to 33 percent; initially it was over 50 percent, this is compared to the average 20 percent water loss in most United States water utilities (WEPIA, 20005; Communication Strategy, 2011; Shridhar, 2012a; Black & Veatch, 2015; "Contentanalysis.org", 2015). In terms of technological advancements, 75 percent of Miyahuna's water and 45 percent of wastewater services are incorporated into GIS models (Shridhar, 2012a).

According to IDARA's Residential Water Use Baseline Survey in 2011, the majority of Miyahuna customers reported that their water storage reservoirs were in satisfactory condition, and a mere 3percent mentioned issues with leaking pipes (DAI *IDARA Perform End Use Analysis- Residential Water Use Baseline Survey* 2011). This could be due to several reasons: lack of understanding as what constitutes as a sufficient piping network, avoiding incurring additional costs with replacing poor systems, and a general lack of knowledge concerning the severity of dysfunctional infrastructure. Studies varied in their reporting on customer satisfaction with Miyahuna. Miyahuna's Communication Assessment reveled that customers had low trust for the water utility and condemned the company for the poor water quality they received (Shridhar, 2012a). Most recent ISSP final report notes that overall water utility management is inefficient and expensive (Mendez England & Associates, 2013a). One of the main reasons for high costs is the extremely old network system that is impairing water quality and leaking, thus exacerbating non- revenue water. However, water utilities noted that

rehabilitating the network system was expensive and not the responsibility of individual utilities to finance (Mendez England & Associates, 2013a).

In general, water utilities have independently improved in terms of reducing non-revenue water and consolidating efforts to achieve total customer gratification. Because AWC is the sole water provider for the entire governorate of Aqaba, it has no additional water companies to compete with, and owns all of its assets (Mendez England & Associates, 2013a). According to IDARA's Residential Water Use Baseline Survey the greatest residential water consumption occurs in Amman, which is obvious given it is the largest area with the densest population (87 percent), followed by 84 percent in the Northern governorate supplied by YWC, mainly because this area reported the highest outdoor water consumption for private irrigated farms (2011). The greatest use of indoor water was in Aqaba 97 percent, tailed by Amman at 96 percent, and the Northern governorate at 90 percent (DAI *IDARA Perform End Use Analysis- Residential Water Use Baseline Survey* 2011). The two main household fixtures that correlated with the highest water consumption were kitchen faucets and toilet flushers. It was further noted that current meters in Jordan fail to accurately report water use and readings are often flawed (Grover et al., 2010). Furthermore, IDARA's Residential Use Baseline Survey indicated that wealth and household size/type were factors that certainly affected water consumption patterns however gender, age and education status had no effect on water use (IDARA's Residential Water Use Baseline Survey, 2011).

The country's water sources have declined substantially from when water laws were created and illegal water use and theft remain prevalent in Jordan. Some farmers argue their right to withdraw excessive amounts of water through land ownership. It was even noted in PAP's surveys that farmers often feel justified in stealing water from the government because it is the latter's job to ensure sufficient supply (PAP, 2011; Bakir, 2010). It unfortunately goes unnoticed that water theft, illegal water use, and misuse feed into an inefficient system; one ultimately governed by corruption. Jordan's local news has published several articles noting the illegal water use and theft throughout the country. Illegal water users are rarely subjected to law enforcement, however since 2013, the MWI has taken severe action to monitor and maintain Jordan's water network system and close down illegal wells (Namrouqa, 2015). According to Namrouqa, new provisions to the 1988 WAJ stipulate that violators of water and wastewater projects could be subject to imprisonment and charged anywhere from 5,000 to 7,000 JDS (roughly 7,060 - 9,882USD). [2]

Government officials, stakeholders, and private companies are well aware that managing water demand and recommending water strategies and reforms will yield savings and bridge the gap between water supply and demand. WDM has displayed enough evidence to suggest this. The National Water Policy Advisory Council was recommended by ISSP and established in 2012 to evaluate and provide policy recommendations to the Ministry (IRG, 2011a; MWI "Water For Life Strategy", 2009).

[2] Per capita income average for Jordan is 5,214 USD, compared to United States 53,042 USD. World Bank Group 2015

Agriculture Sector

According to Jordan's Water For life Strategy, irrigation constitutes as 71 percent of the total national water demand and uses 64 percent of the water supply (MWI "Water For Life Strategy", 2009). In 2009, irrigation water consumption was 584 mcm whereas water for livestock and farming accounted for only 10 mcm (*Water Valuation Study*, 2012). That same year irrigated agriculture accounted for half of the total pumped groundwater for the all sector's needs; this also translated to 80 percent of the total renewable groundwater availability (*Water Valuation Study,* 2012). If groundwater use remains unrestricted, the agriculture sector's water demand will reach 1050 mcm in five years, and by 2050 irrigation water demands will reach an astonishing 1,374 mcm (MWI "Water For Life Strategy", 2009). To combat the excessive water use by this sector, MWI's Water For Life Strategy recommended limiting agriculture withdrawal and incorporating a water tariff to more accurately reflect the price of water and discourage wasteful behavior.

In order to meet irrigation water demand and reduce direct sectorial competition over groundwater resources, the agriculture sector now relies on treated wastewater from the As Samra Wastewater Treatment Plant to meet its demand (*Water Valuation Study*, 2012, ECODIT, 2005). That way there is less competition over groundwater with municipal and industrial users. Some farmers of the Jordan Valley indicated satisfaction with using treated wastewater as opposed to surface water (IRG, 2011a; MENA regional, 2010). Jordan's Water For Life Strategy notes that the agriculture sector uses more than 100 mcm of treated wastewater annually, which indirectly serves more than half of the

population (MWI "Water For Life Strategy", 2009). This is a major breakthrough given that ten years ago using treated wastewater for food production was far from acceptable in the country. Most of the effluent discharged from As Samra flows to the Zarqa River, which ends up in the Jordan Valley irrigation network. Treated wastewater has become an important and additional source of water supply in Jordan, and the Aqaba wastewater treatment plant is recovering water for industrial and agricultural use (Alfarra, Al. 2009).

Water Prices

Most literature agrees that the current water pricing system in Jordan is not reflective of the actual cost of water. Water value does little to account for extraction, treatment, conveyance, distribution, and monitoring. According to the WDM policy, current water and wastewater pricing mechanisms are designed to discourage high water use by charging higher prices for higher quantities of water use (2004). In Jordan, water is priced according to the size of the pipes. Thus, customers are not charged for an accurate volume of water and without metering there remains no way to tell how much they are actually receiving. Those with different pipe sizes (typically larger) are not incentivized to reduce water use or conserve water. This system invites reckless water use and waste. Kubursi argues that incorporating a system of volumetric pricing is more efficient and fit for promoting water conservation in Jordan. With volumetric pricing, the water price increases incrementally with use; as such economists argue that higher water prices will promote water conservation behaviors (Kubursi et al., 2011).

ISSP's Water Valuation Study noted that farmers in the Jordan Valley pay negligible amounts for water and that the price of water in the Jordan Valley is

less 2 percent of the cost of agriculture production (*Water Valuation Study,* 2012). In the highlands, where most of the water used for irrigation comes from groundwater reservoirs, the water cost is 8 percent of production. The former phenomenon has led to excessive water consumption and agriculture production in the Jordan Valley, as it remains more profitable (*Water Valuation Study*, 2012). The prices are so artificially low in the Jordan Valley that there is no incentive to conserve water. Farmers in the Jordan Valley pay 0.012 per m^3 for water; in the highlands the pumping costs alone are 0.25 per m^3 (*Water Valuation Study,* 2012). This has encouraged farmers in the highlands to rely on groundwater irrigation rather than pumping water from the valley (*Water Valuation Study*, 2012). Nonetheless, ISSP, Haddadin, and Kubursi recommended that charging farmers higher prices could lead to cautious water use, incentivize workers to farm higher value crops, and secure funding for improving the irrigation network (*Water Valuation Study, 2012;* 2006).

One of main reasons for high water use in the agriculture sector is the thirty-year-old irrigation network. No information studied in this analysis was indicative of efforts to improve the network. It is recommended that the network be granted higher priority; in addition the government should incorporate a system of water pricing that reflects the actual production, maintenance, distribution and allocation cost of water. Jordan's Water for Life Strategy listed increasing water tariffs for irrigated agriculture and improving the irrigation network as some of the key future goals (MWI "Water For Life Strategy", 2009).

Decentralizing of JVA Water Provision

There are 26 WUA of which 16 are official (Mendez England & Associates, 2013a). Although it is not through formal law, the Task Transfer Agreement allows the WAJ to distribute water to local farmers, which is the case for 16 WUA. WUA were established under the Cooperatives Law, however the lack of specificity has left many of these associations without any benefits like medical insurance or social security (Mendez England & Associates, 2013a). When interviewed WUA members indicated that current JVA financial allocation was based on area and not water needs, and thus inefficient.

According an ISSP report not included in the 73, WUA are successfully managing water distribution in the Jordan Valley. Surveys reported that farmers' level of satisfaction "Reached 83 percent for managerial aspects, and 58 percent for technical aspects of retail water distribution by WUA" (IRG, *ISSP Existing Water Conditions Survey and Assessment of Water Users Associations in the Jordan Valley Report*, 2013, p. 19). Through relying on WUA, localized entities can monitor the distribution networks along with other managerial and maintenance tasks. WUA are expected to give rise to 30 percent in water savings (IRG, *ISSP Existing Water Conditions Survey and Assessment of Water Users Associations in the Jordan Valley Report*, 2013).

Crop Efficiency

Denny et al. note the very little communication and awareness of farmers concerning water resources in Jordan. Bedouins have been cultivating the lands for decades and many still rely on flood irrigation techniques to produce their traditional harvests (Denny et al. 2008). Furthermore, there is a strong sense of

tribe and tradition, more often than not international agencies and foreign consultants do not share the same ideals and visions as local farmers. As indicated in figure 20 for the past three decades, Jordan's main exported crops are tomatoes, clover, cucumbers, potatoes and olives. Grover, Kubursi, and Haddadin have collectively suggested that Jordan practice crop alteration to irrigate less water intense crops. Despite efforts to introduce crop alterations farmers are still overproducing water demanding crops like tomatoes and clover (Grover et al. 2010; FAO, 2008). Tomatoes are water intensive crops produced all year round and exported to other countries in the region. With respect to the growing water scarcity in the Kingdom, famers should consider altering crops by harvesting high value crops that do not consume as much water (Grover et al. 2010; Kubursi et al., 2011).

USAID attempted to improve the irrigation network through promoting pricing structures, decentralizing water provision, and strengthening the role of WUA. Nonetheless, the irrigation network has not received the attention it deserves; if it remains this way the agriculture sector will continue to be Jordan's prominent water user. According to the WEPIA final report, several international organizations such as the World Bank, Japan International Cooperation Agency, and USIAD financed a program designed to restructure the water distribution network in Amman and other large cities in Jordan, in addition to recovering polluted springs and reservoirs in Jordan (AED *WEPIA Final Report*, 2005). Furthermore, because of the Reuse for Industry, Agriculture, and Landscaping Project, (RIAL) not included in this report analysis, treated water has been given

more appreciation in Jordan's overall water management. Wadi Mussa is the only currently functioning water reuse site that utilizes treated wastewater from the Wadi Musa wastewater treatment plant for non-agricultural purposes (Bakir, 2010).

Commercial and Industrial Sector

Discussion of WDM in the commercial and industrial sector was not as prevalent as in the municipal and agriculture sector. Nonetheless, BMP guides for water conservation in hotels, restaurants, large commercial buildings, and high-rise and high-density developments are used thanks to IDARA (DAI, 2011a). Although the industrial sector's water demand represents 5 percent of total national demand and relies almost entirely on groundwater, projected water demands are rising; water for industrial processes may reach up to 307 mcm in thirty-five years (De Stefano & Brown et al. 2010; MWI *Water For Life Strategy*, 2009; Mendez England & Associates, 2013a, 2013b). With the growing industries expected to kick off in the next five years, the country must find ways to meet the growing sector's water demand.

The WREC project assessment is still in the implementation phase as such no figures have been published. Nonetheless, WREC notes that 150 industries were selected and trained on environmental sustainability and management with focuses on water conservation and pollution prevention. Thirty-two of those industries went on further to sign memorandums of understanding and went through further monitoring and evaluation procedures to improve their overall management (Mendez England & Associates, 2013b).

Limitations

Limitations of Methods

Although content analysis serves as an efficient and timely mechanism for coding and manipulating data of significant lengths, the methodology as with any qualitative and quantitative analysis tool has its limitations. To reference the most discernable restraints, the method is limited by the availability of data. Given content analysis is restricted by data that remains accessible, answers to research questions may exist outside the scope of this research. The coding process is subjective; because it was tailored to the definitions of water demand management and questions of the report. Thus autocoding, smart coding, and running proximity and Boolean searches are also subject to error and bias. Expanding the word searches or breaking the codes up into smaller fragments may have yielded different results. To gain a greater and more holistic perspective on Jordan's water management structure and reform in adopting WDM, different modes of gathering information should be pursued in the future. One should examine alternative data sources, and not have to rely on international project documents as a source of data. It has been noted that content analysis does not always uncover the fundamental intentions of observed patterns, which is what this data analysis was attempting to focus on ("contentanalysis.org", 2015).

Technical Limitations

Software constraints were numerous and throughout most of the analysis Atlas.ti was difficult to manage. Originally, the researcher planned to observe and document the frequencies and proximities of word searches and phrases across all documents. The version of software used has yet to develop an option for creating

word frequency outputs for specific chosen words and phrases. When attempting to autocode, run frequency charts and Boolean searches by document, the software quit unexpectedly several times and often crashed while trying to produce outputs. The software had a steep learning curve and was very time consuming; the software program is not recommended for future research.

Data Limitations

Only USAID documents available through the Developmental Clearing House database were included in the data analysis to insure methodological consistency. Other international efforts were not included such as the World Bank, Mercy Corps, and United Nations. Often USAID collaborates with other international programs to broaden and extend projects; as such future studies of WDM in Jordan should address alternative international projects to broaden the scope of study.

In addition, although some of the reports such as ISSP, IDARA and WEPIA were inclusive from initiation to termination, other projects such as WREC, were still in the process of implementation and thus not all the information was available nor published. Furthermore, the search was not limited to a specific time range; rather the search phrase 'water demand management' was used to screen the documents. Several of the aforementioned programs could have additional reports that did not include that phrase, and thus they did not qualify for the search criteria. The researcher is aware that the documents obtained are far from the only source of information of what is happening in Jordan. The search that yielded 73 documents is far from perfect in part, because a particularly useful report by ISSP: Existing Conditions Survey and Assessment of

Water Users Associations in the Jordan Valley Report did not emerge from the search. This specific ISSP report contained data regarding the role, progress, and outcomes of WUAs, which was essential to answering research questions on agriculture sector. Furthermore, in addition to missing reports, the data analysis excluded grey literature, peer reviewed articles and actual policies and laws, which may have provided further insight to understanding the inefficiencies of the current water management structure in Jordan. All reports used in this analysis were in English, even those initially in Arabic were translated, and it is possible that information could have been lost in translation.

One of the most crucial challenges in Jordan was the lack of available baseline data, rendering it difficult to measure progress especially in the case of water utilities' performance. For example, the reports did not indicate the exact number of buildings that currently have water saving devices installed. This could be an information gap, or attributed to the fact that reports with the specific information were not listed as part of the 73 results. Furthermore, several of the projects indicated that the projects ran out of financial resources early on in the programs. This was especially the case for WREC; WEPIA also lacked financial means to carry out their initial retrofit project; thus thorough and long term planning is advised for future project implementation.

Chapter 5: Recommendations and Conclusions

The role of USAID in Jordan represents a long lasting and historical effort to address Jordan's water crisis and future implications through recommending a myriad of institutional, social and political reforms. The agency's role provided

the necessary initiative for Jordan to take its primary steps in effectively managing water resources. Although USAID's role was essential in initiating the movement towards sustainable water demand management, the ability of these programs to sustain long-term impacts remains uncertain. When international financial, human, and technical capacity is removed without instilling a foundation for these resources in the home country, successfully achieving long-term goals is far from likely. WEPIA, PAP and IDARA were able to found principles of WDM within Jordanian society as reports show that five years after WEPIA ended more than half of the homes still took part in water saving techniques. Nonetheless, international organizations need to ensure that their projects and efforts create more than short-lived solutions, but rather found and build an environment for long lasting reform. It remains key to strengthen the capacity of Jordanians across all levels in order to equip them with tools, skills, and knowledge to carry forward after programs end. In order to measure progress, reporting and documentation remains essential, and this lack of information may be contributing to the gap in knowledge among the public, government officials and water providers. Furthermore, the IDARA project proposed best management practices for commercial and industrial sectors but not for the agriculture sector. Although the program stated they did not address the agriculture sector, future policy reform should attend to creating strategies for the greatest water user of the Kingdom.

Furthermore, the USAID projects highlight key efforts in revolutionizing institutional centers in Jordan to promote WDM. For example, WEPIA's attempt

to introduce a WDM Masters degree program in Jordan was an impressive yet short-lived effort in institutionalizing WDM. The discontinuation of these courses after WEPIA ended validates that programs must do more than initiate change, but rather ensure that the resources for success remain long after they terminate. Institutions of all kinds: educational, governmental, and private should integrate WDM into their strategic plans drawing awareness and focus to future goals. Through officially incorporating principles of WDM into institutional plans and policies, the concept transitions from one of pure theory to practical and implementation based. Universities should continue offering WDM courses to accentuate the importance of water conservation, management and governance as a field and domain of future sustainability for Jordan. Unfortunately, the lack of appreciation Jordanians carry for educational emphasis on subjects such as social marketing, behavior change, and WDM should be one of the critical target areas of reform. Future research should look into local policies, actions, and on the ground implementation to determine the progress and efforts made to manage water demand: whether on an institutional, local, or central government level.

In addition, the role of communication as a driving force for behavior change, reform, and effective information sharing should never be underestimated. WEPIA, IDARA, PAP and ISSP focused heavily on the function of communication in driving change and promoting awareness among all levels of Jordanian society. Miyahuna and AWC have improved their overall communication strategies within their companies; however, there is room for further development. Institutions must highlight behavioral change objectives that

are representative of all stakeholders and organizational members. Furthermore, strategic action plans should outline a clear yet integrated path towards achieving desired outcomes, whilst emphasizing the role of communication on every level. Donors, government officials, NGOs, and the public must take part in this and treat the process as an all-encompassing participatory effort. Although the public is now more conscious of water related issues, their access to information is questionable. After WEPIA ended, most of the educational and informational materials were scattered around the Kingdom, thus contributing to the lack of data and information made available to locals.

Furthermore, according to PAP's Survey Findings, a major barrier is the communication and organization between donor agencies and project managers; furthermore, funders rarely are provided details about where or how the money is allocated throughout the project time (Bakir, 2010). There is a large communication gap between the two entities, and this leads to misallocated resources and lack of coordination. Communication strategies must focus on empowering Jordanians to take action and initiatives to improve and understand their water resources and availability. Water, its governance, and management must be viewed as an interconnected discipline, one that requires participation and communication from all members of levels of society. One mustn't undervalue the role of communication in and between governments and the public; barriers to communication should be reduced to allow deliberative dialogue, information sharing, and consolidated participation.

It remains necessary to improve accountability and transparency across all levels of water management in Jordan. The dire need for reforming Jordan's water sector was the most frequently reoccurring theme across the documents analyzed, especially in the in ISSP and IDARA reports. Some documented efforts to support community participation in local water projects were successful, such as the Small Community Wastewater project (Bakir, 2010). Although significant strides have been taken to devolve duties to local bodies such as the WUA, overlap of responsibilities still exists and misdirected priorities in the water sector are contributing to inefficient management and water provision. Increasing capacity of local governments as well as incorporating various stakeholder representatives in policy formation and decision-making is key to democratic, accountable and transparent water management.

For successful implementation of any of the aforementioned recommendations, addressing Jordan's laws and water policies is crucial. The government of Jordan must update the statutes and water doctrines so that responsibilities are clear, and distinctly assigned to specific entities. Legislation must clearly state penalty and legal enforcement measures to penalize violators. These laws provide the corner stone for enforcing accountability and transparency, as such they should be revised to explicitly define and differentiate the roles of each responsible entity. The vague stipulations fail to provide guidance as to how sectors can incorporate water conservation principles and demand side strategies in their policies and plans. Thus the legal framework serves as a major barrier to promoting WDM in Jordan. Policy implementation

and law enforcement often go hand in hand; the former has no legal basis without the latter. For Jordan to move onward in addressing water scarcity, the country must prioritize dual focus on policy and legislative reform. Water related matters must become a socioeconomic and political priority.

Furthermore, although Israel and Jordan have signed a Peace Treaty regarding their water use, this is the only official transboundary cooperative agreement related to water in the Middle East. There is no guarantee the stability and cooperation between the two countries will remain especially given the growing water shortage in the area. In order for the Jordan and Israel to sustain and prolong their existing agreement, their treaties should highlight the importance of cooperation.

Overall, the 73 USAID reports used in this research analysis provided key insight regarding the manner by which WDM is managed in Jordan. Several of the recommendations cited in the major projects serve as the base of institutional water sector reform, and this is evident in Jordan's National Water Strategy and Water for Life Strategy. Furthermore, the country has made significant progress in drawing awareness and institutionalizing WDM principles and strategies across all levels of society. It remains important that the central government and its ministries, water utilities, and local residents maintain this momentum given the escalating water crisis. In order to effectively manage dwindling natural resources, especially those high in demand and limited in supply such as water, a combination of policy, social, institutional and educational reform is needed.

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Appendix

Figure 1: Projected Water Scarcity in 2025.
Source: International Water management Institute

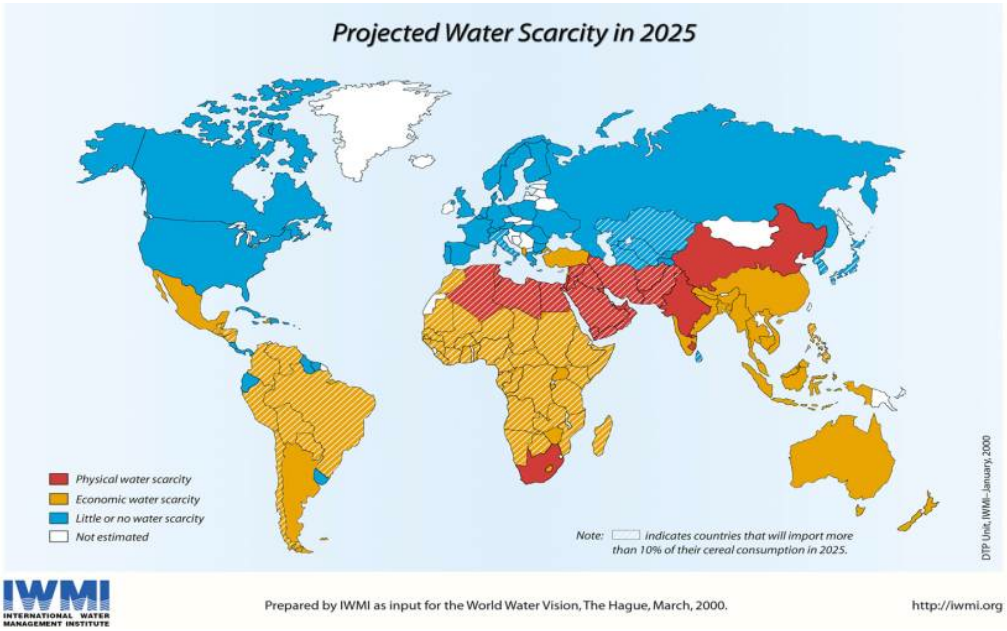
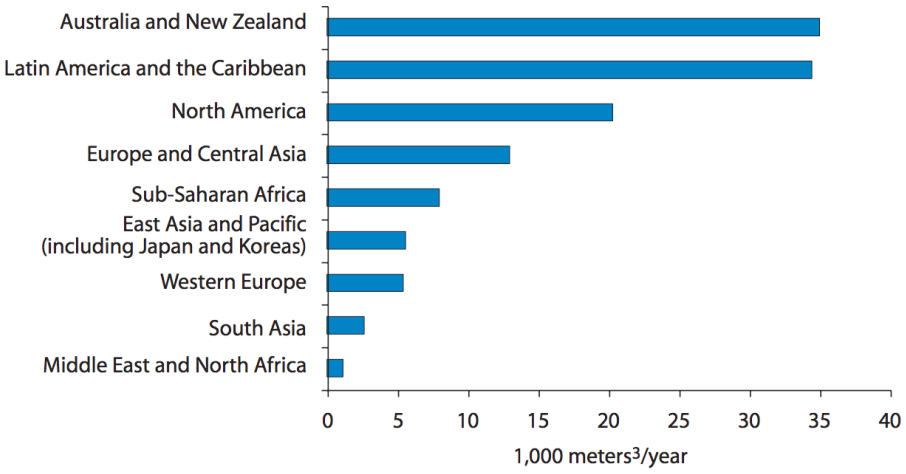


Figure 2 Actual Renewable Water Resources per Capita By Region.
Source: FAO Aquastat 1998-2002



Source: Table A1.1.

Note: Actual Renewable Water Resources (ARWR) is the sum of internal and external renewable water resources, taking into consideration the quantity of flow reserved to upstream and downstream countries through formal or informal agreements or treaties, and reduction of flow due to upstream withdrawal; and external surface water inflow, actual or submitted to agreements. ARWR corresponds to the maximum theoretical amount of water actually available for a country at a given moment. The figure may vary with time. The computation refers to a given period and not to an annual average. ARWR does not include supplemental waters (desalinated, or treated and reused). See table A1.1.

Figure 3: Jordan River Basin.
Source FAO, AQUASTAT, 2009

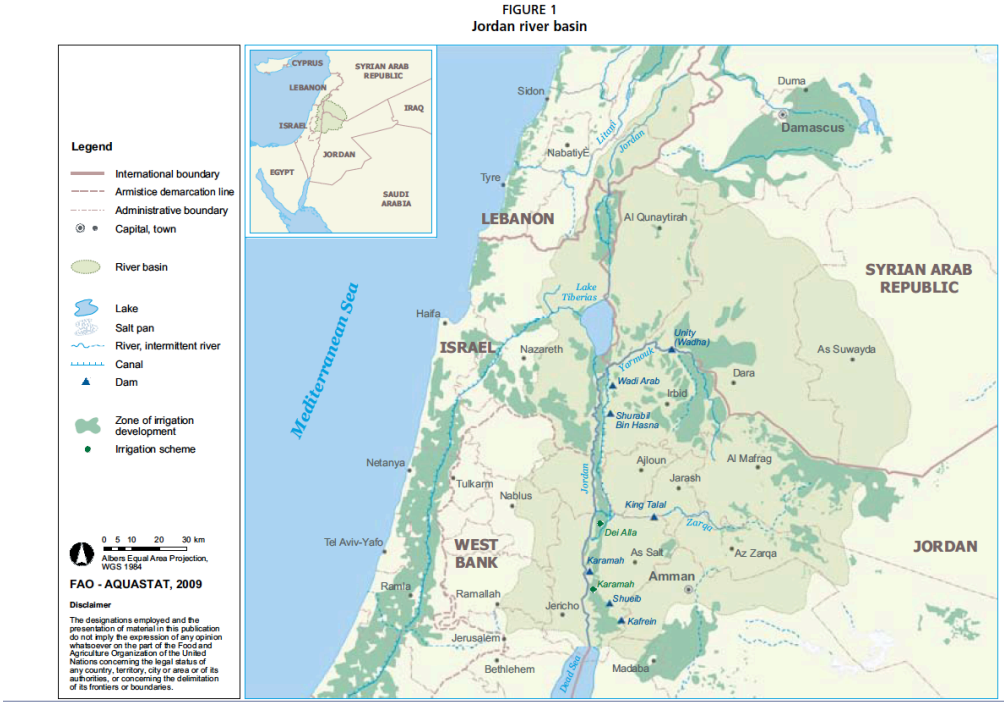
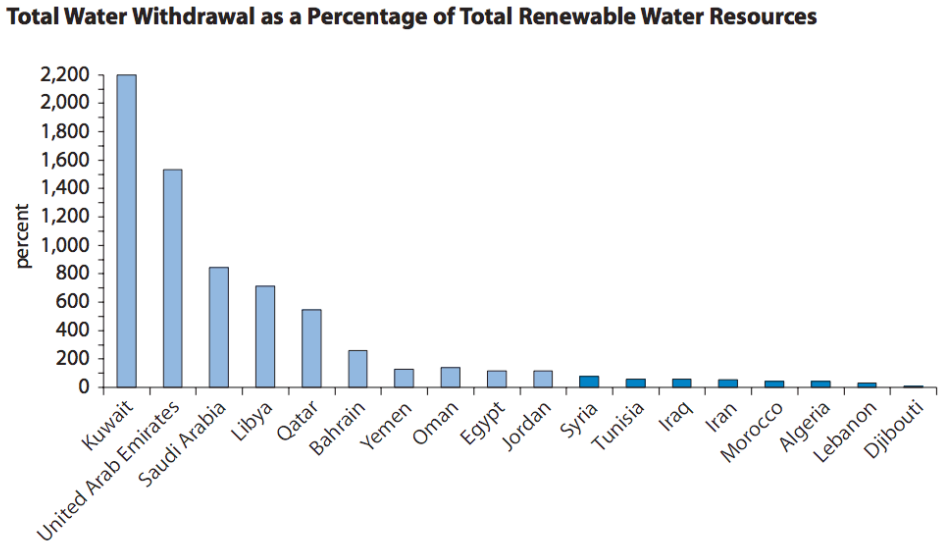


Figure 4: Total Water Withdrawal as percentage of Total renewable Water. Resources
Source: FAO Aquastat 1998-2002



Source: Table A1.6.

Note: Values above 100 percent indicate withdrawal of nonrenewable groundwater resources or use of desalinated and other supplemental water resources that are not included in the total annual water resources figures. Bars in darker color are below 100 percent.

Figure 5: Groundwater Basins in Jordan**.**
Source: Ministry of Water Irrigation, 2005

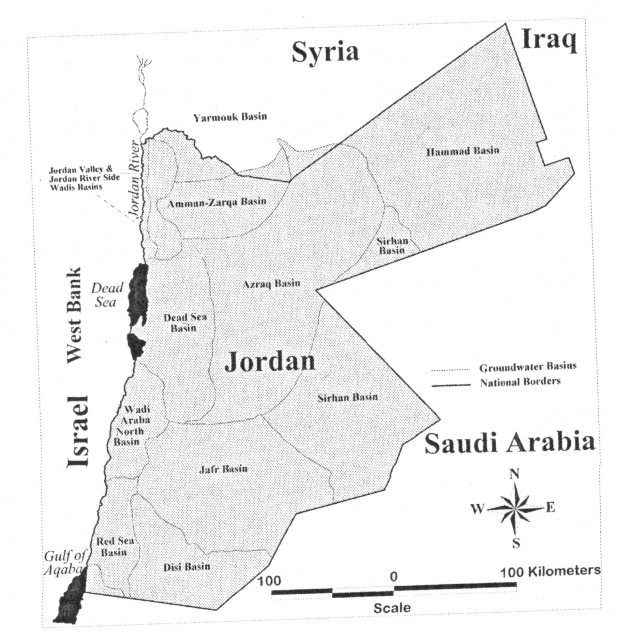


Table 1: Groundwater Characteristics from National Water Master Plan
Reproduced from National Water Master Plan p. 51.

Characteristic	**Quantity (mcm/year)**
Groundwater recharge from precipitation	395
Transboundary groundwater inflow from Syria	68
Return flows from irrigation, pipe leaks, reservoirs, wastewater treatment plants	70
Total Inflow	553
Groundwater withdrawal (wells, springs)	440
Baseflow	197
Total Outflow	637
Change in storage (inflow – outflow)	-104

Table 2 : Surface Water Basins in Jordan from NWMP Source: Rainfall-Runoff Model, Years 1937/1938- 2002/2003. This accounts for areas within Jordanian Territory.
Reproduced from National Water Master Plan p. 45

Basin/Area	Seven Drainage Basins	Catchment Area (km^2)	Average Annual Rainfall (mm/year)
Dead Sea Basin	**Yarmouk**	1,426	280
	Amman Zarqa	3,739	220
	Jordan Valley	780	270
	North Jordan **Valley Rift Side Wadi**	946	490
	South Jordan **Valley Rift Side Wadi**	736	370
	Mujib	6,727	180
	Hasa	2,603	130
	Dead Sea Rift Side Wadis	1,508	240
	North Wadi Araba	2,953	180

Figure 6: Surface Water Basins.
Source: Ministry of Water and Irrigation 2005

Table 3: Water Demand by Sector : "Projected Annual Water demand per sector including physical losses".
Reproduced from National Water Master Plan p. 19

Sector	**Water Demand (including physical losses) [MCM, (%)]**			
	2005	**2010**	**2015**	**2020**
Municipal and Tourist	372 (24)	415 (27)	460 (29)	513 (32)
Industry	59 (4)	77 (5)	100 (6)	120 (7)
Agriculture	1102 (72)	1072 (69)	1040 (65)	983 (61)
Total	1534 (100)	1564 (100)	1600 (100)	1616 (100)

Table 4: Water allocations in million cubic meters (mcm) throughout Johnston's period of Shuttle Diplomacy – Four Attempts.
Reproduced from **:** Haddadin M. J. 2001. *Diplomacy on the Jordan: International conflict and negotiated resolution*. Norwell, MA: Kluwer Academic Publishers
Haddadin, M. J. (Ed.). 2006. *Water Resources in Jordan: Evolving Policies for Development, the Environment, and Conflict Resolution*. Washington DC: Resources for the Future Press.

Riparian	Main TVA Plan 1953	Counterproposal, Arab Plan, 1954	Baker & Harza Co., 1955	Modified United Plan/ Jordan Valley Plan, 1955
Jordan	774 mcm	975 mcm	760 mcm	720 mcm
Israel	394 mcm	298 mcm	448 mcm	554 mcm
Syria	45 mcm	132 mcm	132 mcm	132 mcm
Lebanon	none	35 mcm	35 mcm	35 mcm

Figure 7: Selection of USAID reports.

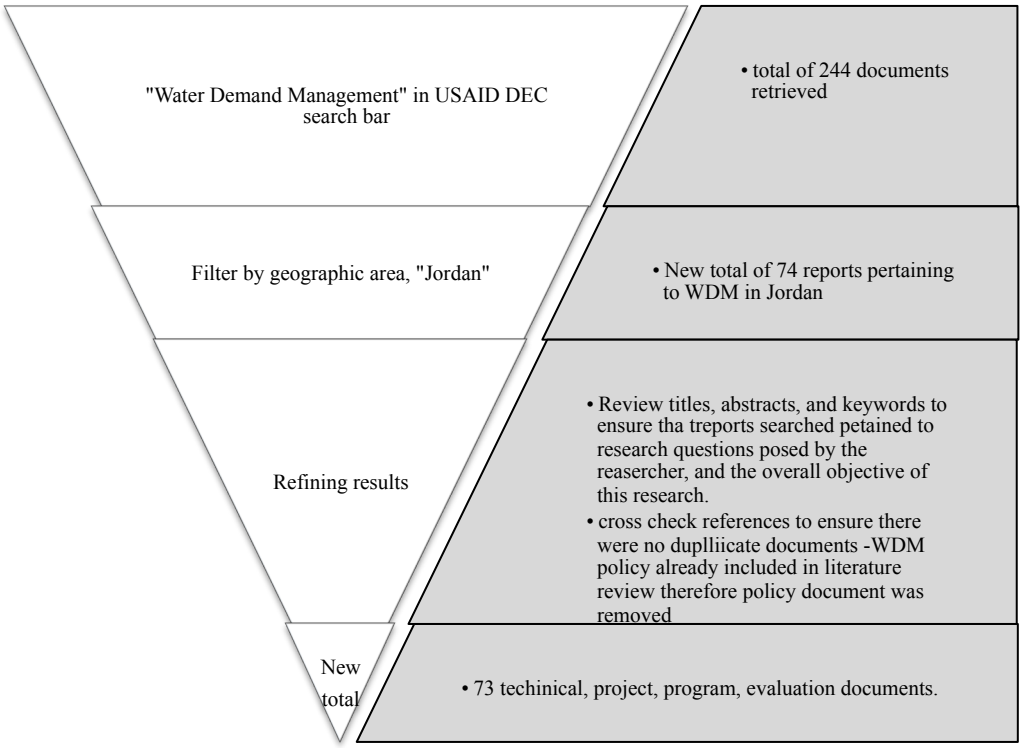


Table 5: Table of Codes and Definitions.

Code	Defined by	As inputted into Atlas.ti
Sector	Areas where : Agriculture, domestic, residential, municipal, tourism, and industrial sectors were mentioned.	Agriculture*|domestic|residential|municipal|touris*|industr*
Water Demand Management	Areas where : water demand management, water demand, water management, water conservation, water use efficiency	Water demand management|water demand|water demand|water management|water conservation|water use efficienc*

Programs	Areas where: education, programs, campaigns, behavior change/incentives, water conservation behaviors, encouraging public participation, community participation, gender, social marketing, community based social marketing, capacity building, information sharing, community organization/ participation/ awareness and incentives were mentioned	educat*|program*|campaign|behavior*|water conserv* behavior*|participat*|public participat*|encourage* participat*|community participation|gender|social marketing|community based social marketing|capacity build*|information sharing|community organiz*|community participat*|community aware*|incentive*
Governance and Management Reform	Areas where: strategic planning, policy and reform, sector reform, best management practices, accountability, governance, and decentralization were mentioned	strategy plan*|strategic plan*|water policy|policy reform|sector reform|best management practice*|accountab*|governance*|decentraliz*
Water Provision	Areas where: ministry of water and irrigation, water authority of Jordan, Jordan valley authority, water users association, Miyahuna, Aqaba Water Company and Yarmouk Water Company were mentioned	Ministry of water and irrigation|MWI|water authority of Jordan|WAJ|Jordan Valley Authority|JVA|Water Users Association|WUA|Miyahuna|Aqaba Water Company|AWC|Yarmouk Water Company|YWC

Table 6: Codes Generated Using Quotation Cooccurance operator.

Code Cooccurrances	Number of coded Paragraphs in Atlas Ti
Water Demand Management + Governance and Management Reform	61
Water Demand Management + Sectors	293
Water Demand Management + Program	465
Water Demand Management + Water Provision	256
Governance and Management Reform + Sectors	63
Governance and Management Reform + Programs	231
Governance and Management Reform + Water Provision	143
Sectors + Programs	796
Sectors + Water Provision	300
Programs + Water Provision	571
Water Demand Management + Sector + Governance and Management Reform	11
Programs + Sector + Water Demand Management	91
WDM + Gov + Water Provision + Sector	2

Figure 8: USAID reports by Year of Publication.

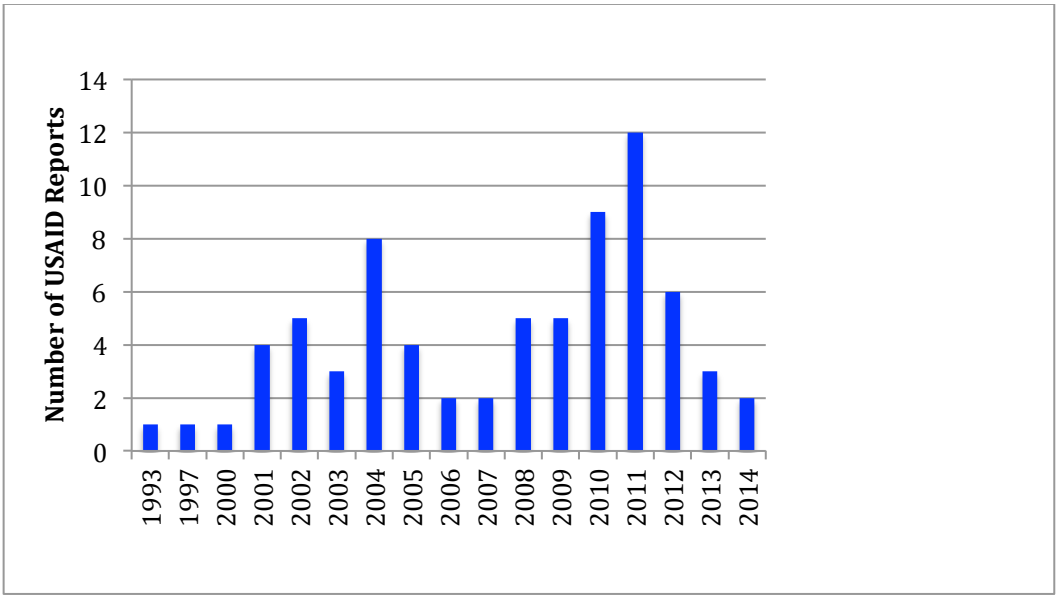


Figure 9: USAID Reports Based on Word & Phrase Appearance in Title.

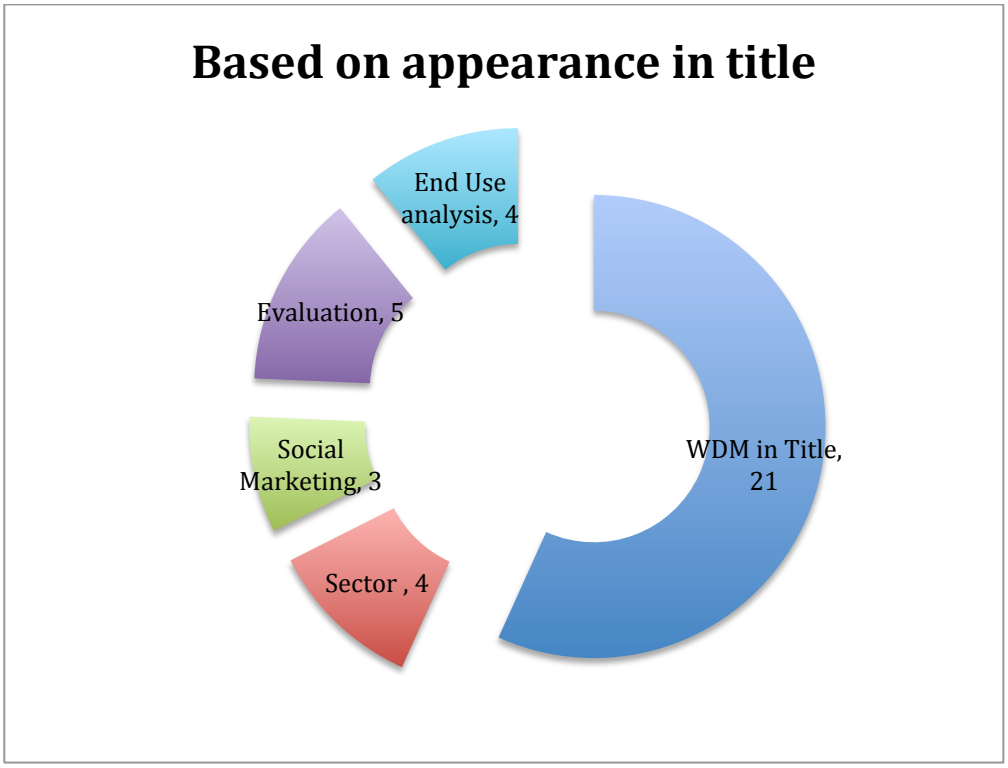


Figure 10: Organizational Structure of Water Management in Jordan. Reproduced from ISSP Institutional Assessment Report p. 57

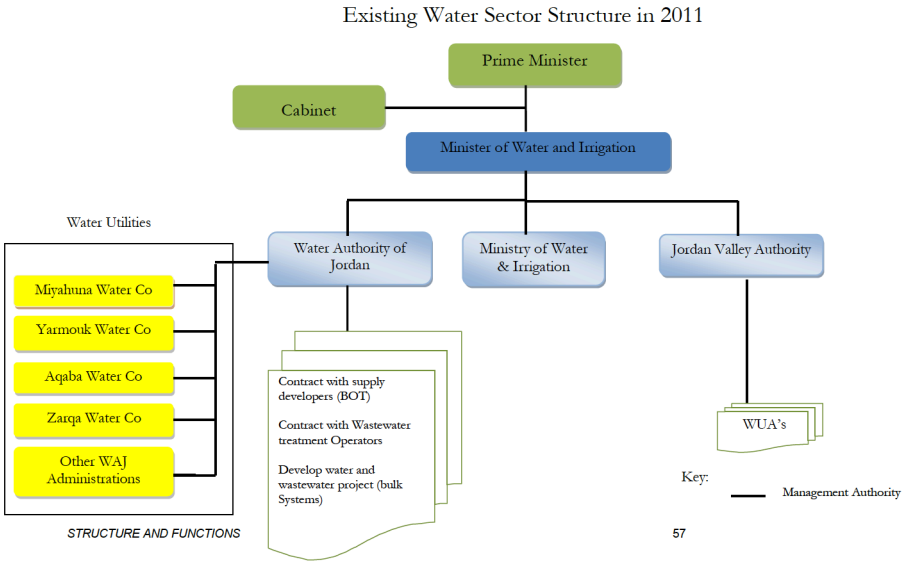


Figure 11: ISSP's proposed responsibilities for water management
Source: ISSP Institutional Assessment Report, 2011 p. 19

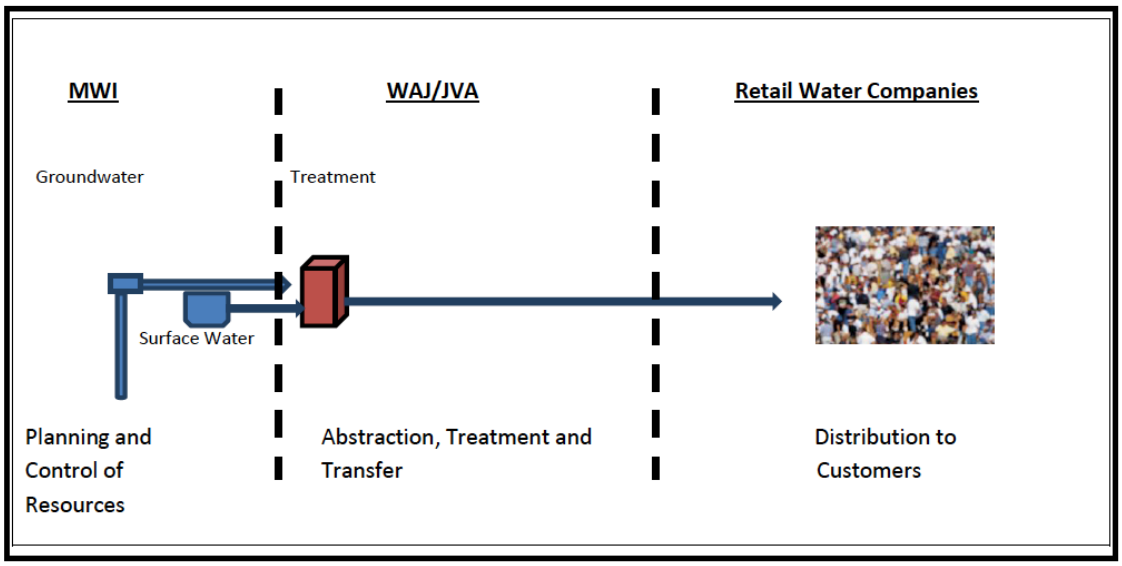


Figure 12 : ISSP's Relationship between Parties.
Reproduced from ISSP Institutional Assessment Report p. 58

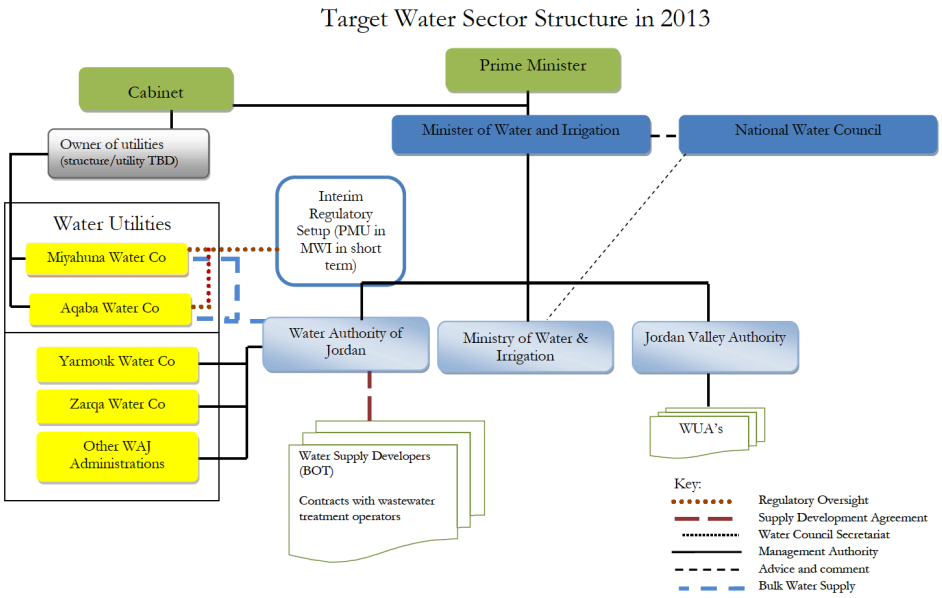


Figure 13: Timeline of USAID Projects.

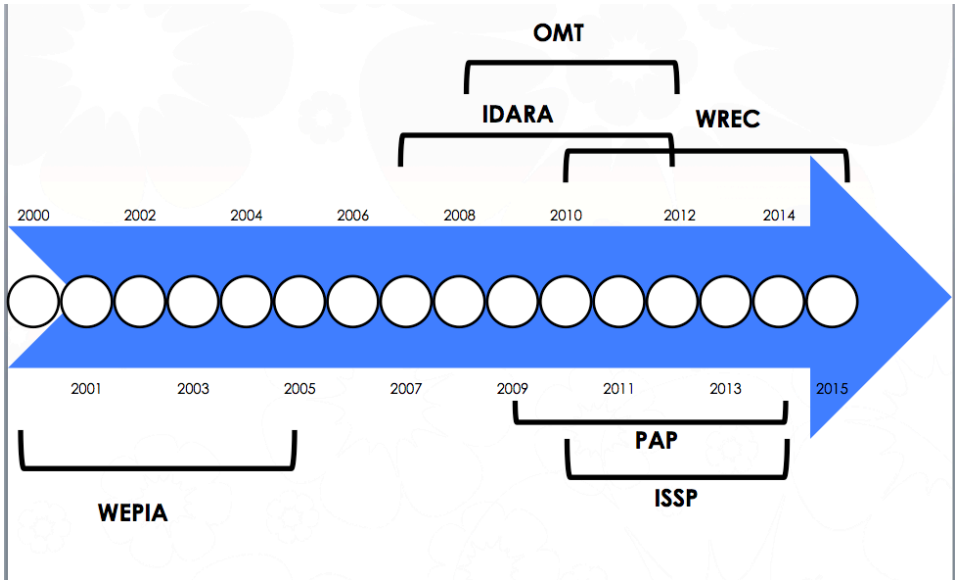
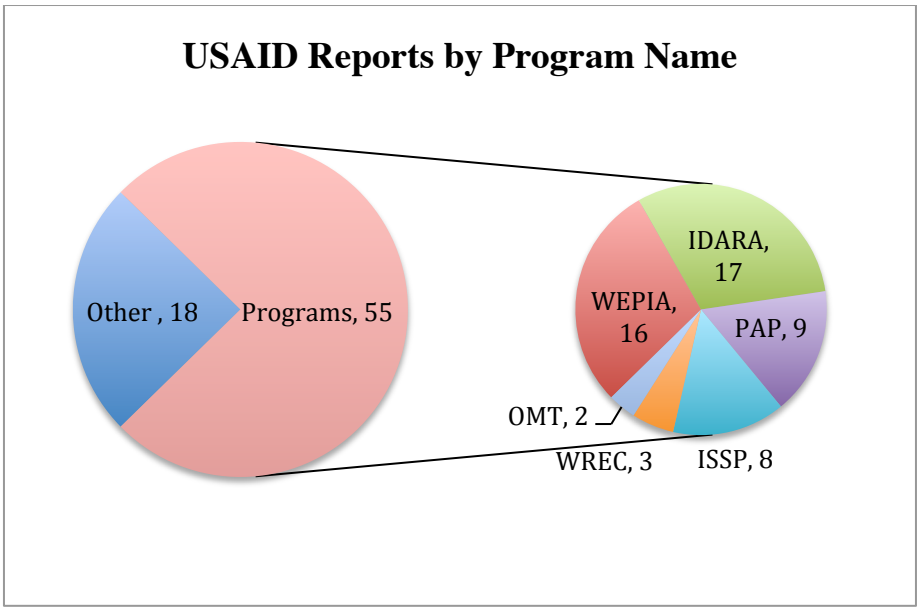
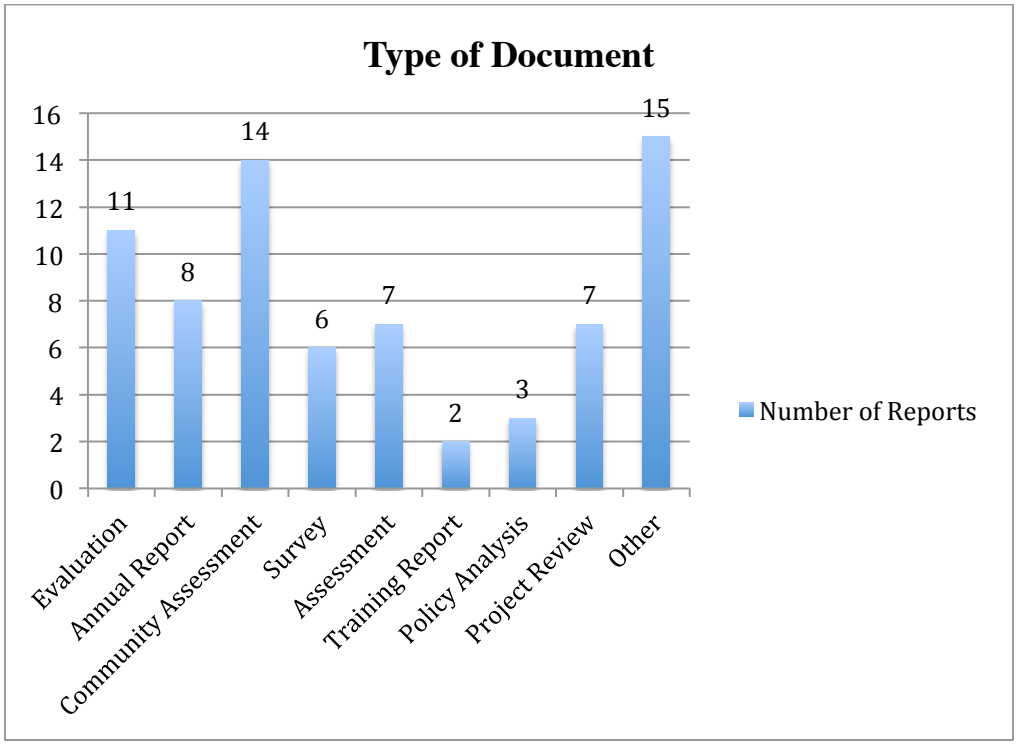


Figure 14: USAID Reports by Program Name.



Others include: community based initiative, operations plan, annual reports, blue ribbon initiative, USAID achievement summary, seminars, educational flyers, compliance charts, strategies, evaluations, groundwater studies, audits, and a benchmarking report.

Figure 15: USAID Report Characteristics, by Document Type.



Others include: final reports, benchmarking project, operating plan, summaries, flyers, compliance charts, seminar, strategy, groundwater studies and audits.

Figure 16: Representation of public knowledge growth.
Reproduced from WEPIA 2000-2005 Final Report p. 132

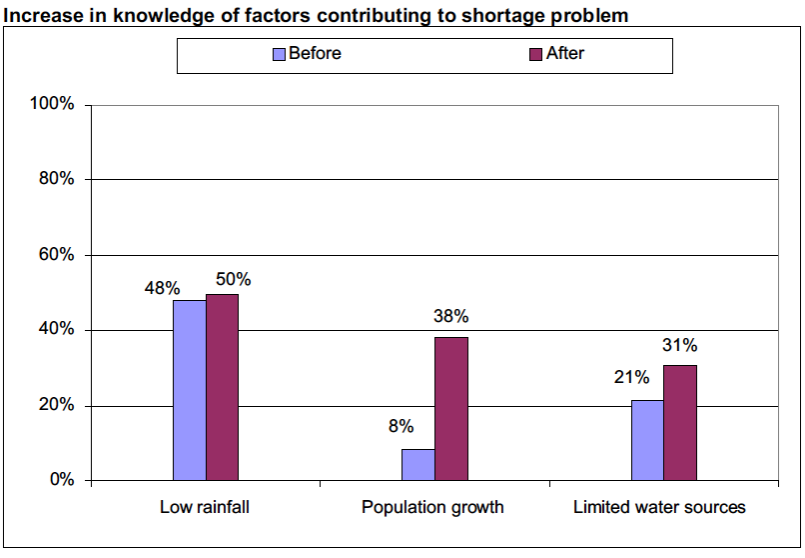


Table 7: Water related articles in Local Newspaper.
Reproduced from WEPIA 2000-2005 Final Report p. 119

Growth percentage in water related articles in local newspaper

Year	2000	2001	2002	2003	2004
% of articles carrying information on water issues	20.0%	30.0%	46.7%	53.4%	55.6%
Average size of the article	one column or less	4 columns with pictures	1/4 page	3/4 page	1/2 page with pictures

Table 8: Overview of Large Building Retrofit.

Reproduced from WEPIA 2000-2005 Final Report p. 106

Summary Statistics for WEPIA's Retrofit Policy Program								
Sector	Actual Annual Water consumption (m^3)[a]	Actual Annual Water Savings Resulting From Phase I (m^3)[b]	Actual Annual Water Savings Resulting From Phase II (m^3)[d]	Overall Actual Annual Water Saving Resulting From the Entire WEPIA Program (m^3)	Portion of Total Savings Attributed to Phase II (%)	Sectoral Contribution to Overall Savings (%)	Sectoral Representation to Universe (%)[e]	Overall Savings as a Percent of Total Consumption (%)
Governmental	2,155,616	75,506	234,398	309,904	75.64%	46.17%	48.00%	14.38%
Hotels	756,504	102,326	64,306	166,632	38.59%	24.83%	16.60%	22.03%
Hospitals	264,012	49,237	60,755	109,992	55.24%	16.39%	6.90%	41.66%
Schools	163,212	31,341	10,303	41,644	24.74%	6.20%	7.30%	25.52%
Commercial	363,360	11,903	13,241	25,144	52.66%	3.75%	12.20%	6.92%
Restaurants	127,892	NA[c]	NA	17,864	NA	2.66%	5.10%	13.97%
Total	**3,830,596**	**270,313**	**383,003**	**671,180**	**57.06%**	**100.00%**	**96.1%**[f]	**17.52%**

a As per the universe prepared in 2001, 192 ineligible sites excluded
b By the end of the Retrofit Policy Program lasting from November 2001 through December 2002
C Only overall savings are available for restaurants and not by phase
d WEPIA's extension lasting from January 2003 to date
e Measured as the proportion of number of sites of each sector to overall universe
f NGOs not taken into consideration

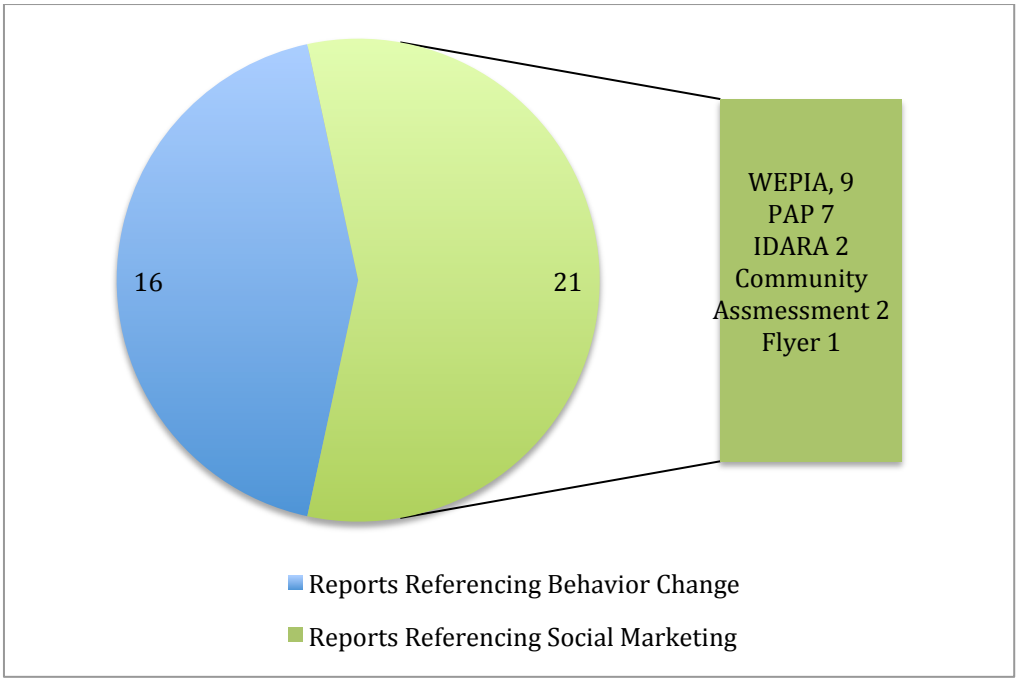
Table 9: IDARA final Outcomes.
Reproduced from Evaluation of instituting water demand management (IDARA) project in Jordan final report, 2011 p. 7

	Descriptions of Achievements
1	A national WDM policy was developed and approved by the Council of Ministers.
2	Action plans were developed for the implementation of WDM policy in the MoTA, MoPWH, MoENV, and MoIT.
3	Water Use Efficiency Plans were developed for the three water utilities: Miyahuna Water Company, Yarmouk Water Company, and Aqaba Water Company.
4	A water-use efficiency tracking tool and demand forecasting model was developed for Miyahuna Water Company, Yarmouk Water Company, and Aqaba Water Company.
5	Technical standards were developed for efficient fixtures and equipment. So far, standards for lavatory and kitchen flow regulators, bidets, and toilets have been approved by Jordan Standards and Metrology Organization's Board, and technical regulations have been adopted.
6	The capacity of WDMU staff in a broad range of policy, institutional and technical aspects was strengthened.
7	Drafting of a new Water and Sanitation Plumbing Code for Jordan.
8	Retrofit of faucets and showerheads fo r approximately 3,450 houses in Amm an, 700 in the Northern Governorates, and 300 in Aqaba as part of the baseline survey in the three utilities, Miyahuna-HSBC residential retrofit program , and Abu Nusseir pilot program.
9	More than 200 houses were provided with plumbing maintenance and retrofit services in the neighborhood of seven community-based organizations (CBOs) in Zarqa and Mafraq Governorates. Grants were provided to the seven CBOs to be used as revolving loans by their beneficiaries for the implementation of water-use efficiency projects.
10	Water-wise landscaping was integrated into the curriculums of German Jordan University, Jordan University, and Jordan University for Science and Technology.
11	A certified Master Plumbing program was established at the Vocational Training Corporation (VTC). Training of Trainers (TOT) on the Master Plumber program for 17 participants from VTC, United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA), National Employment Training (NET), Ministry of Education, Royal Scientific Society (RSS), Jordan Standards and Metrology Organization (JSMO), and WDMU, was provided.
12	A laboratory was established at the RSS for testing residential plumbing fixtures and appliances.
13	Water and energy efficiency was integrated into the sub-criteria of King Abdullah II Center for Excellence (KACE) award for public and private sectors.
14	Abu Alanda Housing Competition for the design of a model water and energy efficient low-income housing apartment building was completed.
15	Engineers from 66 municipalities were trained on principles of water-wise landscaping, drought tolerant plant materials, and planting design. In addition, six water-wise landscaping parks were proposed for demonstration purposes; five have been fully constructed and are completed, the sixth one is currently under construction.

Table 10: PAP Performance Indicators Recommended by Dr. Middlestadt. Reproduced from PAP Second Annual Progress Report, 2011 p.37

PAP outcomes	Water To USAID Water Office	Solid Waste To USAID Water Office	Energy To USAID Energy Office
Household Behavior	Number of households that currently practice at least two sentinel water conservation or efficiency behaviors	Number of households that currently practice at least one sentinel household waste management behavior Number of households that currently practice at least one public litter control behavior	Number of households that currently practice at least two sentinel energy conservation or efficiency behaviors
Household Awareness of actions	Number of households whose head is aware of at least two water conservation and efficiency behaviors	Number of households whose head is aware of at least one household waste and one public litter control behaviors	Number of households whose head is aware of at least two energy conservation and efficiency behaviors
Youth Behavior	Number of youth who currently practice at least one sentinel water conservation behavior	Number of youth who currently practice at least one public litter control behavior	Number of youth who are aware of at least three sentinel energy conservation behaviors
Youth Awareness of actions	Number of youth who are aware of at least three water conservation behaviors	Number of youth who are aware of at least three sentinel water conservation behaviors	Number of youth who are aware of at least three sentinel energy conservation behaviors
Large consumers Behaviors	Number of large consumers who practice at least two water efficiency practices	Not applicable	Not applicable
Competence & skill People trained by PAP or PAP grantees	Number of people trained through PAP in environmental law, enforcement, public participation and cleaner production policies, skills and techniques for water. Number of water sector staff trained through PAP	Number of people trained through PAP in environmental law, enforcement, public participation and cleaner production policies, skills and techniques for solid waste management	Number of people trained through PAP in energy related policy and regulatory issues Number of people trained through PAP in energy technical issues
Competence & skill Social marketing initiatives	Number of social marketing initiatives on water	Number of social marketing initiatives on waste management	Number of social marketing initiatives on energy
Competence & skill Research activities	Number of information gathering & research activities on water	Number of information gathering & research activities on solid waste	Number of information gathering & research activities on energy

Figure 17: USAID Reports, by reference to social marketing and behavior change.



For Behavior change References: CBI 1, Community Assessment 2, ISSP, 2, PAP 7, IDARA 1, Flyer 1, WEPIA 1

Table 11: Community Assessment Purposes and Behavior in water sector. Reproduced from PAP Community Assessment Report p 38

LARGE WATER CONSUMERS		
Purpose	**Focus**	**Behavior**
Increase and Maintain water efficient among large consumers including iconic buildings	Large Consumers use established BMP to reduce water consumption	Large consumers adopt and maintain BMP and track conservation efforts as part of routine management
		Large consumers identify where they need professional expertise and know where to source it
		Large consumers identify, appoint, train and develop an authoritative role for an individual within their organization to become a Water Coordinator with direct access to management and responsibility to manage and oversee water conservation programs within the institution.
	Introduce, amend and enforce water efficient codes for buildings that are considered large water consumers	Concerned authorities amend and enforce codes and regulations that require use of water conserving technologies as indicated by BMPs.
		Concerned authorities clarify enforcement roles and responsibilities and legally delegate authority to appropriate agency.
		Decision-making boards facilitate adoption of new technologies that reduce operational costs and have short payback periods for public buildings.
		The Green Building Council raises the level of voluntary LEED certification for buildings that are considered large water consumers to a minimum of silver or gold.
		Government raise water tariffs for buildings that are considered large consumers.
Increase and maintain water conserving behaviors among large consumers including iconic buildings	Increase knowledge of water conserving technologies and practices among staff from buildings that are considered large consumers	Relevant governmental and quasi-governmental water authorities facilitate availability of correct information to large consumers as relevant to BMPs.
		Managers from buildings that are considered large water consumers notify and educate staff of water conserving measures being implemented in their building.
		Managers from buildings that are considered large water consumers post prominent signs to encourage water conservation practices
		Staff from buildings that are considered large water consumers correctly cite three water conserving practices
	Institutionalize water conserving practices among staff from buildings that are considered large water consumers	Managers from buildings that are considered large water consumers adopt annual preventative maintenance programs.
		Staff from buildings that are considered large water consumers correctly perform and record routine maintenance on water consuming equipment and take remedial action as needed.
		Staff from buildings that are considered large water consumers identify and report potential sources of on-premises water wastage.

Water – Youth		
Purpose	**Focus**	**Behavior**
Increase water conservation behaviors among youth	Increase knowledge about the water crisis in Jordan Among youth	Out of school youth aged 15-25 can cite accurately the sources of Jordan's water, three reasons for scarcity, and three technologies that can improve water conservation at HH level
		School children aged 5-15 (grade 1-10) can cite accurately the sources of Jordan's water, three reasons for scarcity, and three technologies that can improve water conservation at HH level
		There is demonstrated improved interactive teaching methods
		Schools Request, install and demonstrate, as necessary, water conserving technologies
	Demonstrate improved environmental practices around water	School children aged 5-15 (Grades 1- 10) demonstrate improved personal water practices, including practicing two public water-saving
		School children aged 5-15 (Grades 1- 10) correctly cite attitudes about environmental water issues as they exist in or are authoritatively interpreted from the Holy Quran.
		Out-of-school youth aged 15-25 demonstrate improved personal water practices, including practicing two public water-saving tasks.
	Increase engagement in active, public discourse about the water crisis in Jordan of out-of-school youth aged 15-25	Youth in key water deficit areas of Jordan mobilize to promote and encourage improved action a) against illegal wells and b) to improve agricultural use of water in the highlands.
		A cadre of youth familiar with social media demonstrate leadership in advocating and motivating peers to act appropriately and to participate in public dialogue.
		Urban disadvantaged youth that attend an immersion program engage in community programs.
	Rebrand skilled labor, such as plumbing, to overcome the culture of shame and make such professions of interest to youth	More young men in project area focus apply for vocational school training and increase in native Jordanians applying for skilled employment.
		School children aged 5-15 (Grades 1- 10) in public schools state positive attitudes towards skilled trades.

Water – Agriculture		
Purpose	**Focus**	**Behavior**
Increase water efficiency in agriculture	Increase use of water saving technologies on upland farms	Farmers improve performance of drip irrigation
		Farmers increase use of water saving technologies in upland farms
	Introduce, amend and enforce water saving specifications for farms	MWI and MOA establish minimum specifications for drip irrigation in the uplands
	Policy amendments and enforcement	Fewer individuals engage in digging opportunistic wells
	Increase farmer knowledge of water efficient agriculture practices	Improved crop selection in commercial areas

Figure 18: Map of Jordan Governorates.
Source: taken directly from : http://d-maps.com/carte.php?&num_car=26569&lang=en

Table 12: Theory of Behavior Change for Marfaq and Irbid.
Reproduced from Community Based Initiative Report, 2014 p. 28

Theory	Statement	Description	Target	Illustrative Activities
Basic service delivery	If community-based quick-impact water projects are delivered in economically vulnerable communities hosting refugees, then the extent of core grievances about competition over scarce resources will decline.	This theory focuses on community-based assessment and mapping as an empowerment tool to decide on demand-driven quick-impact water projects.	Core grievances	Constructing rainwater catchment systems, increasing water storage capacity, rehabilitating springs, repairing ponds and providing capital for onward lending by CBOs to support household water improvement.
Basic service delivery	If water losses in the municipal water systems in the north can be reduced, then human suffering will be reduced as more water will be available in refugee-vulnerable communities.	This theory focuses on the institutional performance of the municipal water systems by improving water leakages. It prioritizes water leakages because the failure of water delivery feed factors which correlate with community conflict.	Institutional performance; core grievances	Detecting leaks, replacing pipes, repairing networks, providing training and equipment and upgrading pump stations.
Conflict mitigation/ Building bridges	If simple water-based community rifts are addressed and healed, then this will prevent smaller-scale local conflicts from escalating into more violent, broader conflicts involving most groups in fragile communities hosting refugees.	This theory focuses on the crucial role of articulating and healing community rifts where refugees are living driven by escalating competition for scarce resources by promoting mutual trust and understanding.	Social resilience/ cohesion; core grievances	Training for conflict mitigation between host communities and Syrian refugees.

Figure 19 Primary and Secondary Distribution of Reports: By Sector.

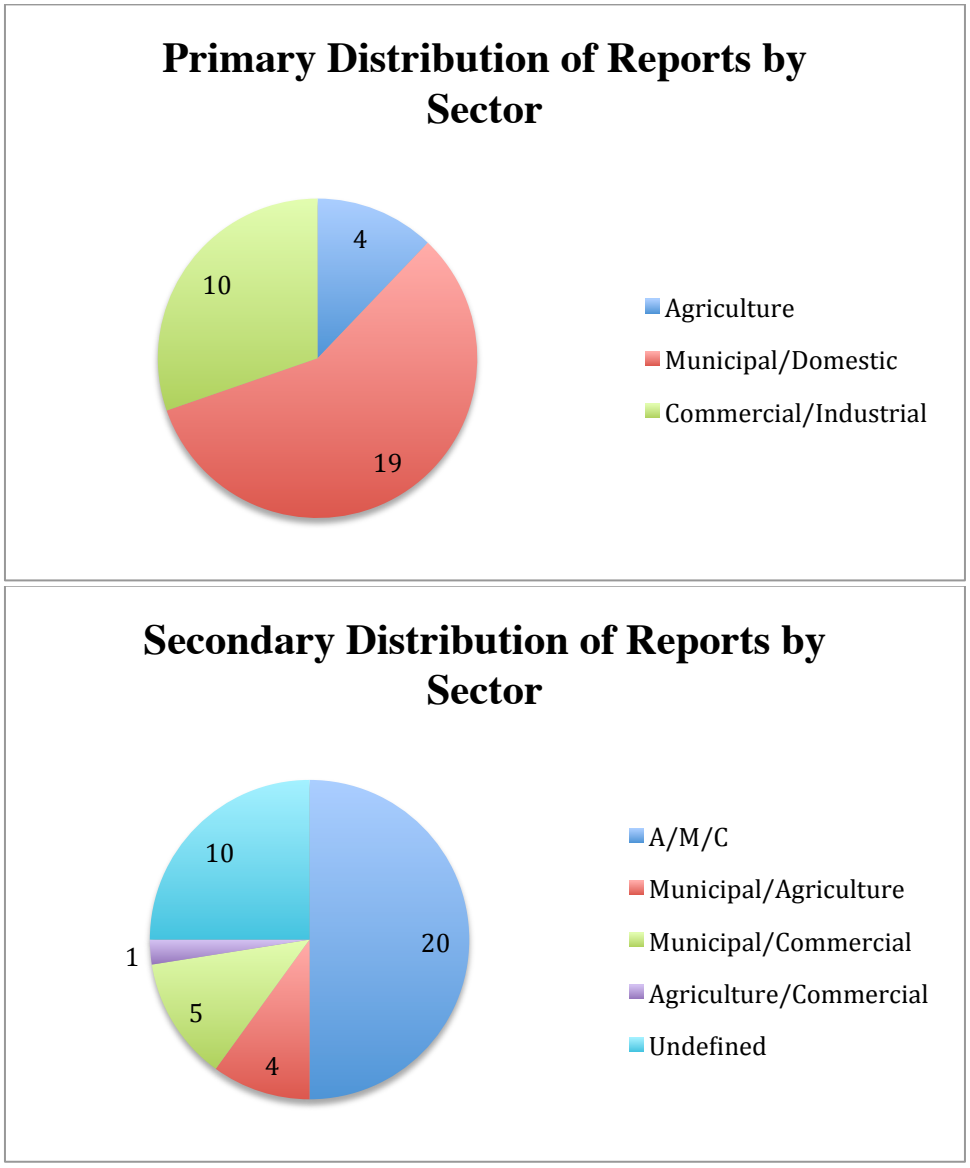


Figure 20 Crop Production over the past three decades.
Source FAOSTAT: http://faostat3.fao.org/browse/Q/*/E