



# Regional NGO Master Plan for Sustainable Development in the Jordan Valley

Final Report – June 2015



# Regional NGO Master Plan for Sustainable Development in the Jordan Valley

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**Royal HaskoningDHV**  
in partnership with:

**MASAR Jordan**  
**CORE Associates**  
**DHVMED**

**EcoPeace Middle East / WEDO / FoE\***  
in co-operation with:

**SIWI – Stockholm International Water Institute,**  
**GNF – Global Nature Fund**

European Union's  
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\* The future scenarios and strategic objectives for the Jordan Valley Master Plan presented in this report reflect the vision of EcoPeace Middle East, and do not necessarily reflect the opinion of the European Union, project partners or the individual consultants and their sub-consultants

## Executive Summary

The overall objective of this NGO Master Plan for Sustainable Development in the Jordan Valley is to promote peace, prosperity and security in the Jordan Valley and the region as a whole. This plan identifies feasible interventions that will restore the valley's environmental and ecological values within a realistic financial and economic framework. The Plan assumes that a future independent State of Palestine will be recognized as one of the three riparians to the Jordan River, side by side with Jordan and Israel, with all three nations entitled to an equitable share of the valley's resources. Furthermore, the plan assumes free access to the valley for all people within appropriate and negotiated security arrangements.

As a regional and civil society led effort, this plan was designed to help create political will towards its full or partial implementation by the Jordanian, Israeli and Palestinian governments and also by donor states and the broader international community and public and private sectors. All these parties are invited to cooperate, invest and help secure funding, in support of the governance, and implementation of the proposed interventions for the sustainable development of the Jordan Valley. It is foreseen that the proposed Israeli interventions are to be funded by the Israeli government, while the international donor community is encouraged to support the proposed Palestinian, Jordanian and Regional, multi-country interventions.

This NGO Master Plan focuses on the Jordan Valley, and provides general outlook for the national water balances of Jordan, Palestine and Israel in particular. Detailed water assessment at national level or at wider Jordan River Basin level including Syria and Lebanon are outside the scope of this study.

In the framework of this study, assessments were made of the existing national plans in Jordan, Palestine, and Israel. However, these national plans generally do not include projections to 2050, and they do not specifically separate the actions required in the Jordan Valley. These aspects are specifically taken up in this NGO Master Plan.

This NGO Master Plan provides a baseline status of the basin in terms of land use, natural and cultural resources, the people living in the basin, their socio-economic circumstances, the different economic sectors and related water demands, and the current governance of the basin. The Master Plan then delivers a projection of population and economic figures for the years 2025 and 2050 and related land and water requirements, and it identifies the major challenges to be addressed.

### **Strategic Planning Objectives**

The key challenge for sustainable development in the Jordan Valley is to strike the right developmental balance between a healthy economic developmental

path for the valley and its people on the one hand, and a Jordan River with sufficient environmental flows to sustain a healthy eco-system on the other hand. To meet this objective the river will need to serve as a natural water conveyor and source for water supply for residents in and outside the valley. Sustainable development is seen as a catalyst to peace building between Israel and Palestine and the deepening of cooperation between Jordan, Palestine and Israel as a means to achieving prosperity, stability and security for their residents in the valley and beyond. A key condition for meeting this challenge is that Palestine is recognized as a full riparian in the Jordan River, entitled to have access to its fair share of water resources and sovereignty over its lands in the valley.

The objective in terms of pollution control is to eliminate all sources of environmental pollution in the Jordan Valley by 2025. This requires full and adequate treatment and reuse of all wastewater flows in the valley and to embark on fully integrated solid waste management. In terms of sustainable water management the key challenge clearly is to overcoming the water scarcity related problems in the Jordan Valley. This means creating a sustainable water supply system that meets current and future domestic and agricultural water demands; and at the same time preserves the water resources for future generations and for the environment.

Sustainable Agriculture Development is one of the most important pillars of the Jordan Valley Plan as it provides livelihood and prosperity for all the people in the valley. The strategic agricultural objective for the study area is improving water use and irrigation efficiencies and economic outputs per unit of water used.

The institutional challenge will be to strengthen land co-operation among the responsible authorities, including JVA, WAJ, IWA and PWA, drainage authorities, municipalities and other related ministries and authorities in their role as authority over and regulator of the Jordan Valley. Improvements are required in areas such as water data collection and management; water planning; water storage and distribution operations, including IT and wireless data transfer, economic and land use planning and related support services. This will also require improved coordination and cooperation between various stakeholders involved in water management, to enable a more efficient and beneficial water economy.

One of the key challenges in the Jordan Valley is to restore the good ecological status of the Jordan Valley, and the role of the Jordan River as a strategic water conveyor (Green Infrastructure), in line with earlier recommendations of EcoPeace's Environmental Flow Study. This also includes restoration of the flood plain and the ecological (flora, fauna) status of the river, based on environmental flows and good water quality; design and implementation of dedicated ecological restoration projects and eco-parks along the borders

of the Jordan River; expansion of currently assigned nature reserves, based on important flora, fauna and bird areas, also in accordance with the Ramsar Convention; and design and develop dedicated nature recreational areas for the urban population.

Development of the tourism sector and the cultural heritage in the Lower Jordan Basin is a major challenge with the main focus on saving the intrinsic cultural heritage values in the Basin, as well as for boosting the economy and creating jobs in the area. This requires investment planning for major sites such as Pella, the proposed Bakoura National Park, Naharayim, Old Gesher and Jericho, developing transboundary sites, creating free tourism areas at the northern head of the Dead Sea between Jordan and Palestine; and the Jordan River Peace Park between Jordan and Israel. It may also include linking the Baptism Sites to other tourism sites and trails in the valley, and creating synergies and stronger economic development opportunities.

To facilitate the anticipated population and economic growth in the Jordan Valley, it will be crucial to develop sufficient urban housing and infrastructure facilities in the valley, and meanwhile increase traffic safety and public transport capacities. This is specifically relevant for the new State of Palestine and for Jordan. This may include improvement of main north-south roads through the valley, including bypass roads around major urban areas; improving traffic safety through traffic lights, lining and public signs; establishment of sidewalks and bicycle trails; prepare for urban planning and housing projects to accommodate the foreseen growing population and

its welfare, and development of trans-boundary infrastructure facilities, such as opening up of the Damya Bridge and the Abdullah Bridge over the Jordan River.

### ***Meeting the Planning Objectives***

A total of 127 interventions have been identified with a total investment value of 4.58 Billion USD until the year 2050. The full set of interventions is presented in annex 1 and grouped around the various strategic planning objectives. The proposed measures have been divided between Israeli (ISR), Jordanian (JOR), Palestinian (PAL), and Regional (REG) interventions. It is assumed that the Government of Israel will finance all Israeli interventions and might co-finance regional interventions.

For every set of interventions a separate regional coordination intervention plan has been formulated, setting up a regional coordination structure, or Steering Committee, among key Jordanian, Israeli and Palestinian governmental stakeholders for the implementation of the proposed national and regional interventions in the Jordan Valley. The objective is that this Steering Committee will eventually be embedded in the structure of the proposed River Basin Organization for the Jordan Valley.

The proposed pollution control related interventions focus on eliminating all sources of environmental pollution in terms of wastewater and solid waste in the Jordan Valley by 2025. This includes full and adequate treatment and reuse of all wastewater flows in the valley and to fully integrated solid waste management. Proposals have been made to include

waste collection, transportation; transfer; reuse and recycling of solid waste streams; sanitary landfilling and closing of existing non-sanitary dump sites.

The sustainable water management related interventions focus on establishing efficient domestic and agricultural water supply within a basin wide water balance. It also includes an Integrated Water Resources Management approach for the whole lower part of the Jordan River, based on international co-operation among Israel, Jordan and Palestine, supported with adequate water management tools (like WEAP) to ensure sustainable water supply and an increase of the base flow and rehabilitation of the ecological values of the Jordan River.

The agricultural related interventions focus on improving water use and irrigation efficiencies and the economic outputs per unit of agricultural water used. It is assumed that the total water demands for the agricultural sector in the Jordan Valley will remain stable and that adequate tariff policies on water used for irrigation will be implemented, including enforcement, to stimulate more efficient use of water through for instance green house drip irrigation.

The governance related interventions include setting up a Palestinian Basin Authority, strengthening the Jordan Valley Authority and establishing a trans-national Jordan River Basin Organization (Israel, Jordan, Palestine) that will address water management related issues from the valley perspective to the benefit of all stakeholders and inhabitants in the valley. It is proposed that a

regional coordination structure, or steering committee, will be set up to implement the suggested interventions. These steering committees shall consist of the key Jordanian, Israeli and Palestinian governmental stakeholders. As stated above, the objective is that these sector-related Steering Committees will eventually be embedded in the structures of the overall River Basin Organization for the Jordan Valley.

The ecological interventions focus on improving the ecological status of the Jordan Valley in general and the Jordan River in particular. This includes restoration of the flood plain and the ecological (flora, fauna) status of the river, based on environmental flows and good water quality; design and implementation of dedicated ecological restoration projects and eco-parks along the borders of the Jordan River; expansion of currently assigned nature reserves.

The proposed interventions in terms of tourism and cultural heritage focus on restoration and saving the intrinsic cultural heritage sites in the Valley, on boosting the tourism economy in the area, including parks, hotel facilities, museums and touristic routes through the valley, as well as tourism branding and promotion. The interventions aim at creating basin wide synergies and stronger economic development opportunities for the valley as a whole. The proposed interventions in terms of urban and infrastructure development focus on developing sufficient urban housing and infrastructure facilities in the valley towards the year 2050, and meanwhile increase traffic safety and public transport capacities.

### ***What can move forward now?***

Within the total set of interventions a series of *short term actions* have been identified, which can be initiated as soon as possible, pending the final peace accord between Israel and Palestine. They represent a total investment value of 495 MUSD, including 165 MUSD of Israeli interventions and 330 MUSD Jordanian and Palestinian interventions to be funded by the donor community. The interventions will cover pollution control, water management, tourism and cultural heritage development, agriculture and ecological restoration. In addition, the preparation for the Jordan Valley Regional Coordination interventions on all strategic objectives can be advanced at this time. This investment will aim at improving the baseline situation in the Jordan Valley substantially, particularly in Palestine and Jordan, resulting in a strong foundation for the establishment of the independent Palestinian State and for effective regional co-operation among the three riparian states as geopolitical conditions allow.

The short term actions mentioned above cover the following projects:

**2020 Target: Remove major pollution sources from the Jordan Valley**

P01	ISR	Fish Ponds Short Term Pollution Control Improvement Project
P02	ISR	Mine Fields Removal Project
P03	ISR	Sustainable Fish Farming in the Jordan Valley
P04	ISR	Betanya Tertiary Wastewater Treatment
P05	ISR	Betanya Desalination Plant and Afikim Reservoir Project

P01	JOR	Solid Waste Management
P02	JOR	Environmental Management and Public Awareness Program
P03	JOR	Agricultural Pollution Control Project
P04	JOR	Separate waste collection and reuse pilots

P01	PAL	Solid and Hazardous Waste Management Plan
P02	PAL	Environmental Management Project
P03	PAL	Wastewater collection and treatment
P04	PAL	Fish farm Pollution control project
P05	PAL	Land and Water quality Protection Project

**2020 Target: Prepare for sustainable water management and supply in the Jordan Valley, including ecological rehabilitation of the Jordan River.**

W01	ISR	Yarmouk River Dredging and Cliff Protection Project
W02	ISR	Western Drainage Basins Flood Management
W03	ISR	Northern Sewerage Expansion Project
W04	ISR	Springs Rehabilitation Project

W01	JOR	Improved Lower Jordan River Basin Management Project
W02	JOR	Wastewater collection, treatment and reuse project
W03	JOR	Emergency Wastewater Management Project
W04	JOR	Waste water reuse pilot projects

W02	PAL	Rehabilitation and Protection of springs
W03	PAL	Rehabilitation and construction of Domestic water networks
W04	PAL	Desalination of Brackish wells

W05	PAL	Rehabilitation of Al Auja Spring
W06	PAL	Development of Water Tariff structure
W07	PAL	Utilization off Al-Fashkha Spring
W10	PAL	Artificial Recharge Scheme
W11	PAL	Construction of Water networks
W12	PAL	Hydro-Geological Assessment of the study Areas

**2020 Target: Development of a framework for sustainable development of the agricultural sector in the Jordan Valley with an efficient water use.**

A01	JOR	Jordan Valley Greenhouses Expansion Project
A02	JOR	Jordan Valley Extension Services Improvement Project
A03	JOR	Jordan Valley Drip Irrigation Improvement Project
A04	JOR	Jordan Valley Post Harvesting Support Project
A05	JOR	Jordan Valley Irrigation Efficiency Improvement Project
A06	JOR	Jordan Valley Authority Support Project

A03	PAL	Water Right Policies and Regulation (internal issues to Palestine)
A08	PAL	Support to Women organizations and Bedouin Communities
A10	PAL	Strengthening of Extension Services
A11	PAL	Promotions of Farmers Cooperative
A12	PAL	Jordan Valley Credit Program
A13	PAL	LEISA Research certification

**2020 Target: Development of a sustainable ecological management and restoration framework in the Jordan Valley**

E05	REG	International Accreditation of the Lower Jordan River Valley
E01	JOR	Ecological Corridors around Valleys and Dams
E02	JOR	Wetlands and Aquatic Fauna Restoration Project
E03	JOR	Ecological Monitoring and Management Project

**2020 Target: Development of a sound foundation for protection of cultural heritage and tourism development in the Jordan Valley**

C01	ISR	Tsemach to Naharaym Tourism Development Project
C02	ISR	Gesher to Bezeq Stream Tourism Development Project
C01	JOR	Pella Tabaqat Fahl Site Improvement Project
C02	JOR	Abu Ubaydah Tomb Improvement Project
C01	PAL	Cultural Heritage Protection and Management Plan
C02	PAL	Tourism Branding and Promotion
C04	PAL	Rehabilitation of the Catchment of Ancient Jericho
C05	PAL	Rehabilitation of salt industry sites, Rusheideyeh
C06	PAL	Rehabilitation of Ancient Jericho
C07	PAL	Rehabilitation of Hisham's Palace
C08	PAL	Rehabilitation of Tel Abu El Alayek
C09	PAL	Rehabilitation of Khirbet El biyadat or Tel Ouja
C10	PAL	Rehabilitation of Khirbet El Makhrouq
C11	PAL	Rehabilitation of Tel El Hamma
C12	PAL	Archaeological Landmark Features
C13	PAL	Spa, Thalasso therapy and Balneo therapy Center
C14	PAL	Jesus Village

## Summary

The overall objective of this NGO Master Plan for Sustainable Development in the Jordan Valley is to promote peace, prosperity and security in the Jordan Valley and the adjacent regions. All three governments, Jordanian, Israeli and Palestinian have shown considerable leadership to date in advancing sanitation solutions and in their master planning efforts. Given that so many of the interim interventions are implementable today, under the current geopolitical situation, investment in these interventions today will help solidify the overarching objective of the NGO master plan, advancing regional cooperation towards the two state solution and regional integration. In this way investment in the Jordan Valley presents itself as a priority area for donor states and the international community, as the investment seeks to bring returns that are greater than just developmental in nature. At a time when few opportunities appear on the horizon of Middle East peacemaking, investment in the Jordan Valley represents relative low hanging fruit that needs to be advanced promptly.

The NGO Master Plan identifies feasible interventions that will restore the valley's environmental and ecological values within a realistic financial and economic framework. The plan assumes that a future independent State of Palestine will be recognized as one of the three riparian states in the Jordan Valley, side by side with

Israel and Jordan with all three nations entitled to an equitable share of the valley's resources. The plan assumes furthermore free access to the valley for all people within appropriate and agreed security arrangements.

This plan will be used as an advocacy tool towards Jordanian, Israeli and Palestinian decision makers and to donors and the international community, who are invited to cooperate, invest, help secure funding, govern, and implement the proposed intervention for the sustainable development of the Jordan Valley. The proposed Israeli interventions are to be funded by the Israeli government, while the international donor community is invited to assist the proposed Palestinian, Jordanian and Regional, multi-country interventions.

The area covered in this NGO Master Plan relates to the Jordan Valley between the Sea of Galilee in the north and the Dead Sea in the south. It is shared by Jordan, Israel and Palestine and is renowned around the world for its remarkable geographic features, its ancient civilizations and its religious heritage. The environmental and ecological values of the basin have declined drastically during the last sixty years: its water has been diverted; its ecological systems degraded and its natural absorption capacities have been pushed to the limits. Large flows of untreated wastewater and saline water are discharged directly into the basin

and substantial parts of the basin are inaccessible for the local inhabitants.

This Regional NGO Master Plan for Sustainable Development of the Jordan Valley aims at identifying feasible interventions that will restore the valley's environmental and ecological values within a realistic financial and economic framework, in which a future independent State of Palestine will be recognized as partner of Israel and Jordan, with all three nations eventually being on Par in terms of development level and each entitled to an equitable share of the valley's resources, including full control of the natural resources within the national boundaries. The Israeli settlements in the West Bank will have been dismantled by 2020. Specific Palestinian and Jordanian projects that have been identified in the national plans need to be executed in order to bring the countries on par with Israel in order for all three parties to benefit equally from the implementation of the Regional NGO Master Plan.

The plan furthermore assumes free access to the valley for all people within appropriate and negotiated security arrangements. This plan addresses interventions on a regional and national scale in the areas of water management, pollution control, agriculture development, tourism and cultural heritage, land use, governance, sustainable energy, urban development and infrastructure. The plan seeks to help create political will amongst



Jordanian, Israeli and Palestinian decision makers towards the adoption of the plan in whole or in part and to gain the support of the international community towards the implementation of the proposed interventions.

This NGO Master Plan focuses on the Jordan Valley, and provides general outlooks to the national water balances of Jordan, Palestine and Israel only. Detailed water assessment at national level or at wider Jordan River Basin level including Syria and Lebanon go beyond the scope of this study.

The rehabilitation of the Jordan Valley has been a central aim of EcoPeace's work since its establishment in 1994. Through education and advocacy campaigns, major research and regional rehabilitation efforts implemented by our respective governments, some real changes have already been made. For instance, new sewage treatment plants are now operating in Jordan, Israel and Palestine, enabling treatment of some of the polluted wastewater flowing currently into the river. Earlier research conducted for EcoPeace concludes that the Lower part of the Jordan River will require 400 MCM of fresh water per year to reach an acceptable rehabilitation level.

In the framework of this study, assessment was made of the existing national plans in Jordan, Palestine, and Israel. However, these national plans generally do not include projections to 2050, and they do not specifically separate the actions required in the Jordan Valley. These aspects are specifically taken up in this NGO Master Plan.

It should be noted that the strategic objectives in terms of wastewater reuse and agriculture set in this Master Plan are ambitious and require a series of interventions to be implemented. However, this Master Plan assumes that a realistic water balance can only be achieved if the three countries embark on maximized reuse of wastewater for agricultural purposes. The suggested agricultural interventions include drip irrigation and other water efficiency measures, but also interventions to improve agricultural production, marketing and extension services.

This NGO Master Plan provides a baseline of the current status of the basin in terms of land use, natural and cultural resources, the people living in the basin, their socio-economic circumstances, the different economic sectors and related water demands, and the current governance of the basin. The Master Plan then delivers a projection of population and economic figures for the years 2025 and 2050 and related land and water requirements, and it identifies the major challenges to be addressed.

This Master Plan presents a series of strategic objectives for the valley including related interventions that aim at restoring the valley's water, environmental and ecological challenges within a realistic financial and economic framework, leading to a sustainable and economic prosperous region within a safe and politically stable environment, and a healthy and lively Jordan River. Finally it describes the organizational, financial and planning aspects

related to these interventions. This Master Plan has been developed in close co-operation with important stakeholders in the valley. During a series of workshops, these stakeholders have been consulted and participated in discussions to identify the major problems in the valley and to formulate and prioritize the appropriate interventions to address these problems.

A total of 127 interventions have been identified. They aim at addressing all strategic objectives of the Master Plan and have been elaborated at pre-feasibility level. This implies that indeed more details are to be elaborated during the next stage following the completion of this study, such as detailed feasibility studies, financing plans and more. It is not unlikely that during this follow-up phase additional ideas and interventions will be proposed and developed to further fine tune the actions required. The Master Plan authors are particularly grateful to the cooperation in Jordan of the JVA and in Palestine of the PWA. In Israel, two drainage authorities have either completed or are developing master plans in their area of jurisdiction. EcoPeace is therefore also grateful for the cooperation developed with the Kinneret and Lower Jordan River drainage authorities in Israel.

This project used the Water Evaluation and Assessment Program (WEAP) to assess the impacts of the interventions on the Jordan Valley's water balance and the Jordan River flow. The WEAP model scheme including all applied nodes and flow lines are provided in annex 9. Any additional information, including all background

detailed hydrological assumptions, will be available on the website of EcoPeace.

The King Abdullah Canal (KAC) in Jordan has been constructed to safeguard the flow, supply and water quality for irrigation purposes. This Master Plan assumes that the canal shall remain crucial until full co-operation between Jordan, Israel and Palestine has been established in terms of river flow and water quality management. This Master Plan proposes that by then the Jordan River will become a multi-functional river, serving the needs for nature and the economy, and will be transformed into the key water conveyor in the Jordan Valley from north to south. One of the quality related aspects is that the southern part of the Jordan River will always remain salty due to brackish groundwater inflow, and therefore cannot be used here as fresh water conveyor. This implies that the southern section of the KAC might remain operative. However, this Master Plan sees a multi-functional river as the only feasible option for creating a long term and sustainable solution for the Jordan Valley.

### ***The Jordan Valley***

The Jordan Valley forms part of the larger Jordan Rift Valley. The internationally recognized World Heritage values of the Jordan Valley are strongly related to its unique historic, religious, cultural, economic and environmental values, not at least due to its typical rift valley topography. The Lower part of the Jordan River (LJR) originates at the Sea of Galilee and meanders along 200 km down to the Dead Sea through the Jordan Valley. About 600,000 people living in the study area on both sides of the

Lower part of the Jordan River, including about 55,000 Israelis (49,000 in Israel and 6,000 settlers in the West Bank), 62,000 Palestinians, 247,000 registered Jordanians and an estimated 250,000 foreign workers in Jordan originating mainly from Egypt, Iraq and recently from Syria. The study area has a total surface area of 2508 square km, most of which (61.5%) consists of uncultivated land. A total of 803 km<sup>2</sup> (32%) is used for agriculture and 89.6 km<sup>2</sup> (3.6%) as built up area.

The average annual rainfall in the study area and the wider region varies from over 500 mm per year in the north to less than 100 mm in the south close to the Dead Sea. With high temperatures and average dry conditions; the average annual evaporation is high, varying from 2150 to 2350 mm per year. The dominant soil types in the area are regosols, rendzinas and serozems, which are mainly tertiary deposits, and to a lesser extend lithosols, all of them generally fertile. As a result, the majority of land in the area that can be provided with water is used for agriculture and horticulture.

Historically the Lower part of the Jordan River received about 600 MCM / yr from Sea of Galilee in the north and about 470 MCM / yr from the Yarmouk River in the north-east. With some addition inflow from the Zarqa River and nine other streams from the East Bank, the Lower part of the Jordan River had an outflow into the Dead Sea of about 1200 – 1300 MCM / year. Since the 1950s the water from the river had been increasingly diverted by Israel, Syria and Jordan for domestic water supply and development of their agricultural sectors. The water

is diverted mainly by the Israeli National Water Carrier taking water from Sea of Galilee, and through the development of various dams and canals in Syria and Jordan, including the Unity Dam on the Yarmouk river on the border between Jordan and Syria, the King Talal Dam in the Zarqa Basin, and the King Abdullah Canal running east and parallel to the river. Today the outflow into the Dead Sea is about 70 - 100 MCM per year or less.

Climatically, the Jordan Valley is characterized by hot dry summers and mild wet winters, becoming progressively drier moving southward through the valley towards the Dead Sea. Climate change impacts are likely to intensify the water supply related problems in the Jordan Valley. Analysis of the impacts of climate change has been made for the wider Middle East Region such as by GLOWA (2008). Overall, these impacts include a foreseen reduction in local annual water resources with a maximum of 20% by 2050 and increasing temperatures and related surface water evaporation rates.

The Jordan Valley is characterized by a wide range of bio-climatological and physical conditions and its location at the crossroads of climatic and botanic regions endows the area with a rich variety of plant and animal life. For example, a total of 20 species of large mammals belonging to six orders have been recorded in the Valley. Among them four species are considered at risk according to the IUCN Red List of Threatened Species. Moreover, 18 bat species were found along the Jordan Valley, two of them are *considered endangered* or *threatened* on a global

scale. Around spring and autumn the Jordan Valley serves as an important migration route for some 500 Million migrant species, flying between Eastern Europe, Western Asia and Africa. Some of these species are currently considered threatened on a global scale by the IUCN and Birdlife International. Most important, large portions, or even entire bird populations, pass through the Jordan Valley, as it serves as a bottleneck for bird migration.

An analysis of the environmental flow requirements for the river indicates that the physical characteristics of the flow are the most important ecological factor for enabling macro-invertebrates. Less water in the LJR caused changes to the stream channel, resulting in a narrower and more canalized river ecosystem. Less water has also resulted in much slower velocities, reducing the habitats depending on flows, such as falls, cascades and rapids. Less water in the river also means less dilution with inflowing polluted water, such as brackish (ground) water or wastewater. This leads to higher salinity and pollution concentrations in the river stream. As a result, the ecology of the river is now reduced to pockets of high resistant and medium to slow velocity habitats.

In the Western part of the Jordan Valley a total of 44 natural reserves and national parks have been assigned by Israel from Sea of Galilee to the Dead Sea. It should be noted that the nature reserves in the West Bank have been established by Israel unilaterally without the consent or co-operation with the Palestinians, A total of 28 of these nature reserves are entirely located inside the project

boundaries, while the areas of the rest are crossed by the project's boundaries. The total protected areas north of Bezeq stream is 61 square km, while the total protected areas south of the Bezeq Stream as defined by Israel amount to 117.5 square km. The areas of the natural reserves and national parks north of Bezeq stream tend to be smaller than those in the Palestinian West Bank. The protected natural reserves in Jordan are mainly located outside the Jordan Valley.

#### ***Pollution Sources***

The major sources of pollution on the Jordan Valley include untreated wastewater and diversion of saline water into the valley, solid waste dumping and pollution from agriculture, husbandry and fishponds. Untreated sewage water flowing in the Jordan River Basin is one of the major pollution sources in the study area. Many communities in Israel, Jordan and Palestine discharge their untreated or poorly treated sewage water directly or indirectly (through groundwater seepage) into the valley.

Apart from the Israeli section of the study area there is a lack of adequate sanitary waste disposal or treatment, both for domestic waste as well as industrial waste. Recycling and reuse of waste takes place in only very limited amounts. It is estimated that approximately 162.000 tons of municipal waste per year is generated in the Jordan Valley, including 120.000 tons in Jordan, 24,000 tons in Israel and 18,000 tons in Palestine. Land filling is the most common waste treatment technique within the study area and apart from Israel this is mainly done without adequate soil and environmental protection

measures. It is estimated that less than 10% of the waste, or 16,000 tons per year is physically transported out of the valley area to be disposed off elsewhere.

Large parts of the study area are used for agriculture. Water is diverted from the Jordan River and its tributaries for irrigation, and return flows end up in the Jordan Valley's groundwater or surface water. The agricultural return flows are generally polluted with phosphates, salt, nitrates, pesticides and chemical fertilizers. Plant tissue and plastics used in agriculture contribute to the total quantity of solid waste produced in the study area, potentially causing pollution to the Jordan River and Jordan Valley. Furthermore remainders of unused pesticides and fertilizers may act as potential sources of pollution as well. Animal husbandry generates pollution sources in terms of manure (solid and fluid) and animal carcasses, which are potential threats for the environmental and public health. Plastic waste in agriculture is generated from plastic covers of greenhouses, plastic mulch covers used for soil protection and plastic pipes used in the fields and the greenhouses used for irrigation. Most of the plastic is collected and sold to plastic recycling factories, located mainly outside the Jordan Valley.

The fish farms are major water consumers in the Israeli part of our project area in the Jordan Valley. The total surface area of the fish farms ponds in the region totals to approximately 2.000 ha. More than 90 % of the fish ponds are concentrated around Harod Stream and in the Valley of Springs Regional

Council. Evaporation in the ponds increases the salinity of the water in the ponds. The discharged influent water may have chloride concentrations varying between 2.000 and 4.000 mg/l depending on the concentrations in the inflow and the differences in operation. About 75 % of the influent is discharged between October and December; the rest of the influent is discharged as late as February.

Jordan ratified the Mine Ban Treaty in 1999. In accordance with its obligations under this international legal standard, Jordan has destroyed its stockpile of antipersonnel mines and has made steady progress to complete demining for its side of the entire Jordan Valley. In the West Bank over 2.000 ha of land has been fenced by the Israeli military due to landmine related risks. Some of the mine fields were laid by Jordan prior to 1967, along the 1949 Armistice border with Israel and surrounding old military bases. Other minefields were laid by Israel after 1967, around its own military bases and the current border with Jordan. Parts of agricultural and grazing land in the West Bank may still contain landmines as well. This causes risk of injury or death for civilians. The marking and fencing of the landmine zones is poorly maintained and mine risk education is almost non-existent. Most of the casualties have been children.

### ***Cultural Heritage***

The internationally recognized World Heritage values of the Jordan Valley are strongly related to its unique geographic features and its historic, religious, cultural and archeological values. The

Jordan Valley area attracted human habitation for thousands of years and is referred to as the most ancient inhabited area of human history. Archaeological sites date back to the pre-historic era. The remains of more than 20 successive human inhabited areas were found in Jericho, the first of which is Tel Es-sultan, located at the north west of the city, and dates back 10,000 years (8000 BC) and is known as the “oldest city in the world”. Remains in archeological sites are concentrated mainly in the western sector of the city of Jericho, but there also a lot of other sites distributed in the Jordan Valley. These sites are the result of the different eras of history, from the Pre-Pottery Neolithic age, the Bronze age, the Hyksos period, the Canaanite period, the Persian, Hellenistic and Roman periods, and the Byzantine and Ottoman periods. For instance, Jericho is considered to be the oldest continuously inhabited city in the world; it has been home to human beings for 10,000 years. During the Roman rule (63 BC-423 AD), Mark Anthony gave the city as a present to his beloved Cleopatra. After her suicide, it reverted to Augustus Caesar, who himself gave it to Herod. From this time, Jericho became a center of Christianity and continued to be an important city throughout the Byzantine Period.

### ***Infrastructure***

The Jordan Valley is in a strategic location that functions as a west – east corridor from the Mediterranean Sea, Israel and Palestine to Jordan and other neighboring countries. It has also been a North-South transport corridor. The Jordan Valley is connecting Israel with Jordan through the Sheikh

Hussein Bridge in the north, and Palestine with Jordan through the King Hussein (Allenby) Bridge. The King Hussein Bridge is located just outside Jericho city and is the only connection between the Palestinian West Bank and Jordan. The Dead Sea Highway (Route 65) is the major regional highway in Jordan that crosses the Jordan Valley from north to south along the western Jordanian border and Dead Sea shoreline. All other roads leading to and leaving from the Jordan Valley connect to this road. The road passes through some heavily populated urban areas where it is widened to four-lane divided with shops and buildings on both sides of the road.

On the western side of the Jordan River the main road from north to south in route 90. This road runs all the way from Metula in the north of Israel to Eilat in the south. Where the road enters and leaves the West Bank, two checkpoints have been erected: the northern one near the Bezeq Stream and Sdei Trumot, and the southern one along the Dead Sea just north of Ein Gedi. Palestinians living in the West Bank are not allowed to pass these checkpoints unless permits from the Israeli Authorities are obtained.

### ***Population and Agriculture***

The native inhabitants of the Jordan Valley in the early 19<sup>th</sup> century are known as Al Ghawarna or Ghorani (meaning people of Al Ghor), who were involved in mixed farms that covered crop and livestock production systems. Semi-nomadic Bedouins also lived in the Jordan Valley and used the lands as grazing ground for their sheep and goats during the winter months because of its warm

climate and available fodder for their animals. However they moved their flocks up into the hills during the summer to avoid the intense heat.

Today, the Jordan Valley houses a population of about 605,000 people. The information with regard to the population numbers in the study area have been obtained through the Jordanian Department of Statistics (DOS), the Central Bureau of Statistics in Israel, and the Palestinian Central Bureau of Statistics. For the Jordan and Israeli parts of the study area there has been an organic growth of the local population, whereas Jordan saw a large inflow of refugees as well. The natural population growth in Jordan and Israel contrasts with the Palestinians, for which the economic opportunities in the region have been much more limited since the late 1960s. Palestinian youth has often been commuting or migrated to other regions in and outside the West Bank looking for opportunities in the labor markets.

In Jordan, the Jordan Valley houses large number of informal foreign workers originating mainly from Egypt and Iraq. Lately, the northern part of Jordan provides shelter to numerous refugees from Syria as well. It is estimated that a total of about 250,000 informal people live in the Jordan Valley today, many of them employed as temporary workers in the agricultural sector. In addition, an estimated total of 6245 people live in about 26 Israeli Settlements within the West Bank part of the study area, divided over Cluster North, including the settlements of Mehola, Shadmot, Maskoit and Rotem; Cluster Central, including a total of 18 small settlements,

and Cluster South, including the settlements of Vered Yeriho, Beit Harava, Almog and Kalia.

Today, agriculture still dominates the socio-economic landscape of study area, although there is significant inequality between the riparian states. The Israeli part of the basin is economically the most advanced zone, with a living standard comparable to some European countries. The World Bank classified Jordan as an "upper middle income country" however with significant economic inequalities: in the Jordan Valley there a small group of wealthy agricultural entrepreneurs, next to a large group of laborers who live close to the poverty line of JD 32.6 per person per month. The Palestinian part of the Jordan Valley, excluding the Israeli settlements, have a standard of living comparable to that in Jordan, be it that the remaining population living under occupation is small and are often subject to stringent Israeli traveling regulations.

The Jordan Valley is divided into three distinct agricultural zones, because of different agro-climatic and ecological conditions. The northern zones on the West and East Banks receive more rainfall; have lower temperature and better soils. These conditions enabled the farming communities to cultivate field crops and tree crops under rain fed conditions. The middle and southern zones receive marginal rainfall; have poorer soils and higher temperatures and therefore higher evaporations. These zones are unsuitable for rain fed agriculture and Bedouin nomadic communities used to rear their goats and sheep flocks there. The altitude, climate, soil types,

and water resources are different and unique for each of the agricultural zones.

The Jordan Valley is the major agricultural production region for Jordan. On a national scale Jordan's agricultural export accounts for about 550 Million JOD (2014), mainly to the United Kingdom, The Netherlands, Canada, Germany and France, and to a lesser extend to Saudi Arabia and the Gulf States. The export increased by 12% compared to 2013, and includes 888,000 tons of fruits and vegetables. About 85% of the export relates to vegetables, particularly tomatoes. In addition, Jordan exported 613,000 heads of cattle in 2014, mainly to the Gulf Region.

Israel is a major exporter of agricultural products as well as agricultural technologies. The Jordan Valley plays a minor role in the agricultural production, since the bulk is produced in the central and western regions of the country. Israel's agricultural exports account for about 2.2 Billion USD, or 4.2% of the total export market. Vegetables account for about 24% of the total agricultural production. In addition, Israel produces about 690,000 tons of fruits, including 190,000 tons of citrus fruits for export, as well as wheat, barley, corn and cotton. Supporting services, including post harvesting, scientific research and agro-industry are highly developed in Israel.

The total annual Palestinian exports account for about 900 Million USD in 2013. The agricultural value chain contributes today to about 4.5% of the Palestine's GDP, compared to 13% in 1993, with the

Jordan Valley playing a very modest role. Israel still fully controls more than 60 per cent of the West Bank including the vast majority of the western Jordan Valley. In real terms, Palestinian agricultural production in the West Bank has fallen by 30 percent in the last two decades. According to the World Bank, the Palestinian economy would grow by one third if Palestinians had access to all the land in the West Bank. Most of the agricultural production is for domestic consumption and local markets, and only limited amounts are exported. About 5.3 Million USD of fruits and 5.9 Million USD of meat products were exported in 2013. More than half goes to Jordan, followed by Europe, Algeria and the United States.

### ***Tourism***

The Jordan Valley has considerable tourism potential and offers numerous historical, scenic and religious attractions. Tourism contributes between 7 and 14% to the economy of the three riparian countries. Tourism in the Jordan Valley is strongly linked to the unique geographic features and its historic, religious, cultural and archeological features in the valley. Tourist destinations include health/spa tourism, nature areas, and cultural heritage (including religious) sites. Many international tourists combine a day trip to the Jordan Valley as part of their overall vacation itinerary. In addition, nationals of the three countries see the Jordan Valley as a popular trip destination during weekends or holidays.

However, tourism facilities are still relatively undeveloped in the Jordan Valley. The potentials in

terms of recreation, thematic site visits and touristic tours are huge. The Jordan Valley is the home of a unique combination of tourist attractions. The Jordan River is one of the sacred places, both historically and symbolically, for Moslems, Jews and Christians throughout the world. In addition, the flora and fauna inside the valley are very diverse as a consequence of the area's particular geological and climatic conditions.

The tourism related challenges, such as identified by the Palestinian National Strategic Master Plan, include better enforcement and updating existing laws, by laws and regulations; developing urban plans with a clear tourism development vision; more archaeological research; better natural and cultural heritage management, tourism product and infrastructure development and management and strengthening fund management capacities.

### ***Industry***

With the exception of the Israeli zone, the industrial sector is weakly developed in the Jordan Valley. In Jordan agriculture related services include industries supplying greenhouses, on-farm water management equipment and agricultural inputs. An initiative was taken to develop a fruits processing plant; however it failed in the opinion of many farmers. In the Palestinian zones of the study area the agro-industrial linkages are also weak. The High External Inputs Agriculture (HEIA) farms have connections with the agro-industries in Israel that provide irrigation equipment and external inputs. The forward linkages are weak, because the products are directly sold to the consumers or the suppliers in

the urban environment that have processing capacities.

The Jordanian industrial sector in the Jordan Valley consists predominantly of small industries for construction the construction sector and package industry. There are several quarries that produce materials for the construction of buildings and infrastructures in the north-eastern governorates of Jordan. Some quarries even export marble. There are also several metal processing plants in the central and southern part of the East Bank that produce metal frameworks of greenhouses and install these for commercial farmers that invest green houses. These small plants spread over the East Bank produce wooden and plastic crates and boxes for the commercial farmers, for packing their produce in accordance with the demands of the export markets.

The agricultural sector in Israel has established strong backward and forward linkages through the Kibbutzim's organization structures. The economic scales of the kibbutz farms enabled mechanization of the farm operations and investing in processing capacities for its main products through clusters of Kibbutzim. Kibbutzim alone or jointly could invest in technical and managerial capacities needed for backward industrial services, like the production and installation of drip irrigation systems, or in forward industrial services like the processing and marketing of milk or fruit products. The cooperative structure enabled the Kibbutzim organization to invest in agro-industrial initiatives that had synergies with their farm activities through the valorization of its products

and for making more efficient use of the labor resources of its members during the off-season of the on-farm activities.

### ***Water Demands and Supply***

The human water demands in the study area have been divided into two categories: domestic/industrial and agricultural water demands. The calculated domestic/urban demands include all household, industrial, institutional, commercial and tourism water demands. An assessment has been made of the current domestic/industrial water demands based on the available population data in the year 2010, and per capita water requirements. For the sake of uniformity these per capita water requirements have been set throughout the valley at 80 m<sup>3</sup> per capita per year.

Agricultural water demands in the valley have been assessed on the basis of agricultural land use, current cropping patterns and crop water requirements. Particularly for Jordan, which is by far the largest agricultural water consumer in the study area, a distinction has been made between vegetables in the open field; vegetables in green houses, fruit trees and field crops. The agricultural water demands have been defined on the basis of currently utilized agricultural lands. The estimated total water demands in the study area are 647 MCM per year (base year 2010), including 60 MCM per year diverted to Amman. This is approximately 72% of the total annual water resources available in the Jordan Valley. The actual water supply figures are based on the information obtained from the major water supply authorities and

associations in the valley, notably the Jordan Valley Authority (JVA) and Water Authority of Jordan (WAJ); the Israeli Jordan Valley Water Association, the Afikey Maim Water Association; the Harod Water Association, Mekorot, and the Palestinian Water Authority. The following page provides an overview.

### **The Water**

Evaluation and Assessment Program WEAP has been used to calculate the impacts of these water demands on the Lower part of the Jordan River itself. This confirms that the annual flow in the northern section of the LJR is only 22 MCM at the point where the Saline Water Carrier enters the river, and consequently the salinity levels are high with 2,409 mg/L salt. Near the Bezeq Stream the flow slightly increases to about 80.5 MCM per year with 1,448 mg/L of salt. When it finally meets the Dead Sea the flow has reached a maximum with about 102.5 MCM per year. Clearly, these values don't meet any of the criteria for lifting the river to a healthy ecological status, and concise interventions will be needed, starting with preventing salt and pollution inflow into the river and mitigating their polluting sources, and next finding sustainable and sensible solutions for a steady increase of the river's base flow.

### **Governance**

The Jordan Valley Authority JVA is the most influential organization in the Jordanian part of the Jordan Valley. Its mandate area stretches throughout the valley (Ghor) areas, up to the 300 m contour line north of the Dead Sea and up to the 500 m contour line south of the Dead Sea. JVA was

created to take up development in the Jordan Valley, with an emphasis on irrigation development, tourism and industrial development. All technical ministries are represented in its management board. At present, JVA operates largely as a regulatory body rather than as a planning organization due to the fact that many plans have been developed during the previous years. It controls all new development initiatives and approves on these on the basis of the Land Use Master Plan, prepared in 2004. In addition, the Water Authority of Jordan deals with water resources development and focuses on water for domestic and industrial use. The Ministry of Agriculture (MOA) supports the agricultural sector and governs the natural forests in Jordan. The local municipalities are responsible for providing most of the local public services.

<b>Water Balance 2010</b>						
<b>Area</b>	<b>Number</b>	<b>Unit</b>	<b>Type</b>	<b>Demand (CM)</b>	<b>Actual Supply (CM)</b>	<b>Deficit (CM)</b>
<b>Jordan</b>						
Agwhar Shamaliyah	108.943	population	domestic	6.536.580	4.902.435	-1.634.145
Deir al Alla / Balqa	67.925	population	domestic	4.075.500	3.056.625	-1.018.875
Shooneh / Janoobiyah	70.294	population	domestic	4.217.640	3.163.230	-1.054.410
Foreign Population	247.000	population	domestic	7.410.000	5.557.500	-1.852.500
To Amman				60.000.000	60.000.000	0
Shooneh North	115.303	dunum	agriculture	103.596.865	94.931.034	-8.665.831
Deir Alla	74.959	dunum	agriculture	107.169.170	62.068.966	-45.100.204
Shooneh South	120.835	dunum	agriculture	65.492.271	35.000.000	-30.492.271
<b>Total</b>				<b>358.498.026</b>	<b>268.679.790</b>	<b>-89.818.236</b>
<b>Israel</b>						
Emek Hayarden	11.000	population	domestic	990.000	990.000	0
Emek Hamaayanot	11.000	population	domestic	990.000	990.000	0
Beit She'an	17.000	population	domestic	1.530.000	1.530.000	0
Hagilbo'a	10.000	population	domestic	900.000	900.000	0
Jordan Valley WA	24.980	dunum	agriculture	21.237.000	21.237.000	0
Afikey Main WA	87.300	dunum	agriculture	52.015.000	52.015.000	0
Harod WA	36.000	dunum	agriculture	22.000.000	22.000.000	0
Fish ponds	20.000	dunum	fish ponds	100.000.000	100.000.000	0
<b>Total</b>				<b>199.662.000</b>	<b>199.662.000</b>	<b>0</b>



Area	Number	Unit	Type	Demand (CM)	Actual Supply (CM)	Deficit (CM)
<b>Palestine</b>						
<b><i>Palestinians</i></b>						
Bardala Cluster	5.259	population	domestic	315.540	315.540	0
Al-Bassariya Cluster	4.564	population	domestic	273.840	273.840	0
Al-Jiftlik Cluster	6.499	population	domestic	389.940	389.940	0
Fasayil Cluster	1.157	population	domestic	69.420	69.420	0
Al-Auja Cluster	4.423	population	domestic	265.380	265.380	0
Jericho	34.112	population	domestic	2.046.720	2.046.720	0
Bardala Cluster	19.575	dunum	agriculture	10.558.755	4.627.000	-5.931.755
Al-Bassariya Cluster	7.652	dunum	agriculture	5.240.855	3.605.687	-1.635.168
Al-Jiftlik Cluster	7.885	dunum	agriculture	5.400.437	5.334.000	-66.437
Fasayil Cluster	1.714	dunum	agriculture	1.173.919	1.173.919	0
Al-AujA Cluster	5.828	dunum	agriculture	3.991.597	3.991.597	0
Jericho	18.854	dunum	agriculture	11.082.381	11.082.381	0
<b>Total</b>				<b>40.808.783</b>	<b>33.175.424</b>	<b>-7.633.360</b>
<b><i>Israeli Settlements</i></b>						
Cluster North	1.425	population	domestic	128.250	128.250	0
Cluster Central	3.960	population	domestic	356.400	356.400	0
Cluster South	860	population	domestic	77.400	77.400	0
Cluster North AD	4.470	dunum	agriculture	3.100.095	3.100.095	0
Cluster Central AD	46.360	dunum	agriculture	36.621.768	36.621.768	0
Cluster South AD	10.128	dunum	agriculture	8.000.662	8.000.662	0
<b>Total</b>				<b>48.284.576</b>	<b>48.284.576</b>	<b>0</b>
<b>Total</b>				<b>89.093.359</b>	<b>81.460.000</b>	<b>-7.633.360</b>
<b>GRAND TOTAL</b>			<b>CM per year</b>	<b>647.253.385</b>	<b>549.801.790</b>	<b>-97.451.596</b>

In Israel the Ministry of Energy and Water Resources MEWR is in charge of securing a supply of energy at a level of reliability, availability, efficiency and quality needed for a highly developed, modern national economy, at an optimal economic, social and environmental cost. The Israeli Water Authority (IWA) is the government's executive branch in charge of Israel's water economy. It is responsible for the administration, operation and development of the Israeli water economy. The Kinneret Drainage Authority is responsible for river rehabilitation issues from the outlet of the Sea of Galilee to the confluence between the Jordan and Yarmouk Rivers and the Lower Jordan River Drainage Authority from the Yarmouk to Bezek stream on the Israeli side. Mekorot, Israel's national water company, operates under the supervision of the Minister of Energy and Water Resources, and is responsible for supplying the Israeli population with water. The Ministry of Agriculture and Rural Development (MOAG) is responsible for agriculture, land preservation, veterinary services and rural land use planning; The Ministry of Environmental Protection is responsible for protection of the environment and ecosystems, with a department dedicated to stream and river rehabilitation. The Israeli part of the Jordan Valley is governed through three local councils.

The Palestinian Authority, according to the Oslo Accords governs only the areas A and B, or about 10% of the total surface area in the West Bank study area through the following governmental organizations: Office of the Prime Minister; Ministry of Finance; Ministry of National Economy; Ministry of

Agriculture; Ministry of Environmental Affairs; Ministry of Local Governorates and Municipalities; Ministry of Health; Palestinian Water Authority. The Palestinian Water Authority is responsible for management/regulation of water, drainage and sewage affairs. The Palestinian Environmental Quality Authority is responsible for implementation of the environmental law of 1999, with the objectives to protect of the environment against all forms and types of pollution; to protect Public health and welfare. The Ministry of Tourism and Antiquities (MOTA) is responsible for governing the tourist sector and the antiquities in Palestine, similar to its counterparts in Jordan and Israel.

In June 2014 a new Palestinian Water Law was passed. An important pillar of the water law is the establishment of a Water Sector Regulatory Council (WSRC). The main objective of the WSRC is to monitor all matters related to the operation of water service providers, with the aim of ensuring water and wastewater service quality and efficiency to consumers in Palestine at affordable prices. The council is to monitor operational performance related to activities of water service providers including production, transportation, distribution, consumption, wastewater collection, treatment and disposal and reuse of treated wastewater for irrigation.

Since 1967, the Jordan River has been under the control of the Israeli and Jordanian military, which operate checkpoints and bases on both sides. The area contains covert listening stations, radar sweeps and thermal- and night-vision cameras. On the mountain tops that rise steeply from the valley floor,

Israel maintains a series of early-warning stations. Troops are on constant patrol along the river and the passes, and on both sides of the river a key strip of land is inaccessible for the general public.

The Israel – Jordan Treaty of Peace was signed by the State of Israel and the Hashemite Kingdom of Jordan in December 1994. The Peace Process between Israel and Palestine seems today far from concluded. During the 2013 and 2014 Peace Negotiations between the Palestinians and Israeli's, the security arrangements in the Jordan Valley as part of any final settlement between the two parties were one of the key issues of dispute.

### ***Projections for 2050***

Based on the population projections made by the Jordanian, Palestinian and Israeli Departments of Statistics, an assessment has been made of the total population in the valley in the years 2025 and 2050. This includes natural growth of the autonomous population to 0.92% in 2050. In addition, this master plan assumes that in Jordan the high number of foreign inhabitants in the valley will gradually decline as a result of assumed improving economic conditions in their countries of origin, including Syria, Iraq and Egypt. It is assumed that all Israeli settlements in the Palestinian part of the Jordan Valley will be removed, and that the Independent Palestinian State created will see a growth towards an estimated 500,000 people living in the Palestinian section of the Jordan Valley by 2050. It assumes natural population growth under strong economic development conditions in Israel. These assumptions lead to a total projected

population in 2050 of 1.048 Million people living in the Jordan Valley, from the southern tip of the Sea of Galilee to the northern edge of the Dead Sea.

The per capita water demands are expected to grow in Jordan and Palestine as a result of better economic circumstances, while in Israel per capita water demand will continue to decrease due to increased efficiencies. A domestic per capita water demand of 80 CM is assumed for all residents of the valley, be they Palestinian, Jordanian and Israeli. The total Domestic Water Demands within the Jordan Valley for 2050 are 99 MCM / yr. The agricultural water demands in the Jordan Valley are about 553 MCM in 2050. The total amount of wastewater that will be generated in the valley directly relates to the domestic water consumption. In this Master Plan it is assumed that 80% of the total domestic water demands will return to the system as wastewater. Within this Master Plan interventions are proposed to treat and reuse the wastewater generated locally to the maximum extend. It is assumed that by 2050 again 80% of all generated wastewater in the valley (or 64% of all urban water supply, or about 63 MCM / yr) will be reused for agricultural purposes. In addition it is assumed that about 44.8 MCM / yr of the total 100 MCM supplied to Amman and the Northern Governorates will return again to the Jordan Valley for agricultural reuse purposes. In terms of solid waste generation, this Master Plan assumes that the per capita waste generation will increase from 400 kg per person today to 475 kg in 2025 and to 600 kg per person per day in 2050. This leads to about

800.000 tons of waste being generated in 2050 in the valley.

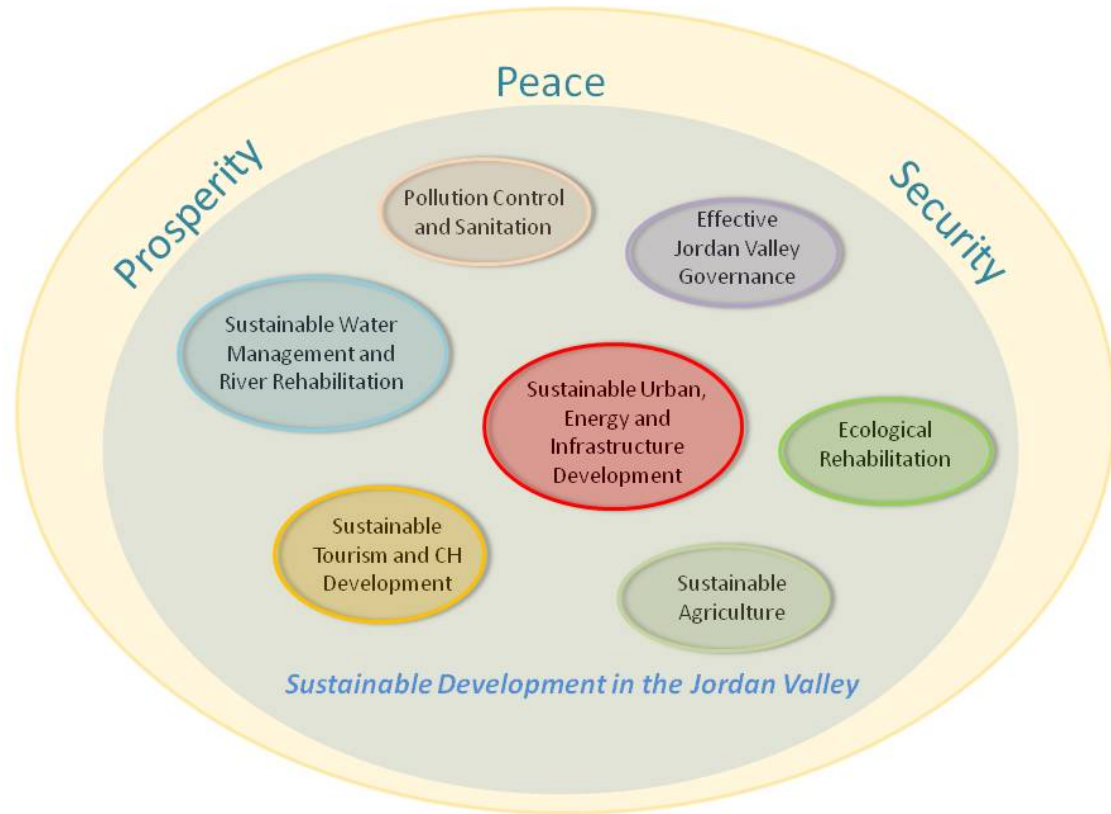


Figure 1 – Strategic Planning Objectives

### ***Strategic Planning Objectives***

The key challenge facing sustainable development in the Jordan Valley is to strike the right developmental balance between a healthy economic developmental path for the valley and its people on the one hand, and a Jordan River with sufficient environmental flows to sustain a healthy eco-system on the other hand. To meet this objective there is a need to ensure that the river serves as a natural water conveyor and source for water supply for residents in and outside the Valley. Sustainable development is seen as a catalyst to peace building between Israel and Palestine and the deepening of cooperation between Jordan, Palestine and Israel as a means to achieve prosperity, stability and security for their residents in the valley and beyond. A key condition for meeting this challenge is that Palestine is recognized as a full riparian to the Jordan River, entitled to have access to its fair share of water resources and sovereignty over its lands in the valley.

The objective in terms of pollution control is to eliminate all sources of environmental pollution in the Jordan Valley by 2025. This requires full and adequate treatment and reuse of all wastewater flows in the valley and to embark on fully integrated solid waste management. In terms of sustainable water management the key challenge clearly is to overcoming the water scarcity related problems in the Jordan Valley. This means creating a sustainable water supply system that meets that current and future domestic and agricultural water demands; and at the same time preserves the water

resources for future generations and for the environment.

Sustainable Agriculture Development is one of the most important pillars of the Jordan Valley Plan as it provides livelihood and prosperity for the whole people in the valley. The strategic agricultural objective for the study area is improving water use and irrigation efficiencies and economic outputs per unit of water used.

The institutional challenge will be to strengthen responsible land co-operation among the involved authorities, including JVA, WAJ, IWA and PWA, drainage authorities, municipalities and other related authorities in their role as authority and regulator of the Jordan Valley. Improvements are required in areas such as water data collection and management; water planning; water storage and distribution operations, including IT and wireless data transfer, economic and land use planning and related support services. This will also require improved coordination and cooperation between various stakeholders involved in water management, to enable to more efficient and beneficial water economy.

Development of the Jordan Valley requires furthermore that local communities will fully participate in identifying their needs and in implementing the interventions for addressing these needs. This requires that local communities are educated and empowered; and that the general public awareness on the current problems and possible solutions in terms of sustainable

development is raised. This requires support from local media, local governments, municipalities, as well as support from the responsible authorities.

One of the key challenges in the Jordan Valley is to restore the good ecological status of the Jordan Valley, and the role of the Jordan River as a strategic water conveyor (Green Infrastructure), in line with earlier recommendations of EcoPeace's Environmental Flow Study. This also includes restoration of the flood plain and the ecological (flora, fauna) status of the river, based on environmental flows and good water quality; design and implementation of dedicated ecological restoration projects and eco-parks along the borders of the Jordan River; expansion of currently assigned nature reserves, based on important flora, fauna and bird areas, also in accordance with the Ramsar Convention; and design and develop dedicated nature recreational areas for the urban population.

Development of the tourism sector and the cultural heritage in the Lower Jordan Basin is a major challenge for saving the intrinsic cultural heritage values in the Basin, as well as for boosting the economy and create jobs in the area. This requires investment planning for major sites such as Pella, the Bakoura National Park, Naharayim, Old Gesher and Jericho, developing transboundary sites, creating free tourism areas at the northern head of the Dead Sea between Jordan and Palestine; and the Jordan River Peace Park between Jordan and Israel. It may also include linking the Baptism Sites to other tourism sites and trails in the valley, and

creating synergies and stronger economic development opportunities.

To facilitate the anticipated population and economic growth in the Jordan Valley, it will be crucial to develop sufficient urban housing and infrastructure facilities in the valley, and meanwhile increase traffic safety and public transport capacities. This is specifically relevant for Palestine and with Jordan. This may include improvement of main north-south roads through the valley, including bypass roads around major urban areas; improving traffic safety through traffic lights, lining and public signs; establishment of sidewalks and bicycle trails; prepare for urban planning and housing projects to accommodate the foreseen growing population and its welfare, and development of trans-boundary infrastructure facilities, such as opening up of the Damya Bridge and the Abdullah Bridge over the Jordan River.

### ***Meeting the Planning Objectives***

A total of 127 interventions have been identified with a total investment value of 4.58 Billion USD. The full set of interventions is presented in annex 1 and grouped around the various strategic planning objectives. Interventions have been distinguished in terms of Israeli (ISR), Jordanian (JOR), Palestinian (PAL), or Regional (REG) interventions. It is assumed that the Government of Israel will finance all Israeli interventions and might co-finance regional interventions.



For every set of interventions a separate regional coordination intervention has been formulated, setting up a regional coordination structure, or Steering Committee, among key Jordanian, Israeli and Palestinian governmental stakeholders for the implementation of the proposed national and

**Figure 2 – Regional Jordan Valley Coordination Scheme**

regional interventions in the Jordan Valley. The objective is that this Steering Committee will eventually be embedded in the structures of the overall River Basin Organization for the Jordan

Valley (ref. intervention IC01 REG Jordan River Basin Organization), as depicted below.

The proposed pollution control related interventions focus on eliminating all sources of environmental pollution in terms of wastewater and solid waste in the Jordan Valley by 2025. This includes full and adequate treatment and reuse of all wastewater flows in the valley and to fully integrated solid waste management. Proposals have been made to include waste collection, transportation; transfer; reuse and recycling of solid waste streams; sanitary landfilling and closing of existing non-sanitary dump sites. The sustainable water management related interventions focus on establishing efficient domestic and agricultural water supply within a basin wide water balance. It also includes an Integrated Water Resources Management approach for the whole (Lower) Jordan River, based on international co-operation among Israel, Jordan and Palestine, supported with adequate water management tools (like WEAP) to ensure sustainable water supply and an increase of the base flow and rehabilitation of the ecological values of the Jordan River.

The agricultural related interventions focus on improving water use and irrigation efficiencies and the economic outputs per unit of agricultural water used. It is assumed that the total water demands for the agricultural sector in the Jordan Valley will remain stable and that adequate tariff policies on water used for irrigation will be implemented, including enforcement, to stimulate more efficient use of water through for instance greenhouse drip irrigation.

The governance related interventions include setting up a Palestinian Basin Authority, strengthening the Jordan Valley Authority and establishing a trans-national Jordan River Basin Organization (Israel, Jordan, Palestine) that will address water management related issues from the valley perspective to the benefit of all stakeholders and inhabitants in the valley. It is proposed that for implementing each set of interventions a regional coordination structure, or steering committee, will be set up. These steering committees shall consist of the key Jordanian, Israeli and Palestinian governmental stakeholders. The objective is that these sector-related Steering Committees will eventually be embedded in the structures of the overall River Basin Organization for the Jordan Valley, as proposed under intervention IC01 REG - Jordan River Basin Organization.

The ecological interventions focus on restoring the good ecological status of the Jordan Valley in general and the Jordan River particularly. This includes restoration of the flood plain and the ecological (flora, fauna) status of the river, based on environmental flows and good water quality; design and implementation of dedicated ecological restoration projects and eco-parks along the borders of the Jordan River; expansion of currently assigned nature reserves.

The proposed interventions in terms of tourism and cultural heritage focus on restoration and saving the intrinsic cultural heritage sites in the Valley, on boosting the tourism economy in the area, including parks, hotel facilities, museums and touristic routes

through the valley, as well as tourism branding and promotion. The interventions aim at creating basin wide synergies and stronger economic development opportunities for the valley as a whole. The proposed interventions in terms of urban and infrastructure development focus on developing sufficient urban housing and infrastructure facilities in the valley towards the year 2050, and meanwhile increase traffic safety and public transport capacities.

Below scheme provides an overview of the proposed interventions. The proposed short term interventions are depicted in blue and can be initiated as soon as possible, pending the final peace accord between Israel and Palestine. These interventions aim at improving the baseline situation in the Jordan Valley substantially, resulting in a strong foundation for the establishment of the independent Palestinian State and for effective regional co-operation among the three riparian states afterwards. The long term interventions are scheduled following the peace accord, when regional co-operation can be implemented to the fullest extent.

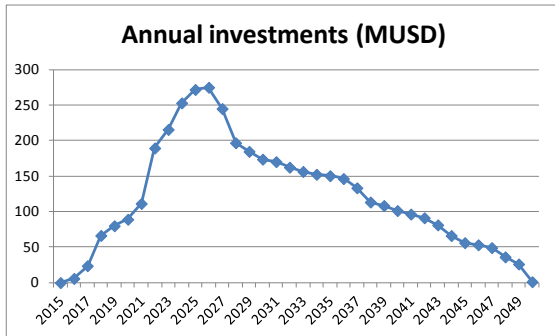
ID	Project (USD)	Subtotal (MUSD)
P01	REG Jordan Valley Regional Coordination on Pollution Control	6.300.000
P01	ISR Fish Ponds Short Term Pollution Control Improvement Project	20.000.000
P02	ISR Mine Fields Removal Project	1.100.000
P03	ISR Sustainable Fish Farming in the Jordan Valley	26.000.000
P04	ISR Betanya Teriary Wastewater Treatment	26.000.000
P05	ISR Betanya Desalination Plan and Afikim Reservoir Project	51.000.000
P01	JOR Solid Waste Management	28.700.000
P02	JOR Environmental Management and Public Awareness Program	4.400.000
P03	JOR Agricultural Pollution Control Project	2.100.000
P04	JOR Separate waste collection and reuse pilots	400.000
P01	PAL Solid and Hazardous Waste Management Plan	30.000.000
P02	PAL Enviromental Management Project	1.000.000
P03	PAL Wastewater collection and treatment	31.000.000
P04	PAL Fish farm Pollution control project	550.000
P05	PAL Land and Water quality Protection Project	200.000
P06	PAL Remediation of Military Bases and Mine Fields	10.300.000
<b>TOTAL POLLUTION CONTROL</b>		<b>239.050.000</b>
ID	Project (USD)	Subtotal (MUSD)
W01	REG Jordan Valley Water Demands Management Project	1.500.000
W02	REG Jordan Valley Regional Coordination on Water Management	6.300.000
W01	ISR Yarmouk River Dredging and Cliff Protection Project	21.300.000
W02	ISR Western Drainage Basins Flood Management	2.100.000
W03	ISR Northern Sewerage Expansion Project	13.000.000
W04	ISR Springs Rehabilitation Project	2.600.000
W01	JOR Improved Lower Jordan River Basin Management Project	2.397.000
W02	JOR Wastewater collection, treatment and reuse project	42.007.000
W03	JOR Emergency Wastewater Management Project	22.701.000
W04	JOR Waste water reuse pilot projects	1.551.000
W01	PAL Wells Rehabilitation and drilling of new well in the jordan valley	2.450.000
W02	PAL Rehabilitation and Protection of Springs	2.790.000
W03	PAL Rehabilitation and construction of Domestic water networks	3.700.000
W04	PAL Desalination of Brackish wells	750.000
W05	PAL Rehabilitation of Al Auja Springs	750.000
W06	PAL Development of Water Traficc structure	100.000
W07	PAL Utilization off Al-Fashkha Spring	5.200.000
W08	PAL Development of a water conveyance system	12.500.000
W09	PAL Utilization of Jordan River	29.500.000
W10	PAL Artificial Recharge Scheme	11.000.000
W11	PAL Construction of Water networks	31.250.000
W12	PAL Hydro-Geological Assessment of the study Areas	1.000.000
<b>TOTAL WATER MANAGEMENT</b>		<b>216.446.000</b>

ID	Project (USD)	Subtotal (MUSD)
A01	REG Jordan Valley Agricultural Water Efficiency	1.500.000
A02	REG Jordan Valley Regional Coordination on Agriculture	6.300.000
A01	JOR Jordan Valley Greenhouses Expansion Project	3.000.000
A02	JOR Jordan Valley Extension Services Improvement Project	2.171.400
A03	JOR Jordan Valley Drip Irrigation Improvement Project	12.690.000
A04	JOR Jordan Valley Post Harvesting Support Project	2.326.500
A05	JOR Jordan Valley Irrigation Efficiency Improvement Project	3.877.500
A06	JOR Jordan Valley Authority Support Project	3.102.000
A01	PAL Shifting in Cropping Patterns	800.000
A02	PAL Rehabilitation and upgrading of water systems	17.000.000
A03	PAL Water Right Policies and Regulation	150.000
A04	PAL Operate and expand the Agro-Industrial Park	2.000.000
A05	PAL construction of Agricultural Roads	1.000.000
A06	PAL enhancement of Palm Production`	1.600.000
A07	PAL Development and Support livestock Sector	3.995.000
A08	PAL Support to Women organizations and Bedouin Communities	650.000
A09	PAL Land Rehabilitation	152.000.000
A10	PAL Strengthening of Extension Services	100.000
A11	PAL Pomotions of Farmers Cooperative	500.000
A12	PAL Jordan valley Credit Program	1.098.000
A13	PAL LEISA Reseach certification	525.000
A14	PAL Establish an Agro-Industrial Zone in the Northern JV	12.000.000
A15	PAL Hand over of Settlements Agricultural Lands	16.000.000
<b>TOTAL SUSTAINABLE AGRICULTURE</b>		<b>244.385.400</b>
IC01	REG Jordan River Basin Organization (JORBO)	4.150.000
IC01	PAL Jordan Valley Authority Development Program	1.000.000
<b>TOTAL LOWER JORDAN BASIN GOVERNANCE</b>		<b>5.150.000</b>
ID	Project (USD)	Subtotal (MUSD)
E01	REG Jordan River Environmental Flows Project	5.000.000
E02	REG Jordan River Ecological Restoration Project - Regional	30.500.000
E03	REG Jordan River Fisk Stock Restoration Project	5.500.000
E04	REG Nature Protection Areas and Management Plan	5.500.000
E05	REG International Accreditation of the Lower Jordan River Valley	1.500.000
E06	REG Jordan Valley Regional Coordination on Ecology	6.300.000
E01	ISR Jordan River Ecological Restoration Project - Israel	3.100.000
E01	JOR Ecological Corridors around Valleys and Dams	7.800.000
E02	JOR Wetlands and Aquatic Fauna Restoration Project	2.130.000
E03	JOR Ecological Monitoring and Management Project	3.550.000
E04	JOR Jordanian Eco-parks and Projected Areas Project	28.910.000
E01	PAL Nature Protection Areas and Management Plan	5.500.000
<b>TOTAL ECOLOGICAL REHABILITATION</b>		<b>105.290.000</b>

ID	Project (USD)	Subtotal (MUSD)
U01	REG Non-fossil, Renewable Energy Development Project	3.000.000
U02	REG Adam / Damia Bridge Rehabilitation Project	90.000.000
U03	REG King Abdullah Bridge Rehabilitation Project	30.000.000
U04	REG Efficient Border Bridges Crossings	10.000.000
U05	REG Jordan Valley Regional Coordination on Urban and Infra Dev.	6.300.000
U01	ISR Center of Excellence at Kinneret College	10.500.000
U02	ISR Eden Regional Agricultural Research and Training Center	21.100.000
U01	JOR Infrastructure Development Project	267.900.000
U02	JOR Urban and Infrastructure development Master Plan	1.424.100.000
U03	JOR Higher Education and Vocational Development Project	30.000.000
U04	JOR Non-fossil, Renewable Energy Development Project	285.000.000
U01	PAL Urban and Infrastructure development Master Plan	1.019.900.000
U02	PAL Educational and Vocational Needs Assessment	250.000
U03	PAL School building Program	4.900.000
U04	PAL Higher Education and vocational Training Program	10.300.000
U05	PAL Health Care services Development Project	10.100.000
U06	PAL Electricity and Telecommunicaions Development Project	202.000.000
U07	PAL Develop Renewable Energy Resources	22.000.000
U08	PAL Import and Export Logistics Center	2.000.000
U09	PAL Utilization of Dead Sea Minerals for economic production	23.500.000
	<b>TOTAL URBAN AND INFRASTRUCTURE DEVELOPMENT</b>	<b>3.472.850.000</b>
	<b>GRAND TOTAL, all investments</b>	<b>4.583.048.083</b>

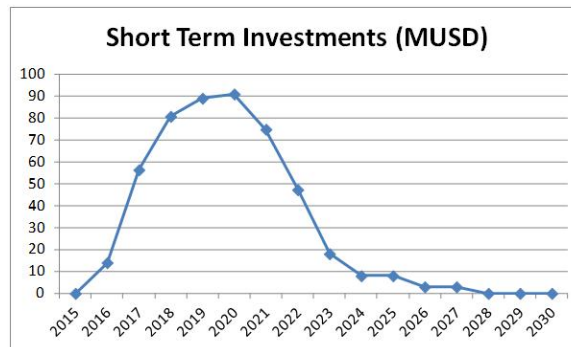
ID	Project (USD)	Subtotal (MUSD)
C01	REG Jordan River Mouth Tourism Information Center	2.200.000
C02	REG Jordan River Baptism Site Improvement Project	4.100.000
C03	REG Jordan River Peace Park Improvement Project	4.100.000
C04	REG Jordan River Regional Routes	2.000.000
C05	REG Cultural and Historic Museum for the Lower Jordan Valley	3.000.000
C06	REG Jordan Valley Regional Coordination on CH and Tourism	6.300.000
C01	ISR Tsemach to Naharaym Tourism Development Project	26.000.000
C02	ISR Gesher to Bezeq Stream Tourism Development Project	26.000.000
C01	JOR Pella Tabaqat Fahl Site Improvement Project	3.102.000
C02	JOR Abu Ubaydah Tomb Improvement Project	775.500
C03	JOR Cultural and Historic Museum for the Lower Jordan Valley	3.080.850
C04	JOR Archaeological Landmarks Development Project	4.935.000
C01	PAL Cultural Heritage Protection and Management Plan	1.700.000
C02	PAL Tourism Branding and Promotion	500.000
C03	PAL Museum of Natural and Cultural History of the Rift valley	42.750.000
C04	PAL Rehabilitation of the Catchment of Ancient Jericho	12.600.000
C05	PAL Rehabilitation of salt industry sites, Rusheideyeh	4.300.000
C06	PAL Rehabilitation of Antient Jericho	4.300.000
C07	PAL Rehabilitation of Hisham's Palace	3.700.000
C08	PAL Rehabilitation of Tel Abu El Alayek	4.733.333
C09	PAL Rehabilitation of Khirbet El biyadat or Tel Ouja	5.800.000
C10	PAL Rehabilitation of Khirbet El Makhrouq	5.800.000
C11	PAL Rehabilitation of Tel El Hamma	5.300.000
C12	PAL Archaeological Landmark Features	1.500.000
C13	PAL Spa, Thalasso therapy and Balneo therapy Center	3.300.000
C14	PAL Jesus Village	3.500.000
C15	PAL Hiking trail Development	2.000.000
C16	PAL Sport and Adventure Center	18.000.000
C17	PAL Travelers Centers	5.200.000
C18	PAL Hotel Rooms 4 Stars (Resort)	80.000.000
C19	PAL The Mud Brick Youth Village	5.100.000
C20	PAL Youth and Guest houses	4.200.000
	<b>TOTAL SUSTAINABLE TOURISM AND CH DEVELOPMENT</b>	<b>299.876.683</b>



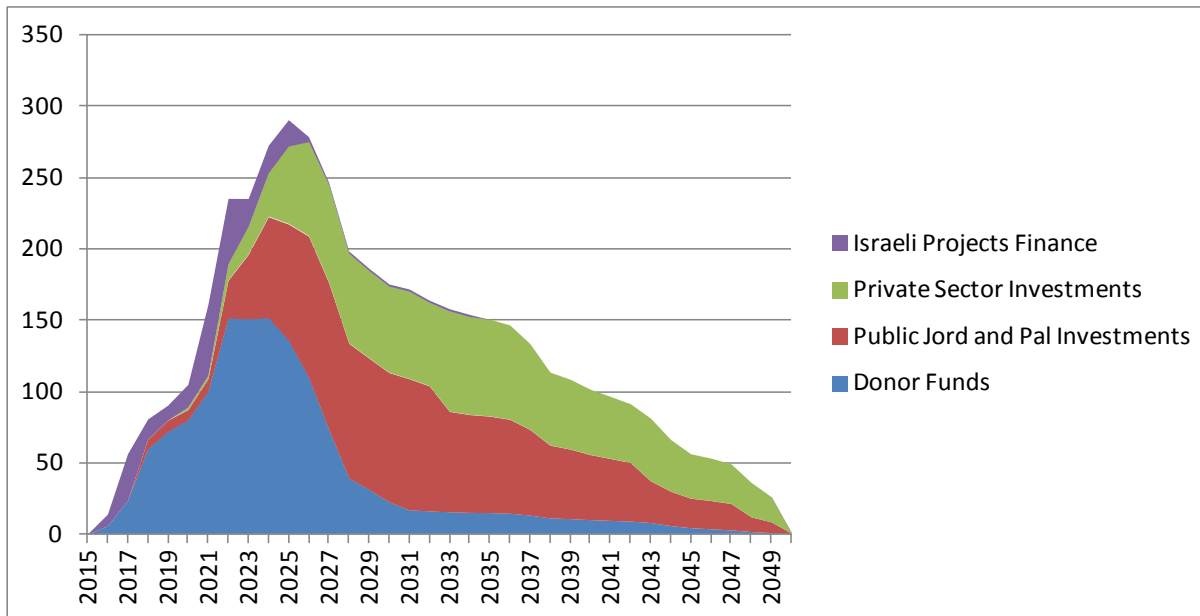


The totally required investments are 4.58 Billion US Dollars until the year 2050, excluding operation costs. The annual disbursement schedule is shown below (in MUSD per year).

As shown above, the annual investment requirements gradually increase until the year 2025



and then gradually decline until the end of the planning period in 2050. . As mentioned, the short term interventions depicted in blue in the table above can be initiated as soon as possible, The related annual short term investments are presented above (in MUSD per year).



The bulk in the investment will be required in the Long Term from 2020 onwards and include urban and transportation development investments. The annual investments will reach its maximum in 2025, when about 260 MUSD of investments will be required, of which 76% relates to urban development and infrastructure investments.

This Master Plan assumes that the required investments in the Lower Jordan Basin for Jordan and Palestine will largely depend on international donor funds until 2028, reaching its peak by 2023 with about 150 MUSD donor investment requirements for that year. It assumes furthermore that the Israeli Government will invest about 250 MUSD in the Israeli part of the Jordan Valley in the period mainly until 2027. Gradually national public investments by Jordan and Palestine will catch up, and later on private investment as well, due to increasing economic opportunities, lower investment risks and a more attractive investment environment in the basin. This leads to the following investment scheme for donor funds, public investments and private investments (in MUSD per year)

The aim of the proposed interventions in this Regional Master Plan for the Jordan Valley is to use it as an advocacy tool with national stakeholders, international financiers and various actors of the international community to increase political will for the adoption in full or in part of the proposed interventions. The interventions that have been described in annex 1 include a suggested institutional setting for each. Financing for the proposed interventions has yet to be secured, and

will require additional preparation and design activities, including elaboration of the proposed institutional and governance aspects, also depending on the specific requirements of the financiers, either nationally or internationally. However, it is foreseen that the national authorities will play the major role in implementation of most of the interventions, since its main task is the development, protection and improvement of the water and environment in the Jordan Valley.

The Municipalities and the civil community have to play an important role in the further preparation and implementation of the suggested interventions, since they represent the local population living in the valley, and they play a key role in providing services to these inhabitants in terms of water, wastewater collection and solid waste management. The subsidiary principle is again here relevant. In addition, proper Environmental and Social Impact Assessments, including stakeholder participation and if needed Resettlement Action Plans shall be part of all infrastructure preparation works.

Finally EcoPeace Middle East is foreseen to play a key role in most of the interventions as one of the major NGO's active in the Jordan Valley, particularly with regard to organizing grass root environmental protection activities, and engaging and organizing the local stakeholders in the further preparation and implementation of the proposed interventions. Furthermore, EcoPeace as a unique organization at the forefront of the environmental peacemaking movement, and is therefore very well equipped to help promote trans-boundary co-operation and

dissemination components of the proposed interventions.

#### ***The Year 2050***

Under the scenario and strategy described in this Regional Master Plan, by 2050 the Jordan Valley will be a co-operative, confident and peaceful region with a healthy economy and strong development perspectives for the people living here. They will experience a clean and healthy environment and sufficient flows in the Jordan River to sustain healthy eco-systems. At the same time the river will act as natural water conveyor and source for water supply in the Jordan Valley. Water will be equitably shared among the three riparian countries and the valley will be freely accessible for all nationalities within an appropriate security framework. Local, private and foreign investments will be encouraged due to the stability in the region. In short, there will be an investment climate resulting from the reforms in general, and a conducive regulatory business environment that promotes sustainable development.

In 2050 the valley will house around 750,000 people in Jordan, 500,000 people in Palestine and 90,000 people in Israel, who will enjoy their living environment in terms of living, working and recreational conditions. They will live in a comfortable and sustainable urban setting with an average of about 3.5 people per household. There will be about 370,000 household units in the valley, compared to about 65,000 today. This will be the result of substantial investments in urban and infrastructure projects in the range of 3.47 Billion US

Dollar until 2050, with relative smaller housing units than existing today. Meanwhile the roads and infrastructure have been upgrade with adequate traffic safety measures, including efficient public transport, bypasses around urban centers, pedestrian and bicycle sideway capacities and more.

Due to investments in tourism, sustainable agriculture and agri-business, as well as in housing, infrastructure, higher education and public services the people in the valley will enjoy attractive job opportunities. The economy will become more service and high added value oriented, with a higher percentage of people being employed in the service sector. The average income will have risen substantially to about 14,000 USD per person or about 50,000 USD per household in Jordan and Palestine and to about 72,000 USD per person in Israel.

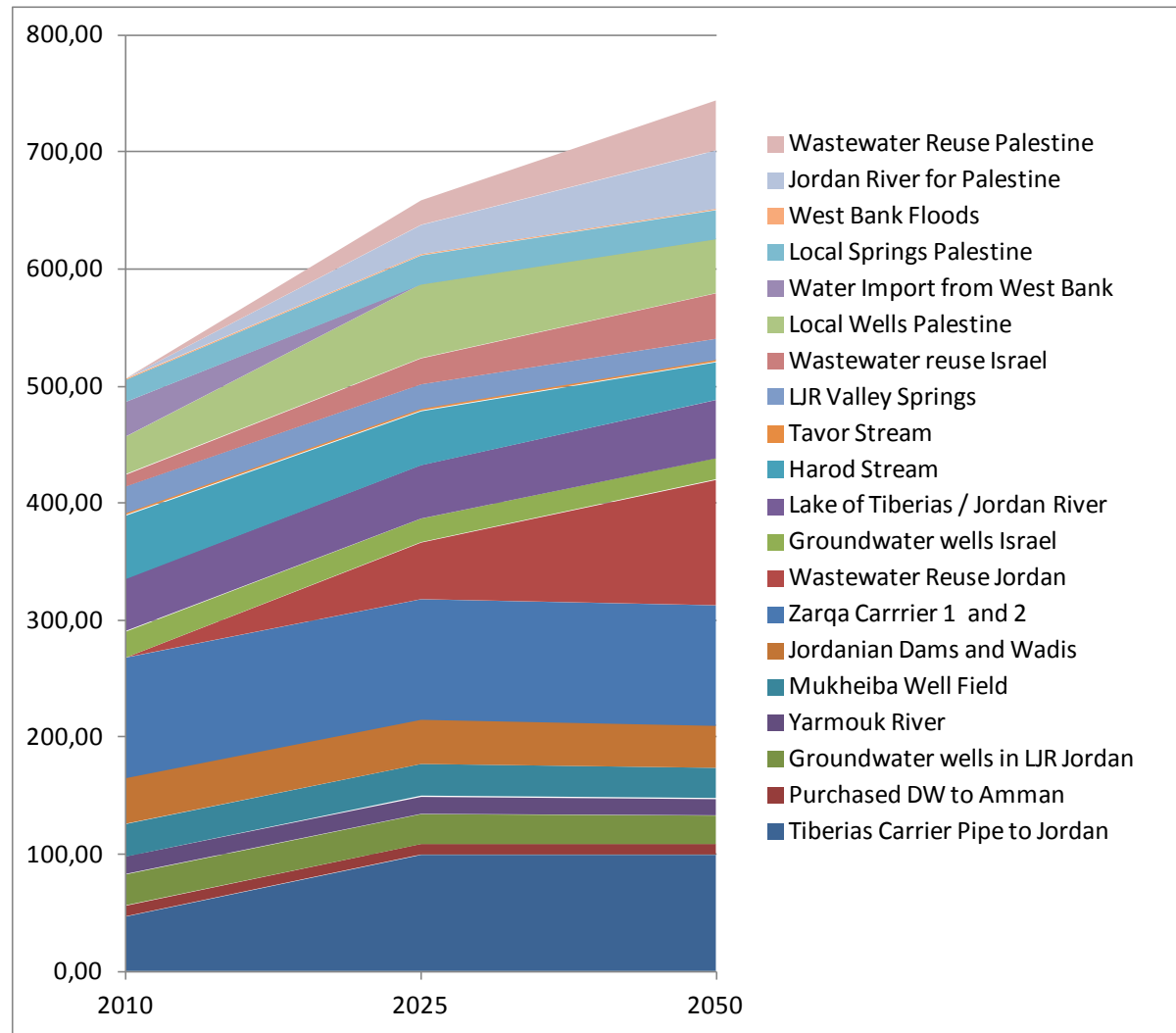
In 2050 the Palestinian economy will experience substantial growth, unrestricted by land use or access and sufficient water resources to meet their demands as described before. This will have synergetic positive impacts on the basin economy at large, due to growth of export and import of goods and knowledge both from Israel and Jordan.

The basin economy in 2050 will strongly benefit from the expanding construction and real estate sector, responsible for the realization of the additionally required infrastructure and urban housing units. This in turn will have an economic spin off to related sectors, such as the stone and

marble industries, public utilities, commercial sectors, telecommunication and more. In addition it is expected that land prices rises will contribute substantially to the overall economic growth. This will particularly be the case for the Palestinian land prices in (previous) area C. For instance the World Bank's economic analysis of area C and its future economy (Orhan Niksic et al, 2014) indicates that current cost per dunum in area A in Jericho is around USD100,000, while in area C, like in Bardala, it is not more than USD10,000 per dunum. These differences will gradually disappear in a future independent Palestine, leading to an increase of average land prices.

The tourism industry will be one of the cornerstones of the basin's economy in 2050 and will largely benefit for the full co-operation among the three riparian partners that is foreseen by then. Up to 5 – 10 Million of national, regional and international tourists per year will visit the cities, nature parks, the cultural and religious sites and a wide variety of museums established in the valley, leading to an economic growth in the range of 5 – 10 Billion USD per year. In additional, the expanded urban centers will provide wide variety commercial services. This leads to an estimated 6,000 people in Israel being employed in the tourism and commerce sectors, 40,000 people in Jordan and 33,000 people in Palestine.

By 2050 the Jordan Valley will be supplied with water from the following resources (MCM / yr)



The land use distribution in the Jordan Valley will be as follows.

Area (km2)	Israel	Jordan	Palestine	Total
<b>2010</b>				
Uncultivated / nature reserves	61.9	810.3	671.3	1,543.5
Agriculture	178.3	451.8	173.0	803.1
Built up area	19.6	44.6	25.3	89.6
Fish Farms	21.5	0.7	0.3	22.6
Water reservoirs	0.61	5.55	0.26	6.43
Wadis	5.3	24.2	13.8	43.24
<b>TOTAL</b>	<b>287.2</b>	<b>1,337.2</b>	<b>884.0</b>	<b>2,508.4</b>
<b>2050</b>				
Uncultivated / nature reserves	45.8	747.9	575.1	1,368.8
Agriculture	199.8	451.8	215.7	845.9
Built up area	35.7	107.0	78.8	221.5
Fish Farms	0	0.7	0.3	22.6
Water reservoirs	0.61	5.55	0.26	6.43
Wadis	5.3	24.2	13.8	43.24
<b>TOTAL</b>	<b>287.2</b>	<b>1,337.2</b>	<b>884.0</b>	<b>2,508.4</b>

In the vision for 2050 the Jordan River will play a crucial and multi-functional role. This implies that the

water in the river will serve different important functions at the same time, in terms of sustaining ecology, supporting tourism and related economic development, and conveying and supplying water throughout the valley, particularly for Jordan and Palestine.

Within the framework of this Master Plan the following Environmental Flow Strategy has been assumed. The 2050 Environmental Flow regime is based on a multi-functional river approach. This means that the river will be used for both ecological, economic / tourism and water conveyance purposes, as such maximizing the flow within the river itself, and maximizing the ecological / economic value of the water flow. This implies that all sources of pollution have been mitigated and that the river water will have reclaimed a natural water quality, only affected negatively by the natural salt inflow from the southern brackish aquifer systems.

In accordance with the study's water modeling calculations this will require that by 2050 some 238 MCM / yr of water will be released into the Jordan River from the Sea of Galilee, reflective of Israeli leadership needed in the rehabilitation effort. In addition, the river will receive 12 MCM / yr from the Valley of Springs, 8 MCM / yr from the Harod Spring and 8 MCM / yr from Wadi Arab. It will also receive 18 MCM / yr as natural groundwater outflow in the Israeli part of the valley, and 5-6 MCM / yr in the Palestinian part of the valley. No groundwater contribution from the Jordanian side is foreseen. However, it is assumed that by 2050 Jordan will use the Jordan River instead of the King Abdullah Canal

for conveying water from north to south to the point where brackish groundwater naturally infiltrates into the Jordan River, near the Harod Stream.

In addition it is proposed to have at least one minor flood (c.a. 20-50 m<sup>3</sup>/sec) per two years, to be achieved for instance by fully opening the Deganiya dam for 24 hours every other winter. In order to bring back the original habitats of the river, also the flow bed of the river will be widened to 50 m in the north and at least 15 m down to Wadi Qelt, with flood plains on both sides. This includes construction of new meanders and cascades.

This measure will lead to an average flow of 200 – 300 MCM / yr in the upper section of the river, and around 100 MCM / yr of water flowing into the Dead Sea. The average salt content will be between 300 – 700 ppm in the upper section and around 1350 ppm in the lower section, which is highly acceptable from an ecological point of view. The final southern stretch of the river, below Wadi Qelt will see higher concentrations up to 3000 ppm due to brackish groundwater seepage and discharge of the Saline Water Carrier.

In order to reach a minimum flow of 400 MCM of fresh water per year throughout the major stretch of the Jordan River, one depends on an additional contribution of 100 MCM / yr from Syria by 2050 through the Yarmouk River; and an additional inflow of 100 MCM / yr of treated wastewater into the Jordan River from the wider region in Israel, Jordan and Palestine around the Jordan Valley. However, these options will come against certain costs of

probably not below 30 MUSD / yr, which is to be assessed in a detailed cost-benefit analysis, for instance during the feasibility assessment phase of such interventions.

In all, this study and the related model calculations show that a sustainable and environmentally friendly water regime can be created in the Jordan Valley by 2050 that creates a clean and healthy river system and facilitates the interests all three riparian states of Palestine, Jordan and Israel appropriately.

Finding international and national partners for implementing the most urgent interventions is the next challenge. We trust that the depth of the analysis presented here, the consistency in the applied planning approach and the importance of the overarching objectives of the NGO Master Plan will convince the international community that it makes sense to embark on implementing this plan, including continued co-operation within the Jordan Valley among the Jordanian, Israeli and the Palestinian neighbors.

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## PREFACE

The *Jordan River*, the river with the lowest elevation in the world, originates on the slopes of Jabal al-Sheikh (Mount Hermon) on the Syrian-Lebanese-Israeli border, flows southward through Northern Israel to the Sea of Galilee, and then divides Israel and the Palestinian West Bank on the west from the Kingdom of Jordan on the east, before flowing into the Dead Sea at an elevation of about 427 meters below sea level.

The *Lower part of the Jordan River* is the section of the Jordan River that flows between the Sea of Galilee and the Dead Sea. As it flows out of the Sea of Galilee, intercepts with the Yarmouk River and next meanders for 200 km through the Jordan Valley down to the Dead Sea. The Jordan Valley, the focus of this report, is shared by Jordan, Israel and Palestine and is renowned around the world for its remarkable geographic features, its ancient civilizations and its religious relevance. The environmental and ecological values of the valley have declined drastically during the last sixty years: its water has been diverted; its ecological systems demised and its natural absorption capacities have been pushed to the limits. Large flows of untreated wastewater and saline water are discharged directly into the valley and substantial parts of the valley are no longer accessible for the inhabitants who live there.

Water and Environment Development Organization (WEDO) under the umbrella of EcoPeace Middle East in partnership with the Stockholm International Water Institute (SIWI) and the Global Nature Fund (GNF) have assigned Royal HaskoningDHV and its partner MASAR in Jordan, Core Associates in Palestine and DHVMED in Israel to develop this Regional NGO Master Plan for Sustainable Development in the Jordan Valley. The overall objective of this project is to promote peace and prosperity within the Jordan Valley. The specific objective of the plan is to identify feasible interventions that will restore the valley's environmental and ecological values within a realistic financial and economic framework, in which a future State of Palestine will be recognized as one of the three riparians to the Jordan Valley, side by side with Israel and Jordan with all three nations entitled to an equitable share of the valley's resources. The plan assumes furthermore free access to the valley for all people within appropriate and negotiated security arrangements. This plan will be used as an advocacy tool towards Jordanian, Israeli and Palestinian decision makers and the international community for the implementation of the proposed interventions.

An estimated 500,000 Jordanians, 49.000 Israeli's and 56.000 Palestinians live today on both sides of the Jordan River. This Master Plan provides first a summary of the current status of the valley in terms of its land use and its natural and cultural resources;

next it describes the people living in the valley, including their socio-economic circumstances and the different economic sectors and related water demands; and it describes the current governance of the valley. Next, this Master Plan shows projected population and economic figures for the years 2025 and 2050 and related land and water requirements, and it identifies the major challenges to be addressed.

Next, it presents a series of strategic objectives for the valley including related interventions that aim at restoring the basin's water, environmental and ecological challenges within a realistic financial and economic framework, leading to a sustainable and economic prosperous region within a safe and politically stable environment, and a healthy and lively Jordan River. Finally it described the organizational, financial and planning aspects related to these interventions. This Master Plan has been developed in close co-operation with a number of important stakeholders in the valley. During a series of workshops, these stakeholders have been consulted and participated in discussions to identify the major problems in the valley and to formulate and prioritize the appropriate interventions to address these problems.

## ABBREVIATIONS

AMWA	Afikey Maim Water Association	MCM	Million Cubic Meters
CA	Current Accounts (WEAP)	mg/L	milligram per liter
DOA	Department of Agriculture (Jordan)	MoA	Ministry of Agriculture (Israel)
dunum	Surface area unit: 0.1 ha	MSL	Mean Sea Level
ET	Evapotranspiration	NGO	Non-governmental Organization
FMS	Frequent Maximum Salinity	NIS	New Israeli Shekel
EXACT-ME	Executive Action Team - Middle East	NPA	Nature and Parks Authority (Israel)
EcoPeace	EcoPeace Middle East, (formaly Friend s of the Earth Middle East)	NWC	National Water Carrier (Israel)
GDP	Gross Domestic Product	PCBS	Palestinian Central Bureau of Statistics
GoJ	Government of Jordan	ppm	Parts per Million
HEIA	High External Inputs Agriculture	PWA	Palestinian Water Authority
IWA	Israeli Water Authority	RS	Reintroduced Scenario (WEAP)
IWRM	Integrated Water Resources Management	SoG	Sea of Galilee
JD	Jordanian Dinar	SWC	Saline Water Carrier
JRV	Jordan River Valley	SWM	Solid Waste Management
JVA	Jordan Valley Authority (Jordan)	THS	Tiberias Hot Springs
JVWA	Jordan Valley Water Association (Israel)	UJR	Upper Jordan River
KAC	King Abdullah Canal (Jordan)	WBWD	West Bank Water Department (Palestine)
KWh	Kilowatt Hour	WEAP	Water Evaluation and Planning System
LEISA	Low External Input Sustainable Agriculture	WW	Wastewater
LJR	Lower part of the Jordan River	WWTP	Wastewater Treatment Plant
L/s	Liter per second	ZS	Zero Scenario (WEAP)
m3/s	cubic meter per second		

# INTRODUCTION

## 1.1 This Regional Master Plan

WEDO / EcoPeace Middle East assigned Royal HaskoningDHV on the 27<sup>th</sup> of August 2012 to develop national NGO Master Plans for sustainable development of the Jordan Valley for Jordan and Palestine, and one Regional Master Plan for the Jordan Valley, located between the Sea of Galilee and the Dead Sea. WEDO / EcoPeace view this final Master Plan as an advocacy tool to engage with national stakeholders and the international community for the full or partial adoption of the proposed interventions.

The future scenarios and strategic objectives for the Jordan Valley Master Plan presented in this report reflects the vision of WEDO / EcoPeace Middle East, and do not necessarily reflect the opinion of the European Union or the individual consultants and their sub-consultants.

This Regional NGO Master Plan describes the current land and water related issues in the Jordan Valley, and the projections in the valley for the years 2025 and 2050. It presents the major challenges in the valley towards creating sustainable development conditions, including environmental flows provided through its natural resources; a healthy eco-system; equitable sharing of water resources, and it present a list of prioritized interventions that will restore the valley's environmental and ecological values within

a realistic financial and economic framework. The Jordan Valley is part of the wider Jordan Basin, which includes catchment areas in Lebanon and Syria as well. The upper part of the Jordan River Basin is connected to the Lower part of the Jordan River Basin through Sea of Galilee and the Yarmouk River. This study does not address analysis of the wider Jordan River Basin as a whole, but assumes the hydrological characteristics of Sea of Galilee and the Yarmouk as boundary conditions for this study.

An extensive baseline report of the trans-boundary Jordan Valley has been prepared by the Consultant in March 2014, which provides the base for this NGO Master Plan.

## 1.2 The Consultants

Royal HaskoningDHV B.V. is WEDO / EcoPeace's main contractor for this study, and has established sub-contracts with CORE Associates in Palestine, MASAR Center from Jordan and DHVMED from Israel. Key experts from these organizations form together the core study team, headed by DHV's project manager. The study team represents an excellent track record in the areas of development of river basin master plans around the world, as well as in water and environmental management projects in Jordan, Israel and Palestine. They have provided a wide range of services, from strategy and policy

development, feasibility studies to designs and construction supervision in the Middle East and in different river basins around the world.

RHDHV BV from the Netherlands is part of Royal HaskoningDHV, which is one of the largest independent consultancy groups, employing currently around 8000 employees world-wide. The firm is a merger between DHV Group and Royal Haskoning Group established on the 1<sup>st</sup> of July 2012. DHV was founded in 1917 and has gained a world-wide reputation from many projects in a wide range of sectors implemented in more than 70 countries, including river basin and water resources management. Royal HaskoningDHV is registered with the major Financial Institutions and International Agencies, and regularly carries out projects financed by them. See also [www.royalhaskoningdhv.com](http://www.royalhaskoningdhv.com)

CORE Associates is a specialized provider of high-end professional services in Economic and Trade Policy, International Trade, Planning and Business Development Services with its headquarters in Ramallah. CORE provides timely, pragmatic and cost-efficient advice and training in the context of economic, and trade policy and negotiations, the formulation and implementation of national policy and private sector development. CORE's clients include governments, international governmental organizations as well as NGOs, trade associations and private businesses. See also [www.core.ps](http://www.core.ps)

MASAR has been established since 1994 as a regional Non government, not-for-profit organization focusing on training projects involving about 12 countries from the MENA region and Europe. MASAR implemented projects in the fields of environment, democracy education, peace and conflict resolution, human rights, gender, interfaith dialogue, youth employment and entrepreneurship. Besides projects in these fields, Masar has also been engaged in providing consulting and expertise to local, regional and international beneficiaries on matters related to Euro-Med cooperation. See also [www.masarcenter.org](http://www.masarcenter.org)

DHVMED from Israel was founded at 1996 as a subsidiary of DHV Group. The company in Israel practice consulting engineering services in water, environment and related infrastructure and counts 30 professional staff. DHV MED specialized in master planning, overall engineering from concept through feasibility studies and up to general and detailed design. The company provides consulting , design and to the industrial and public sectors such as the Ministry of Environment, WTP (water treatment plants), WWTP (wastewater treatment plants), in the areas of river basin management, air emission treatment, alternative energy, solid waste management, polluted soil treatment and more. See also [www.dhvmed.com](http://www.dhvmed.com)

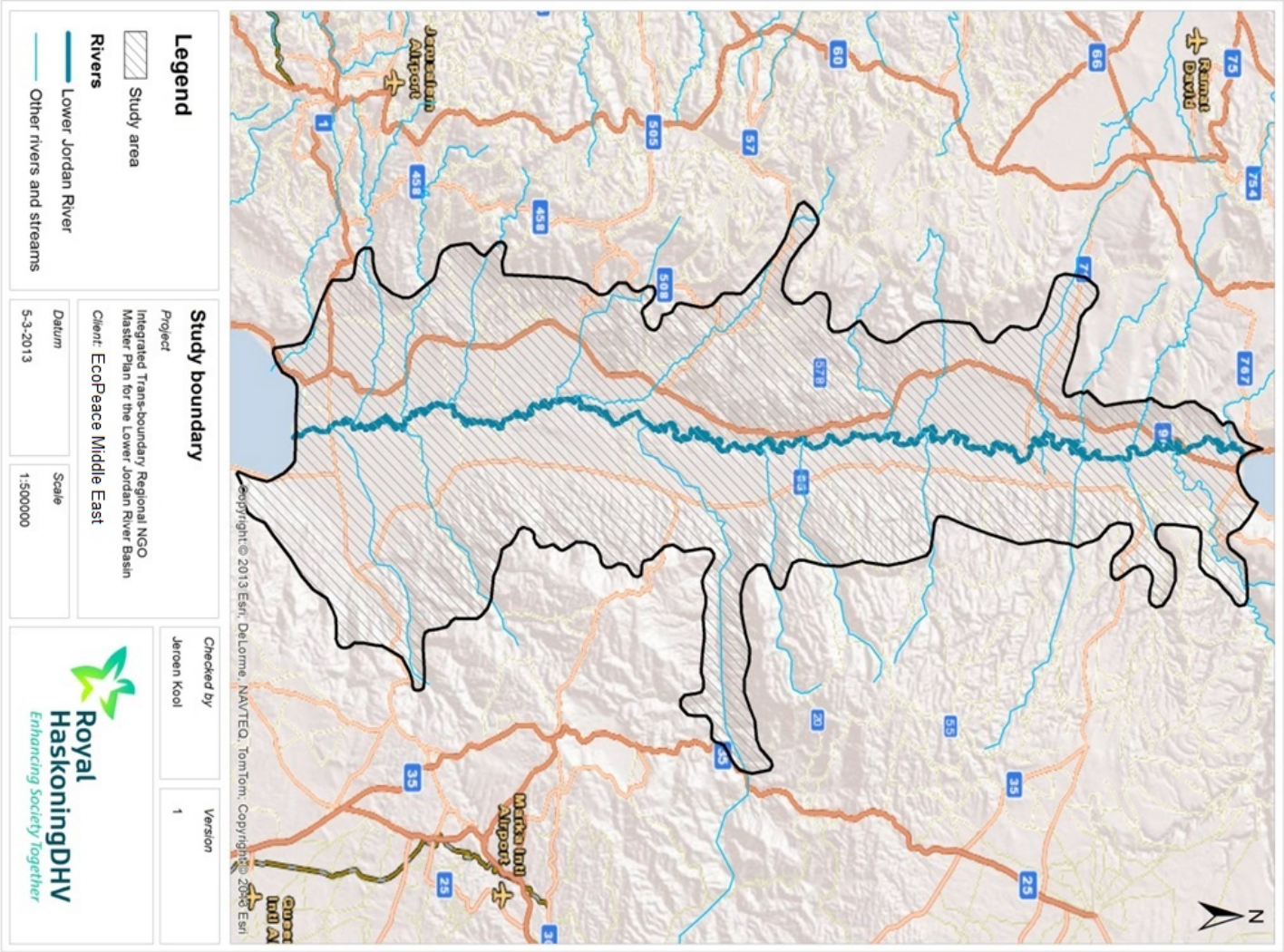


Figure 3 – Jordan Valley

### 1.3 The Project Team

This technical analysis for this Master Plan has been performed by an international team of renowned Jordanian, Palestinian, Israeli and Dutch experts, who have co-operated with the staff of WEDO / EcoPeace to prepare this Regional NGO Master Plan for the Jordan Valley as presented in this report.

#### Consultant's Team

KOOL, Jeroen, project manager

AL KHATIB, Saad, Economist

AL MASRI, Dr. Mohammad, GIS expert

AL SHEIKH, Banan, Environmental Expert

BAMYA, Saeb, Geo-political Expert  
and Palestinian Team Leader

DE GROOT, Mark, Pollution Control Expert

ELRON, Eldad, Ecological Expert and Israeli Team Leader

HARTVELD, Dr. Aard, sociologist

HUNTJENS, Dr. Patrick, governance expert

JAYYOUSI, Anan, water management expert

KAPLAN, Moti, land use expert

KWAKKEL, Jeroen, information management support

MALHAS, Haidar, agricultural expert

SAFIER, Gilad, Water Modeling expert

SHARIF, Dr. Walid, archeological expert

TALOZI, Dr. Samer, water management expert

and Jordanian team leader

#### EcoPeace Staff

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Adnan Budieri	EcoPeace Amman	Assistant Director Amman
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Marina Djernaes	WEDO/EcoPeace Regional	Executive Operations Officer

##### ISRAEL

Gidon Bromberg	EcoPeace Tel Aviv	Director Israel
Mrs. Elizabeth Ya'ari	EcoPeace Tel Aviv	Israel Project coordinator
Uri Ginot	EcoPeace Tel Aviv	Government Relations

## The Jordan Valley

### 2.1 Introduction

In March 2014 a Baseline Report has been prepared and published by Eco Peace Middle East on their website, describing the current situation in the Jordan Valley, including the physical and environmental characteristics of the valley, the population living in the valley and their socio-economic status and the governance structures in the valley. This report concluded with the major challenges that the valley faces, both from national perspectives and in terms of trans-boundary challenges. This section here provides a summary of this baseline report.

### 2.2 The Jordan Valley

#### Land Use

The Jordan Valley (Arabic: الغور; Hebrew: Ghor-Al , הירדן עמק Hayarden , Emek) forms part of the larger Jordan Rift Valley. The internationally recognized World Heritage values of the Jordan Valley are strongly related to its unique historic, religious, cultural, economic and environmental values, not at least due to its typical rift valley topography. The Lower part of the Jordan River (LJR) originates at the Sea of Galilee and meanders along 200 km

down to the Dead Sea through the Jordan Valley. About 600,000 people living in the study area on both sides of the Lower part of the Jordan River, including about 55,000 Israelis (49,000 in Israel and 6,000 settlers in the West Bank), 62,000 Palestinians, 247,000 registered Jordanians and an estimated 250,000 foreign workers in Jordan originating mainly from Egypt, Iraq and recently from Syria.

The rehabilitation of the Lower part of the Jordan River has been a central aim of WEDO / EcoPeace's work since its establishment in 1994. Through education and advocacy campaigns, major research and regional rehabilitation efforts, some real changes have already been made. For instance, new sewage treatment plants have been constructed in Jordan, Israel and Palestine, which will enable treatment of polluted wastewater flowing currently into the river. Earlier research conducted for WEDO / EcoPeace concludes that the Lower part of the Jordan River will require 400 - 600 MCM of fresh water per year to reach an acceptable rehabilitation level.

The topographic nature of the area has the typical rift valley characteristic with drastic drop in elevations over short distances from the edges of the valley, and a more gently decline closer towards the Jordan River. Alongside the axe of the valley,

the elevation drops from north to south. In the northern part of the valley the drop is almost 375 m over a distance of 10 km. In the middle part of the valley this drop in elevation exceeds 500 m over a distance of 9 km. In the very south, this drop reduces to 100 m over a distance of 8 km. An overview of the topography of the Jordan Valley is provided in Figure 4.

The study area has a total surface area of 2508 square km, most of which (61.5%) consists of uncultivated land. A total of 803 km<sup>2</sup> (32%) is used for agriculture and 89.6 km<sup>2</sup> (3.6%) as built up area. An overview is provided hereafter.

**Table 1 – Land use in the study area**

Land use	Surface area in km <sup>2</sup>	%
Agriculture	803,1	32
built area	89,6	3,6
fish farming	22,6	0,9
Natural/Uncultiva	1.543,50	61,5
Reservoirs	6,4	0,3
Wadi's	43,2	1,7
Grand Total	2.508,40	100



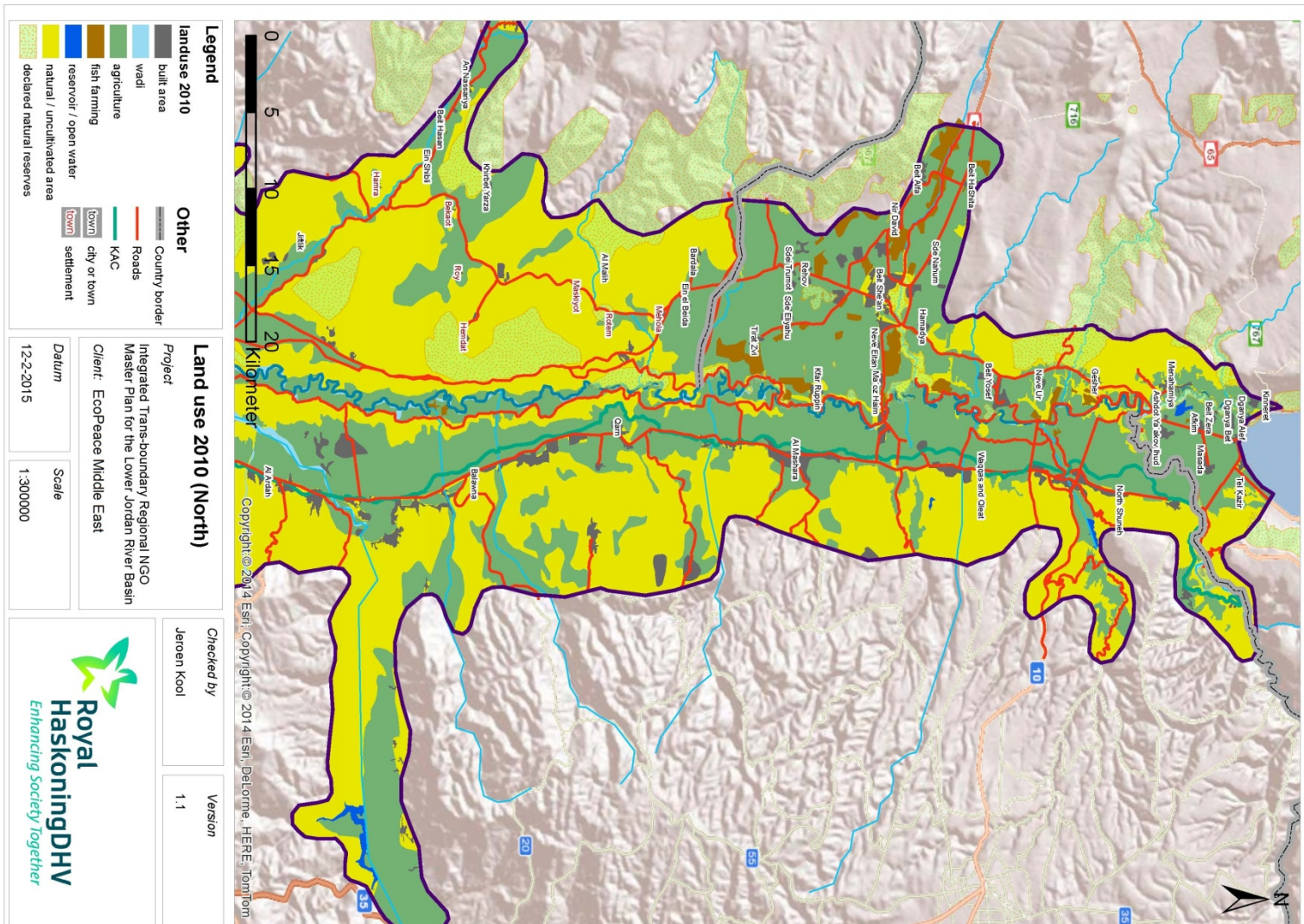


Figure 4 – Current Land use of the Northern Part of the Jordan Valley

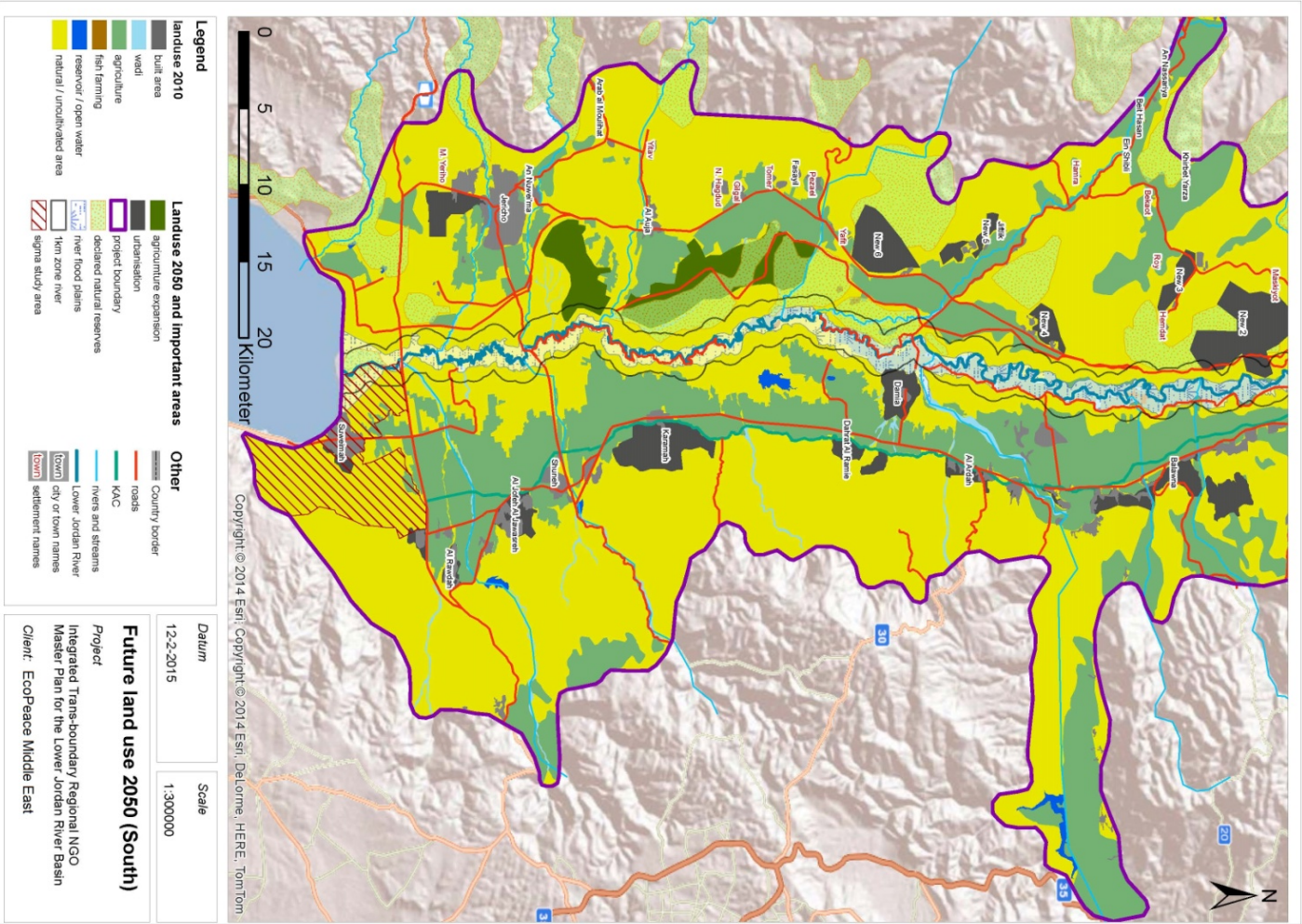


Figure 5 – Current Land use of Southern Part of the Jordan Valley South

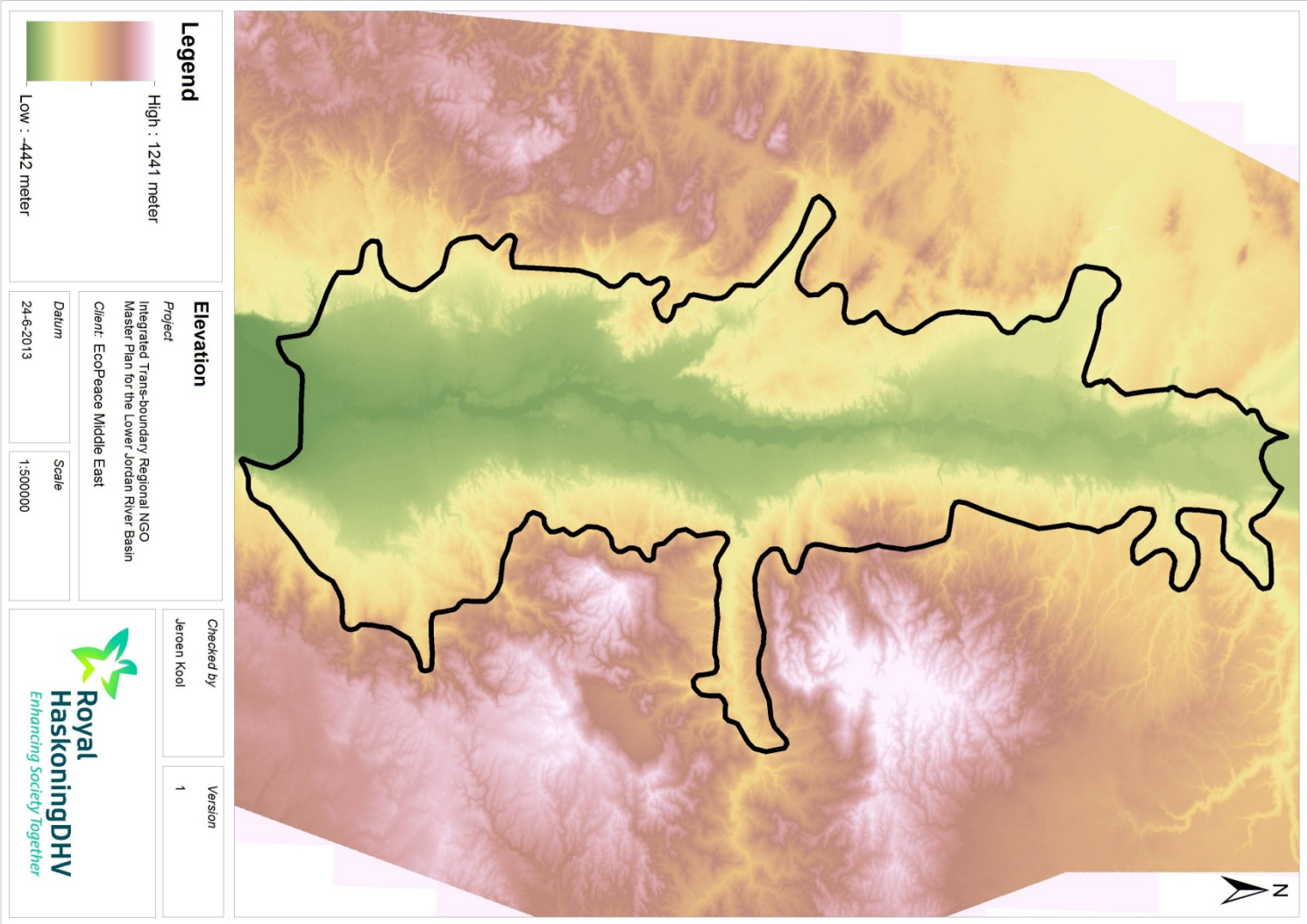


Figure 6 – Topography of the Jordan Valley

The dominant soil types in the area are regosols, rendzinas and serozems, which are mainly tertiary deposits, and to a lesser extent lithosols, all of them generally fertile. As a result, the majority of land in the area that can be provided with water is used for agriculture and horticulture.

## Water

The Lower part of the Jordan River originates at the Sea of Galilee and meanders along 200 km down to the Dead Sea through the Jordan Valley. The average annual rainfall in the study area and the wider region is shown below. It varies from over 500 mm per year in the north to less than 100 mm in the south close to the Dead Sea. With high temperatures and average dry conditions; the average annual evaporation is high, varying from 2150 to 2350 mm per year.

Historically the Lower part of the Jordan River received about 600 MCM / yr from Sea of Galilee in the north and about 470 MCM / yr from the Yarmouk River in the north-east. With some addition inflow from the Zarqa River and nine other streams from the East Bank, the Lower part of the Jordan River had an outflow into the Dead Sea of about 1200 – 1300 MCM / year.

Since the 1950s the water from the river has been increasingly diverted by Israel, Jordan and Syria for domestic water supply and the development of the agricultural sector in the region.



**Figure 7 – The Jordan River**

The water is diverted mainly by the Israeli National Water Carrier taking water from Sea of Galilee, and through the development of various dams in Syria and dams and canals in Jordan, including the Unity Dam in the Yarmouk river on the border between Jordan and Syria, the King Talal Dam in the Zarqa Basin, and the King Abdullah Canal running east

and parallel to the river. Today the outflow into the Dead Sea is about 70 to 100 MCM per year or less.

The northern most section of the river is regulated in Israel by the Deganya Dam at the Sea of Galilee, and the Alumot Dam, about 2 km further downstream. During the last 50 years, no fresh water was discharged into the LJR, other than during flood years. In 2013 a new Israeli policy was

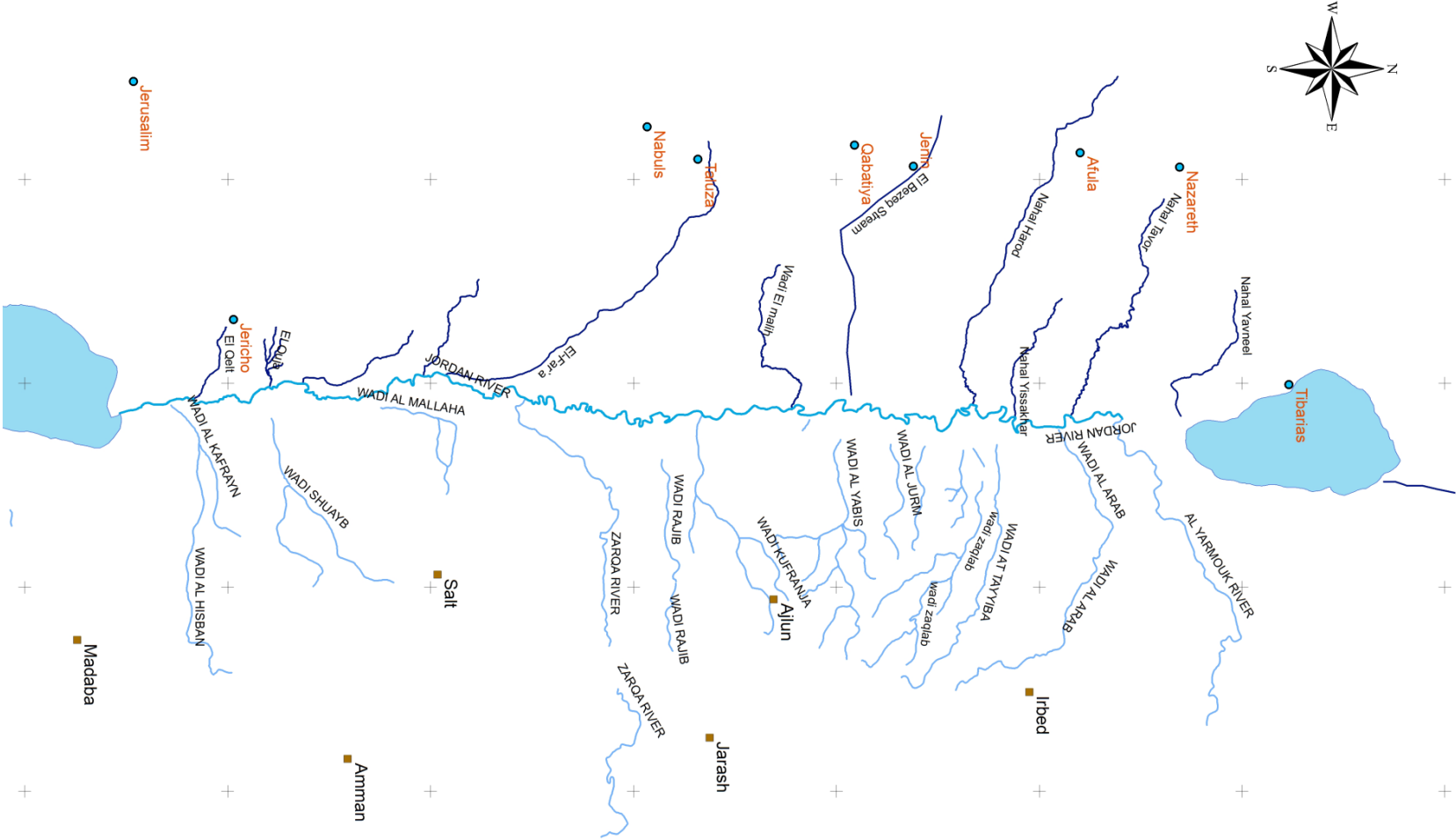
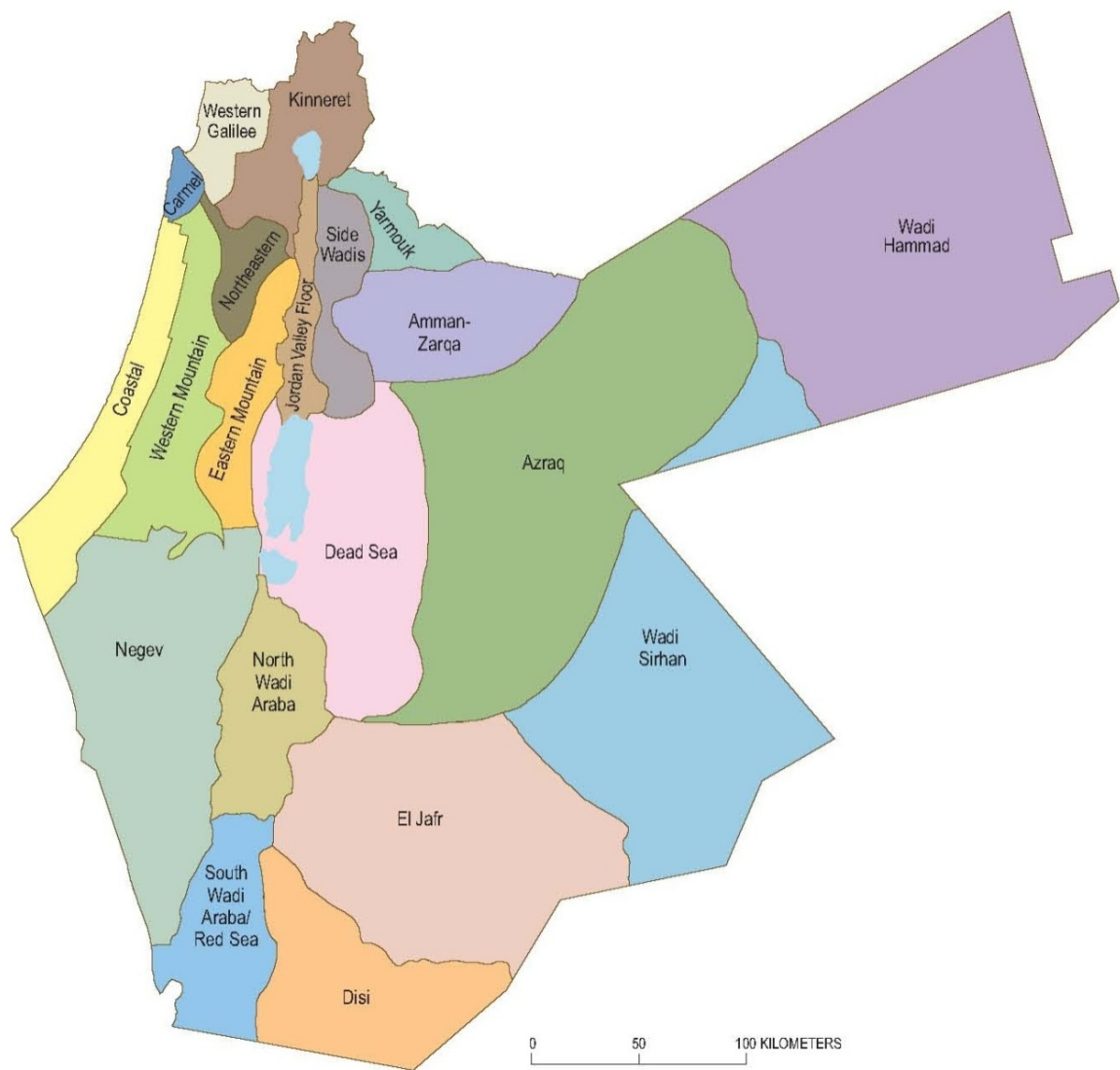


Figure 8 – Lower part of the Jordan River and its main tributaries

implemented where increased fresh water levels would be released, starting with 9 MCM / yr and growing to 30 MCM / yr in 2016. During the winter season, the river may occasionally contain flood waters after heavy rainfall in the upper catchment of the Jordan Valley, as happened during the early months of 2013.

The Jordan River has become polluted due to inflow of untreated wastewater and saline water which was diverted into the river from springs west of Sea of Galilee through the Saline Water Carrier. As of late 2014 a secondary level wastewater treatment plant has been completed on the Israeli side, releasing now treated wastewater into the river. By the end of 2015 the plant will be upgraded to tertiary level and all wastewater will be reused for agriculture and replaced by fresh water from the Sea of Galilee. On the Jordanian side, most of the wastewater locally generated is not treated and discharged directly into the groundwater and Wadi's and eventually in the Jordan River. Here the exception is the newly built North Shuna wastewater treatment plant. More WWTPs are however needed on the Jordanian side. This is also the case for most of the wastewater generated by the Palestinians (with the exception of the newly built WWTP in Jericho) and Israeli Settlements in the West Bank part of the valley, be it that the population here is considerably smaller than in the East Bank. Finally, the Jordan River is polluted by flushing of fishponds in Israel, about twice a year. This water is polluted by fish excrements and anti-biotic components usually added to these fish ponds.



**Figure 9 – Groundwater Aquifer Systems in the Region [ref: EXACT-ME]**

The groundwater system in the Jordan Valley consists of a shallow aquifer system from the Plio-Pleistocene ages, which overlays the upper sub-aquifer system of the Upper Cenomamian and Turonian ages and the deep confined aquifer of the Lower Cenomamian age. The groundwater resources are particularly important for supply of the West Bank and the southern parts of the East Bank.

The aquifers are subject to increasing salinity levels, particularly in the south mainly as result of over exploitation and up coning of deep brines that flow through the Jordan Rift Fault system; and from contamination of agricultural return flows and sewage effluents. An overview of the main groundwater aquifer systems in the region is given in the above figure.

The current low flow levels and bad water quality of the Lower part of the Jordan River have severe impacts on the area's unique ecosystem including the approximate 500 million migratory birds that migrate through the Jordan valley twice a year.

The King Abdullah Canal (KAC), on the east side parallel to the Lower part of the Jordan River, was built in three phases between 1957 and 1966. It captures mainly runoff from the Yarmouk River, the Mukheibeh Wells and several wadis. The canal plays a central role in Jordan's agricultural development as it supplies irrigation water via pumping stations to farmers in an area of 400-500 ha. In addition, Amman receives about 50 MCM /of



**Figure 10 – Arab Dam**

water per year from KAC. This transfer constitutes around one-third of water supplied to Amman and also corresponds to one third of the water diverted to KAC. The amount of water pumped from KAC to Amman is likely to increase as Jordan purchases more water from Israel following the signing of a 2015 MoU on water trade.

### Climate Change

Climatically, the Jordan Valley is characterized by hot dry summers and mild wet winters, becoming progressively drier moving southward through the valley towards the Dead Sea. Climate change impacts are likely to intensify the water supply related problems in the Jordan Valley. The next table provides an overview of the climate characteristics of the Jordan Valley

Analysis of the impacts of climate change has been made for the wider Middle East Region such as by GLOWA (2008). Overall, these impacts include a foreseen reduction in local annual water resources with a maximum of 20% by 2050 and increasing temperatures and related surface water evaporation rates. A summary of the related impacts is proved below.

**Table 2 – Climate Characteristics relevant for the Jordan Valley**

Climate Characteristic	Type 11 (north)	Type 9 (middle)	Type 8 (south)
Annual Temperature	18 - 20° C	18 - 20° C	18 - 20° C
Summer Temperature	21 - 27° C	21 - 27° C	21 - 27° C
Winter Temperature	10 - 12° C	10 - 12° C	10 - 12° C
Annual Precipitation	> 600 mm	70 - 100 mm	< 70 mm
Summer Precipitation	< 10 mm	10-30 mm	< 10 mm
Winter Precipitation	> 300 mm	< 30 mm	< 30 mm

The northern part of the East Bank of the Jordan Valley in Jordan will be impacted most negatively by climate change, with a foreseen substantial reduction of annual and winter rainfall, although the summer rainfall will increase slightly. The southern part of the East Bank will see a slight improvement

of rainfall conditions, both annually as during the summer.

**Table 3 – Climate Change related Impacts to the Jordan Valley**

Jordan Valley regions	Annual Precipitation	Summer Precipitation	Winter Precipitation
Jordan (North)	substantial reduction of annual rainfall in the coming decades from more than 600 mm historically to less than 100 mm	Slight increase of summer rainfall from less than 10 mm historically to maximum 30 mm	substantial reduction of winter rainfall in the coming decades from more than 300 mm historically to about less than 30 mm
Jordan (South)	8-9 Slightly increase of annual rainfall from historically less than 70 mm to about 70 – 100 mm	Slightly increase of summer rainfall from less than 10 mm historically to maximum 30 mm	No change in winter rainfall, which remains to be less than 30-70 mm
Israel	No change in average annual rainfall, which remains more than 600 mm	No change in summer rainfall, which remains to be less than 10 mm	No change in winter rainfall, which remains more than 300 to 600 mm
Palestine	Gradual shift southwards of more annual rainfall (from less than 70 to more than 600 m, with exception of the Jordan Valley itself, which remains very dry	No change in summer rainfall, which remains to be less than 10 mm	Gradual shift southwards of more winter rainfall (from less than 30-70 more than 300 - 600 m) with exception of the Jordan Valley itself, which remains very dry

### Ecosystems

Below figure provides the “Normalized Difference Vegetation Index” for the Jordan Valley. This index has been calculated on the basis of Satellite images,

wherein the green(er) parts represent high(er) vegetation densities, or higher concentrations of natural photosynthesis processes.



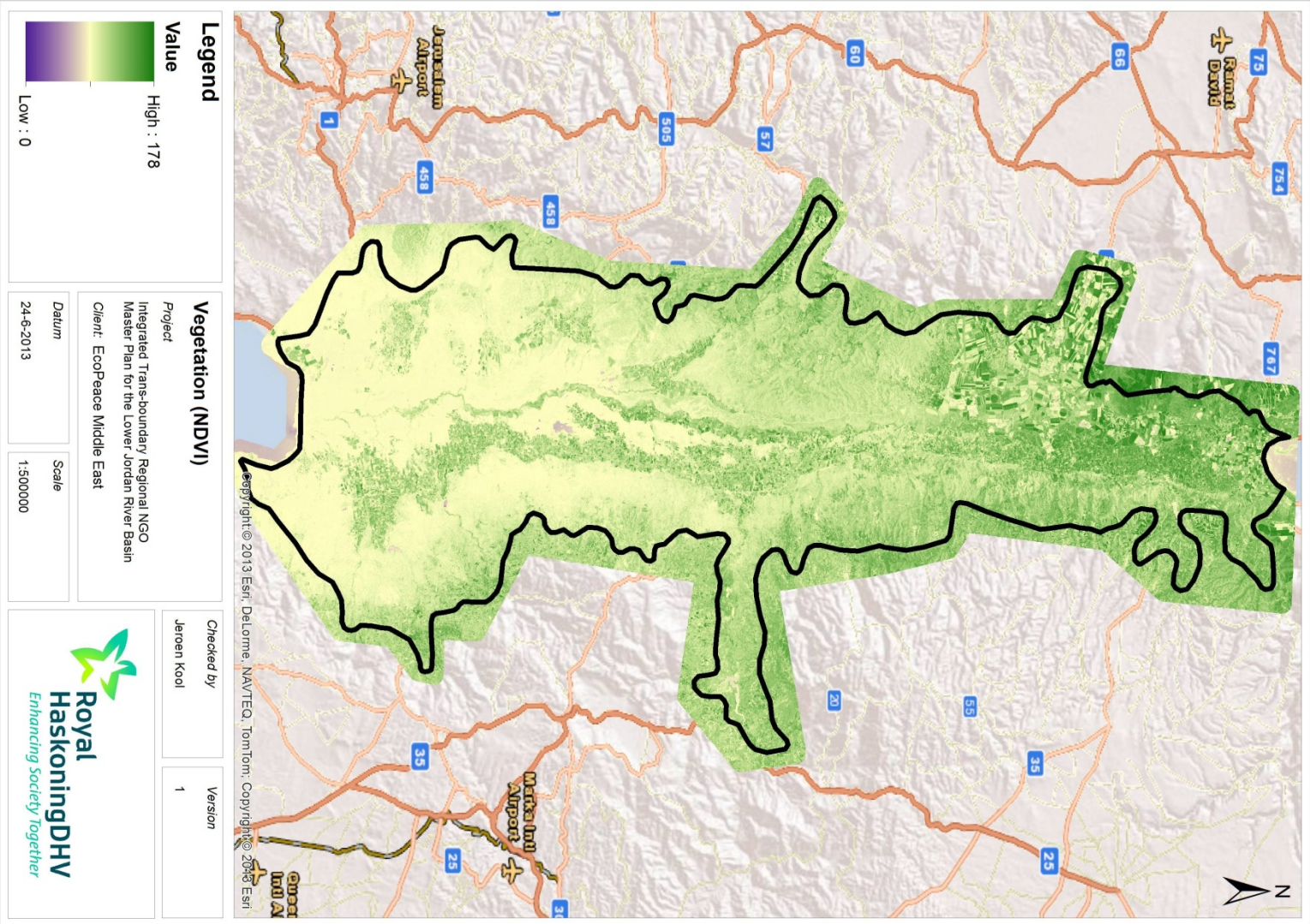


Figure 11 – Vegetation Index

The Jordan Valley is characterized by a wide range of bio-climatological and physical conditions and its location at the crossroads of climatic and botanic regions endows the area with a rich variety of plant and animal life. For example, a total of 20 species of large mammals have been recorded in the Valley. Among them four species are considered at risk according to the IUCN Red List of Threatened Species. Moreover, 18 bat species were found along the Jordan Valley, two of them are considered endangered or threatened on a global scale.

The area around the southern end of Sea of Galilee is characterized as a Mediterranean zone. On the Jordanian side of the Jordan Valley, the Mediterranean zone stretches about 150 km further south than on the western counter part in Israel. Mediterranean vegetation is typical for those areas of the mountain range which received an annual precipitation of 350 mm or more. These areas have been intensively managed by mankind since historical times and large areas are cultivated fields or orchards. Southward, down to the northern limit of the southern Jordan Valley, the environment is Irano-Turanian. Rainfall gradually decreases here from an average of 400 mm to the north to about 200 mm at the southern end. In Jordan this zone is often a transition between the Mediterranean and the desert areas.

Around spring and autumn the Jordan Valley serves as an important migration route for some 500 million birds, flying between Eastern Europe, Western Asia and Africa. Some of these species are currently considered threatened on a global scale by the

IUCN and Birdlife International. Most important, large portions, or even entire bird populations, pass through the Jordan Valley, as it serves as a bottleneck for bird migration. A good example is the White Stork, some 500,000 of which pass through the region twice yearly. This quantity amounts to almost the entire Eastern European population.

A total of 15 native freshwater fish species exists in streams and springs in the Jordan Valley. In addition, some 12-13 native freshwater fish can be found in the Yarmouk River systems. Furthermore several alien species were introduced in to the water systems of the Jordan Valley.

During the last century the area has undergone major developmental processes with substantial impacts on the local nature and ecology. Those processes include establishment of new communities and infrastructure, industrial facilities and transformation of natural land into agriculture land. Excessive pumping caused groundwater depletion, as well as flow reductions in natural springs.

The Lower part of the Jordan River has undergone severe alternation due to diversion of freshwater and inflow of polluted water. Moreover, floods were once part of the natural flow regime in the Lower part of the Jordan River until the construction of Deganya Dam in 1932, and essential in shaping the river meanders, flushing fine sediment and creating healthy functioning ecosystem. As a result aquatic habitats have deteriorated, accompanied by decrease in macro-invertebrate, fish populations and

vegetation diversity. Today the river vegetation is dominated by halophytic plants rather than the natural vegetation that disappeared over large areas.

An analysis of the environmental flow requirements for the Lower part of the Jordan River indicates that the physical characteristics of the flow are the most important ecological factor for enabling macro-invertebrates. Less water in the LJR caused changes to the stream channel, resulting in a narrower and more canalized river ecosystem. Less water has also resulted in much slower velocities, reducing the habitats depending of flows, such as falls, cascades and rapids. Less water in the river also means less dilution with inflowing polluted water, such as brackish (ground) water or wastewater. This leads to higher pollution concentrations in the river stream. As a result, the ecology of the river is now reduced to pockets of high resistant and medium to slow velocity habitats.

Reduction in water flows, but also dams in the river and its tributaries, resulted also in smaller river sediment loads. Slower velocities carry far less sediment with smaller grain sizes. The formation of streamside water bodies, such as deserted meanders, has stopped, and related habitats have disappeared from the river's ecosystem, resulting in the loss of unique community compositions of both plant and animal species specifically adapted to these habitats. If healthy freshwater ecosystems are to be restored, it is important to address the natural flows around which flora and fauna can develop. Critical parameters in this respect are: the

quality of the water; the magnitude of the flow; the seasonable fluctuation of the flow; the frequency, duration and variability of floods and droughts.

The Yarmouk and Jordan River are also important for hosting many mammals in the vicinities of the river banks. Despite the deterioration of their natural habitat, many carnivores and other mammalian species have managed to survive because access to the area has been limited due to military restrictions. However, the number of species in the Jordan River has diminished and needs further research. It might be possible, after thorough research, that some of the species could be reintroduced if conditions would again be appropriate.

The main ecological threats and their causes that have been identified in the Jordan Valley are presented in the next table.

The challenges to ecosystems and biodiversity protection in the Lower part of the Jordan River are particularly to create a stronger legal, management and information framework that enables adequate allocation, management and enforcement of nature protection.

Freshwater is the major environmental and socio-economic resource in the Jordan Valley, directly supporting all human activity, vegetation, and wildlife habitats and their associated productivity, with considerable inter-country variability. Freshwater sources are also the natural resource component



**Figure 12 - Water Snake in the Lower part of the Jordan River**

most at risk since there is no economic substitute for the valley's watercourses and associated aquifers, which are also the final repository of human waste.

Despite past impacts, the Jordan River still provides important wildlife and fish habitat. This lowland riparian habitat has been identified by many national and international environmental agencies as the

single most important habitat type in the region for avian species.

#### **Nature Reserves**

In the Western part of the Jordan Valley a total of 44 natural reserves and national parks have been assigned by Israel from Sea of Galilee to the Dead Sea. A total of 28 of these nature reserves are

entirely located inside the project boundaries, while the areas of the rest are crossed by the project's boundaries. The total protected areas north of Bezeq stream is 61 square km, while the total protected areas south of the Bezeq Stream as defined by Israel amount to 117.5 square km. The areas of the natural reserves and national parks north of Bezeq stream tend to be smaller than those in the Palestinian West Bank.

From a biological and wildlife diversity perspective the most important nature reserves are the Valley's lower plain (the Zor), the Jordan Valley inland salt flats (sabkhas) and Wadi Auja. The two largest salt flats in the Valley contain rare plant species that are exclusive and need these extreme conditions to their life cycle. Other important nature reserves include Wadi al-Fasayil and Umm Zuka ridge, Wadi El Maliah, Wadi Fara'a, Wadi el-Fasayil and Wadi Qelt. Some of these wadis are of seasonal nature and others are partially perennial. From an ecological point of view the most spectacular stream is Wadi Qelt.

**Table 4 - Current threats for ecosystems in the Jordan Valley**

No	Threat	Root Cause
1	Fragmentation of habitats	<ul style="list-style-type: none"> <li>• Agricultural encroachment</li> <li>• No land use strategies, which were implemented and monitored</li> <li>• No guideline policies on conservation with development agencies</li> <li>• Unregulated urban and infrastructure expansion</li> <li>• No clearly mandated management agency</li> </ul>
2	Inappropriate agricultural development	<ul style="list-style-type: none"> <li>• Lack of comprehensive land use strategy</li> <li>• No conservation-orientated policies or extension services</li> <li>• Weak coordination between farmers and government agencies and local NGOs</li> <li>• High water demanding crops</li> </ul>
3	Water pollution	<ul style="list-style-type: none"> <li>• Excessive agrochemical use</li> <li>• Inadequate guidelines on use of agrochemicals</li> <li>• Minimal sewage treatment</li> <li>• Inadequate controls on industrial effluent</li> </ul>
4	Air pollution	<ul style="list-style-type: none"> <li>• Inadequate controls on industrial emissions</li> </ul>
5	Solid waste	<ul style="list-style-type: none"> <li>• Lack of treatment infrastructure</li> </ul>
6	Excessive hunting pressure	<ul style="list-style-type: none"> <li>• Inadequate enforcement of laws</li> <li>• Declining bird populations</li> </ul>
7	Excessive grazing Pressure	<ul style="list-style-type: none"> <li>• Inadequate enforcement of regulations</li> <li>• Lack of grazing land</li> <li>• Limited alternative livelihoods</li> </ul>
8	Tree cutting	<ul style="list-style-type: none"> <li>• Inadequate enforcement of regulations</li> <li>• Limited fuel supplies for subsistence communities</li> <li>• Lack of alternative livelihoods</li> </ul>
9	Unregulated tourism Development	<ul style="list-style-type: none"> <li>• Inadequate planning and enforcement of regulations</li> </ul>
10	Over-extraction of water	<ul style="list-style-type: none"> <li>• Lack of coordinated strategy between government and users</li> <li>• Weak enforcement of regulations (EIAs)</li> <li>• Lack of water conservation technologies</li> <li>• High water demanding crops</li> <li>• No coordination between supply and demand</li> </ul>

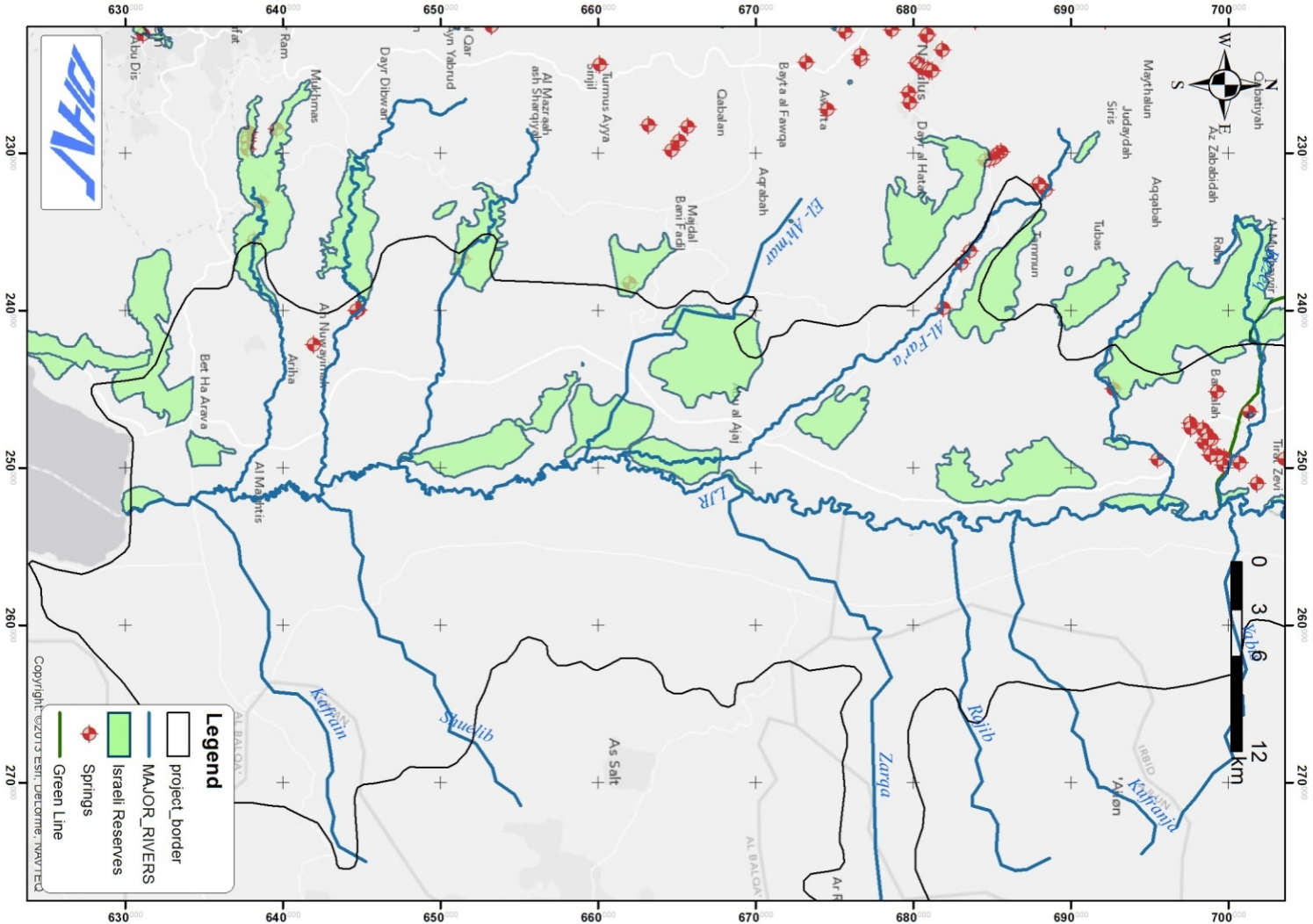


Figure 13 - Parks in the north part of the Jordan Valley

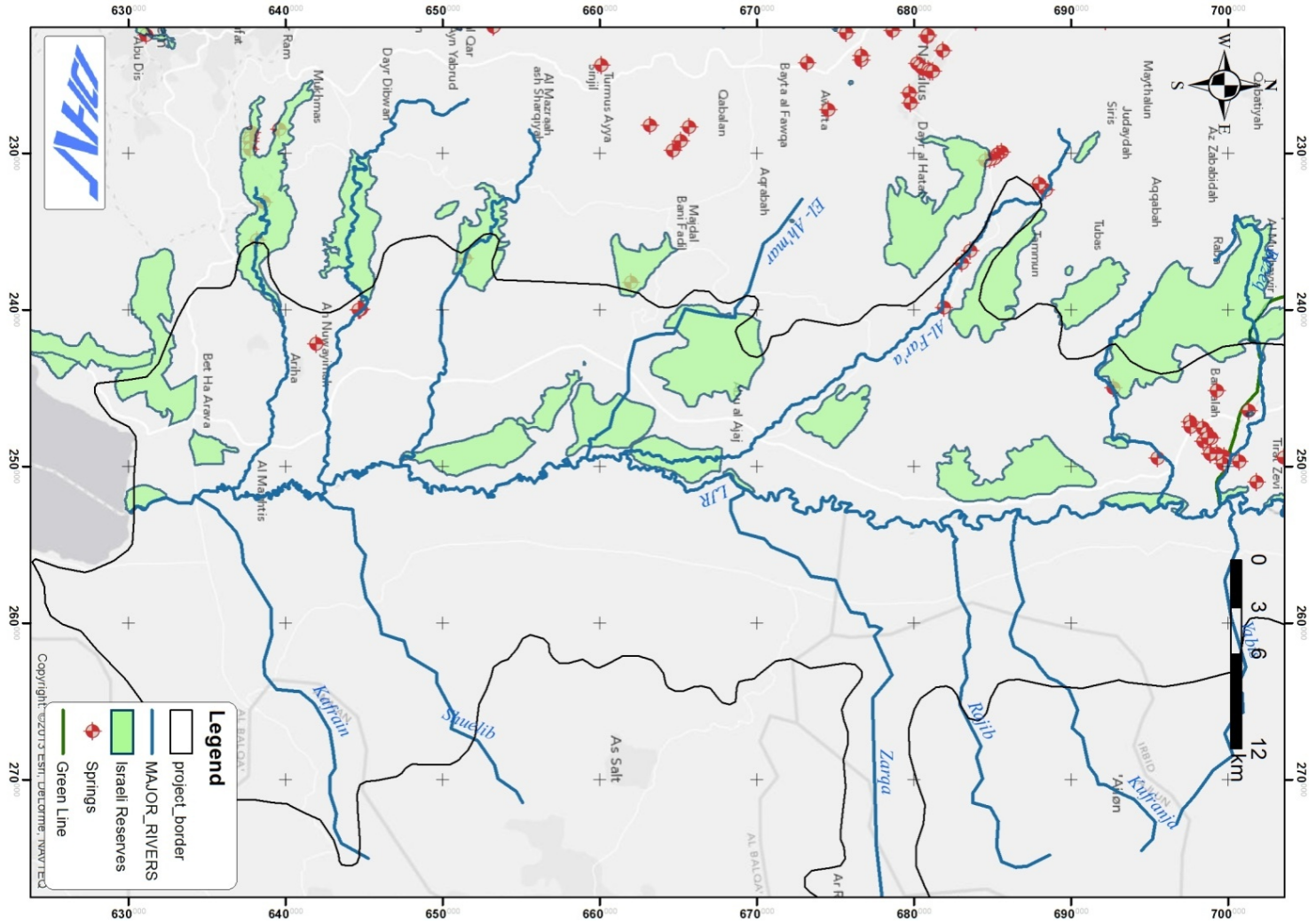


Figure 14 - Nature reserves and national parks in the southern part of the LJV (West Bank)

The part of the Yarmouk River valley, where it borders with Israel and Jordan, has been left largely undisturbed due to its strategic political location. As a result of this it supports a wide variety of plant and animal communities typical of intact and less polluted river systems. It is proposed to allocate this area as a dedicated protection site (around 30 Km<sup>2</sup>), because the area includes important woodlands and wildlife.

### Pollution Sources

The major sources of pollution on the Jordan Valley include untreated wastewater and diversion of saline water into the valley, solid waste dumping and pollution from agriculture, husbandry and fishponds.

#### Wastewater

Untreated sewage water flowing in the Jordan Valley is one of the major pollution sources in the study area. The Lower part of the Jordan River downstream of the Alumot Dam until 2014 contained high concentrations of Fecal Coliforms, indicating large sewage spills into the river system. Many communities in Israel, Jordan and Palestine until recently discharge or continue discharge their untreated or poorly treated sewage water directly or indirectly (through groundwater seepage) into the valley.

In Jordan there are two wastewater treatment plants in operation: the Tal Al Mantah WWTP located to the west of Deir Alla, which started operations in

2005. This WWTP receives the waste water from the Deir Alla and South Shouneh regions. Its maximum capacity is 400 m<sup>3</sup>/day and it received in 2013 about 320 m<sup>3</sup>/day (365 m<sup>3</sup>/day in 2012). These two small treatment plants treat only a fraction of all generated wastewater in the valley. In Jericho a treatment plant and sewage collection network for the whole city is under construction. The majority of Jordanian and Palestinian towns and villages are presently left with no sanitation solution.

The *Beit Shean regional WWTP* is a primary and secondary treatment facility, which has been taken in operation in October 2009. The Beit Shean WWTP is currently treating 3.8 million m<sup>3</sup> of wastewater year and its effluent is reused for agricultural purposes. Its influent originates from most of Beit Shean (1.2 million m<sup>3</sup>/year), from twelve communities in the Valley of Spring Regional Council (800.000 m<sup>3</sup>/year), from the Beit Shean industrial area (1.2 million m<sup>3</sup>/year) and from some tourist resorts (600.000 m<sup>3</sup>/year). In the near future the wastewater of Gilboa regional council will also be treated here.

As of late 2014 a secondary level wastewater treatment plant has been completed just south of the Sea of Galilee in Bitaniya, on the Israeli side, releasing now treated wastewater into the river. By the end of 2015 the plant will be upgraded to tertiary level and all wastewater will be reused for agriculture. A new desalination plant has also been scheduled in Bitaniya to treat saline water from the Saline Water Carrier (SWC). As such, local agriculture will receive high quality effluents, which

will reduce the pressure on fresh water resources from the Jordan River and lead to a release of up to 30 MCM in to the River Jordan. There is continued discussion as to whether the brine of the desalination plant will be released into ponds near the Green line or whether a pipeline will take the brine all the way to the Dead Sea. WEDO / EcoPeace is calling for the later.

Wastewater collection and treatment in the Palestinian part of the study area was neglected for a long time, since higher priorities are given to safe water supply and protecting reliable resources for domestic use. In the study area, all the Palestinian communities lack wastewater collection networks and rely on cesspits for the disposal of wastewater, with the exception of Jericho that has a new central wastewater treatment plant, which was recently constructed with finance from Japan. Wadi Fara'a (Tirza stream), the largest stream in the West Bank, is partially polluted because of sewage water coming from the east part of Nablus. Most of this water is used for agriculture, infiltrated in the soil or evaporated before it reaches the Jordan River. Also a lot of waste and litter ends up in this Wadi. In the rainy season the pollution may be transported further downwards into the Jordan Valley.

The Israeli settlements in the West Bank use mainly oxidation ponds or cesspits to dispose of their wastewater. The larger settlements are obliged by Israel to develop full scale wastewater treatment plants, and two related plants are foreseen for the settlements Fazael - Netiv HaGdud and Shdemot Mehola.

### Solid waste

Apart from the Israeli section of the study area, there is a lack of adequate sanitary waste disposal or treatment, both for domestic waste as well as industrial waste. Recycling and reuse of waste takes place in only very limited amounts. It is estimated that approximately 162,000 tons of municipal waste per year is generated in the Jordan Valley, including 120,000 tons in Jordan, 24,000 tons in Israel and 18,000 tons in Palestine. Land filling is the most common waste treatment technique within the study area and apart from Israel this is mainly done without adequate soil and environmental protection measures. It is estimated that less than 10% of the waste, or 16,000 tons per year is physically transported out of the valley area to be disposed off elsewhere.

Waste collection, transportation and disposal in Jordan are handled by local municipalities. Sometimes, smaller municipalities combine forces into a Common Services Council. In the study area the municipalities in the north co-operate within the Northern Joint Services Council. The Ministry of Municipal Affairs is responsible of providing municipalities and Common Services Councils with finance to provide these municipal services. The Ministry of Environment is responsible for policies and planning of the waste sector, and is currently (2014) in the process of developing a national waste management strategy based on principles of maximized recovery, reuse, and recycle, with disposed as final solution, as well as on the proximity principle.



**Figure 15 - Deir Alla landfill**

Solid waste collection fees today vary between about 14 to 20 JOD per year per household.

Collected waste in the Jordan Valley is brought to the Deir Alla dumpsite. This dumpsite is located 1 km from the Jordan River to the west of Deir Alla. The dumpsite is badly sited, because the location is close to a community and a groundwater reservoir



which is used for drinking water. The dumpsite doesn't have any facilities like lining or percolate collection. Percolation water goes directly to groundwater and the Jordan River.

The Hagal landfill, north of Gesher, is the only authorized landfill in the Israeli part of the master plan project area. As an authorized landfill it has all the required infrastructure and operations of a sanitary landfill, including lining system, percolation water collection and treatment, landfill gas collection and energy production. The landfill is owned by the private Israeli engineering firm TAHAL, and started operations in 1999. The total landfill volume is 3.5 million m<sup>3</sup>.

The Palestinian waste is often dumped just outside the communities in the surrounding area. Luckily, as result of the very dry conditions, the waste material will dry out very quickly, so that leachate problem or nuisance of smell and pollution will be limited. However, the plastics waste remains, and this forms a visual nuisance as well as a threat to animals. In the wet season, the littered waste causes a larger problem in terms of leachate, migration and pollution. During floods, waste may end up in the Jordan River itself, even including waste originating from the Eastern part of Nablus through Wadi Fara'a.

Agricultural waste forms most of the waste generated in the Palestinian area. The only semi controlled landfill in the Palestinian project area is the Tovlan landfill site, operated by the Israeli settlements. It is managed by the settlements

belonging to the Bik'at Hayarden Regional Council. It receives waste from municipalities in Israel and from Israeli settlements in the West Bank. In the past it also received waste from some Palestinian communities, including Nablus city (80 tons/day), but this is not the case anymore. In addition, plans have been developed for a sanitary landfill for Jericho. Today there is a controlled dumpsite on the east side of Jericho. The dumpsite is not lined and its capacity is reaching its limits.

This all has a direct impact on public health, groundwater quality and eventually the water quality in the Jordan River. It is expected that less than 10% of the waste, or 16,000 tons per year is physically transported out of the study area to be disposed of elsewhere.

#### **Agricultural pollution**

Large parts of the study area are used for agriculture. Water is diverted from the Jordan River and its tributaries for irrigation, and return flows end up in the Jordan Valley groundwater or surface water. The agricultural return flows are generally polluted with phosphates, salt, nitrates, pesticides and chemical fertilizers. Plant tissue and plastics used in agriculture contribute to the total quantity of solid waste produced in the study area, potentially causing pollution to the Jordan River and Jordan Valley. Furthermore remainders of unused pesticides and fertilizers may act as potential sources of pollution as well. Animal husbandry generates pollution sources in terms of manure (solid and fluid) and animal carcasses, which are

potential threats for the environmental and public health.

Plastic waste in agriculture is generated from plastic covers of greenhouses, plastic mulch covers used for soil protection and plastic pipes used in the fields and the greenhouses used for irrigation. Most of the plastic is collected and sold to plastic recycling factories, located mainly outside the Jordan Valley.

#### **Fish Ponds**

The fish farms are major water consumers in the Israeli part of our project area in the Jordan Valley. The total surface area of the fish farms is ponds in the region totals to approximately 2,000 ha. More than 90 % of the fish ponds are concentrated around Harod Stream and in the Valley of Springs Regional Council. The main fish ponds in the Israeli part of the study area are: the Gesher Fish Ponds, about 560 dunum in size; the Neve Ur & Hamadia Fish Ponds, about 1100 dunum in total; and the Emek Hamaayanot Fish Ponds, about 10,000 dunum in total. The fish ponds are operated by AMWA, Gesher, Harod and Neve Ur & Hamadia.

The Afikim fishponds will soon terminate its operations, and will be turned into a reservoir to store water from the new desalination plant to be built in Bitaniya for the water from the Saline Water Carrier, and for the effluent of Bitaniya WWTP. The brine which remains after desalination might be used in some of the fish farms. However, this would have a negative impact on the quality Jordan River.



**Figure 16 - Gesher fish farm**

On average a fish pond requires an inflow of water of 50.000 to 60.000 m<sup>3</sup>/ha. This results in a total consumption of about 100 MCM per year. These amounts have a large influence on the water balance in this part of the Jordan Valley. The water consumption is facilitated by a range of water - Gesher fish farm reservoirs, which both serve as water storage and as fish cultivation capacity. Each reservoir is designated for a specific waste quality, making distinction between fresh water (< 500 mg

Chlorine/l), treated waste water and saline water coming from, or mixed with local springs (> 500 mg Cl / l). In this manner the fish farm can make an optimal mix for their production.

Evaporation in the ponds increases the salinity of the water in the ponds. The discharged effluent water may have chloride concentrations varying between 2.000 and 4.000 mg/l depending on the concentrations in the inflow and the differences in

operation. About 75 % of the effluent is discharged between October and December; the rest of the effluent is discharged as late as February.

Fish farms consist of numerous small ponds often differing in age, depth, lining etc. The water in the ponds is circulated several times between the ponds until it is discharged. The water may be recirculated for a period of 3 years before discharge. Since most of the ponds in the area were constructed without lining (90 %), water losses by percolation are estimated at 20-50% of the inflow. Most of this water finds its way to the Jordan River by means of the groundwater. Another 40-50% is lost to evaporation and the rest is discharged back to the river as saline polluted effluent. This means that 10 to 40 % of the inflow (so about 10 – 40 MCM per year) directly flows to the Jordan River as waste water.

### **Land Mines**

The Hashemite Kingdom of Jordan ratified the Mine Ban Treaty in 1999. In accordance with its obligations under this international legal standard, Jordan has destroyed its stockpile of antipersonnel mines and has made steady progress to complete demining for its side of the entire Jordan Valley.

In the West Bank over 2.000 ha of land has been fenced by the Israeli military due to landmines related risks. Some of the mine fields were laid by Jordan prior to 1967, along the 1949 Armistice border with Israel and surrounding old military bases. Other minefields were laid by Israel after 1967, around its own military bases and the current border with Jordan. Parts of agricultural and grazing

land in the West Bank may still contain landmines as well. This causes risk of injury or death for civilians.

The marking and fencing of the landmine zones is poorly maintained and mine risk education is almost non-existent. Most of the casualties have been children. The Israeli military have started to remove mine fields in tourism related areas. In Israel this includes Naharyim and Gesher and around the Baptism site in the West Bank.

### Cultural Heritage

The internationally recognized World Heritage values of the Jordan Valley are strongly related to its unique geographic features and its historic, religious, cultural and archeological values. This section provides a short summary of the major cultural heritage sites in the Jordan Valley. A full assessment is provided in the Baseline Report (March 2014).

The Jordan Valley area attracted human habitation for thousands of years and is referred to as the most ancient inhabited area of human history. Archaeological sites date back to the pre-historic era. The remains of more than 20 successive human inhabited areas were found in Jericho, the first of which is Tel Es-sultan, located at the north west of the city, and dates back 10,000 years (8000 BC) and is known as the “oldest city in the world”. Remains in archeological sites are concentrated mainly in the western sector of the city of Jericho, but there also a lot of other sites distributed in the

Jordan Valley. These sites are the result of the different eras of history, from the Pre-Pottery Neolithic age, the Bronze age, the Hyksos period, the Canaanite period, the Persian, Hellenistic and Roman periods, and the Byzantine and Ottoman periods.

Around 100,000 years ago the Red Sea extended north to the area of Sea of Galilee. Then a combination of geological uplifts and a declining rainfall caused this inland gulf of water to retreat. 20,000 years ago a 220 kilometer-long lake named Lisan (‘tongue’ in Arabic) extended from Sea of Galilee to the Wadi ‘Aruba. The increasingly arid climate caused the level of the lake to fall until, by 12-10,000 years ago, the Dead Sea and Sea of Galilee, as seen today were formed. Linking them is the 104 kilometer-long Jordan River Valley with a width ranging from 5 to 20 kilometers. The Valley has two levels: the valley floor, or Ghor in Arabic, and the river floodplain, or Zor in Arabic. It was this Zor zone with its thick belt of trees and bushes, which is referred to in the Bible as “the jungle of the Jordan” or “the pride of the Jordan” (Jeremiah 12: 5; Zachariah 11:3). The Jordan River flowed into the Dead Sea, and was fed by many wadis (small rivers in Arabic) from the west and east, created by perennial fresh water springs. These springs were part of the natural ground water system until they were exposed in deep chasms produced by the creation of the Rift Valley. These fresh water sources have enabled a rich environment of plant and animal life to flourish as well as attracting a burgeoning human population.

Due to its greater rainfall there are more springs on the eastern side of the Jordan Valley then on the western side. This relative abundance of water allowed the earliest-known communities to be established over 10,000 years ago, two of which are Pella and Drah. When compared to the harsher and more arid conditions of Jordan’s eastern plateau and to the Negev and Sinai deserts, one can readily imagine that the Jordan Rift Valley was indeed the lush well-watered land referred to in the Bible as the “garden of God” (Genesis 13:10-11).

Early expeditions in the Jordan Valley were characterized by massive excavations on major archaeological sites (tells). This started in the late 19<sup>th</sup> century and continued through the first half of the 20<sup>th</sup> century, mainly conducted by British and German scholars. They managed to identify a few important sites that are partially related to biblical history of the region, as well as the Hellenistic-Roman and Byzantine periods. In the first half of the 20<sup>th</sup> century, archeologists made some important discoveries that go back to the prehistoric periods. Still, it is believed that many remains of various prehistoric periods are still resting untouched below the ground surface, and new findings and additional sites may be uncovered in the years ahead.

Eco Peace is bringing attention to the cultural heritage and environmental values and challenges of the Jordan Valley to faith-based communities that reside in and visit the valley. As the river is emphasized as a symbol in Christianity, Judaism, and Islam, and hundreds of thousands of pilgrims



Figure 17 – Ancient Hisham Palace in Jericho

visit the river each year, Eco Peace is working with faith-based communities to firmly tie the river's religious significance to the importance of its environmental preservation. To advance awareness and understanding of the problems and the potential rehabilitation of the Lower part of the Jordan River, Eco Peace has developed faith-based tool kits to launch campaigns that are geared toward congregations from each of the three Abrahamic religions. The Jordan River Peace Park, the Auja Eco Center and the Sharhabil Ben Hassneh Ecopark (SHE) play a crucial role in this work. Here, local students and faith-based groups visiting the valley are encouraged to discuss the river's current state and potential rehabilitation.

The Jordan Valley and its surrounding can provide authentic natural and cultural experiences for responsible tourism demands. Its unique natural and cultural history is not only a resource for tourism development. But it is also an important knowledge to understand and appreciate, for the preservation of its natural and cultural resources. Responsible tourism can play an important role to upgrade the level of awareness in the local, regional and international scales about the value of Jordan Valley and even subsidize its conservation and protection measures. This is why the development of the Jordan Valley including tourism should consider its venerability to intensive exploitation of its resources. There is no doubt that the competition between the sharing countries to maximize their exploitation of its resources will be destroying its value and will create more regional conflicts that will make the



**Figure 18 – Walls of Ancient Jericho**

conservation of the Jordan Valley an international responsibility.

#### *Jericho*

Jericho is considered to be the oldest continuously inhabited city in the world; it has been home to human beings for 10,000 years. During the Roman rule (63 BC-423 AD), Mark Anthony gave the city as

a present to his beloved Cleopatra. After her suicide, it reverted to Augustus Caesar, who himself gave it to Herod. From this time, Jericho became a centre of Christianity and continued to be an important city throughout the Byzantine Period.

*Al Maghtas - Baptism Site*

The Baptism Site, "Bethany Beyond the Jordan (Al-Maghtas) Protected Area is located in the Southern Jordan Valley on the east side of the Jordan River around 9 km north of the Dead Sea and is part of the District of South Shuneh in the Governorate of Al-Balqa. The site is located a few kilometers to the east of the oasis and ancient site of Jericho and ca. 50 km west of Amman, the capital of Jordan. The site covers an area of 533.7 hectares where five archaeological sites dating back to the Roman and Byzantine periods have been discovered. The precise limits of the archaeological remains are undetermined, although all identifiable cultural traces are included in the protected area. Several modern villages are located in the vicinity of the property. These include Al-Kafrein, Al-Ramah, Al-Jofah, Al-Rawdah, Sweimeh, New Shuneh, Al-Karamah, Al-Nahdah, Al-Jawasreh, Nimrin Al-Gharbi and Nimrin Al-Sharqi.

*Abaqat Fahal \ Pella*

Ancient Pella at Tabaqat Fahal is one of the most important archaeological sites in the Jordan Valley. Its central location in the land of biblical 'Gilead' on the most strategic east-west trade route to the Mediterranean coast was the key to its prosperity. The city is referred to almost a hundred times in various historical texts including the Old Testament which names this city 'Penuel' and records that it was here that Jacob wrestled with God who was in the form of an angel (Genesis 32: 22-30). The famous Amarna letters from ancient Egypt names Mut-Baal as the ruler of Pella in the 14th century

BC. During the Bronze and Iron Ages, Pella had the largest known Migdal-type temple in the entire region. The base of this massive multi-storied structure measures 32 x 24 meters with two fortification towers and was dedicated to the Canaanite God Baal. In the fourth century BC, Pella was established as a Hellenistic city and was later included in the Roman Decapolis league. Some of the first Christian converts were known to have taken refuge from Roman persecution here in around 70 AD. The city thrived during the Byzantine period having three basilica churches.

It is intriguing that a thirteenth to fifteenth century mosque was built on the same site as the Bronze Age Migdol temple of Baal.

*Tell Deir 'Alla*

Strategically located at the mouth of the river Jabbok/Wadi Zarqa, Deir 'Alla is the Old Testament site of Succoth (Genesis 33: 17; Joshua 13: 27; 1 Kings 7: 46; 2 Chronicles 4: 17; Psalms 60: 6; and 108: 7) which was purported to have been fortified by Jeroboam and visited by Gideon as he pursued



**Figure 19 – Tell Deir' Alla**

the eastward retreating Midnights (1 Kings 12: 25; Judges 8: 5-17). Succoth means 'small structures' which may have derived from the ancient town's function as a central market place for the Gilead region during the Late Bronze and Iron Ages. To this day it remains a trading centre for the Jordan Valley. Archaeological excavations have also revealed an important sanctuary here where many items bought in the town may have been donated as offerings.

*The Tomb of Abut 'Ubaydah (north of Deir Alla)*  
Abut 'Ubaydah 'Amr ibn Algeria was a relative and one of the 'Blessed Ten' companions of the Prophet Mohammed who were assured a place in heaven. During the Battle of Uhud he broke his front tooth whilst pulling a link of chain mail from the Prophet's cheek and because of this act the Prophet personally named him as an Ameen (trusted guardian) of the Nation of Islam. Abut 'Ubaydah led the Northern Army of Muslims after the Prophet's death, and also contributed to the writing of the Holy Qua'ran. He died during a plague in the central Jordan Valley where he is buried. An impressive modern mosque complex has now been built over Abut 'Ubaydah's tomb which serves as the principle Islamic centre in the Jordan Valley.

*The Hydroelectric power station at Bakoura / Naharyim*

In 1927, Pinchas Rutenberg, a Russian immigrant and founder of the Palestine Electric Company (PEC), reached a unique agreement with HM King Abdullah I of Jordan to build the company's main hydroelectric power station. To this aim, canals and dams were built, creating a manmade island that



**Figure 20 - The Tomb of Abut 'Ubaydah**

harnessed the flow of the two rivers to produce electricity. By 1932 the hydroelectric power plant began supplying electricity on both sides of the river and continued to do so until it ceased operations as a result of the Israeli Arab hostilities of 1948. In 1994, with the signing of the Peace Treaty by Jordan and Israel, the island was returned to Jordan but was leased with special usage and visitation status to Israeli and international tourists. Today a tour is offered from the Israeli entrance at Naharayim, where one can cross to the island, catch a glimpse of the river beneath and see the remnants of the power station. Military personnel schedule

and coordinate opening of the fences on both sides, allowing tens of thousands of visitors per year to enter the island without the need for a visa. The Municipalities at both sides, supported by WEDO / EcoPeace, propose to expand this area into a trans-boundary park, the Jordan River Peace Park, reaching 3 kilometers down the meandering river to the Jeser Al Majama / Gesher site.

*Tel Rehov*

Tel Rehov is an important Bronze and Iron Age archaeological site approximately five kilometers south of Beit Shean and three kilometers west of the Jordan River. The site represents one of the largest



**Figure 21 – Belvoir Fortress**

ancient city mounds in Israel, its surface area comprising 120,000 m<sup>2</sup> in size, divided into an "Upper City" (40,000 m<sup>2</sup>) and a "Lower City" (80,000 m<sup>2</sup>). Archaeological excavations have been conducted at Rehov since 1997, under the directorship of Amihai Mazar. The excavations revealed successive occupational layers from the

Late Bronze Age and Iron Age. In September 2007, 30 intact old beehives, made of straw and unbaked clay, dated to the mid-10th to early 9th century BCE were found, evidence of an advanced honey-producing beekeeping industry 3000 years ago in the city, then thought to have a population of around

2000. Also found alongside the hives was an altar decorated with fertility figurines.

#### *Tel Ubeidiya*

Tel Ubeidiya, located some 3 km south of SoG is another archaeological site of the Pleistocene, ca. 1.5 million years ago, preserving traces of the earliest migration of *Homo erectus* out of Africa. The site yielded hand axes of the Acheulean type. Tel Ubeidiya is located between the village Menahamia and Kibbutz Beit Zera, one kilometer northwest of the kibbutz Beit Zera. Prehistoric remains were found northwest of the Tel, starting from about 1.7 million years were discovered in the excavations, including human bones and remains of ancient animals. The site also features rock surfaces in which the Prehistoric man lived during the Pleistocene period. As a result of geologic breakage and foldage activity, the rock surfaces are now inclined at an angle of 70 degrees. It is thought that the area used to feature a pristine lake along which *Homo erectus* lived after his exodus from Africa.

#### *As-Sinnabra*

As-Sinnabra, or Sinn en-Nabra, is a historic site on the southern shore of the Sea of Galilee. The hill upon which al-Sinnabra was situated, Khirbet Karak of Beit Yerah, is one of the largest tells in the area, spanning an area of over 50 acres. Beit Yerah was in the Hellenistic era a twin-city of al-Sinnabra, located at the same tel. The city was inhabited in the Hellenistic, Roman-Byzantine, and early Islamic periods. Later, an Arabic "Qasr" was located here known as as-Sinnabra and served as a winter resort for the Umayyad from 650-704 AD. During the



Crusader period, a bridge was made here, called the "Crusader Bridge of Sennabris", constructed over the Jordan River, which at the time ran to the immediate north of the village.

#### *Belvoir Fortress*

Belvoir Fortress is a crusader fortress, located on a hill 20 kilometers south of the Sea of Galilee. Its construction began in 1168, and is currently located in Belvoir National Park. It is the best-preserved Crusader fortress in Israel. Standing 500 meters above the Jordan Valley, the plateau commanded the route from Gilead into Israel and a nearby Jordan River crossing, and as such dominated the surrounding area. It has been known to have served as a major obstacle to the Muslim goal of invading the Crusader "Kingdom of Jerusalem" It withstood an attack by Muslim forces in 1180, but eventually was conquered during the campaign of 1182 in the Battle of Belvoir Castle by Saladin.

#### *Beit Alpha*

Beit Alpha is a sixth-century synagogue, located at the foot of the northern slopes of the Gilboa Mountains near Beit Shean. It is now part of Bet Alfa Synagogue National Park and managed by the Israel Nature and Parks Authority. Architectural remains from the Beth Alpha synagogue indicate that the synagogue once stood as two-story basilic building and contained a courtyard, vestibule, and prayer hall. The first floor of the prayer hall consisted of a central nave measuring 5.4 meters wide, the apse, which served as the resting place for the Torah Ark, the bema, the raised platform upon which the Torah would have been read, and benches. The

Torah Ark within the apse was aligned southwest, in the direction of Jerusalem.

#### *Hamadia*

Hamadia is a kibbutz just north of Beit Shean. It belongs to the Valley of Springs Regional Council, and is situated on a terrace of ancient Lake Beisan, 200 meters below sea level. Tel Hamadia is a single layer archaeological site of about 100 m<sup>2</sup>, first reported and excavated at Hamadia by Tzori in 1958. It contains ovens, pits and fireplaces with Yarmukian pottery. Large saw elements indicated possible earlier Neolithic occupation as well.

#### *Moaz Haim Synagogue*

The Maoz Haim Synagogue was originally constructed in the 3rd century as a simple Byzantine-era type basilica building, later apsidal, in the Beit Shean region. Discovered in February 1974 by Mr. A. Ya'aqobi, it stands out as an unusual archeological find that contains a record of synagogue development from a time of otherwise sparse historiography. The synagogue was located amongst a large settlement in which it served as a center of worship for Jews there from its beginning up through its final destruction by fire sometime in the early 7th century. The initial layout began as a fourteen by twelve and a half meter square room with two rows of five columns with benches lining the walls, although none remained standing.

#### *Beit Shean*

The pre-historic settlement at Beit Shean has often been strategically significant, as it sits at the junction of the Jordan River Valley and the Yezreel Valley,

essentially controlling access from the interior to the coast. It is suggested that settlement began in the sixth to fifth millennia BCE. Occupation continued intermittently up to the late Early Bronze Age I from 3200–3000 BCE. After the Egyptian conquest of Beit Shean by pharaoh Thutmose III in the 15th century BCE the small town became the center of the Egyptian administration of the region. The Egyptian newcomers changed the organization of the town and left a great deal of material culture behind. An Iron Age I Canaanite city was constructed on the site of the Egyptian center shortly after its destruction. Around 1100 BC, Canaanite Beit Shean was conquered by the Philistines. The Hellenistic period saw the reoccupation of the site of Beit Shean under the new name Scythopolis. In 63 BCE Pompey made Judea a part of the Roman Empire. Beit Shean was re-established and rebuilt by the name of Gabinus. The town center shifted from the summit of the Mound (the "Tel") to its slopes. Scythopolis prospered and became the leading city of the Decapolis, a loose confederation of ten cities which were centers of Greco-Roman culture.

## Infrastructure

#### *Main bridges over the Jordan River*

The Jordan Valley is connecting Israel with Jordan through the Sheikh Hussein Bridge in the north, and Palestine with Jordan through the King Hussein (Allenby) Bridge. The King Hussein Bridge is located just outside Jericho city and is the only connection between the Palestinian West Bank and Jordan. The

West Bank side of the King Hussein / Allenby Bridge is considered a border entry point by the Israeli Authorities. The Jordanian authorities recognize the bridge as an international border entry point, but in contrast to other border crossings with Israel, do not grant entry visas to foreign passport holders at this crossing. Palestinians traveling abroad must use this bridge to exit the West Bank into Jordan and then use the Queen Alia International Airport in Amman to fly abroad, because they are not permitted to use Ben Gurion Airport near Tel Aviv. Travel permits from both Israeli and Jordanian authorities are required, with varied stringency depending on the political situation. Israeli citizens are not permitted to use the terminal. Tourists who wish to travel to Jordan must be in possession of a visa from Jordan in advance, with the exception of Palestinians who are allowed to travel to Jordan without a permit. Foreigners who leave Jordan via the King Hussein Bridge may return by showing the exit visa. Tourists and inhabitants of East Jerusalem may travel directly to an Israeli terminal, although Palestinians from the West Bank have to start the departure procedure at the special Palestinian border terminal in Jericho city.

#### *Road Network in Jordan*

The Dead Sea Highway (Route 65) is the major regional highway in Jordan that crosses the Jordan Valley from north to south along the western Jordanian border and Dead Sea shoreline. All other roads leading to and leaving from the Jordan Valley connect to this road. The road passes through some heavily populated urban areas where it is widened to

four-lane divided with shops and buildings on both sides of the road.

This road is heavily used for local traffic as well as regional transportation. The traffic along Route 65 is dense, consisting of slow moving trucks carrying agricultural produce, farm vehicles, and local traffic. The road is heavily intersected by minor roads used by farmers. Most intersections with major roads are signalized. The Dead Sea Highway along the Jordan Valley is poorly serviced for major sections, and there is a need for maintenance and improvements, particularly pavement, marking and signage. There are plans for upgrade the road into four divided lanes, or to construct a new highway parallel to the existing one.

#### *Traffic Safety*

Although no detailed information is available on traffic accidents in the Jordan Valley, the number of traffic deaths in Jordan as a whole is relatively high with 12 to 14 deaths per 100,000 inhabitants (ref. Jordan Traffic Institute, 2011). In 2010 Jordan had a total of about 1 million registered vehicles; including 770,000 4-wheeled light vehicles and 100,000 buses. Extrapolating the traffic accident percentages to the current population in the Jordan Valley would imply 25 – 30 traffic deaths on average in the Jordan Valley. Statistics show that 63% of these casualties are among drivers and passengers of 4- wheeled cars and light vehicles, 33% among pedestrians and 4% among buses and heavy trucks. Improving road safety conditions along Route 65, including street lightning and separate protected pedestrian lanes

and cross-overs will likely reduce the annual number of deathly traffic accidents considerable.

The government is considering to either upgrade the Route 65, or to construct a new parallel highway though the LJR Valley. The argument for constructing a new highway is currently stronger than that of upgrading the existing road, as upgrading entails demolition of existing village buildings and farms. In addition, increased traffic will increase noise, pollution and accidents in urban areas. Also the large number of intersections makes the existing highway unsuitable for international (through) traffic.

The Amman - Naur - Dead Sea (Route 40) is the main entrance in Jordan to the Jordan Valley. It is a well engineered four-lane divided expressway, but there are steep inclines that slow down heavy trucks. The last segment of this road from Al Rama intersection to Al Quds intersection with Route 65 has been upgraded to a four-lane divided highway.

The Al Ardah – Al Salt Road (Route 24) connects with Route 65 approximately 32 km north of South Shuneh. This road is a rural two-lane two-way road of approximately 8 m wide carriageway that climbs along the wadi up to Al Salt for approximately 23 km. The intersection with Route 65 (Muthallath Al Arada) is a signalized “T” Intersection. The road at the intersection is widened to four-lanes, with shops and buildings on both sides. The road has some very sharp reverse and broken back curves and steep grades. The surface of the road needs some rehabilitation work to repair pavement cracks and

pot holes. In addition, some protection from falling rocks and drainage works are needed.

Continuing north (approximately 15 km) along Route 65 from Muthallath Al Arada intersection is the intersection of the Kufranja – Ajloun Road. This is a two-lane, two-way undivided rural road that runs for about 24 km to Kufranja and Ajloun. This road has approximately 6 m of paved width. The road climbs up the hills and mountains towards Ajloun.

The Qalat ar Rabad – Ajloun Road climbs along Wadi Al Yabis passing Qalat (Castle) ar Rabad on to Ajloun (approximately 40 km). The road intersects Route 65 approximately 12 km north of Kufranja – Ajloun Road. This two-lane road features approximately a 7 m wide paved carriage way. Further north (approximately 16 km) along Route 65 is the intersection with Abu Saeed – Irbid Road. This two-lane, two-way road climbs about 34 km up to Irbid city. The Ash Shuneh (North) – Irbid (Route 16) two-lane two-way road has been upgraded to a four-lane divided rural highway with shoulders.

#### *Infrastructure network in Israel and Palestine*

On the western side of the Jordan River the main road from north to south is route 90. This road runs all the way from Metula in the north of Israel to Eilat in the south. Where the road enters and leaves the West Bank, two checkpoints have been erected: the northern one near the Bezeq Stream and Sdei Trumot, and the southern one along the Dead Sea just north of Ein Gedi. Palestinians living in the West Bank are not allowed to pass these checkpoints

unless permits from the Israeli Authorities were obtained.

Other major roads that cross the region are Routes 505 and 508, known in Hebrew as the Alon Road. Just north of the Dead Sea at the Beit Ha Arava junction, Route 90 crosses Route 1, leading to the West through the West Bank towards Bethlehem, Jerusalem and Tel Aviv. Highway 90 bypasses Jericho from the east, and the entrance road to Jericho was recently opened – allowing both a north and south entrance. Driving north from Ein Gedi, Israel, you pass an Israeli military checkpoint as you cross into the West Bank.

A secondary level network connects Jericho to the other Governorates, mainly branching from Road 90 to Nablus (Road 505) and Ramallah, and to Jerusalem (Road 1). Four accesses link Jericho city to its surroundings: two in the northern part towards Al Auja, Nablus and northern part of the Jordan Valley, one towards east Jordan, one to the south-west towards Ramallah and Jerusalem. The region of Jericho is connected to the other urban centers by public transport, mainly mini-van buses. Jericho city is the main hub toward the surrounding villages and houses the main national bus stations (Nablus for the northern regions, Ramallah for all Palestine, Bethlehem for the southern regions). In addition to that, the main cities of Palestine are linked to the border station (Esteraha) by a bus service.

On the western side road 90 along the valley is a major tourism artery connecting Jerusalem and then

Jericho with the SoG. Many foreign tourists take this journey along road 90 which presents real opportunity for further development in the valley. The main tourism route in Jordan is Amman – Jerash and south to Petra. Jordan would therefore also benefit if border crossings were easier for tourists capturing some of the road 90 market on the west side.

#### *Public Transport*

The main public transport in the Jordan Valley in Jordan is by minibus. These buses travel generally frequently, but generally without fixed schedules, depending on the number of passengers being picked up. Minibuses generally stop anywhere at request. For many destinations in the Jordan Valley, the minibus is the only other public transport option. Some large air-conditioned bus companies are operating in Jordan as well, although mainly along the main routes such as from Amman to Aqaba or Amman to Petra. There is no information that the bus routes pass through the Jordan Valley. The system of shared taxis is also applied in Jordan. Like the minibuses, they pick up passengers and generally depart to specific destinations when full.

In Israel public buses are the main form of public transport in the Jordan Valley. Within Israel a total of 16 different companies operated buses for public transport, with Egged being the largest bus company, operating routes throughout the country. Buses travel frequently from Beit Shean to Afula, Haifa and to Jerusalem. Smaller carriers, operated by companies like Dan Bus Company offer alternative public transport services. In addition,

shared taxi services, often as yellow minivans, are available as well, run by private companies, in addition to regular taxicab services. The shared taxis allow passengers generally to get in and leave anywhere along the path of travel. During Shabbat normal bus services cease their operations.

A new train line from Haifa to Bet Shean is expected to be completed and running in 2016. The train will have two stations in Bet Shean. In the mid 1990s there were plans to link the Beit Shean Railway across the Jordan River with a Jordanian rail network.

For most cities in Palestine, taxis are widely available, but blue and green license plates are generally not permitted to enter Jerusalem. Jericho is well connected to other Palestinian cities by service taxis / minivans. These are usually minivans which operate on a fixed route for a fixed price, similar to a bus.

### *Energy*

The Jordanian national interconnected grid transmits electricity from the power stations to the distribution substations and transformer substations in the Jordan Valley via 400-kV and 132-kV power lines. The grid has a clearly identifiable north-south axis. The national 400-kV power line runs outside the Jordan Valley from Aqaba via Amman and up to the Syrian border. In the north, the power grid is connected to the Syrian grid by means of a 230-kV and a 400-kV power line. In the south, there is a 400-kV connection to the Egyptian grid. The interconnected grid feeds the local distribution

systems via which almost the entire population of Jordan, including in the Jordan Valley receives its electricity.

The Israel Electric Corporation (IEC) is the sole integrated electric utility in Israel and generates and transmits substantially all of the electricity used in the country, including in the Jordan Valley. Like most countries in Europe, the Middle East, and Asia, the electricity in Israel is rated at 220V (220V - 240V) and 50Hz.

The framework for the electricity power supply varies in Palestine between the Jordan Valley and the rest of Palestine. The Jordan Valley has two different sources: the first is Israeli, which is also connected to the Palestinian. This network serves Israel well, but provides insufficient capacity to serve all Palestinian adequately as well. The solution is expected from Palestinian interconnection with Jordan: PNA and Jordan have agreed on connecting the Palestinian power grid to the Jordanian with a 33kV transmission line through King Abdullah Bridge, with a capacity of 20MW. A transformer substation is built in the south of the Jericho City and connected to the existing network. The other Palestinian communities get the electricity from JDECO (Jerusalem District Electricity Company), or from the Israeli company Qutria.

WEDO / EcoPeace is currently researching the possibility to create a water and energy nexus across the region. This entails investments in the eastern deserts of Jordan proposed to be producers of large scale solar based renewable energy that would be traded by Jordan with Israel and Palestine.

Israel and Palestine would in turn use some of that electricity to desalinate Mediterranean Sea waters that would be traded with Jordan. Though the nexus concept is outside of the Jordan Valley, the implications for the valley are significant because it would make available large quantities of renewable energy and reduce pressure on the current demand for the natural waters of the valley. See also the report [Water\\_Energy\\_Nexus\\_Web3.pdf](#) at [www.foeme.org](http://www.foeme.org)

The Jordan Valley is a strategic location that functions as a west – east corridor from the Mediterranean Sea, Israel and Palestine to Jordan and other neighboring countries. It has also been a North-South transport corridor. The Jordan Valley opens up many opportunities for regional continuity. This includes establishing land transport, energy and communications connections between the parties in the region, as well as logistic facilities to serve both regional and international economic activities which will enable more diverse and efficient routing options for the flow of goods and people, both regionally and internationally. A major component of the economic development of the Palestinian Jordan Valley would be the upgrading of west – east transportation routes.

## 2.3 It's People

### Population

The Jordan Valley houses a population of about 605,000 people. The information with regard to the population numbers in the study area have been obtained through the Jordanian Department of Statistics (DOS), the Central Bureau of Statistics in Israel, and the Palestinian Central Bureau of Statistics. For the Jordan and Israeli parts of the study area there has been an organic growth of the population, except for the recent influx of refugees from Iraq and Syria in Jordan. This contrasts with the Palestinians, for which the economic opportunities in the region have been much more limited since the late 1960s. Palestinian youth has often been commuting or migrated to other regions in and outside the West Bank looking for opportunities in the labor markets.

The population growth rates for the Jordan and Israeli sections of the study area are estimated at respectively 2.2 and 1.87%. For Jordan the growth rate during the period 1994-2004 was calculated at 2.6% and decreased to 2.2% during the period 2004-2010. A slightly further decline of the birth rate in Jordan is expected, however the communities in the Jordan Valley follows the national trends with some years delay and therefore the birth rate for the period 2011 to 2020 is estimated at 2.2%.

Separate from the registered Jordanian population, the Jordan Valley houses large number of informal foreign workers originating mainly from Egypt and

Iraq, and lately including some refugees from Syria. It is estimated that a total of about 250,000 informal people live in the Jordan Valley today, many of them employed as temporary workers in the agricultural sector.

In addition, the United Nations had registered 619,000 official refugees from Syria in Jordan in August 2014, with over 80,000 registered in the refugee camp Za'atri, located close to the Syrian border, just outside the study area. However, the impact of these refugees on the population in the Jordan Valley is limited, due to strict travel restrictions for Syrian refugees, enforced through checkpoints on the roads towards the Jordan Valley.

For Israel the current population growth rate is about 1.87% and no further decline is expected for the study area. This has to do with a large percentage of the population living in rural communities, where birth rates are commonly higher than in urban communities. Various studies show that Palestinians in the occupied West Bank C areas, including the Jordan Valley, have declined drastically over the last years, mainly as result of migration of Palestinians to areas A, where the economic perspectives and public services, such as water, sanitation and electricity are much better.

An estimated total of 6245 people live in about 26 Israeli Settlements within the West Bank part of the study area, divided over Cluster North, including the settlements of Mehola, Shadmot, Maskoit and Rotem; Cluster Central, including a total of 18 small settlements, and Cluster South, including the

settlements of Vered Yeriho, Beit Harava, Almog and Kalia.

Below table provides an overview of the population figures.

**Table 5 - Estimated population in the Study area (2010)**

Country	2010
<b>Jordan</b>	
Agwhar Shamaliyah	108.943
Deir al Alla / Balqa	67.925
Shuneh / Janoobiyah	70.294
<i>Foreign population</i>	<i>247.000</i>
<b>TOTAL JORDAN</b>	<b>494.162</b>
<b>Israel</b>	
Emek Hayarden	11.000
Emek Hamaayanot	11.000
Beit Shean	17.000
Hagilbo'a	10.000
<b>TOTAL ISRAEL</b>	<b>49.000</b>
<b>Palestine</b>	
<i>Palestinians</i>	
Bardala Cluster MD	5.259
Al-Nassariya Cluster MD	4.564
Al-Jiftlik Cluster MD	6.499
Fasayil Cluster MD	1.157
Al-Auja Cluster MD	4.423
Jericho MD	34.112
<i>Subtotal Palestinian</i>	<i>56.014</i>

Country	2010
<i>Settlements</i>	
Cluster North MD	1.425
Cluster Central MD	3.960
Cluster South MD	860
<b>Subtotal Israeli Settlers</b>	<b>6.245</b>
<b>TOTAL PALESTINE</b>	<b>62.259</b>
<b>TOTAL Population Jordan Valley</b>	<b>605.421</b>

### Socio-economic Situation

The native inhabitants of the Jordan Valley in the early 19<sup>th</sup> century are known as Al Ghawarna or Ghorani (meaning people of Al Ghor), who were involved in mixed farms that covered crop and livestock production systems. Semi-nomadic Bedouins also lived in the Jordan Valley and used the lands as grazing ground for their sheep and goats during the winter months because of its warm climate and available fodder for their animals. However they moved their flocks up into the hills during the summer to avoid the intense heat.

Today, agriculture still dominates the socio-economic landscape of study area, although there is significant inequality between the riparian states. The Israeli part of the valley is economically the most advanced zone, with a living standard comparable to some European countries. The World Bank classified Jordan as an "upper middle income country" however with significant economic

Socio-economic Statistics (2011) Parameter	Jordan Amount Unit	Israel Amount Unit	Palestine Amount Unit
Average Household size	6 pers	3,3 pers	6 pers
Average Monthly Household Expenditures	701 JD	14460 NIS	1058,4 JD
Average Monthly Per Capita Expenditures	117 JD	4382 NIS	188,1 JD
Average Monthly Income per household	704 JD	14629 NIS	1100 JD
Illiteracy rate for persons aged >15 years			4,1 %
<i>Males</i>	5 %	1,5 %	
<i>Females</i>	12,6 %	4,1 %	
Gender Ratio (= males / females in %)	106,4 %	102,7 %	103,2 %
Labor Force Participation >15 years			
<i>Males</i>	63,4 %	68,6 %	69,1 %
<i>Females</i>	17,8 %	61,3 %	17,4 %
Poverty rates	12.5 %	22.5 %	23.7 %
Unemployment > 15 years			
<i>Males</i>	11 %	5,6 %	17,3 %
<i>Females</i>	21,2 %	20,2 %	25,3 %
Employment per sector (%)			
<i>Agriculture, fishing, forestry</i>	20 %	1,6 %	33,3 %
<i>Mining, quarrying and manufacturing</i>	9,5 %	11,5 %	7,6 %
<i>Construction</i>	15 %	5 %	6,2 %
<i>Commerce, restaurants, hotels</i>	20 %	19,5 %	13,3 %
<i>Transportation</i>	6,5 %	3,8 %	5,1 %
<i>Services, others</i>	29 %	58,6 %	34,5 %
Basic Education (%)			
<i>Males</i>	51,3 %	100 %	
<i>Females</i>	48,7 %	97,7 %	
Population Growth	2.2 %	1.87 %	Negative/ migration

**Table 6 - Socio-economic parameters**

inequalities: in the Jordan Valley there a small group of wealthy agricultural entrepreneurs, next to a large group of laborers who close to the poverty line of JD 32.6 per person per month. The Palestinian part of the valley, excluding the Israeli settlements, have a

standard of living comparable to that in Jordan, be it that the remaining population living under occupation is small and are often subject to stringent movement restriction by the Israeli military authorities.

The importance of agriculture is expected to decrease in the valley for all three riparian states. In Israel the proportion of the population engaged in the agricultural sector started to decline already in the 1970s when the industrial and service sectors achieved higher growth levels compared to the agricultural sector. Also gave a higher priority to agricultural development was given to regions where tensions between different water users were less prominent (e.g. Negev Region). For Jordan and Palestine this shift from agriculture to service sector started during the 1990s and continues until today. It is expected that once a final peace settlement is in place, the Palestinians will see a further boost of the socio-economic perspectives.

Below table provides an overview of some socio-economic parameters in the study area. These figures have been obtained from literature, from the Jordanian Department of Statistics (DOS), the Central Bureau of Statistics in Israel, and the Palestinian Central Bureau of Statistics, supported by data from indexmundi.com These data reflect the status in the wider region around the Jordan Valley: this study did not include specific field data surveys in the Jordan Valley itself, and below data should therefore be considered indicatively.

Within the study area, the size of households in Jordan and Palestine are similar, about 6 persons per household, which is comparable to the wider Middle East region, while Israel has about 3.3 persons per household, which more resembles the situation for instance in Europe.



**Figure 22 – Jericho City Center**

The differences in expenditures show slightly different pattern. Household and per capita expenditures in Jordan are resp. 701 JD and 117 JD (€ 728 and € 121). In Palestine these are about 50% higher: 1058 JD and 188 JD (€ 1098 and € 195). In Israel, the household and per capita expenditures are about 5 times higher: 14460 NIS and 4382 NIS (€ 3.051 and € 924). However, the Consumer Price Index for Jordan is about 65,55 against 92,24 for Israel and Palestine, meaning that Jordanians can

buy about 40% more consumptions goods for their money than the Israeli's and Palestinians.

Unemployment rates (percentages of the labor force without a job) are relatively high for the region, with an exception of the male unemployment rate in Israel, which was 5.6% in 2011.

Among the male population Palestine has the highest unemployment rate with 17.3%, followed by Jordan with 11%. Under the female population, unemployment is again highest in Palestine (25.3%), followed by Jordan (21.2%) and next Israel (20.2%).

In all three countries there are considerable income disparities between the upper and lower strata of the societies. In the three riparian states a substantial proportion of the households are living below the poverty line: Jordan 12.5%, Palestine 23.7% and Israel 22.5%. It should be noted that the three countries apply different poverty definitions, and that in absolute income terms the poverty in Palestine is much more severe than in Israel. Nevertheless, the Gini Coefficient of Jordan and Israel confirms that large income disparities exist between the top 20% and the bottom 20% of the income earners, and the expectation is that a similar pattern can be observed in Palestine.

Employment rates per economic sector show that Palestine has a relative high portion of people working in the agricultural sector (33.3%), while in Jordan this is estimated to be around 20%, and only 1.6% of the Israeli working force is employed in the agricultural sector. Although detailed information on agricultural employment rates in the Jordan Valley are not available, it may be expected that agriculture is more important here than at national levels.

A different pattern can be seen in the construction sector, with 15% for Jordan and 6.2% for Palestine, against 5% in Israel. Sectors such as mining, manufacturing, commerce, restaurants and hotels

and transportation employ percentages which are more or less similar for the three countries. Finally the Service sector, including research and government, is best developed in Israel, employing 58.6 % of the work force, against 39.8% in Jordan and 34.5% in Palestine. These differences may explain to some extent the income differences in the three countries, since the agriculture and construction sectors generate generally lower wages than the service sector.

The agricultural activities of the settlements in the Palestinian study area generate about 500 Million NIS of revenues. The total agricultural area in the West Bank part of the study area that is under control of Israel is approximately 60,000 dunum, including 4.470 dunum in Cluster North; 46.360 dunum in Cluster Central and 10.128 dunum in cluster south. Main crops are dates, vegetables, fruit trees and field crops. About one third of the Israeli settlement population is involved in agricultural activities, and another one third is engaged in agro-business related activities. The final one third of the working population is involved in industrial activities and services. In addition, an estimate 6,000 Palestinian workers are employed on a temporary basis on the agricultural settlements.

The industrial activities of the settlements in the Palestinian study area include exports of dried fruits, dates, herbs and nuts; infrastructure contracting; packaging of grapes, figs, peppers, tomatoes and herbs, nylon bags production; metal works, rubber, plastics and sealing production; arts and crafts, marketing and investment in pesticides, fertilizers

and packaging materials for farmers, manufacturing cosmetic products from Dead Sea minerals.

The gender ratio in the Jordan Valley (number of males compared to number of females) is highest in Jordan (106.4%), and similar in Israel and Palestine (102.7% and 103.2%). Illiteracy rates in all three countries are relatively low: below 5%, be it that females in Jordan are an exception with an average illiteracy ratio of 12.6%. Labor force participation for the male population is also similar in all three countries: 63.4% in Jordan, 68.6% in Israel and 69.1% in Palestine. Differences are larger for the female population: 17.8% and 17.4% of women participate in the labor market in Jordan and Palestine, while 61.3% of the adult female work force participates in the labor market in Israel.

The gender issue in Jordan is influenced both by national socio-economic conditions as well as by tribal traditions. In some rural areas local Shari'a courts have some jurisdiction over matters related to marriage, divorce and inheritance. The Jordanian National Commission for Women (JNCW) has established a network called Sham'a ("candle"), which aims to combat violence against women by coordinating the efforts of both governmental and non-governmental organizations. In 2009, the JNCW established a Women's Complaints Office to receive complaints of discrimination and violence against women in private and public life and to raise awareness of these issues and provide legal aid, among other services. This work is carried out in collaboration with governmental and non-governmental organizations. There are also several



NGOs that provide services to women, and a national register on violence against women has been established. In 2007, the Ministry of Social Development created the “Family Reconciliation Centre” for victims of domestic violence.

In 2012, Israel ranked eleventh out of 59 developed nations for participation of women in the workplace. In the same survey, Israel was ranked 24th for the proportion of women serving in executive positions. Israeli law prohibits discrimination based on gender in employment and wages; nonetheless, there are still complaints of significant wage disparities between men and women in Israel, as well as significant social disparities particularly in orthodox communities. On the other hand, Israel was the third country in the world to be led by a female prime minister, Golda Meir, and in 2010, women's parliamentary representation in Israel was 18%, compared to about 6% in Palestine and Jordan, and to 40% for instance in the Scandinavian countries.

In Palestine the position of women is positive relative to most other Arab countries, be it that external conditions such as limited economic perspectives and traveling restriction imposed by the Israeli authorities are serious constraints for improving the position of women in the Palestinian society. In addition, Palestinian women still face some discrimination within Palestinian society itself. Despite high levels of education and activity within civil society, women remain underrepresented in public life, in part due to the societal norms that place pressure on women to conform to traditional gender roles. It has been difficult for Palestinian

women during the previous decades to have their voices heard within a society that struggles with the occupation, putting justice for women to a secondary issue on the national agenda. However, the 2010 UNFPA report mentions that there is a gradual improvement in gender roles and relations, leading towards greater equality in Palestine.



**Figure 23 – Old Farm House in the Southern Part of the Jordan Valley**

## Agriculture

The Jordan Valley is divided into three distinct agricultural zones, because of different agro-climatic and ecological conditions. The northern zones on the West and East Banks receive more rainfall; have lower temperature and better soils. These conditions enabled the farming communities to cultivate field crops and tree crops under rain fed conditions. The middle and southern zones receive marginal rainfall; have poorer soils and higher temperatures and therefore higher evaporations. These zones are unsuitable for rain fed agriculture and Bedouin nomadic communities used to rear their goats and sheep flocks there. The altitude, climate, soil types, and water resources are different and unique for each of the agricultural zones.

The communities that farmed in the Jordan Valley had a reputation for the export of agricultural product to regional urban centers. The Arab-Palestinian communities, who are locally known as Al Ghawarna, were initially engaged in subsistence activities like herding, gathering and later cultivating cereals. Later they involved in the cultivation of wheat, barley, maize and vegetables, eventually irrigating these crops from water they obtained from rivers, streams, springs and wells inside the Jordan Valley and its side-wadis. In ancient documents the Al Ghawarna communities were praised for their irrigation practices and their capacities to export agricultural produce to urban centers in the region (Khouri 1981). Bedouins traditionally used the valley during winter months to forage their sheep and

goats and then moved them to the fresher High Lands during the summer months.

In the 1950ies the riparian states developed a strong interest in irrigation development to expand the agricultural output of the Jordan Valley. The Government of Jordan started the construction of the East Ghor Canal in the late 1950s, which later got known as the King Abdullah Canal. This main canal flows on the East Banks and takes its water from the Yarmouk River and the streams flowing from the side-wadis of the Lower part of the Jordan River. The King Abdullah Canal supplies irrigation water to a series of irrigation schemes on the East Bank and to drinking water processing plants of urban centers in the High Lands of Jordan. The Government of Israel made major investments in irrigation development and the Carrier Canal enabled even irrigation development outside the Jordan Valley.

The development of a hydraulic revolution during the 1960s and 1970s has caused what El musa (1994) called a “Super Green Revolution” in the Israeli and Jordanian zones of the Jordan Valley. The expansion of the irrigated area and the successful application of Green Revolution technologies caused a boom to the production of high value crops like fruits and vegetables, which proved to be commercially highly profitable when exported to the regional and European markets.

Due to occupation of the West Bank, the Palestinian West Bank has missed out on large-scale irrigation development initiatives and continued to rely of

small-scale irrigation initiatives around communal owned springs and privately owned wells. Israel controls the water resources in the West Bank and prevents Palestinians from drilling below certain depths, and utilizes the West Bank water resources for the settlements, having serious impacts of the water availability.

The riparian states applied very different policy and organizational concepts for the development and management of irrigated agriculture. On the East Bank the Government of Jordan established the Jordan Valley Authority (JVA) that obtained the mandate to develop and manage the public owned irrigation systems and to carry out a land reform inside the command areas of the irrigation schemes. The JVA established a family farm model of 3.5 ha for the production of irrigated fruits and vegetables. The semi-public JVA organization allocated about 6,800 farm units inside the Jordan Valley study area to families of the indigenous Al Ghawarna and Bedouin farming communities and to investors from outside the valley, who were considered capable of developing and managing these resources intensive farms. A network of public and private sector irrigation and agricultural support service providers was established to assist these farming families to develop and manage on-farm irrigation systems, and to produce high value fruits and vegetables crops using the Green Revolution packages.

Irrigated agriculture in the Beit Shean agricultural-water zone developed through close collaboration between the public water agency, the cooperative farming enterprises (Kibbutzim) and the agricultural

**Table 7 - Main features of the three agricultural zones of the Jordan River Valley**

Characteristics	Zone 1	Zone 2	Zone 3
Elevation below sea level (m)	205 – 235	235 – 315	315 – 395
Name	Northern JV	Middle JV	Southern JV
Administrative centre East Bank	North Shuna	Deir Ala'a	South Shuna
Administrative centre West Bank	Beit Shean	Tubas	Jericho
Total degree of aridity	Semi arid	Semi arid-Arid	Arid–severely arid
Percent area of soil class-A East Bank <sup>1</sup>	43	29	18
Percent area of soil class-B East Bank	41	27	17
Percent area of soil class-C East Bank	13	12	7
Percent area of soil class-D East Bank	3	32	58

Source: Jordan Valley Authority.

**Table 8 - Cultivated and irrigated land (ha) in the Jordan valley per zone in 2009/2010**

Zones	Administrative Units	Cultivated land ha	Irrigated land ha
Northern East Bank *2	Northern Shouneh District	11.574	11.332
Northern West Bank *3	Beit Shean District	17.820	10.430
Middle East Bank *2	Dair Al Alla District	9.718	9.718
Middle West Bank *1	Tubas-Nablus Governorates (p	5.682	2.722
Southern East Bank *2 <sup>2</sup>	Southern Shouneh and (Ghor Safi) districts	6.412 (4611)	6.412 (4611)
Southern West Bank*1	Jericho & Al Aghwar Governorate	3.627	3.428
<b>TOTAL</b>		<b>32.319</b>	<b>32.073</b>

Sources

1. PCBS Agricultural census 2010 – Table 10 of Tubas/Nablus and Jericho and Al-Aghwar Governorates

<sup>1</sup> Class-A soil is deep and level and has good permeability, low salinity, and no clay (Marl). This type of soil is suitable for all types of crop. Class-B soil is similar to Class A but is shallower, less permeable, and slightly more saline. Class-C and class D soils are shallow and have high salinity and low permeability, as a result of the impediment offered by its clay layers.

<sup>2</sup> The agricultural enterprises in the Ghor Safi District are located outside the study area but inside the service area of the King Abdullah Canal. Therefore data on irrigated agriculture is included into this baseline report.

2. DOS Agricultural census 2011- Al-Aghwar region

3. ARC: 2002: Table 3-3 and 3-4

**Table 9 - Agricultural land use in the agricultural-water zones of the JORDAN VALLEY study area in 2011**

Agricultural land use	Shouneh North *1	Beit Shean *3	Deir Al Alla *1	Tubas/ Nablus *2	Jericho-AI Aghwar *2	Shouneh South*1	Ghor Safi *1
*Fodder crops	182,8	4.700	91,1	485,5	43	55,6	
*Field crops	967,3	2.790	224,5	1.894	254,1	563,7	46,6
*Vegetables		8.160		1.782,9	2.630		
-Open field	2.763,3		3.463,4			3.301,5	4.537,8
-Green houses	918,7	(20)	2.124,6			682,8	281
*Fruit crops	6.698,2	2.150	1.592,3	397,7	700,7	2.135,4	479,1
*Fish ponds		1.050					
*Fallow	1.447,7		2.611,6			351,1	133,6
*Others <sup>3</sup>	105		147,7			152,8	6,5
<b>TOTAL</b>	<b>13.068</b>	<b>18.850</b>	<b>10.255,2</b>	<b>4.560,1</b>	<b>3.627,8</b>	<b>7.242,9</b>	<b>5.484,7</b>

*Sources*

\*1 DOS 2011 Agricultural Census 2010 - Table 5.1.1

\*2 PCBS Agricultural Census 2010 – Table 10 Tubas, Nablus and Jericho & AI Aghwar Governorates

\*3 ARC 2002- Table 3-4

<sup>3</sup> The category others covers for example nurseries.

and irrigation support service providers of the public and private sector. Cooperative and family farms are the two main organization forms that are involved in primary agricultural production in the Beit Shean zone. Leaders of the Kibbutz movement were the driving force behind irrigation development in the Beit Shean zone because their farms controlled the land and water resources, and they had the vision, the technical and financial capacities and the required connections with the public water agency.

The Kibbutzim made substantial investments in research to develop the appropriate crops and cultivation techniques adapted for the specific physical and climatic conditions of the valley, and to cope with the increasingly stringent environmental and social standards of the export markets. With the agricultural sector investing in technical and commercial capacities to manage irrigation schemes and to practice irrigated farming, the public water agency could focus on the development and management of the main irrigation infrastructures and bulk water supply to organized agricultural water users.

Individual farmers were the driving force for the development of irrigated agriculture in the Palestinian zones. They manage the communal springs for their family or community groups and their private irrigation systems in case they controlled a well. The agricultural support service providers of the public and private sector are their knowledge partners. However the commercial farmers increasingly depended on the Israeli private service providers and the peasants on NGOs and

their own experiments for agricultural development initiatives. The majority of farming households lacked irrigation facilities and on their smallholdings can only practice rain fed-agriculture and extensive livestock production.

Irrigated agriculture in the Jordan Valley focuses on the production of irrigated high value fruit crops and vegetables for the export markets. The growers have to meet the stringent standards of the export agencies, with a stress upon completely bug-free crops, controlled usage of chemicals and strict requirements for packing-houses and refrigeration. In the Israeli section of the study area the growers collaborated with national knowledge partners to develop appropriate cultivation techniques for the crops and livestock production systems. There is growing collaboration between the Israeli agribusinesses and the Palestinian commercial farmers for the production, processing and marketing of agricultural export products (Levy 2011). In the Jordan section of the valley the commercial farmers increasingly relied on the experts of the international agro-industries to deal with irrigated crop production technologies and the quality standards of export markets.

The livestock production systems play an important role in the mixed farming systems in the valley especially in the Israeli and Palestinian sections. The Kibbutzim and Moshavim in the Israeli zone of the study area were recorded to rear 9.500 cattle for dairy and beef production in 2002. The majority of the Palestinian farmers are involved in livestock production systems either in the mixed farming

systems or their semi-nomadic livestock farming systems. In Jordan section of the valley livestock production is also considered economically relevance given the production of fodder crops (clover trefoil) and dairy products but not statistical data is collected concerning livestock production systems.

In the baseline report a distinction has been introduced between farming systems using high external inputs and low external inputs farming styles. The High External Inputs Agriculture or HEIA farming style applies the Green Revolution technologies, like chemical fertilizers, chemical control of weeds and pests, and genetically modified seeds. These inputs are produced externally to the farms by agro-chemical industries. LEISA farming style covers a series of practices that serve to reinforce ecological principles that are in line with local ecosystems<sup>4</sup>. The Low External Inputs

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<sup>4</sup> Low External Input Sustainable Agriculture (LEISA) is receiving increased attention of scientists and policy makers, both as a sustainable alternative to Green Revolution-technologies that make intensive use of internally produced inputs, and as a strategy of sustainable agriculture in resource-poor environments where no or very few external inputs are used. In areas with a high production potential, LEISA is considered to simultaneously improve ecological sustainability, food quality and farmers' socioeconomic conditions by minimal application of chemical inputs to reduce pollution of soil and water resources, chemical residuals in food, and financial incentives to increase labor production and ignore non-commercial functions of the agricultural sector. LEISA

Sustainable Agriculture (LEISA) farming styles apply inputs that preferably are prepared internally of their farms or partners' farms like manure and seeds and planting materials. The farmers use biological rather than chemical pest control techniques and mechanical weed control rather than herbicides. In Palestine LEISA production methods by family farms is dominant.

For this socio-economic baseline a classification matrix is applied that uses a farming style and a farm organization dimension. For farming styles the distinction between HEIA and LEISA technology is applied and for the farm organization the distinction is made between entrepreneurial, cooperative and family farms.

In Jordan, industrial farming is being developed by entrepreneurs and large groups of family farms specifically in the Middle Section of the LJV. Other farmers face the problem that their farm units are fragmented and their turn over is generally too limited to effort and apply extensive technologies.

In Palestine industrial farming is mainly done by the illegal Israeli settlement and by Palestinian entrepreneurs. The entrepreneurial, cooperative and family farms are distinguished on the ownership structure, the economic purpose of the farm and the

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cover different set of agricultural practices that have different names (organic, ecological, bio-dynamic, and conservation agriculture (<http://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/3143.pdf>).

labor recruitment strategy applied. The entrepreneurial farm is private property of the shareholders and its purpose is profit-making usually only in on-farm activities<sup>5</sup>. Therefore these farms are engaged in commodity production on the basis of commercial principles. The Palestinian cooperative farm is communal property of its members and its purpose is income generation for its members through on-farm and non-farm activities. The Israeli cooperative farm systems in the West Bank are all part of the illegal settlements and shall be removed by 2020 under the assumptions of this Master Plan. The family farm is private property usually of the family members in which social, economic, cultural and financial functions are combined. The purpose of the family farms is secured subsistence/income for the family members and therefore they can be engaged both in subsistence and commodity production<sup>6</sup> through on-farm and non-farm activities. Professional farm managers are in charge of the entrepreneurial and cooperative farms and they recruit laborers for the farm operations respectively through labor markets, and from the cooperative's members. They have to or try to pay market conform wages. However, the family farms recruit their labor from its members, who do not receive wages but subsistence security

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<sup>5</sup> Profitability is considered an achievement or success criteria for the managed enterprise.

<sup>6</sup> Subsistence production deals with the production of use values, which are consumed by the producers themselves, while commodity production deals with the production of exchange values or products that are exchanged through market forces.

on the basis of solidarity within the family network.

The HEIA and LEISA farming styles have beside distinct capital intensity level also different socio-technical-commercial networks that serve them. The farms applying HEIA farming style have made high investments in intensive irrigated crops or livestock production systems. The HEIA farms get their technical and commercial support from upstream and downstream mainly private service providers and they often have production and marketing contracts for integrated service packages with agrobusiness companies or supermarket chains. The farmers applying the LEISA farming style use internally produced inputs and therefore are weakly connected with the external input suppliers: the agribusinesses and bio-technology companies. The peasants miss connections with the product markets, however the commercial family farms are connected to processors and market for environmentally and animal friendly produced food. In many countries public sector has established regulations and organizations, to supervise the trade and application of chemical inputs, which focus on the HEIA farming style. Usually LEISA farmers voluntarily abandon the use of chemical inputs and have consultation platforms with consumers/environmental organizations and knowledge partners where the stakeholders decide jointly on guidelines and standards and supervision and labeling procedures of LEISA farming products.

**Table 10 - Livestock in the Western Jordan Valley**

Animals	Beit Shean	Tubas	Jericho
Dairy Cattle	3,600	640	1,030
Other Cattle	5,900	535	1,072
Goat and Sheep	1,000	14,000	67,000
Chicken	1,000,000	240,000	940,000
Other (horse and donkey)		20	320

Source ARC 2002: Table 3-14.

**Table 11 - Classification matrix of farm organizations and farming styles in the Jordan Valley**

Farming style Farm organization	High External Input Agriculture (HEIA)	Low External Input Sustainable Agriculture (LEISA)
Entrepreneurial farm	Capital intensive farms controlling moderate to large holdings where specialized crop and livestock production systems are practiced using hiring specialized farm managers and wage laborers	No information available yet
Cooperative farm	Capital intensive farms controlling large holdings specialized in intensive crop and livestock production systems using the management and labor capacities of the cooperative's members	No information available yet
Family farm	Widespread in family farms practicing specialized irrigated crop productions for which they depend on external upstream and downstream flow of commodities. These farmers had to take loans and engaged in production and marketing contracts to minimize risks are commonly called 'farmer'.	Widespread in family farms practicing mixed and subsistence farming and who want to control the internal resource base and to avoid risks of commercial loans. The farmers that focus on subsistence food production are commonly called 'peasants'.





**Figure 24 - Greenhouses in the Jordan Valley**

### **Export of Agricultural products**

The Jordan Valley is the major agricultural production region for Jordan. On a national scale Jordan's agricultural export accounts for about 550 Million JOD (2014), mainly to the United Kingdom, The Netherlands, Canada, Germany and France, and to a lesser extent to Saudi Arabia and the Gulf States. The export increased by 12% compared to 2013, and includes 888,000 tons of fruits and

vegetables. About 85% of the export relates to vegetables, particularly tomatoes. In addition, Jordan exported 613,000 heads of cattle in 2014, mainly to the Gulf Region.

Israel is a major exporter of agricultural products as well as agricultural technologies. The Jordan Valley plays a minor role in the agricultural production, since the bulk is produced in the central and western regions of the country. Israel's agricultural exports account for about 2.2 Billion USD, or 4.2% of the

total export. Vegetables account for about 24% of the total agricultural production. In addition, Israel produces about 690,000 tons of fruits, including 190,000 tons of citrus fruits for export, as well as wheat, barley, corn and cotton. Supporting services, including post harvesting, scientific research and agro-industry are highly developed in Israel. In addition, Israel produces 95% of its own food requirements, supplementing this with imports of grain, oilseeds, meat, coffee, cocoa and sugar.

The total annual Palestinian exports account for about 900 Million USD in 2013. The agricultural sector contributes today to about 4.5% of Palestine's GDP, compared to 13% in 1993, with the Jordan Valley playing a very modest role. This decline largely relates to increasing transport restrictions, agricultural land confiscations and limited control over most of the agricultural lands situated in the areas C. Most of the agricultural production is for domestic consumption and local markets, and only limited amounts are exported. About 5.3 Million USD of fruits and 5.9 Million USD of meat products were exported in 2013. More than half goes to Jordan, followed by Europe, Algeria and the United States.

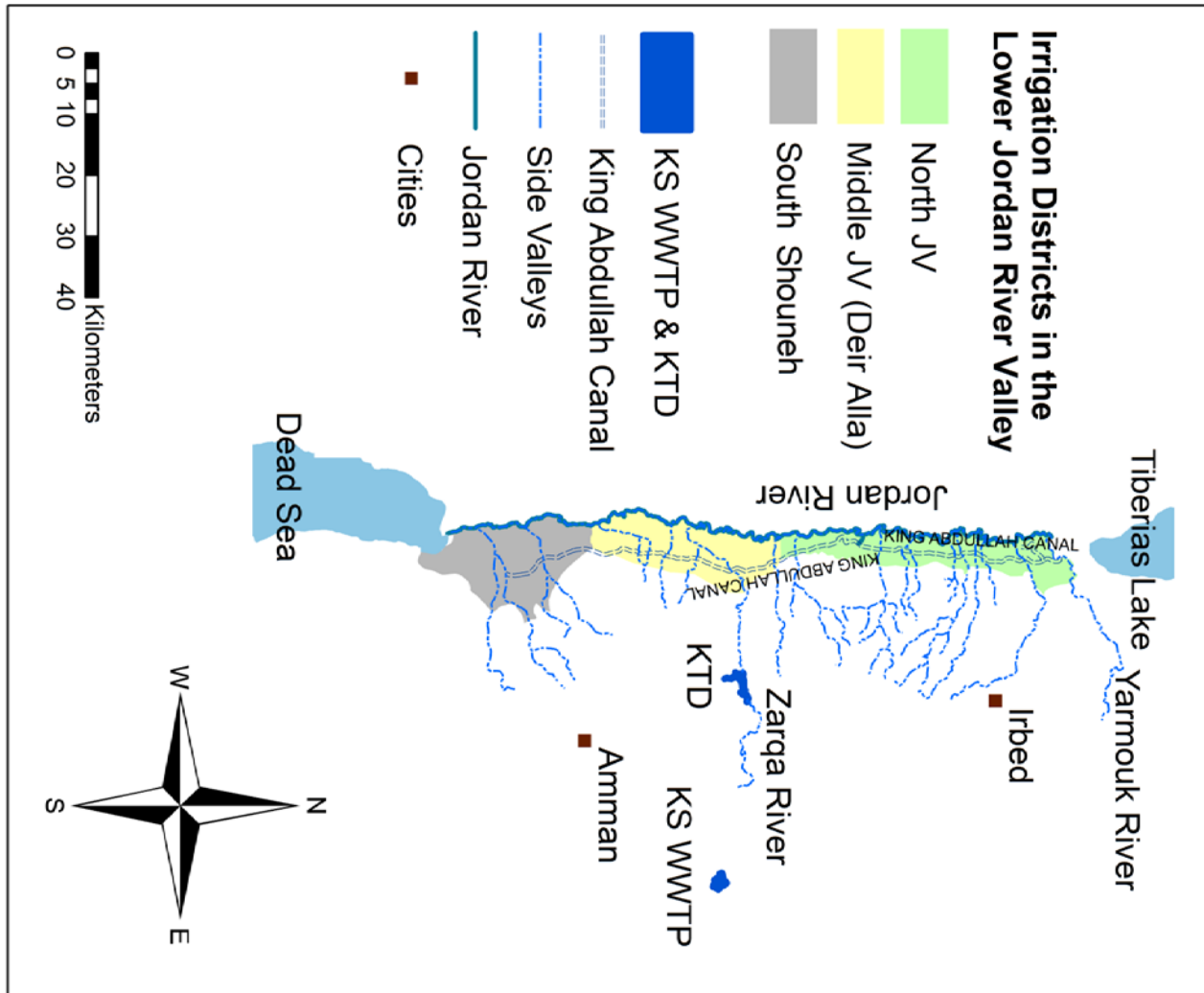


Figure 25 – Agricultural Zones in the Jordan Valley (Jordan)

## Tourism

The Jordan Valley has considerable tourism potential and offers numerous historical, scenic and religious attractions. Tourism contributes between 7 and 14% to the economy of the three riparian countries. Tourism in the Jordan Valley is strongly linked to the unique geographic features and its historic, religious, cultural and archeological features in the valley. Tourist destinations include health/spa tourism, nature areas, and cultural heritage (including religious) sites. Many international tourists combine a day trip to the Jordan Valley as part of their overall vacation itinerary. In addition, nationals of the three countries see the Jordan Valley as a popular trip destination during weekends or holidays.

However, tourism facilities are still relatively undeveloped in the Jordan Valley. The potentials in terms of recreation, thematic site visits and touristic tours are huge. The Jordan Valley is the home of a unique combination of tourist attractions. The archaeological and biblical sites have been described earlier in this report. The Jordan River is one of the sacred places, both historically and symbolically, for Moslems, Jews and Christians throughout the world. In addition, the flora and fauna inside the valley are very diverse as a consequence of the area's particular geological and climatic conditions. Potentials to be further developed could include hiking or biking along the Jordan River and Dead Sea Trails, camping, rock climbing and boating in dam waters along the LJR or in the Jordan River itself. Other potentials could be

religious tours such as a Pilgrims Path of the Companion of the Prophets (Islamic tour), the Hajj Trail (regional tour), a journey in the Footsteps of Moses, John, and Jesus in the Land of Moab, and many others. In addition, there could be potentials for deepening the linkages between established tourism accommodations and rural communities, such as organizing excursions and traditional meals in Arab and Bedouin communities, guided tours to nature reserves and bird watching, and horse and camel riding in the desert.

Further the Jordan River feeds the Dead Sea, which has no outlet and has the geographical reputation as "the lowest point on earth," lying almost 430 meters below sea level. This results in high evaporation and in extremely high contents of salt and other minerals. Swimming in the Dead Sea water is beside a special experience also considered to have curative effects for skin and respiratory diseases. Finally huge numbers of migratory birds fly yearly twice through the Jordan Valley moving from their breeding grounds in North and West Europe and their wintering grounds in South and East Africa. This diversity of tourist attractions gives the Jordan Valley the potentials to become one of the main tourist destinations in the Middle East Region.

However for developing these potentials the riparian states will have to create a supportive policy environment through constructive collaboration. The tourism sector is very sensitive to political tensions in the region and the number of tourists decline sharply when disputes escalated. Although tourists become more adventure-oriented, they avoid

destinations where they consider that their safety is at risk. The socio-political developments in Middle East with its growing encounters between political and religious fractions and alliances had negative effects on the Jordan Valley's reputation as a diverse and safe tourist destination.

Below table provides an indication of the main tourism indicators in the Jordan Valley. These figures are based on information from the Jordanian Ministry of Tourism & Antiquities (2010), the Israeli Ministry of Tourism and Antiquities (2012) and the Palestinian Ministry of Tourism and Antiquities (2011), supported with data from the national central bureaus of statistics and some assumptions.

In Israel, 29% of foreign tourists, about 58% of them being people with a Christian background, define their trip as a pilgrimage, which most likely include a trip to the Baptism site at Yardenit along the Jordan River. There is a total of approximately 588,700 visits to the Yardenit site in the Jordan Valley, mostly on a day trip basis from Tiberias or Jerusalem.

The Baptism site in Jordan is visited about by about 80,000 foreign tourists per year, while Mount Nebo, along the boundary of the Jordan Valley is visited by 394,993 foreign visitors and 1566 Jordanian nationals per year. The Dead Sea in Jordan is visited by 16,873 foreign visitors and 7,072 local visitors per year. Based on these figures it has been assumed that a total of about 491,000 foreign tourist visit the Jordanian study area on an annual basis.

**Table 12 – Jordan Valley Tourism Indicators (2010)**

Indicator	Jordan (2010)		Israel (2012)		Palestine (2011)	
	<i>Nation</i>	<i>JV*</i>	<i>Nation</i>	<i>JV*</i>	<i>Nation / West Bank</i>	<i>Jericho and JV*</i>
Foreign Visitors per Year	3,644,267	491,000	3,500,000	588,700	2,200,000	750,000
Local Visitors per Year	451,444	8.638	500,000	50,000	2,700,000	250,000
Number of Hotels available	487	28	340	53	93	12
Number of Beds available	46.141	2.496	<i>95,800</i>	1,235	2,167	800
Number of Hotel Guests					264,000	34,000
Bed Nights – foreigners	4.557.024	24,651	10,000,000	80,000	220,000	30,000
Bed Nights – nationals	?	?	12,000,000	40,000		
Revenues from Tourism	1.01 B JD	11.1 M JD	9 B USD	12 M USD	250 M USD	5-10 M USD?
Employees in Tourism sector	41.900	2266	105,000	100	10,000	200
Main Tourism Season	July, August, Sept	Easter, July, August, Sept	July, August, Sept	Easter, July, August, Sept	July, August, Sept	Easter, July, August, Sept

\* JV = in the Jordan Valley, excluding Dead Sea

*Italic* = best estimate

Jericho, which is the main urban center in the Palestinian part of the study area with about 34,000 inhabitants, welcomes around 1.1 Million daily visits and 34,000 hotel guests per year. Assuming that the tourist sector in Jericho counts for about 14% of the Gross Domestic Product, as for the rest of Palestine in the West Bank, and taking into account a per capita GDP of 1,036 USD, this leads to an estimated revenues for the tourist sector in the Palestinian study area of around 5 to 10 M USD per year.

The two main hotel resorts in Jericho are the 4 stars Jericho Resort with 104 rooms and 254 beds, and the 5 stars Intercontinental Jericho Hotel with 181 rooms and 362 beds. The large amount of inbound tourism in Palestine (over 60% of inbound daily visits and over 90% of inbound overnights) is faith based Christian tourism. The Palestinian citizens of Israel visit Palestine in a considerable daily visits as well as overnights are recorded. They made the top most daily visitors and made the third most overnights. Tourist coming from USA, Germany, France, Korea and some other like Britain and Norway create a growing demand for Palestinian tourism. The tourists often combine their trip to Jericho with visits to archaeological sites, historic features as well as the cultural and natural landscape in the Jordan Valley.

As indicated in this table, the Jordan Valley between the Sea of Galilee and the Dead Sea is visited annually by about 1.33 million foreign visitors on an annual basis, including 491,000 foreign visitors in the Jordanian part of the study area; 588,000 foreign visitors in the Israeli part of the study area, and approximately 250,000 foreign visitors in the West

Bank part of the study area. In addition, it is estimated that a total of 70,000 local nationals visit the study area for recreational purposes on an annual basis.

Most visitors come to the area on a one-day basis. Only about 1% of foreign visitors stay overnight in the study area during their trip, leading to approximately 134,000 Bed Nights per year in the study area. Most of the international tourists have night accommodation in other parts of the region, mostly in Amman, Jerusalem and Tel Aviv.

The revenues from tourism in the study region cannot be separated sharply from the national tourist revenues. Direct revenues in the region include hotel and restaurant costs, local travel costs, purchase of goods and souvenirs and admission fees to various sites and attractions. Indirect revenues relate international flights, day trips to wider parts of the region, and the theoretical percentage of tourists that decide to come to the one of the three countries for reasons directly related to touristic sites in the Jordan Valley.

It is estimated that approximately 1% of the total tourism revenues within Jordan is directly earned in the study area, or about 11 million Jordanian Dinars out of approximately a total tourism related national revenue of 1 billion JD. The tourism sector in Israel is the largest of the region, with 9 billion USD of revenues per year (2013). The portion earned directly in the study area is only a fraction of this. It is estimated that 12 million USD or 0.1% is directly earned from tourism in the study area.

For the Palestinian part of the study area the situation is more complicated, since the Palestinians have no access to the major portions of the West Bank, and many visitors to for instance the Baptism Site in the West Bank are served by tourist operators from elsewhere in Israel. It is the Consultant's estimate that the direct Palestinian earnings from tourism in the study area is about 5 million USD, against a total Palestinian income from the tourist sector in the West Bank of about 250 million USD [ref. Ministry of Tourism and Antiquities.

## Industry

With the exception of the Israeli zone, the industrial sector is weakly developed in the Jordan Valley. In Jordan agriculture related services include industries supplying greenhouses, on-farm water management equipment and agricultural inputs. An initiative was taken to develop a fruits processing plant; however it failed in the opinion of many farmers.

In the Palestinian area the agro-industrial linkages are also weak. The HEIA farms have connections with the agro-industries in Israel that provide irrigation equipment and external inputs. The forward linkages are weak, because the products are directly sold to the consumers or the suppliers in the urban environment that have processing capacities.

The agricultural sector in Israel has established strong backward and forward linkages through the

Kibbutzim's organization structures. The economic scales of the kibbutz farms enabled mechanization of the farm operations and investing in processing capacities for its main products through clusters of Kibbutzim. Kibbutzim alone or jointly could invest in technical and managerial capacities needed for backward industrial services, like the production and installation of drip irrigation systems, or in forward industrial services like the processing and marketing of milk or fruit products. The cooperative structure enabled the Kibbutzim organization to invest in agro-industrial initiatives that had synergies with their farm activities through the valorization of its products and for making more efficient use of the labor resources of its members during the off-season of the on-farm activities.

The Jordanian section of the Jordan Valley houses a number of mainly small industrial operations, including:

- The Wadi Rayyan Free Zone, between Pella and Karamah, including a gold and jewel factory.
- The AMPC Tomato Paste Factory.
- the Pella Trading Gypsum Board plant;
- the Indian Jordanian Chemical Company;
- Insustrong Polystyrene Factory south of El Arda;
- A small polystyrene factory between Sleikhat and Karn;
- the Jordan Plastics Factory at Facku Rama; and the Jordan Fertilizer Company north of Arda; and



**Figure 26 : Stone cutting workshop and car workshop near Moath Bin Jabal**

- The Travertine Company Ltd. (TRAVCO) located in the Middle Jordan Valley at Fanoush - Ghor Damia.

Agricultural developments in the Jordan Valley had strong links with the service sector but contributed marginal to industrial development. Sophisticated water management equipment is imported from Israel, India, and European countries that have a comparative advantage with water saving and

treatment of wastewater. Jordan has an advanced position in the production of phosphate and potash fertilizers but the plants are in Aqaba because of the transport advantages. USA and European agri-business companies dominate the markets for agricultural seeds and chemical inputs. Many of these international companies have their headquarters in Amman and one sales and service office in the valley.

Agriculture processing industries have a poor base in the Jordan Valley. Fruits and vegetables production is focused on fresh products that are directly sold to the Jordanian consumers or exported. During the 1980s the Jordanian Government invested in the establishment of a processing plant for fruits and vegetables with support of the European Union. The processing plant was established in Dair Al Alla, and the Department of Industries and a local organization of commercial farmers jointly managed it for the production of tomato paste. The farmers liked the plant since it enables them to process their low-grade tomatoes or to sell their products when prices dropped too much. Farmer leaders have the opinion that management of the plant deteriorated after the Jordanian Government ousted the farmer representatives from the management and sold the plant to a foreign private investor, who was interested in its assets. The remaining agro-industries are small-scale family enterprises for the processing of minor agricultural products like grains, olives and dates.

The backward linked industries in the East bank consist predominantly of small industries for construction the construction sector and package industry. There are several quarries that produce materials for the construction of buildings and infrastructures in the north-eastern governorates of Jordan. Some quarries even export marble. There are also several metal processing plants in the central and southern part of the East Bank that produce metal frameworks of greenhouses and install these for commercial farmers that invest

green houses. These small plants spread over the East Bank that produce wooden and plastic crates and boxes for the commercial farmers, for packing their produce in accordance with the demands of the export markets.

Other industrial sites in the study area include small stone quarries, cement production, pumps, tubes, pipes, textiles, leather, furniture, paper, printing, chemicals, metals, mechanical and electrical equipment, and transport.

In Israel, Beit Shean is a regional centre of fish-farming and fruit trees cultivation. Many residents of the Beit Shean district are members and employees of Kibbutzim that initially focused on farming activities but have diversified during the past decade in backward and forward linked industries to their farming activities. The industrial non-farm activities of these cooperatives cover production and installation of water management equipment (e.g. rain water collection and drip irrigation), fish processing and marketing capacities, processing and marketing of fruits and dairy products.

In November 2013, Israel and Jordan agreed on construction of a multimillion-dollar joint industrial zone on the border between Israel and Jordan near Beit Shean. This is considered to be the first large-scale economic co-operation project since the peace treaty was signed in 1994. It is foreseen that the Israeli section of the park will include offices, warehouses, export and trade-related activities, while the Jordanian section will include various large scale industrial production complexes.

The park will consist of two parallel industrial and employment zones that will be connected by a bridge spanning the Jordan River. From both sides, only authorized personnel and visitors will be allowed to enter the industrial park, while Israeli law will apply to the Israeli side and Jordanian law to the Jordanian side. A new governmental body called the Jordan Gateway Authority will be created to oversee activity on the Israeli side of the park. Movement of employees from both nationalities within the Park limits will not be restricted.

However, there are serious environmental concerns related to this project because of its chosen location on pristine land on the banks of the River Jordan. WEDO / EcoPeace proposes that the site location be reconsidered and moved to land adjacent to the existing crossing point at Sheikh Hussein Bridge.

In Palestine, the key existing industrial activities are located in Jericho: aluminum windows and doors, bricks, clothes, iron products, meat processing, metal windows and doors, plastic packing materials, tiles, Tannery, and wooden furniture. Furthermore there are well advanced plans for the realization of the Jericho Agro-Industrial Park (JAIP), including common solar power supply, waste supply and wastewater treatment facilities. The area will have a size of 11.5 hectare and will be operated as a Public-private enterprise. Palestinian companies, mainly small- and medium-sized business, are offered financial concessions, including tax cuts, to lease plots of land in the park to process agricultural products that can be sold in the West Bank and

abroad. All investors will have access to risk insurance from the Multilateral Investment Guarantee Agency, set up by the World Bank to protect them against negative impacts of conflict situation with the Israelis. The project is coordinated by the Palestinian Industrial Estates and Free Zones Authority (Piefza), based in Ramallah, backed by a grant of about \$47.7m from the Japan International Co-operation Agency (JICA), which is paying for the solar power system, the installation of a sewerage and water system in the park, plus support from Japanese engineers. PRICO has been appointed as park developer, and so far around 20 businesses – from Palestine and Jordan, and one Arab-Israeli company – have expressed interest in setting up business on the Park. The park's objective is to eventually generate as much as \$41.6m turnover per year and create more than 3,700 jobs.

### Human Water Demands and Supply

The human water demands in the study area have been divided into two categories: domestic/industrial and agricultural water demands. The calculated domestic/urban demands include all household, industrial, institutional, commercial and tourism water demands. An assessment has been made of the current domestic/industrial water demands based on the available population data in the year 2010, and per capita water requirements. For the sake of uniformity these per capita water requirements have been set throughout the valley at 90 m<sup>3</sup> per capita per year.

Agricultural water demands in the valley have been assessed on the basis of agricultural land use, current cropping patterns and crop water requirements. Particularly for Jordan, which is by far the largest agricultural water consumer in the study area, a distinction has been made between vegetables in the open field; vegetables in green houses, fruit trees and field crops. The agricultural water demands have been defined on the basis of currently utilized agricultural lands, and do not include potential agricultural lands that have not been developed so far.

Water demands for livestock, fish farming and industrial activities have been made on the basis an assessment of their current size and extension in the study area, in combination with data from earlier work done by the Austrian Research Centre in their water resources management study for the Jordan Valley.

The total water demands are not fully met by actual water supply figures. In general the valley experiences a gap between the required water demands and the actual water supply, as elaborated below as well. Below table provides a summary of the total human water demands in the Jordan Valley in 2010.

Water demands are provided directly from the Sea of Galilee, and should therefore be added to annual water resources available in the Jordan Valley.

### Domestic Water Demand

The domestic water demand has been calculated using the assessment of the current valley population and the regional domestic water use per capita presented in the tables below. The per capita domestic water demands are very variable between the three riparian states and between the urban and rural populations.



Figure 27 - King Abdullah Canal



Table 13 - Assessment of the human water demand in the Jordan Valley in 2010

Total Domestic Water Demands Jordan		2010
	Agwhar Shamaliyah	6.536.580
	Deir al Alla / Balqa	4.075.500
	Shouneh / Janoobiyah	4.217.640
	<i>Informal population (according to JVA)</i>	<i>7.410.000</i>
	to Amman	60.000.000
<b>TOTAL</b>		<b>82.239.720</b>

Total Agricultural Water Demands Jordan		2010
	Zone 1 (115,300 dunum)	103.596.865
	Zone 2 (74,959 dunum)	107.169.170
	Zone 3 (120,835 dunum)	65.492.271
<b>TOTAL</b>		<b>276.258.306</b>

Total Domestic Water Demands Israel		2010
	Emek Hayarden	990.000
	Emek Hamaayanot	990.000
	Beit Shean	1.530.000
	Hagilbo'a	900.000
<b>TOTAL</b>		<b>4.410.000</b>

Total Agricultural Water Demands Israel		2010
	Jordan Valley WA	21.237.000
	Afikey Main WA	52.015.000
	Harod WA	22.000.000
	Fish ponds	100.000.000
<b>TOTAL</b>		<b>195.252.000</b>

Total Domestic Water Demands (CM / yr) Palestine		2010
<i>Palestinians</i>		
	Bardala Cluster MD	315.540
	Al-Nassariya Cluster MD	273.840
	Al-Jiftlik Cluster MD	389.940
	Fasayil Cluster MD	69.420
	Al-Auja Cluster MD	265.380
	Jericho MD	2.046.720
<b>Subtotal Palestinian</b>		<b>3.360.840</b>
<i>Settlements</i>		
	Cluster North MD	128.250
	Cluster Central MD	356.400
	Cluster South MD	77.400
<b>Subtotal Israeli Settlers</b>		<b>562.050</b>
<b>TOTAL</b>		<b>3.922.890</b>

<b>Total Agricultural Water Demands (CM/yr) Palestine</b>		<b>2010</b>
<i>Palestinians</i>		
PAD 1	Bardala Cluster	10.558.755
PAD 2	Al-Nassariya Cluster	5.240.855
PAD 3	Al-Jiftlik Cluster	5.400.437
PAD 4	Fasayil Cluster	1.173.919
PAD 5	Al-Auja Cluster	3.991.597
PAD 6	Jericho	11.082.381
<i>Settlements</i>		
IAD 1	Cluster North AD	3.100.095
IAD 2	Cluster Central AD	36.621.768
IAD 3	Cluster South AD	8.000.662
<b>TOTAL</b>		<b>85.170.469</b>
<b>GRAND TOTAL WATER DEMANDS JORDAN VALLEY (CM / yr)</b>		<b>647.253.385</b>

Table 14 – Water Demands versus Supply in the Jordan Valley (2010)

Country	Region in LJR Basin	Number	Unit	Demand Type	Demand (CM)	Actual Supply (CM)	Deficit (CM)	
Jordan	Agwhar Shamaliyah	108,943	population	domestic	9,804,870	7,342,007	-2,462,863	
	Deir al Alla / Balqa	67,925	population	domestic	6,113,250	4,577,677	-1,535,573	
	Shooneh	61,424	population	domestic	5,528,160	4,139,554	-1,388,606	
	Janoobiyah	8,870	population	domestic	798,300	597,777	-200,523	
	To Amman					60,000,000	60,000,000	
	Shooneh North	115,303	dunum	agriculture	116,823,380	81,192,451	-35,630,929	
	Deir al Alla	74,959	dunum	agriculture	61,386,872	42,663,982	-18,722,890	
Palestine	Shooneh South	67,390	dunum	agriculture	58,056,150	40,349,124	-17,707,025	
	Ghor Safi	53,445	dunum	agriculture	39,991,904	27,794,442	-12,197,462	
	<b>Total</b>				<b>298,502,886</b>	<b>268,657,014</b>	<b>-29,845,872</b>	
	<b>Jordan</b>							
Israel	Emek Hayarden	11,000	population	domestic	990,000	990,000	0	
	Emek Hamaayanot	11,000	population	domestic	990,000	990,000	0	
	Beit She'an	17,000	population	domestic	1,530,000	1,530,000	0	
	Hagilboa	10,000	population	domestic	900,000	900,000	0	
	Jordan Valley WA	24,980	dunum	agriculture	21,237,000	21,237,000	0	
	Atkey Main WA	87,300	dunum	agriculture	52,015,000	52,015,000	0	
	Harod WA	36,000	dunum	agriculture	22,000,000	22,000,000	0	
	Fish ponds	20,000	dunum	fish ponds	120,000,000	120,000,000	0	
	<b>Total</b>				<b>219,662,000</b>	<b>219,662,000</b>	<b>0</b>	
	<b>Israel</b>							
Palestine	Bardala Cluster	5,259	population	domestic	473,310	209,000	-264,310	
	Al-Bassariya Cluster	4,564	population	domestic	410,760	149,000	-261,760	
	Al-Jiftik Cluster	6,499	population	domestic	584,910	500,000	-84,910	
	Fasayil Cluster	1,157	population	domestic	104,130	169,000	64,870	
	Al-Auja Cluster	4,423	population	domestic	398,070	1,830,000	1,431,930	
	Jericho	34,112	population	domestic	3,070,080	1,830,000	-1,240,080	
	Bardala Cluster	19,575	dunum	agriculture	10,558,755	4,627,000	-5,931,755	
	Al-Bassariya Cluster	7,652	dunum	agriculture	5,240,855	1,342,000	-3,898,855	
	Al-Jiftik Cluster	7,885	dunum	agriculture	5,400,437	5,334,000	-66,437	
	Fasayil Cluster	1,714	dunum	agriculture	1,173,919	789,000	-384,919	
	Al-Auja Cluster	5,828	dunum	agriculture	3,991,597	2,825,000	-1,166,597	
	Jericho	18,854	dunum	agriculture	11,082,381	14,134,000	3,051,619	
	<b>Total</b>				<b>42,489,203</b>	<b>33,738,000</b>	<b>-8,751,203</b>	
	Israel	Cluster North	1,425	population	domestic	128,250	128,250	0
		Cluster Central	3,960	population	domestic	356,400	356,400	0
Cluster South		860	population	domestic	77,400	77,400	0	
Cluster North AD		4,470	dunum	agriculture	3,100,095	3,100,095	0	
Cluster Central AD		46,360	dunum	agriculture	36,621,768	36,621,768	0	
Settlements	Cluster South AD	10,128	dunum	agriculture	8,000,662	8,000,662	0	
	<b>Total</b>				<b>48,284,576</b>	<b>48,284,576</b>	<b>0</b>	
Palestine	<b>Total</b>				<b>90,773,779</b>	<b>82,022,576</b>	<b>-8,751,203</b>	
	<b>GRAND TOTAL LJR Basin</b>			<b>CM per year</b>	<b>608,938,665</b>	<b>570,341,590</b>	<b>-38,597,075</b>	

For the assessment of the current domestic water no differentiation has been made between the lower per-capita water consumption in rural villages and the higher consumption in urban agglomerations, and all in annual per-capita water demand is assessed at 60 m<sup>3</sup> per person per day in Jordan and Palestine, and 90 m<sup>3</sup> per person per day in Israel for the year 2010.

### **Industrial Water Demand**

There are few industrial activities in the valley. Only one location has been established in Beit Shean municipality and two locations have been planned inside the valley. One location is planned on the East Bank near the Sheik Hussein Crossing and another near Jericho. No information about type of industries and their water demands can be made yet because the private sector considers investments too risky in the current hostile political and economic environments. The water demand from industry is low and the ARC and its partners estimated the industrial water usage as less than 1 MCM/year in the valley, with most of it being used in the Beit Shean region (ARC 2003).

### **Agricultural Water Demand**

For agricultural water demand a distinction is made between the water requirements of the crops, animal husbandry, fishery production systems that form integral components of the farming systems in the valley. Crop production systems dominate the farming systems in the Jordan Valley. However, the combination of crop and livestock production systems is prominent in the farming systems both in the Israeli and Palestinian section of the West Bank.

Processing facilities inside the farming systems are only relevant in the Israeli section of the study area and their water demands are considered under industrial water demands.

The calculation of irrigation water demands for crop production depends on many factors such as climatic conditions and soil types, crop-specific requirements, the efficiency of irrigation systems and the operation system applied by the irrigation managers. As the Jordan Valley have different transitional climates with different precipitation and evaporation rates for the northern and southern zones of the valley. Accordingly also the crops grown in the different zones have also differentiated water requirement parameters. However the irrigation systems are managed on demand-basis during the winter season when supplementary irrigation is practices and on supply-basis during the summer season when the available water resources dictate how these should be most efficiently. This sub-section only introduces the human water demand issues since the results of the water resources management scenario and modeling exercise will be presented in a separate report.

Statistical data for irrigated crops production have been provided for the study area by the organizations managing or supervising the management of water resources. The project partners provided data about the monthly crop water demands in the different agricultural zones. See table below.

### **Fish Ponds Water Demands**

Fishponds are pivotal to understanding the local consumption and water balance in the LJR. On average, a fishpond requires 3-6 MCM / yr per km<sup>2</sup>. Since most of the ponds in the area were constructed without lining, water losses by percolation are estimated at 20-50% of the water put in the ponds, most, if not all finds its way to the LJR. Another 40-50% is lost to evaporation and the rest is discharged back to the river as saline polluted effluent.

Israel operates the majority of the fish ponds in the study area. The surface area of fishponds in the region totals to about 20.000 dunums, which means a combined consumption of approximately 120 MCM/Yr. Most of the fishponds – 16.8 km<sup>2</sup>, are concentrated around Harod Stream and in Emeq Hamaayanot. Fish cultivation is periodical with most of the effluent being discharged in October-December. In Emeq Hamaayanot there is also some discharge in January-February. These fish ponds are supplied with water from a series of reservoirs. The reservoirs serve a dual purpose of operational storage and fish cultivation. Each reservoir is designated for a specific water quality. For example, the AMWA maintains a total storage capacity of 32 MCM as follows: 5 MCM for fresh water (under 500 mg/L Chlorine), 2 MCM for treated wastewater (WW) – namely from the newly built WWTP of Beit Shean, which produces 0.7 MCM/Yr; 25 MCM for saline water that come from local springs. The main fish ponds in the Israeli part of the study area are:

- Gesher Fish Ponds, about 560 dunum, consuming about 2 MCM / yr of water taken from the Jordan River
- Never Ur & Hamadia Fish Ponds, about 1100 dunum in total, consuming about 16.9 MCM / yr from the Jordan River. These ponds are rather old, with high percolation rates towards the groundwater.
- Emek Hamaayanot Fish Ponds, about 10,000 dunum in total, consuming 50 MCM / yr. These ponds also serve as reservoirs for saline water irrigation

### **Demand versus Supply**

Whereas the water demands are based on estimated requirements on the basis of the current population, economic activities and existing agricultural areas, the water supply figures represent an assessment of the actual 2010 water supply throughout the valley. The difference between the two represents water shortages for the various (current) water users in the valley.

The combined domestic and industrial water demands have been set at assessed at 60 m<sup>3</sup> per person per day in Jordan and Palestine, and 90 m<sup>3</sup> per person per day in Israel for the year 2010. This is based on the actual water demands in the valley in Jordan, Israel and Palestine. It has been assumed that actual water demands in Jordan would be of a similar level, assuming that water availability would be adequate. The agricultural water demands have been calculated on the basis of current agricultural land use and crop water requirements on a monthly basis.

The actual water supply figures are based on the information obtained from the major water supply authorities and associations in the valley, notably the Jordan Valley Authority (JVA) and Water Authority of Jordan (WAJ); the Israeli Jordan Valley Water Association, the Afikey Maim Water Association; the Harod Water Association, Mekorot, and the Palestinian Water Authority.

Specifically the water use of Israeli settlements in the Palestinian study area represents sensitive information that generates a lot of discussions. The UNOCHA for instance claims that the settlements consumption of water in the West Bank is about four times higher than the Palestinians water consumption. In the below table the Consultant estimated various water uses in the study area, based on total population numbers, agriculture field areas and crop water requirements within the study area. An overview of the total water demands versus supply in the valley is provided in the above table.

The total water supply in Jordan from the Jordan Valley has been estimated to be approximately 269 MCM per year (2010). It should be noted that the water supply includes conveyance of 60 MCM of water per year from the King Abdullah Canal to Amman through the Deir Alla Diversion, leading to an actual water supply within the valley of 209 MCM per year, compared to 299 MCM of total water demands within the valley. This implies that approximately 70% of the total water demands are actually supplied.

Based on the information obtained, the water demands within the study area in Israel, the water demands in Israel are fully met in terms of actual water supply. This means that the current population, economic activities and existing agricultural areas in this area are fully supplied with the water they need. Again, this is based on the current water users in the valley, and does not include potential water demands related to new economic, agricultural or urban development ambitions that there may be.

Domestic water supply to the Palestinians in the study area is derived from the groundwater aquifer systems, a series of springs that emanate from the aquifers, and minor amounts of surface runoff in addition to purchased water from Mekorot and from cisterns. The estimated unaccountant for water, defined as water that is either lost through leakages of is not paid for, is estimated to be about 25%. Irrigated agriculture takes mainly place in Wadi Fara'a in and in Jericho region.

Most of the water resources in the Palestinian part of the study area are utilized for water supply purposes. Runoff into the Jordan River is limited to some storm water runoff from Wadi Fara'a, which is estimated to be about 6.4 MCM per year, mainly as a peak flow sometime during the months of January or February.

The total water supply in the Palestinian part of the Jordan Valley study has been estimated to be approximately 82 MCM per year (2010). This includes 34 MCM per year for the Palestinians and

48 MCM for the Israeli settlements in the Palestinian study area. The water demands of the Israeli settlements are supposed to be supplied fully. The Palestinian water demands have been estimated to be 42 MCM. This implies that approximately 80% of the total Palestinian water demands are actually supplied. This is based on the current population numbers and utilized agricultural lands. This does not include potential agricultural lands that are structurally not utilized due to the limited water resources.

### WEAP Model for the Jordan Valley

WEAP is based on the principle of closing the water balance in a basin, in order to understand the balance between the total water resources on the one hand, and the total water consumption on the other hand, leading to a model for the monthly and annual flows in the Lower part of the Jordan River, as well as the salinity levels in the river. The hydrological year taken in this study starts at October 1<sup>st</sup> until September 30<sup>th</sup> of the next year, with monthly model steps in between. The model strives to describe the current situation (current accounts) of one average year, which is this WEAP model runs from October 1<sup>st</sup> 2009 until September 30<sup>th</sup> 2010. Runoff is defined here as surface water flow that reached the LJR, which is the direct result of a rain event. Salinity is the only indicator of water quality.

Direct contribution of groundwater to the LJR from Israel (north of Bezeq Stream) was calculated

according to Holtzman, who quantified groundwater in two segments of the LJR, between the Yarmouk and Harod Stream. The model simulates groundwater contribution, by adding groundwater inflow in two reaches: below the Yarmouk and below Issachar. The annual contribution of groundwater into the LJR was estimated to be 18 MCM, with an average salinity of 1150 mg/L. In the West Bank (south to Bezeq stream) direct information on the connection between the groundwater system in the Jordan Valley and the Lower part of the Jordan River has been described in some studies. In the current WEAP model it has been assumed that groundwater inflow is constant throughout the year and is based on flow measures performed at Qasr El Yahood (5-6 MCM/month).

In the East Bank, the shallow groundwater system consists of lacustrine sediments and Clastic fluvial components. The aquifer has been developed largely since the 1960ies, and many shallow wells have been drilled, largely for irrigation purposes. Consequently, groundwater levels have dropped and salinity levels increased substantially. Where historically groundwater flow in the Eastern Jordanian valley area had a westwards direction, today more water is abstracted than recharged naturally. In this model it has therefore been assumed that there is no annual contribution of groundwater into the LJR from the Jordanian side.

The current accounts run of the WEAP model for the hydrological year 2010 confirms that within the limits of the currently available water resources, the Jordan Valley is subject to structural water

shortages. This is particularly the case for the agricultural water users in Jordan and Palestine and to a lesser extent for Israel.

#### *Jordan*

As outlined in above table, the total Jordanian water demands in the study area have been assessed at 298 MCM per year, of which 268 MCM is supplied through the various sources described above. Particularly the agricultural sector suffers from shortages, whereas these shortages become more severe along the southernmost stretches of the King Abdullah Canal. These shortages are closely linked to the overall water balance in Jordan, and the increasing demands from other parts of the country, particularly the urban area of Amman. Currently Amman receives already 60 MCM of water per year from the sources of the Jordan Valley. This situation puts a clear cap on future agricultural and economic aspirations in the Jordan Valley. It will be required to find solutions that require less water, or reducing unaccounted for water percentages against higher benefits per unit of production.

#### *Israel*

The Israeli water demands, as well as supplies, have been assessed in the study area at 220 MCM per year. Similarly, there seems not much room for further expansion of water depending economic or agricultural activities. It should be noted that fish ponds use a large portion of the available water resources, about 120 MCM per year. Finding methods to reducing this share, and meanwhile reducing their environmental impacts on the Lower part of the Jordan River, seems to be one of the

major challenges for the coming years. Recent developments such as releasing more water from the Sea of Galilee into the LJR as result of the growing Israeli reliance on desalinated coastal water may provide an outlook to the direction where solution could be found to relieve the water stress in the Jordan Valley in the future.

#### *Palestine*

The Palestinians have limited control over their lands and water resources in the West Bank, except for Area A around the city of Jericho. The water demands of the Palestinians that currently live in the study area have been assessed at 42 MCM per year of which 34 MCM is actually supplied. In addition about 48 MCM of water is supplied from the locally available water resources to the Israeli settlements. These figures show clearly the development limitation for the relative small number of about 56 thousand Palestinians that still live in the area, set aside any larger economic or agricultural ambitions that the Palestinians may have. Solutions for the Palestinian water stress lay largely in the political arena and the current Peace Negotiations with Israel, and should include securing the comprehensive Palestinian control and management of their water resources, including the ground and surface water originating inside Palestine, in addition to respecting the riparian rights of the Palestinians as equal partners in the Jordan Valley.

#### *Lower part of the Jordan River*

The current account run of the WEAP model clearly shows the impacts of these water demands on the Lower part of the Jordan River itself. Below tables

show the calculated monthly and annual water flows along different spots in the river, and their related salt concentrations for the hydrological year of 2010: The annual flow in the northern section of the LJR is only 22 MCM at the point where the Saline Water Carrier enters the river, and consequently the salinity levels are high with 2,409 mg/L salt. Near the Bezeq Stream the flow slightly increases to about 80.5 MCM per year with 1,448 mg/L of salt. When it finally meets the Dead Sea the flow has reached a maximum with about 102.5 MCM per year. Clearly, these values don't meet any of the criteria for lifting the river to a healthy ecological status, and concise interventions will be needed, starting with preventing salt and pollution inflow into the river and mitigating their polluting sources, and next finding sustainable and sensible solutions for a steady increase of the river's baseflow.

## 2.4 It's Governance

### Stakeholders in the Jordan Valley

Stakeholders can be identified furthermore on various criteria: power, support, influence and importance. There is a correlation between the stakeholders' interest in the consultation issue and their support or lack of support for the project initiative. The stakeholders' interest in the consultation issue can change during the consultation process and a stakeholder can become more or less supportive towards the initiative. Balancing between economic and environmental interests of various stakeholders is a sensitive process. Therefore the identification and selection of the stakeholders is a critical step that influences the constituencies of the Master Plan that has been developed.

Irrigated agriculture is a core economic activity in the Jordan Valley and therefore stakeholders are distinguished for the agricultural, the water and the environmental sectors. Concerning Integrated Water Resources Management the stakeholders representing the agricultural and environmental interests take very divergent opinions and it is hoped that through interactions they start to take more convergent positions. Exclusion or inclusion of stakeholders for the consultations can have far-reaching consequences on the discussions and the compromises reached through the negotiations, but also for the constituency of the plans. For the identification of the stakeholders a distinction will be made between public, private and voluntary

organizations, keeping in mind that these are the three societal pillars of effective water governance systems. Special attention has been given to the stakeholders that have a positive influence on the consultations through the formulation of compromises based on common needs of stakeholders with perceived antagonist's interests.

#### Jordan

For the water sector in Jordan the Ministry of Water and Irrigation, the Jordan Valley Authority and the Jordan Water Authority are recommended to represent the public sector. Representatives of the Water Users Associations, the Southern Shouneh Chambers of Commerce represent respectively the agricultural and industrial water users in the consultations. Of the NGOs in Jordan EcoPeace Middle East has developed various water related initiative in the Valley and therefore is representative the voluntary sector. Four WUA representatives in the Forum's Steering Committee have represented all WUAs in the consultation process during preparation of this Jordan Valley NGO Master Plan.

For the agricultural stakeholders in Jordan the Ministry of Agriculture, NCARE and ACC represent the public sector. The Jordan Farmers Unions, the Irbid and Southern Shouneh Chambers of Commerce and the Fruits and Vegetables Association represented the private sector organizations. Of the environmental NGOs, the Jordan Environmental Society is working on tensions between economic and environmental issues in relation to irrigated agriculture. In the agricultural sector of the Jordan Valley

representatives of the three major tribal clans have to be involved to obtain a critical mass among farmers. Unfortunately there is not yet a farmer's organization for the promotion of LEISA production techniques that could represent the interests of this sub-group of farmers, which the HEIA farmers might not allow the Jordan Farmers Union to do.

The Southern Shouneh Chamber of Commerce and the Dead Sea Tourist Board represent the private sector organizations. Of the environmental NGOs, the Royal Society for the Conservation of Nature and the Jordan Environmental Society have been both involved in the discussions about sustainable development and natural resources management initiatives.

#### Israel

For the water sector in Israel the Ministry of Energy and Water Resources, the Israeli Water Authority on a local scale, and the Jordan Valley Water Association, the Afikey Maim Water Association and the Harod Water Association, as well as the Kinneret Drainage Authority and Lower Jordan River Drainage Authority (Israel) represent the public sector in the study area. The environmental sector at governmental level is represented by the Ministry of Environmental Protection, the Israel Nature and Parks Authority INPA. The tourism sector is represented by the Ministry of Tourism.



**Table 15 - Stakeholders representing the Jordanian Water Sector**

Sectors	Formal organizations that have been identified as representatives of stakeholders groups	Groupings involved in the Jordan Valley NGO master plan initiatives
Public sector	-Ministry of Water and Irrigation -Jordan Valley Authority -Jordan Water Authority	(MoWI and WUAs participate in the Jordan Valley Water Forum that the World Bank Institute facilitates)
Private sector	-Water users Associations -Irbid Chamber of Industry	
Voluntary sector	-EcoPeace Middle East Jordan Valley network	Women organization that represents the women as stakeholder in water and environmental services in the residential areas of the Jordan Valley

**Table 16 - Stakeholders representing the Jordanian Agriculture Sector**

Sector	Formal organizations that have been identified as representatives of stakeholders groups	Groupings involved in the Jordan Valley NGO master plan initiatives
Public sector	-Ministry of Agriculture -National Centre for Agricultural Research and Extension -Agricultural Credit Corporation	
Private sector	-Jordan Farmers Union -Irbid and Southern Shouneh Chambers of Commerce -Fruits- and Vegetables Exporters Association	Representatives of El Wakid, El Ghezawi and El Adwan clans representing the Al Ghawarna family farmers
Voluntary sector	-Jordan Environmental Society Jordan Valley Branch Office	Grouping of LEISA family farms that has as objective to promote environment-friendly agriculture production technologies in the JORDAN VALLEY

**Table 17 - Stakeholders representing the Jordanian Recreation and Environmental Sectors**

Sector	Formal organizations that have been identified as representatives of stakeholders groups
Public sector	Ministry of Tourism -Ministry of Environment
Private sector	-Southern Shouneh Chamber of Commerce -Dead Sea Tourism Board
Voluntary sector	-EcoPeace Middle East Amman Office -Jordan Hashemite Fund for Human Development (JOHUD) -Royal Society for the Conservation of Nature -Jordan Environmental Society Jordan Valley branch

**Table 18 - Stakeholders representing Israel**

Sectors	Formal organizations that have been identified as representatives of stakeholders groups	Groupings involved in the Jordan Valley NGO master plan initiatives
Public sector	Ministry of Energy and Water Resources Israeli Water Authority Kinneret Drainage Authority Lower Jordan River Drainage Authority Ministry of Environmental Protection Israel Nature and Parks Authority Ministry of Tourism Ministry of Agriculture Israel Land Authority Ministry of Defense Airports Authority – Land Border Control Ministry of Transportation National Economic Council- Prime Minister's Bureau. Ministry of Finance Ministry of Regional Cooperation Ministry of Galilee and Negev Development	Representatives of authorities and users groups with respect to land, water, environment

<b>Sectors</b>	<b>Formal organizations that have been identified as representatives of stakeholders groups</b>	<b>Groupings involved in the Jordan Valley NGO master plan initiatives</b>
Local Communities	Valley of Springs Regional Council Jordan Valley Regional Council Beit Shean Municipality	
Private sector	Water users Associations Chamber of Industry	
Voluntary sector	EcoPeace Middle East Tel Aviv office Society of Protection of Nature of Israel Zalul Jewish National Fund	

**Table 19 - Stakeholders representing the Palestinian Water Sector**

<b>Sector</b>	<b>Formal organizations that have been identified as representatives of stakeholders groups</b>	<b>Groupings involved in the Jordan Valley NGO master plan initiatives</b>
Public sector	- Water Sector Regulatory Council -Palestinian Water Authority -Jericho Municipality	
Private sector	-Water users Associations -Jericho Chamber of Industry	
Voluntary sector	-EcoPeace Middle East-Bethlehem office -PHG -House of Water	Women organization that represents the women as stakeholder in water and environmental services in the residential areas of the Jordan Valley

**Table 20 - Stakeholders representing the Palestinian Agriculture Sector**

Sector	Formal organizations that have been identified as representatives of stakeholders groups	Groupings involved in the Jordan Valley NGO master plan initiatives
Public sector	-Ministry of Agriculture -National Agricultural Research Centre (NARC) -Agricultural Extension Centers,	
Private sector	-General Union of Palestinian Peasants and Cooperatives -Palestinian Farmers Union -Chamber of Commerce and Industry	Representatives of leading clans in the farming communities need to be represented in the peasants and farmers unions or in the Chamber of Commerce and Industries
Voluntary sector	-Rural Women Development Society -Palestinian Agricultural Relief Committees (PARC) -Palestine Environmental NGO Network (PENGON)	Grouping of LEISA farms that has as objective to promote LEISA farming styles in the Palestinian zone of the Jordan Valley

**Table 21 - Stakeholders representing the Palestinian Water Sector**

Sector	Formal organizations that have been identified as representatives of stakeholders groups	Groupings involved in the Jordan Valley NGO master plan initiatives
Public sector	- Water Sector Regulatory Council -Palestinian Water Authority -Jericho Municipality	
Private sector	-Water users Associations -Jericho Chamber of Industry	
Voluntary sector	-EcoPeace Middle East-Bethlehem office -PHG -House of Water	Women organization that represents the women as stakeholder in water and environmental services in the residential areas of the Jordan Valley

**Table 22 - Stakeholders representing the Palestinian Agriculture Sector**

Sector	Formal organizations that have been identified as representatives of stakeholders groups	Groupings involved in the Jordan Valley NGO master plan initiatives
Public sector	<ul style="list-style-type: none"> <li>-Ministry of Agriculture</li> <li>-National Agricultural Research Centre (NARC)</li> <li>-Agricultural Extension Centers,</li> </ul>	
Private sector	<ul style="list-style-type: none"> <li>-General Union of Palestinian Peasants and Cooperatives</li> <li>-Palestinian Farmers Union</li> <li>-Chamber of Commerce and Industry</li> </ul>	Representatives of leading clans in the farming communities need to be represented in the peasants and farmers unions or in the Chamber of Commerce and Industries
Voluntary sector	<ul style="list-style-type: none"> <li>-Rural Women Development Society</li> <li>-Palestinian Agricultural Relief Committees (PARC)</li> <li>-Palestine Environmental NGO Network (PENGON)</li> </ul>	Grouping of LEISA farms that has as objective to promote LEISA farming styles in the Palestinian zone of the Jordan Valley

The Israeli local communities are represented by the Jordan Valley Regional Council and the Valley of Springs Regional Council, who provide various municipal services in the region, as well as Beit Shean Municipality as one of the major cities in the study area.

### **Palestine**

The main public sector stakeholders involved Integrated Water Resources Management in the Palestinian zones are the National Water Regulator, the Palestinian Water Authority, the Ministry of Agriculture and the Environmental Quality Authority. On December 14th 2009, the Cabinet of Ministers of the Palestinian National Authority endorsed the "Action Plan for Reform" towards the definition and implementation of a comprehensive program of institutional and legislative reform in the Palestinian water sector. In June 2014 a new water law was passed. An important issue of this water law is the establishment of a Water Sector Regulatory Council (WSRC).

The main objective of the WSRC is to monitor all matters related to the operation of water service providers, with the aim of ensuring water and wastewater service quality and efficiency to consumers in Palestine at affordable prices. The council is to monitor operational performance related activities of water service providers including production, transportation, distribution, consumption, wastewater collection, treatment and disposal, and reuse of treated wastewater for irrigation.

The PWA shares responsibility for irrigation development with the Directorate of Soil and Water Management in the Ministry of Agriculture (MoA) and the Environmental Protection Section of the Environmental Quality Authority. These public organizations are expected to provide irrigation support services to individual farmers and community-based groups who own and manage the local irrigation system. The community-based groups are encouraged to organize themselves into water users associations to enhance technical and managerial capacities and to clarify land and water rights and management responsibilities for efficient user's provision of irrigation services.

The Directorates of Agricultural Services and Soil and Water Management of the Ministry of Agriculture are the main public service providers for irrigated agriculture. The Directorate of Agricultural Services is responsible for agricultural research and agricultural extension Services. The National Agricultural Research Centre (NARC) coordinates the research stations, which are linked to 17 Agricultural Extension Centers that coordinate the frontline staffs of the public agricultural support services.

There is not yet an umbrella organization of Water Users Organizations that can represent the interests of the water user organizations at supra-local and national level. The General Union of Palestinian Peasants and Cooperatives and the Palestinian Farmers Union are representing the user organizations in the policy dialogue platforms and take an advocacy function for users groups involved

in local irrigation and drainage development initiatives. For the representation of potential investors in the upgrading or establishment of agro-industries, the involvement of the Jericho Chamber of Commerce and Industry needs to be considered.

The Palestinian Agricultural Relief Committees (PARC) was established in the early 1980s as a response to the lack of agricultural extension service during the Israeli occupation. The NGOs adopted a dynamic development process where the focus of the committees shifted from voluntarism (1983-87) to development and expansion (1988-92), and via institutionalization (1993-99) it ended in a network organization structure (2000-present). At the current networking stage the organization of beneficiaries are considered as a mean to make extension services more demand-driven and to build democratic and outward-oriented organizations in farming communities.

Rural Women's Development Society (RWDS) is a women's non-governmental organization that works in rural areas in Palestine aiming at empowering rural women. RWDS was initially a women committee within PARC, and in 2001 it was officially registered as an independent NGO. The RWDS has focused on rural livelihood issues and established 65 women's clubs that represent more than 4300 members and beneficiaries and the number is still increasing. RWDS believes in gender equality in all life aspects and it works at ensuring women's involvement in rural development and capacity building initiatives.

## Governance of the Jordan Valley

This section provides an overview of the governance structure and major governmental organizations and their responsibilities in the Jordan Valley.

### Jordan

#### *Ministry of Planning and International Cooperation (MOP)*

MOP's role is to channel funds from international donors. MOP is also carrying out programs that are contributing to small scale enterprise development.

#### *Jordan Valley Authority (JVA) under the Ministry of Water and Irrigation (MWI)*

Water

#### *Water Authority of Jordan (WAJ)*

The tasks of JVA and the WAJ are not precisely delineated. Both are dealing with water resources development. JVA focuses on water to be used in the Jordan Valley, especially for irrigation, WAJ focuses on water for domestic and industrial use. Consequently, JVA's activities are not all confined to its mandate area, depending on the sources of water.

#### *Ministry of Environment (MOE)*

The Ministry of Environment (MOE) was created in 2003 and is still in the process of institutional development and internal capacity building, and of preparation of its legislation. MOE is responsible for environmental protection as a whole, including nature conservation. RSCN is assisting MOE in environmental legislation (for example regulation on

protected area designation) based on more profound experiences in this field. The Ministry of Environment delegated the RSCN to manage the natural reserve under the supervision of the Ministry through a memorandum of understanding (MoU). Through this MoU both work on preparing management plans for natural reserves. Also, based on this MoU both have cooperated together in issues related to biodiversity conservation such as international conventions. In addition to that the MOE is responsible of declaring new natural reserves.

#### *Ministry of Tourism & Antiquities (MOTA)*

The Ministry of Tourism & Antiquities (MOTA) is responsible for management of the tourist sector and the antiquities in the Jordan Valley.

#### *Ministry of Agriculture (MOA)*

The Ministry of Agriculture (MOA) supports the agricultural sector and governs the natural forests in Jordan, based on the Provisional Law of Agriculture No. 44 (2002), which describes the responsibility for achieving the objective of "sustainable use of the natural agricultural resources without harming the environment", and for "combating desertification and conserve biodiversity". The Agricultural Law focuses on plant production and protection and on animal production and health, and also includes a number of articles concerning forests/ forest lands and rangelands and fishery. Desertification control and biodiversity conservation are also vested in the law. Biodiversity is given explicit attention in articles on protection of wild birds and wild animals in the Law of Agriculture. Important activities are Forestry,

Rangelands and Agricultural production support, promotion of integrated pest management and biological farming, Plant Protection, Extension services. Furthermore it houses the National Centre for Agricultural Research and Technology Transfer (NCARTT).

#### *Ministry of Municipal Affairs (MOMA)*

The Ministry of Municipal Affairs (MOMA) may play a role through municipalities as a focal point for local level and alternative livelihood development.

#### *Ministry of Transport (MOT)*

The Ministry of Transport (MOT) has the overall statutory authority for transport planning in Jordan.

#### *Department of Land and Surveys (DLS), Ministry of Interior*

The Department of Land and Surveys (DLS) is responsible for land management and registration.

#### *Natural Resources Authority (NRA)*

The Natural Resources Authority (NRA) is responsible for mineral exploration. In its latest map (2005) of potential mining areas, sites are depicted both inside and outside protected areas.

#### *Jordan Army Forces (JAF)*

The Jordan Army Forces (JAF) is important, since it manages the security zones along the western and northern borders in the Jordan Valley. JAF has reportedly expressed its willingness to allow access to the areas for ecological surveys and other project activities.

*Geographic Centre*

The Geographic Centre is the traditional source for topographic maps and some thematic maps.

*Department of Statistics (DOS)*

The Department of Statistics is responsible for managing and dissemination of statistical information about Jordan for a wide variety of sectors.

**Israel***Ministry of Energy and Water Resources*

The MEWR is in charge of securing a supply of energy at a level of reliability, availability, efficiency and quality needed for a highly developed, modern national economy, at an optimal economic, social and environmental cost. The Ministry of Energy and Water Resources is also responsible for the energy economies and national resources of the State of Israel: electricity, fuel, cooking gas, natural gas, energy conservation, water, sewer mains, oil exploration, ores, scientific research of soil and the sea and more. The Ministry supervises the public and private entities involved in these fields and acts to ensure an adequate solution to the changing energy and infrastructure needs of the national economy, today and in the future, while regulating the market and protecting the consumer and the environment.

*Israeli Water Authority*

Israeli Water Authority (IWA) is the government's executive branch in charge of Israel's water economy, it is responsible for the administration, operation and development of the Israeli water

economy, including the preservation and restoration of natural water resources, the development new water resources and the oversight of water consumers and producers, so as to allow high quality water and sewage services of optimal reliability, while increasing the sustainable welfare of Israeli citizens.

*Mekorot*

Mekorot, Israel's national water company, operates under the supervision of the Minister of Energy and Water Resources, and is responsible for supplying the Israeli population with water. Mekorot's water supply system unites most regional water plants, the National Water Carrier System and the Yarkon Negev Facility. One of its tasks is to integrate waters from the Kinneret, the shore and mountain aquifers, drilling waters, sea water and desalinated waters in its overall water supply strategy.

*Ministry of Agriculture and Rural Development (MOAG)*

Ministry of Agriculture and Rural Development (MOAG) is responsible for agriculture, land preservation and veterinary services. MARC is also planning the development of rural areas in terms of public and private service institutions, development of physical rural infrastructures, conservation and prevention of environmental nuisances, rural soil preservation and drainage.

*Ministry of Environmental Protection (MEP)*

The Ministry of Environmental Protection is responsible for protection of the environment and

ecosystems, as well as sustainable development. MEP operates nationally, regionally and locally. Among other things, the ministry is responsible for formulating and implementing a national environmental protection policy, enforcing environmental legislation in local authorities and serving as an advisory body to municipalities. With regard to river rehabilitation the Ministry supports and promotes removal of pollution components and sources; assurance of permanent sources of water at the required quality to the river; conservation of open spaces and ecosystems in the vicinity of the river, establishment of tourist and recreation centers based on nature and cultural assets in the environs of the river, promotion of public awareness of the condition of the streams and their importance to the landscape and open space.

*Israeli Meteorological Service (IMS)*

The Israel Meteorological Service (IMS) provides a variety of meteorological, climatic and supplementary services. Services include forecasting, monitoring, analyzing and interpreting the weather and climate the region, while maintaining national and international cooperation and conforming to national and international standards.

*Israel Nature and Parks Authority (INPA)*

Israel Nature and Parks Authority (INPA) protects nature and heritage sites, and educates the public accordingly. Its assets, nature reserves and national parks are public properties. Services include protecting nature, making sites accessible to the



public, conserving and reconstructing heritage, planning and development.

#### *Lower Jordan River Drainage Authority*

The Lower Jordan River Drainage Authority was established in October 2009 in order to promote and coordinate conservation activities, rehabilitation and development in the river area. The activities of the river authority are coordinated by the drainage authority. Members of the river authority are the ministry for regional development; the Ministry of environmental protection; the Ministry of agriculture & rural development, the Ministry of interior; the Ministry of tourism; the Ministry of Defense; the Ministry of foreign affairs; the Israel Water authority; the South Jordan drainage authority; the Jewish National Fund; the Springs Valley Regional Council; the Israel Nature and Parks Authority; representative of various Israeli green NGOs; the Israel land administration, the Israel antiquities authority and the Regional Water provider- *Afikey maim*

The Lower Jordan River Drainage Authority is responsible for drainage and water management in the Jordan Valley from Naharyim to the Bezeq Stream. Its plans are aligned with other national and regional plans, such as the below Kinneret Drainage Authority, responsible for the area from the Deganiya Dam (where the Lower Jordan exits the Sea of Galilee) to Naharyim.

#### *Kinneret Drainage Authority*

The Kinneret Drainage Authority is responsible for the section of the Jordan Valley from the Kinneret/ Sea of Galilee to Naharyim. It is responsible for

drainage and water management and is presently implementing river rehabilitation efforts in its section of the river.

#### *Ministry of Tourism*

The Ministry of Tourism is responsible for the tourism industry in Israel, which is the employer of 60,000 people throughout the country.

#### *Ministry of Economy and Trade*

The Ministry of Economy and Trade in governing local and foreign investments by offering a wide range of incentives and benefits to investors in industry, tourism and real estate. It is in charge of the promotion of economic growth in Israel.

#### *Ministry of Regional Co-operation*

The Ministry of Regional Cooperation deals with facilitating cross border cooperation projects with Jordan and the Palestinian Authority in terms of economic co-operation and infrastructure development.

#### *Ministry for Development of the Negev and the Galilee*

The Ministry for Development of the Negev and the Galilee is responsible for advancing and promotion of the Negev and the Galilee regions and place them at the top of the government's list of priorities. It deals with infrastructure, industry and employment, settlement and housing as well as education and culture.

#### *Ministry of Finance*

The Finance Ministry overlooks all national budgetary decisions.

#### *Ministry of Interior*

The Interior Ministry overseeing Israel's urban planning agencies and municipal affairs.

#### *Ministry of Defense*

The Ministry of Defense holds control over Israel's military, and is the supreme agency in charge of governing the Jordan Valley from the Bezeq Stream to the Dead Sea in accordance with the Oslo Agreements.

#### *The Antiquities Authority*

Israel antiquities authority is in charge of the country's antiquities and antiquity sites, their excavation, preservation, conservation, study and publication thereof, as well as the country's antiquity treasures.

#### *Beit Shean Municipality*

Largest Israeli city in the Jordan Valley.

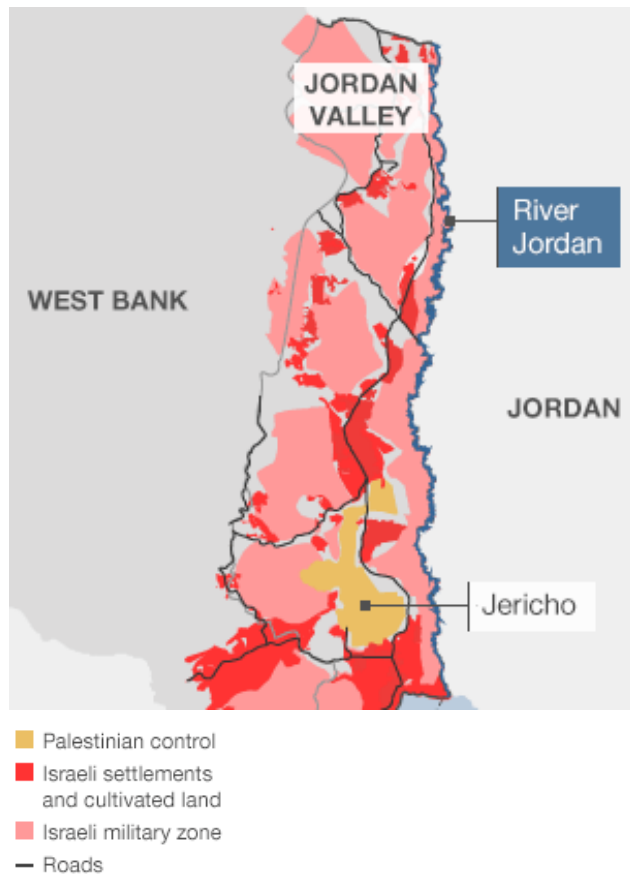
#### *Jordan Valley Regional Council*

Extends from the north of the Sea of Galilee down the eastern side and then along both banks of the Jordan River until the confluence with the Yarmouk River at Naharyim.

#### *The Valley of Springs Regional Council*

The Valley of Springs Regional Council is the regulator of municipal services for the villages within its territory from Gesher to the Green Line

## Palestine



**Figure 28 - Palestinian versus Israeli control in the Jordan Valley**

The Palestinian Authority governs the areas A and B in the West Bank study area through the following governmental organizations: Office of the Prime Minister; Ministry of Finance; Ministry of National

Economy; Ministry of Agriculture; Environmental Quality Authority; Ministry of Local Governorates and Municipalities; Ministry of Health; Palestinian Water Authority.

But despite being a riparian to the Jordan River, the Palestinian Authority (PA) has de facto no direct control over the Lower part of the Jordan River itself and little over the surrounding riparian zone. As a result of the Interim (Oslo I and II) Agreements, and the agreement on the handover of responsibilities between the Palestine Liberation Organization and the government of Israel, the Jordan Valley was divided to 3 different categories of land, security and civil administration (A, B and C).

This division has resulted in a serious problem for the enforcement of laws and Palestinian development potential in the Jordan Valley, whereby any establishment that is to be created (whether residential or commercial) must receive its licensing and building permits from the Israeli Ministry of Defense's Civil Administration. This does not function in accordance with the PA's development plans, and causes tremendous delays and costs to development plans. Furthermore, access to the river by Palestinians is limited, and thus, there is little domestic Palestinian tourism or other use of the river. In 2003, the Water Law has been issued by the Palestinian Authority.

### *Palestinian Water Authority (PWA)*

In 2003, the Water Law has been issued by the Palestinian Authority. The Palestinian Water Law stipulates establishment of the Palestinian Water

Authority and assigns to it the responsibility for the management/regulation of water, drainage and sewage affairs. Also, the law stipulates that a draft Water, Drainage and Sewage Plan to be prepared by the Planning Department of the Palestinian Water Authority. Although the law transfers the licensing jurisdiction to the PWA and requires the detailed water registry, the ownership of the water resources is not transferred to the Palestinian Authority. The Palestinian Water Authority (PWA) has prepared a draft of National Water Strategy in 2012 which defines how the water resources in the occupied Palestinian territory will be managed in an integrated manner outlining the massive investment program of projects and activities needed for water sector development in the occupied Palestinian territory from 2012 till 2015.

### *Palestinian Environmental Quality Authority*

The Palestinian Environmental Quality Authority is responsible for implementation of the environmental law of 1999, with the objectives to protect of the environment against all forms and types of pollution; to protect Public health and welfare; to insert environmental protection in social and economic Palestinian development plans; to encourage sustainable development of vital resources in a manner that preserves the rights of future generations; to protect bio-diversity and environmentally sensitive areas, as well as improvement of environmentally harmed areas; and to encourage collection and publication of environment-related information to raise public awareness of environmental problems.

### *Ministry of Tourism and Antiquities (MOTA)*

MOTA is responsible for governing the tourist sector and the antiquities in Palestine. The basic law of 1968 is currently being updated to adapt to current challenges and needs. The new law will identify the variety of accommodations and agents, restaurants and other facilities. It will also indicate a general structure for the public private joint leading council that will carry responsibilities in marketing and development. A new hotel classification system is underway and expected to have all hotel in Palestine classified between 1-5 stars by end of 2013. An ad-hoc joint committee was established for this purpose. Other initiatives are also underway on the level of tourism signage, tourism education, and rehabilitation of archeological sites and other antiquities. Enforcement of the aforementioned laws in the Jordan Valley is of the utmost importance.

## Current International Agreements and Co-operation Issues

The international legal agreements applicable to the Jordan Valley include the following:

### **The Helsinki Rules**

The Helsinki Rules, on the Uses of the Waters of International Rivers, adopted by the International Law Association in 1966 and the 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses are two of the most referenced and developed of international legal agreements on the uses of transboundary

watercourses. These legal agreements could also provide a framework in which freshwater is shared between Israel and Palestine in an equitable manner, and which takes into consideration environmental concerns and future water needs. The current restrictions on Palestinian water use do not meet the criteria for equitable sharing between riparian parties of the Jordan Valley. Agreement on the available water quantities to be distributed on an equitable basis is thus needed in order to provide a basis for sustained management of these limited water resources.

### **The UNESCO Convention**

The UNESCO Convention concerns the Protection of the World Cultural and Natural Heritage of 1972. Palestine became a state party to the agreement in 2011. The Jordan Valley should fall under the protection of this agreement as a cultural and natural heritage area. An important step forward would be to advance the listing of the Jordan Valley under UNESCO in a trilateral fashion.

Other international agreements that are applicable to the Jordan River are:

- i. The Seoul Rules on International Groundwaters (Adopted by the International Law Association at the Sixty-Second Conference Held at Seoul in 1986)
- ii. The Berlin rules 2004 (an update of the Helsinki rules that are already added in the international legal agreements section).

- iii. United Nations Convention on Biological diversity (1992) and Cartagena Protocol on Biosafety;
- iv. Convention on International Trade in Endangered Species (CITES);
- v. Ramsar Convention (Wetlands);
- vi. Bonn Convention on Migratory Species;
- vii. The Hague conventions and fourth Geneva convention: international Humanitarian law / international customary law ;

### **Bi-lateral Agreements**

The *Declaration of Principles* is the first Bi-lateral Agreement between the PLO and Israel signed on 13 September 1993. According to this agreement, water issues were to be discussed by the Permanent Palestinian Israeli Committee for Economic Co-operation. It was agreed to prepare plans for water rights, and equitable use of water for the shared resources. However, this agreement did not quantify the water right for each party.

The *Gaza Jericho First Agreement* is the temporary Agreement regarding autonomous rule of the Palestinian Authority in Jericho and the Gaza Strip, signed on 4 May, 1994. Article 2 paragraph 31 deals with the water issues in the two regions. Limited authority on water uses was transferred to the Palestinian Authority.

### **Bi-lateral water and wastewater Agreements**

The water and wastewater sectors in Palestine are governed by two agreements with the Israeli side:

*The Palestinian-Israeli Interim Agreement on the West Bank and Gaza Strip, Washington, D.C., September 28, 1995; Annex III, Protocol Concerning Civil Affairs, Article 40, Water and Sewerage. Essentially Article 40:*

The agreement was based on Israel's recognition of Palestinian water rights in the West Bank. It sets governance arrangements for a five year interim period, notably a Joint Water Committee (JWC) to oversee management of the aquifers, with decisions to be based on consensus between the two parties. It allocates to either party specific quantities of the three West Bank aquifers underlying both territories - the share allocated to the Palestinian West Bank was about one quarter of the allocation to Israel and the settlements. It provides for interim extra supplies from new wells and from Mekorot as immediate needs- an extra 28.6 MCM was to be allocated to Palestinian needs. Finally the agreement estimates needs for the interim period for the Palestinian West Bank at 70-80 MCM.

*The Memorandum of Understanding (MOU) on Guidelines and Technical Criteria for Sewerage Projects, signed on December 31, 2003, Israeli-Palestinian "Joint Water Committee".*

The MOU sets out agreements for the collection systems, wastewater treatment, sludge treatment, effluent reuse and disposal, sludge reuse and disposal and cooperation between the two sides. The very high standards in this MOU restrict donors' involvement and makes implementation costly and very difficult for Palestinians even though a phased

implementation approach to meeting requirements has been agreed upon.

The MOU version 2 is the most recent document that governs wastewater treatment and reuse standards and will consequently drive the treatment technology and reuse strategies that will be used in Palestine. The interim water and wastewater Agreement "Article 40" of Oslo 2 will be used as the basis for water sector planning and project implementation during the "interim period" and until a final status agreement is reached. These are to be negotiated and settled in the Permanent Status Agreement relating to the various water resources. (4)

#### **Trans-boundary Water Management Issues between Israel and Palestine as relevant to the Jordan Valley.**

An Israel – Palestinian Treaty of Peace is not in place. With regard to water related matters the following information is of particular importance within the context of this situation.

##### *Water Resources*

Prior to 1967, Israel had developed the water resources to which it had access and established the National Water Carrier to supply agricultural, municipal and industrial water demands. Since 1967 Israel also took control of water resources in the West Bank as well, together with water supply networks serving Israeli settlements in the West Bank. At the same time Palestinian water rights in

Palestine were abrogated, including from the Jordan River.

Currently, the economic disparity between Palestine and Israel is large, and the water resources availability to the two neighbors is likewise far apart, with fresh water per capita in Israel much higher than that of Palestine. Whereas Israel has been able to develop an efficient water infrastructure and management, the Palestinians are still struggling to attain the most basic level of infrastructure and services of a low income country. Furthermore, the Palestinian water infrastructure systematically suffers from lack of development because of Israeli restrictions and obstacles and this is particularly evident in the Jordan Valley.

Above all, a just settlement between Israel and Palestine is a prerequisite to real improvements and achieving effective water governance in Palestine, including the current study area. WEDO / EcoPeace's proposal for an Agreement to Share Water between Israelis and Palestinians (March 2012) might serve as an example on how to adopt a joint water management structure for Israel and the future State of Palestine. The proposed structure allows for ongoing resolution of issues concerning fresh water by de-nationalizing and de-securitizing water uses. WEDO / EcoPeace proposes to share water by rules that are designed to protect the ecosystem for everyone's benefit, and to deliver water to all parties in ways that meet their needs and equitable rights.

### **Paris Protocol bilateral trade agreement**

Additionally, Palestine and Israel are bilaterally bound by the Paris Protocol. However, the agreement is partially and ineffectively implemented. The Paris Protocol (PP) was signed in 1994 as an interim economic agreement to maintain the free movement of goods and labor between Palestine and Israel within the framework of customs union. The Palestinians viewed that, with international aid and support, the Paris Protocol provides the basis for sustainable growth of the Palestinian economy. However, facts are in sharp contrast with this vision. The Israeli restrictions of movement of goods and people, and closure of roads and areas, resulted in one sided decision making of the Israeli power, and a weakness in the Palestinian economy. The latter created a dependency on the Israeli market for goods and labor and in a huge structural economic imbalance between the two economies. The implementation of the Paris Protocol in accordance with its basic rules of free movement of labor and goods would have encouraged fair trade between Palestine and Israel and supported the development of a viable Palestinian economy.

### **Security Arrangements along the Jordan River**

Since 1967, the Jordan River has been under the control of the Israeli and Jordanian military, which operate checkpoints and bases on both sides. The Palestine side of the Jordan River is under Israeli military control since 1967. The area contains covert listening stations, radar sweeps and thermal- and night-vision cameras. On the mountain tops that rise steeply from the valley floor, Israel maintains a

series of early-warning stations. Troops are on constant patrol along the river and the passes, and on both sides of the river a key strip of land is inaccessible for the general public.

On the Israeli and Palestinian side of the river, more than 1.000 hectares have been mined, including both antipersonnel and antitank mines. Mined areas are also located near villages such as Kfar Ruppin and include parts of nature reserves such as the East Gilboa Reserve. They also include former Syrian minefields. In the late 90's the Israeli Ministry of Tourism initiated activities to remove former Syrian mines in certain areas along the Jordan River suspected of containing Syrian antipersonnel mines, such as around Kibbutz Gesher. Along the river, Israeli and Jordanian mine fields are still part of the overall security framework.

Israel and Jordan are connected though the Sheikh Hussein Bridge in the north, and Palestine (West Bank) with Jordan through the King Hussein (Allenby) Bridge. These bridges are subject to strict security measures in terms of trans-passing persons and goods. The King Hussein Bridge is located just outside Jericho city and is the only connection between the Palestinian West Bank and Jordan. The West Bank side of the King Hussein / Allenby Bridge is considered a border entry point by the Israeli Authorities. The Jordanian authorities recognize the bridge as an international border entry point between Jordan and Palestine, but in contrast to other border crossings, they do not grant entry visas to foreign passport holders at this crossing. Palestinians from the West Bank traveling abroad

use this bridge to exit the West Bank into Jordan, since they are not permitted to use Ben Gurion Airport near Tel Aviv. Travel permits from Israeli authorities are required, with varied stringency depending on the political and security situation. Israeli citizens are not permitted to use the terminal. Travel permits for Palestinians are not required by the Jordanian authorities.

### **Trans-boundary Water Management Issues among Israel and Jordan**

The Israel – Jordan Treaty of Peace, sometimes referred to as the Wadi Araba Treaty, was signed by the State of Israel and the Hashemite Kingdom of Jordan in December 1994. With regard to water related matters the following elements of particular importance within the context of the current study.

#### *Water Allocation from the Yarmouk River*

The agreement stipulates that during the summer period from 15 May to 15 October of each year, Israel shall receive 12 MCM and Jordan is to retain the rest of the Yarmouk water flow. During the winter period, from 16 October to 14 May of each year, Israel is entitled to receive 13 MCM and Jordan is to keep the rest of the flow. Furthermore, Israel is entitled to borrow an additional 20 MCM during the winter period, to be transferred back to Jordan during the next summer. With regard to excess flood waters from the Yarmouk that would otherwise flow into the Lower part of the Jordan River, it was agreed that both Jordan and Israel are allowed to utilize this water in equal portions for their own purposes.

*Water Resources from the LJR*

The agreement stipulates that during the summer period of each year, Jordan shall receive 20 MCM from the Lower part of the Jordan River upstream of the Yarmouk from Israel. During the winter period Jordan shall receive an additional 20 MCM from Israel from the LJR south of the Yarmouk. With regard to remaining water flows in the LJR south of the Yarmouk it was agreed that both Jordan and Israel are allowed utilize this water in equal shares for their own purposes, provided that neither party would harm the water quality of the LJR. A Joint Jordanian – Israeli Water Committee has been established to monitor the actual water flows and water allocations.

*Saline Springs and additional water resources*

Furthermore the agreement stipulates that Jordan is entitled to receive 10 MCM of desalinated water from Israel, originating from the saline springs near the Sea of Galilee, provided that this is financially feasible. If so, it has been agreed not to discharge the brine into the Jordan Valley. Currently, this saline water is conveyed from these springs directly to the LJR through the Saline Water Carrier by Israel. The agreement confirms that Israel will explore the possibility of financing the operation and maintenance cost of supplying this desalinated water to Jordan, while Jordan will explore the possibilities to finance the required capital expenditures. Finally the agreement includes the intension to jointly develop an additional 50 MCM of drinkable water, without yet specifying its source, for the benefit of Jordan.

*Operations and Maintenance*

From an operational point of view, the agreement states that Israel accepts responsibility for operating, supplying and maintaining systems on Israeli territory that supply water to Jordan. Under this set-up Jordan is allowed to choose the related Operator, provided these operations only serve Jordan (so not Israel at the same time). Israel guarantees easy access for the involved operations personnel and equipment.

*Water Storage*

Both parties agree to co-operate in the development of a new water storage dam in the Yarmouk River, downstream of the Adassiya Diversion, and of a storage facility in the LJR south of the Yarmouk confluence and north of the Bezeq stream.

*Water Quality*

Both parties agree to protect the Jordan and Yarmouk Rivers and related groundwater systems and water supply systems against pollution, contamination, harm and unauthorized withdrawals of each other's allocations. They agree to jointly monitor the quality of water along their border, using jointly (to be) established monitoring stations under the Joint Water Committee. This includes treatment of municipal and industrial wastewater to agricultural standards before discharging it into the Yarmouk and the Jordan Rivers.

*Information and Notification*

The agreement stipulates that the Joint Water Committee is the official body through which

relevant data on water resources is to be exchanged from one party to the other. The JWC can assign sub-committees to perform technical tasks, such as a northern sub-committee and a southern sub-committee. Furthermore, deliberate changes in the Jordan and Yarmouk Rivers require prior mutual agreement. In particular, both parties agreed to six months advance notice of projects likely to change the quality or flow of either river along their common boundary via the Joint Water Committee. Also, planning for increasing water supplies and improving efficiency is to be done in a co-operative manner within the context of bilateral, regional or international cooperation agreements.

## Outlook for Future Security Arrangements

During the 2013 and 2014 Peace Negotiations between the Palestinians and Israeli's, the security arrangements in the Jordan Valley as part of any final settlement between the two parties was one of the key issues in dispute. In line with this Master Plan, the Jordan Valley should be an integrated part of the independent Palestinian State, with eventual full control by the Palestinian Authorities.

According to the Israeli's, the Jordan Valley forms the closest border to the heartland of Israel, and is considered by many as the only realistic eastern topographically defensible border against potential aggression from the east. The political upheaval in the Middle East and the violence in Syria and Iraq have already caused a large stream of a great

variety of refugees entering Jordan. Israel fears that some of these refugees may attempt to infiltrate into Israel. This, together with the radical forces active in these countries and the fear that extremists with advanced weapons will be smuggled into the West Bank underlines the notion that a well-defended eastern border is essential for the security of the Israeli people, including secure road access from the west.

At the outset of the recent peace talks, the Palestinian position on this subject recognized the need for a transition period in which Israel would retain some military presence in the Jordan Valley, say up to about 5 years. After this period the Palestinians would agree on the deployment of international forces, such as UN forces or NATO along the Jordan River as a way to ensure security and allay Israeli fears, be it without any Israeli soldier left behind.

The Israeli position on this subject welcomes cooperative security arrangements with the Palestinians and Jordan under a final settlement, but rejects the idea that at a certain date international forces, such as UN or NATO, would fully replace Israeli troops, since this would undermine Israel's ability to act effectively against terrorist infiltration and weapons smuggling, or to provide a first line of defense against any other future threat from the east. During the present war in Syria in which the UN peacekeeping troops withdraw their contingents, when under attack, decreased even further the trust and willingness of Israel to place security responsibility completely in the hand of third parties.

During the recent peace negotiations, the United States attempted to bridge this gap by drawing on U.S. security experiences in Afghanistan, and proposing the use of high level U.S. provided intelligence and technology, such as advanced sensors; drones and high-tech fences. It has been proposed that during the transitional period, there will remain some Israeli military presence in the Jordan Valley at roughly about 200 – 500 troops plus a number of civilian Israeli security personnel at the border crossings co-operating closely with Palestinian and Jordanian security forces. During this period the security structure would shift towards higher security technology (e.g., scanners, sensors, sniffers, remote sensors etc.), while progressively handing over certain security responsibilities to Palestine and Jordan.

Although both parties seem to have been sympathetic to elements of these ideas, eventually Israel seem to have classified them as too much reliance on technology as a substitute for essential military people. The Palestinians on the other hand seem to have rejected this concept, since they rule out any kind of enduring Israeli presence in the Palestinian State once the transition period has concluded.

However, similar challenges have been faced in the past. For instance, during the negotiations for the 1979 peace treaty between Israel and Egypt, both parties repeatedly rejected mutual security proposals, whereas today the situation has evolved into a generally acceptable security framework,

including a set of strict security regulations and a framework for mutually tolerated ad hoc interventions when needed. Within the framework of this Master Plan it is believed that continuing the joint Palestinian – Israeli security negotiations on a factual and security-technical basis will eventually lead to a joint security solution for both the transition period and beyond, doing justice to the legitimate rights of the Palestinians for a free, sovereign and independent state, and the legitimate security rights of the Israeli people.

# PROJECTIONS AND OBJECTIVES

## 3.1 Projections for 2025 and 2050

Based on the population projections made by the Jordanian, Palestinian and Israeli Departments of Statistics, an assessment has been made of the total population in the valley in the years 2025 and 2050. This includes natural growth of the autonomous population to 0.92% in 2050. In addition, this Master Plan assumes that in Jordan the high number of foreign inhabitants in the valley will gradually decline as a result of assumed improving economic conditions in their countries of origin, including Syria, Iraq and Egypt. Under this projection it is assumed that all Israeli settlements in the Palestinian part of the Jordan Valley will be removed, irrespective of security arrangements, and that the Independent Palestinian State created will see a growth towards an estimated 500,000 people living in the Palestinian section of the Jordan Valley by 2050. It assumes natural population growth under strong economic development conditions in Israel. These assumptions lead to a total projected population in 2050 of 1.048 Million people living in the Jordan Valley, from the southern tip of the Sea of Galilee to the northern edge of the Dead Sea as presented below.

The per capita water demands are expected to grow in Jordan and Palestine as a result of better economic circumstances, while in Israel per capita

water demand will continue to decrease due to increased efficiencies. A domestic per capita water demand of 80 CM is assumed for all residents of the valley, be they Palestinian, Jordanian and Israeli.

The total Domestic Water Demands within the Jordan Valley for 2050 are 99 MCM / yr. This has been calculated as the total population times their per capita water demands. Local industrial and commercial water demands are considered to be included in these total estimates. In addition 100 MCM / yr are expected to be transferred from the valley to supply Amman and the Northern Jordanian Governorates within the framework of a water trade between Israel and Jordan. However this will likely require adjustments to the Sea of Galilee water balance.

The agricultural water demands in the Jordan Valley are about 553 MCM in 2050. In this Master Plan it is assumed that the total agricultural water demands will not increase for Jordan and Israel, and that the Palestinian agricultural water demands will grow with 40 MCM per year to accommodate for the under developed status in 2010, and that the agricultural water currently consumed by the settlements in the Jordan Valley will also be used by the Palestinians once the independent state has been established. See table below. In addition it is suggested that highly treated wastewater from Jordan (70 MCM / yr) and Jerusalem / West Bank

(50 MCM /yr) will be diverted to the Jordan Valley for Agricultural purposes.

In this Master Plan it is assumed that the agricultural efficiencies will increase substantially, particular for Jordan and Palestine, ensuring that with the available water resources higher financial returns will be realized.

The total amount of wastewater that will be generated in the valley directly relates to the domestic water consumption. In this Master Plan it is assumed that 80% of the total domestic water demands will return to the system as wastewater. Within this Master Plan interventions are proposed to treat and reuse the wastewater generated locally to the maximum extent. It is assumed that by 2050 again 80% of all generated wastewater in the valley (or 64% of all urban water supply, or about 63 MCM / yr) will be reused for agricultural purposes. In addition it is assumed that about 44.8 MCM / yr of the total 100 MCM supplied to Amman and the Northern Governorates will return again to the Jordan Valley for agricultural reuse purposes. This figure is based on the assumptions that 80% of all supplied water is returned as wastewater, that 70% of this wastewater will be made available in Jordan Valley and 30% will remain in the high lands, and that 80% of the wastewater in the Jordan Valley can be made available on the fields for reuse purposes. See below table.



Table 23 – Projected Population Numbers

Jordan LJR Population		Population		
		2010	2025	2050
			137,42%	240,00%
JMD 1	Agwhar Shamaliyah	108.943	149.713	261.463
JMD 2	Deir al Alla / Balqa	67.925	93.345	163.020
JMD 3	Shoonah / Janoobiyah	70.294	96.600	168.706
JMD 4	Foreign population	247.000	200.000	150.000
TOTAL, incl foreign population		494.162	539.658	743.189
Total Jordanian nationals		247.162	339.658	593.189

Israel LJR Population		Population		
		2010	2025	2050
		growth	124,80%	180,00%
	Emek Hayarden	11.000	13.728	19.800
	Emek Hamaayanot	11.000	13.728	19.800
	Beit She'an	17.000	21.216	30.600
	Hagilboa	10.000	12.480	18.000
<b>TOTAL</b>		49.000	61.152	88.200

West Bank LJR Population		Population		
		2010	2025	2050
		Automous growth	140,47%	195,27%
<i>Palestinians</i>		Immigration	112,00%	700,00%
			62.736	392.098
PMD 1	Bardala Cluster MD	5.259	16.923	70.619
PMD 2	Al-Bassariya Cluster MD	4.564	15.787	68.380
PMD 3	Al-Jiftlik Cluster MD	6.499	18.948	74.615
PMD 4	Fasayil Cluster MD	1.157	10.223	57.401
PMD 5	Al-Auja Cluster MD	4.423	15.557	67.925
PMD 6	Jericho MD	34.112	64.048	163.591
<b>Subtotal Palestinian</b>		56.014	141.485	502.531
<i>Settlements</i>				
IMD 1	Cluster North MD	1.425	0	0
IMD 2	Cluster Central MD	3.960	0	0
IMD 3	Cluster South MD	860	0	0
<b>Subtotal Israeli Settlers</b>		6.245	0	0
<b>TOTAL</b>		62.259	141.485	502.531

**Table 24 – Projected Per Capita Urban Water Demands**

Per Capita Water Demands in Jordan				
		2010	2025	2050
			117,00%	133,33%
JMD 1	Agwhar Shamaliyah	60	70	80
JMD 2	Deir al Alla / Balqa	60	70	80
JMD 3	Shoonah / Janoobiyah	60	70	80
JMD 4	<i>Foreign population</i>	30	30	30

Per Capita Water Demands in Israel				
		2010	2025	2050
			94,44%	88,89%
	All water users	90	85	80

Per Capita Water Demands in Palestine				
		2010	2025	2050
			116,67%	133,33%
	Palestinians	60	70	80
	Settlements	90	0	0

Table 25 – Projected Urban Water Demands

Total Domestic Water Demands Jordan (CM / yr)				
		2010	2025	2050
JMD 1	Agwhar Shamaliyah	6.536.580	10.509.846	20.917.056
JMD 2	Deir al Alla / Balqa	4.075.500	6.552.796	13.041.600
JMD 3	Shoonah / Janoobiyah	4.217.640	6.781.336	13.496.448
JMD 4	Foreign Population	7.410.000	6.000.000	4.500.000
JMD 5	from LJR Basin to Amman (and northern Gov)	60.000.000	80.000.000	100.000.000
<b>TOTAL</b>		<b>82.239.720</b>	<b>109.843.979</b>	<b>151.955.104</b>

Total Domestic Water Demands Israel (CM / yr)				
		2010	2025	2050
	Emek Hayarden	990.000	1.166.880	1.584.000
	Emek Hamaayanot	990.000	1.166.880	1.584.000
	Beit She'an	1.530.000	1.803.360	2.448.000
	Hagilboa	900.000	1.060.800	1.440.000
<b>TOTAL</b>		<b>4.410.000</b>	<b>5.197.920</b>	<b>7.056.000</b>

Total Domestic Water Demands Palestine (CM / yr)				
		2010	2025	2050
<i>Palestinians</i>				
PMD 1	Bardala Cluster MD	315.540	1.099.962	5.649.520
PMD 2	Al-Bassariya Cluster MD	273.840	1.026.155	5.470.400
PMD 3	Al-Jiftlik Cluster MD	389.940	1.231.587	5.969.200
PMD 4	Fasayil Cluster MD	69.420	664.462	4.592.080
PMD 5	Al-Auja Cluster MD	265.380	1.011.205	5.434.000
PMD 6	Jericho MD	2.046.720	4.163.119	13.087.280
<b>Subtotal Palestinian</b>		<b>3.360.840</b>	<b>9.196.490</b>	<b>40.202.480</b>
<i>Settlements</i>				
IMD 1	Cluster North MD	128.250	0	0
IMD 2	Cluster Central MD	356.400	0	0
IMD 3	Cluster South MD	77.400	0	0
<b>Subtotal Israeli Settlers</b>		<b>562.050</b>	<b>0</b>	<b>0</b>
<b>TOTAL</b>		<b>3.922.890</b>	<b>9.196.490</b>	<b>40.202.480</b>

**Table 26 – Total Agricultural Water Demands (including brackish water)**

Total Agricultural Water Demands Jordan		CM / yr		
		2010	2025	2050
JAD1-4	Zone 1 (115,300 dunum)	103.596.865	103.596.865	103.596.865
JAD5-8	Zone 2 (74,959 dunum)	107.169.170	107.169.170	107.169.170
JAD9-16	Zone 3 (120,835 dunum)	65.492.271	65.492.271	65.492.271
<b>TOTAL</b>		<b>276.258.306</b>	<b>276.258.306</b>	<b>276.258.306</b>

Total Agricultural Water Demands Israel		CM / yr		
		2010	2025	2050
	Jordan Valley WA	21.237.000	21.237.000	21.237.000
	Afikey Main WA	52.015.000	52.015.000	52.015.000
	Harod WA	22.000.000	22.000.000	22.000.000
	Fish ponds	56.400.000	56.400.000	56.400.000
<b>TOTAL</b>		<b>151.652.000</b>	<b>151.652.000</b>	<b>151.652.000</b>

Total Agricultural Water Demands Palestine		CM / yr		
		2010	2025	2050
<i>Palestinians</i>				
PAD 1	Bardala Cluster	10.558.755	13.658.850	13.658.850
PAD 2	Al-Bassariya Cluster	5.240.855	14.396.297	14.396.297
PAD 3	Al-Jiftlik Cluster	5.400.437	24.555.879	24.555.879
PAD 4	Fasayil Cluster	1.173.919	20.329.361	20.329.361
PAD 5	Al-Auja Cluster	3.991.597	23.147.039	23.147.039
PAD 6	Jericho	11.082.381	29.083.044	29.083.044
<i>Settlements</i>				
IAD 1	Cluster North AD	3.100.095	0	0
IAD 2	Cluster Central AD	36.621.768	0	0
IAD 3	Cluster South AD	8.000.662	0	0
<b>TOTAL</b>		<b>85.170.469</b>	<b>125.170.470</b>	<b>125.170.470</b>

**Table 27 - Wastewater Reuse Projections**

Jordan Valley (Jordan) Wastewater Reuse for LJRB Agricultural		CM / yr		
		2010	2025	2050
<b>Reuse Targets</b>		0%	50,00%	80,00%
JMD 1	Agwhar Shamaliyah	0	4.203.938	13.386.916
JMD 2	Deir al Alla / Balqa	0	2.621.119	8.346.624
JMD 3	Shoonah / Janoobiyah	0	2.712.535	8.637.727
JMD 4	Foreign population	0	2.400.000	2.880.000
JMD 5	Return flow to LJRB from Amman / Northern GV	0	22.400.000	44.800.000
<b>TOTAL</b>		<b>0</b>	<b>34.337.591</b>	<b>78.051.267</b>

Jordan Valley (Israel) Local Wastewater Reuse for Agricultural		CM / yr		
		2010	2025	2050
<b>Reuse Targets</b>		80%	80,00%	80,00%
	Emek Hayarden	633.600	746.803	1.013.760
	Emek Hamaayanot	633.600	746.803	1.013.760
	Beit She'an	979.200	1.154.150	1.566.720
	Hagilboa	576.000	678.912	921.600
<b>TOTAL</b>		<b>2.822.400</b>	<b>3.326.669</b>	<b>4.515.840</b>

Jordan Valley (Palestine) Local Wastewater Reuse for Agricultural		CM / yr		
		2010	2025	2050
<b>Reuse Targets</b>		0%	50,00%	80,00%
<i>Palestinians</i>				
PMD 1	Bardala Cluster MD	0	473.830	3.615.693
PMD 2	Al-Bassariya Cluster MD	0	442.036	3.501.056
PMD 3	Al-Jiftlik Cluster MD	0	530.530	3.820.288
PMD 4	Fasayil Cluster MD	0	286.230	2.938.931
PMD 5	Al-Auja Cluster MD	0	435.596	3.477.760
PMD 6	Jericho MD	0	1.793.344	8.375.859
<b>Subtotal Palestinian</b>		<b>0</b>	<b>3.961.566</b>	<b>25.729.587</b>
<i>Settlements</i>				
IMD 1	Cluster North MD	0	0	0
IMD 2	Cluster Central MD	0	0	0
IMD 3	Cluster South MD	0	0	0
<b>Subtotal Israeli Settlers</b>		<b>0</b>	<b>0</b>	<b>0</b>
<b>TOTAL</b>		<b>0</b>	<b>3.961.566</b>	<b>25.729.587</b>

**Table 28 – Solid Waste Generation Projections**

Jordan Total Waste Generation		tons / year		
		2010	2025	2050
JMD 1	Agwhar Shamaliyah	43.577	71.114	156.878
JMD 2	Deir al Alla / Balqa	27.170	44.339	97.812
JMD 3	Shoonah / Janoobiyah	28.118	45.885	101.223
	<i>Foreign Population</i>	98.832	107.932	148.638
	<b>TOTAL</b>	197.697	269.269	504.551

Israel Total Waste Generation		tons / year		
		2010	2025	2050
	Emek Hayarden	6.600	8.237	11.880
	Emek Hamaayanot	6.600	8.237	11.880
	Beit She'an	10.200	12.730	18.360
	Hagilboa	6.000	7.488	10.800
	<b>TOTAL</b>	29.400	36.691	52.920

Palestine Total Waste Generation		tons / year		
		2010	2025	2050
<i>Palestinians</i>				
PMD 1	Bardala Cluster MD	2.104	8.038	42.371
PMD 2	Al-Bassariya Cluster MD	1.826	7.499	41.028
PMD 3	Al-Jiftlik Cluster MD	2.600	9.000	44.769
PMD 4	Fasayil Cluster MD	463	4.856	34.441
PMD 5	Al-Auja Cluster MD	1.769	7.390	40.755
PMD 6	Jericho MD	13.645	30.423	98.155
	<b>Subtotal Palestinian</b>	22.406	67.205	301.519
<i>Settlements</i>				
IMD 1	Cluster North MD	855	0	0
IMD 2	Cluster Central MD	2.376	0	0
IMD 3	Cluster South MD	516	0	0
	<b>Subtotal Israeli Settlers</b>	3.747	0	0
	<b>TOTAL</b>	26.153	67.205	301.519

If fully reused for agricultural purposes, this water is sufficient to supply water to 30.000 to 50.000 dunum of agricultural land. It is also suggested that highly treated wastewater from Jerusalem / West Bank (50 MCM /yr) will be diverted to the Jordan Valley for Agricultural purposes.

In terms of solid waste generation, this Master Plan assumes that the per capita waste generation will increase from 400 kg per person today to 475 kg in 2025 and to 600 kg per person per day in 2050. These assumptions are based on expected economic growth and related growing waste generation per capita similar to Western European averages. This Master Plan proposes interventions that will process and treat these waste streams in a fully sanitary fashion, based on a maximum of reuse and recycling, and including the use of sanitary landfills.

Assuming that in 2050 about 50% of the domestic waste stream consists of organic waste, this leads to about 400.000 tons of organic waste being generated in 2050 in the valley. Regional experience shows that a maximum of 50% of the organic waste stream could be physically separated, leading to 200,000 tons of organic waste being separated in 2050. If fully processed into compost, this leads to a compost production in 2050 of 200,000 tons per year, which is sufficient to support about 120.000 to 200.000 dunum of agricultural land in the Jordan Valley.

The remaining waste fraction is to be treated (50%) and recycled separately (50%). Eventually this might

be done through incineration or sanitary landfilling. Assuming that sanitary landfilling is the preferred treatment technology in the Jordan Valley, this leads to a total required landfilling capacity until 2050 of about 7 MCM of waste. Assuming average sanitary landfills with a height of 15 meters, this will require sanitary landfill surface area of about 500 dunum until 2050, excluding related infrastructure.

### 3.2 Strategic Planning Objectives

#### Introduction

The key development challenge facing the NGO Master Plan is to strike the right developmental balance between a healthy economic developmental path for the valley and its people on the one hand, and a Jordan River with sufficient environmental flows to sustain a healthy eco-system on the other hand. To meet this objective there is a need to ensure that the river serves as a natural water conveyor and source for water supply for residents in and outside the valley. Creative solutions are therefore needed to provide sufficient water to supply the projected water requirements of both people and nature for 2025 and 2050. A prerequisite for peace and prosperity is the equitable sharing of water resources and public access to lands and the riverbanks for all riparian nationalities within an appropriate security framework.

Sustainable development is seen as a catalyst to peace building between Israel and Palestine and the

deepening of cooperation between Jordan, Palestine and Israel as a means to achieve prosperity for their residents in the valley. A key condition for meeting this challenge is that Palestine is recognized as a full riparian to the Jordan River, entitled to have access to its fair share of water resources and sovereignty over its lands in the valley. This planning document has made no attempt to quantify equitable water rights from the Jordan River. All water allocations identified to each side are based on the needs of each side within the valley, with the assumption that the equitable water rights will be negotiated between the parties directly and might supply additional water resources to populations outside the valley. The terms Jordan Valley or Lower Part of the Jordan River Basin are interchangeable in this document.

In an earlier document researched and published by WEDO / EcoPeace Middle East, the target environmental flow for the river was identified as an estimated 400 MCM per annum, with the target return flow of 220 MCM, 100 MCM and 90 MCM identified for Israel, Syria and Jordan respectively. Given both the political situation in Syria and that there is no possibility for a Syrian team to be party to this NGO planning effort, there is therefore no attempt to determine in any detail from where and how the 100 MCM requirements from Syria would flow into the river by 2050, other than stating that it would lead to an additional 100 MCM flow from the Yarmouk River into the Jordan River. Therefore the 100 MCM annual contribution is not part of the WEAP model developed below and the model

therefore speaks of a 300 MCM annual flow to the Dead Sea.

The key strategic planning objectives that would promote sustainable development for the trans-boundary NGO Master Plan for the Jordan Valley have been identified below:

### Pollution Control and Sanitation

The objective in terms of pollution control and sanitation is to eliminate all sources of environmental pollution in the Jordan Valley by 2025. This requires full and adequate treatment and reuse of all wastewater flows in the valley and to embark on fully integrated solid waste management, including:

- (separate) waste collection,
- transportation;
- transfer;
- reuse and recycling of solid waste streams;
- selection, planning, design and construction of a sanitary landfill;
- closing of existing non-sanitary dump sites;
- development of composting facilities;
- Based on the polluter – pays – principle and progressive taxation for heavy consumers.

The situation today in terms of sanitation and wastewater treatment in Jordan and Palestine is poor. This impacts the public health, as well as the possibilities to use the water resources for economic development. The challenge is to reach a situation where generated wastewater is collection, treated

and reused for agricultural purposes, or to introduce better functioning sanitation systems using substantially smaller amounts of water, such as vacuum removal of toilet effluents, or electric incinerating toilets. In any case, localized solutions are preferred, avoiding the use of extensive sewer systems throughout the Jordan Valley.

In terms of environmental management, the challenge will be to implement integrated environmental management systems throughout the valley, including monitoring, enforcement and public awareness on wastewater and solid waste management, also focused on non-pollution sources; groundwater protection; water quality management; soil quality and air quality. Land preservation, groundwater protection zoning and problems related to overgrazing are to be addressed adequately.

Sustainable environmental management also requires adequate tools, such as dedicated impact assessment tools and Strategic Environmental Assessments to test new policies and strategies related to the Jordan Valley. In addition, environmental management in the valley requires enhancing water and environmental awareness of all communities, schools and municipalities in the valley, and implementing environmental standards instance according to the ISO norms 14000 and 14001. In terms of agricultural environmental management the challenge is to assist farmers in applying sustainable agronomic practices, including regulation of the use of pesticides and fertilizers and promotion of environmentally sustainable

substances. This will support farmers in reaching international agricultural export and import standards.

### Sustainable Water Management and River Rehabilitation

In terms of sustainable water management the key challenge clearly is to overcoming the water scarcity related problems in the Jordan Valley. This means creating a sustainable water supply system that meets that current and future domestic and agricultural water demands; and at the same time preserves the water resources for future generations and for the environment. This requires an Integrated Water Resources Management regime for the whole (Lower) Jordan River, based on international co-operation among Israel, Jordan and Palestine, supported with adequate water management tools (like WEAP) to ensure sustainable water supply and an increase of the baseflow and rehabilitation of the ecological values of the Jordan River.

One of the related key challenges is to achieve full treatment of wastewater generated in the study area and full reuse for agricultural purposes. This will both reduce public health related risks and strengthen the agricultural sector. This requires development of a detailed technical and financial plan, including designs and tender documents, for full scale collection, treatment and reuse of the locally generated wastewater flows, including domestic, industrial (mainly olive oil wastewater in Jordan) and manure management.

Another key challenge is to restore the function of the Lower part of the Jordan River as a natural river and water conveyor in the valley for supply purposes, by keeping its flow as long as possible in the river. Rehabilitating the river will include actions in terms of realizing at least one minor flood (c.a. 20-50 m<sup>3</sup>/sec) per year. In order to bring back the original habitats of the river, also the flow bed of the river are to be widened to about 50-70 m in the north and at least 30 m in the south, with flood plains on both sides.

The salinity of the Jordan River has a natural tendency to increase downstream. This is caused by natural drainage of brackish groundwater into the river, particularly in the southern part of the valley near the Dead Sea. The key challenge is to prevent any inflow of salt or brackish surface water into the river above the point where the river would still be fresh, i.e. above the confluent with Wadi Qelt. This implies bypassing the salt water from the Israeli Saline Water Carrier (SWC), the brackish water from the Israeli Fish Ponds, and the brine from the Abu Zeighan desalination plant to a new outflow located south of the river's confluent with Wadi Qelt, close to the Dead Sea. If this will be done, the river will be able to provide water of good quality for different user functions. In terms of chloride concentrations this means a maximum of 400 mg/l for drinking water purposes; 600 mg/l for fresh water irrigation; and 1500 mg/l for irrigation of date palms.

Another key challenge is to maintain total agricultural water demands at the same level as today, with the exception of Palestine which is

currently heavily underdeveloped in terms of agriculture. To achieve a sustainable water balance within the valley and sufficient flows in the river it will furthermore be required that around 2020 Israel will largely cease pumping water to the extent possible out of the valley from the Sea of Galilee through the National Water Carrier (NWC), meanwhile maintaining its present agricultural water consumption within the valley; that the Sea of Galilee will be kept on a medium water level between the top and bottom red lines ("green line" as defined by the Israeli Water Authority); and that by 2050 Jordan will stop diverting water from the Yarmouk and other tributaries to the King Abdullah Canal (KAC) to the extent possible, and instead will use the Jordan River as main conveyor for its irrigation supply purposes. In addition, by 2050 Palestine would also use the Jordan River as its main water conveyor, meaning that the planned development of the West Ghor Canal will not be built.

These challenges require a series of related interventions, including adequate water data monitoring and modeling; promotion of water saving and water demand management measures in all sectors; provision of related training and institutional strengthening support services; improved regulations and enforcement on groundwater abstractions to stop groundwater depletion and salination; and implementation of efficient water pricing policies and related enforcement.

In terms of water governance, the challenge will be to strengthen the authorities, including JVA, PWA, in

their role as regulator of the water sector in the Jordan Valley. This includes skills with regard to water data collection and management; water resources planning; efficient operations of the water storage and supply system; and strengthening the co-operation with the local water user associations. It also includes monitoring, regulations and enforcement of surface water and groundwater abstractions; protection of sensitive shallow aquifers, efficient tariff policies, and monitoring reduction of agricultural pollution loads.

### Sustainable Agriculture

Sustainable Agriculture Development is one of the most important pillars of the Jordan Valley Plan as it provides livelihood and prosperity for the whole people in the valley. The strategic agricultural objective for the study area is improving water use and irrigation efficiencies and economic outputs per unit of water used, and meanwhile stabilize, or even reduce the total water demands for the agricultural sector in the Jordan Valley. This will require adequate tariff policies on water used for irrigation, including enforcement, to stimulate more efficient use of water through for instance green house drip irrigation. These are challenges specifically relevant for Jordan and Palestine.

Greenhouses are a very effective manner to improve water efficiencies and economic outputs in the agricultural sector, using greenhouses reduce the production related risks, provide for better quality crops and provide wider options for crop



diversification. Finally, evapotranspiration from greenhouses is substantially less than from open field agriculture (and it does not cause soil salinity). However, greenhouses decrease open spaces, with negative visual impacts to rural landscapes and to wildlife corridors. Hence greenhouse development needs to be carefully planned and many farmers would require adequate and reliable micro-credits in order to invest in greenhouses.

Drip irrigation is another effective manner to improve water efficiencies in the open fields. The challenge is to set up sustainable drip irrigation systems in the Jordan Valley, including appropriate operations and maintenance and monitoring systems. This requires also financial facilities for farmers to invest, standardization of designs and manufacturing and provision of technical support services. A related challenge is to maximize the reuse of treated wastewater, efficient use of pesticides and fertilizers, introduction or expansion of growing high yield crops, and improving extension services and post harvesting support to the farmers to enable them to create higher economic returns.

The main agricultural challenge in Israel is to address the negative environmental impacts associated with the fish farms. These farms consume substantial amounts of water, due to high evaporation rates, which may be as much as 1-2 meter of water per year. In addition the ponds are flushed once or twice per year, releasing water into the Jordan River, which is polluted with excrements from the fishes, and anti-biotic medications that have to be added to the fish ponds. Due to the

evaporation, the effluent is usually brackish as well. Consequently, discharging this wastewater into the environment has substantial impacts to surface water and groundwater quality. Mitigating these impacts require investments in wastewater treatment facilities, and converting the process to a closed system. Without resolving these issues the future of this industry in the valley must be in doubt, despite any ecological benefits that the fish farms present for bird migration and associated tourism related to bird watching. The master plan sees the need to ensure that those communities relying currently on the fish ponds as their main source of income enjoy stability and that they be supported in the effort to move to closed systems.

A related challenge will be to strengthen the Extension Services for the farmers in the Jordan Valley. These services might be provided through the existing water user associations. In terms of rural economics, an important challenge is to improve the post-harvesting and marketing potentials of the farmers in the Jordan Valley, including setting up product organizations, better information about markets (nationally and internationally) and related product requirements and creating better access to export markets, with particular focus on eco-friendly and sustainable production techniques, regional labeling and fair-trade related markets.

## Jordan Valley Governance

### *Institutional Strengthening*

The institutional challenge will be to strengthen responsible land and water authorities, including JVA, WAJ and PWA, municipalities and related authorities in their role as authority and regulator of the Jordan Valley. Improvements are required in areas such as water data collection and management; water planning; water storage and distribution operations, including IT and wireless data transfer, economic and land use planning and related support services. This will also require improved coordination and cooperation between various stakeholders involved in water management, to enable to more efficient and beneficial water economy. The subsidiary principle is here recommended where decision making and empowerment should take place at the level of authority closest to the resident for the issue concerned. In Jordan and Palestine this would result in considerable investment in municipal authorities.

### *Advocacy and Local Community Empowerment*

Development of the Jordan Valley requires that local communities will fully participate in identifying their needs and in implementing the interventions for addressing these needs. This requires that local communities are educated and empowered; and that the general public awareness on the current problems and possible solutions in terms of sustainable development is raised. This requires support from local media as well as local governments and municipalities, as well as support from the responsible authorities.

*Social Responsibility*

Sustainable development and governance of the Jordan Valley shall also include social responsibilities, including fair payment of wages, inclusion of social security, safe and healthy working conditions, training of employees and equal gender opportunities.

*International Co-operation*

Maximizing the economic and environmental development perspectives in the Jordan Valley requires that trans-boundary co-operation will be strengthened, particularly among Jordan, Israel and Palestine. This may include preparing for a joint Jordan Valley Organization; updating the Jordanian – Israeli Water Agreements taking into account the increased water stress in Jordan and a new water division based on proportional distribution of water (percentages instead of fixed flows); joint restoration of the Lower part of the Jordan River; and development of joint economic initiatives. Within the framework of this Master Plan proposals have been elaborated to establish regional Steering Committees under each Strategic Objective, which can eventually be incorporated into this joint Jordan Valley Organization. In the (very) long run the challenge might be to work towards an integrated Jordan Basin Commission for all riparian countries, including Israel, Jordan, Palestine, Syria and Lebanon. In the interim a Jordan Valley Commission between Jordan, Palestine and Israel should be advanced.

**Ecological Rehabilitation**

One of the key challenges in the Jordan Valley is to restore the good ecological status of the Jordan Valley, and the role of the Jordan River as a strategic water conveyor (Green Infrastructure), in line with earlier recommendations of WEDO / EcoPeace's Environmental Flow Study. This also includes restoration of the flood plain and the ecological (flora, fauna) status of the river, based on environmental flows and good water quality; design and implementation of dedicated ecological restoration projects and eco-parks along the borders of the Jordan River; expansion of currently assigned nature reserves, based on important flora, fauna and bird areas, also in accordance with the Ramsar Convention; and design and develop dedicated nature recreational areas for the urban population.

**Sustainable Tourism and Cultural Heritage Development**

Development of the tourism sector and the cultural heritage in the Jordan Valley is a major challenge for saving the intrinsic cultural heritage values in the valley, including its typical geology and morphology, the history of salt industries along the northern shores of the Dead Sea; the ancient sugar mills, the pre-historic irrigation systems, the archeological settlement and land use patterns, the mud brick architecture, and the beautiful hiking trails and related panoramas over the Jordan Valley. Developing these potentials will boost the economy and create jobs in the area, but requires planning for

investments in related sites and infrastructure, such as near Jericho, Pella, the Bakoura National Park, and Old Gesher and the Naharayim sites.

This Master Plan aims to provide a sustainable management for an integrated natural-cultural Heritage and tourism development plan. The first priority is to develop a conservation management plan for natural and cultural heritage resources in the Jordan Valley. This conservation and management plan should lead to a sustainable management institution for monitoring the implementation of this plan and the protection of the Jordan Valley. A window for cooperation with other equivalent institutions in the other countries who share the Jordan Valley should be opened for common issues relevant to the management of the Jordan Valley.

This Master Plan also aims to facilitate the creation and the growth of the tourism business environment. The creation of business opportunities for the tourism industry is a multi-dimensional activity that can be initiated by public funds for vision and planning, access, infrastructure, public services as well as incentives for investment. There are some major projects like attractions that can be initiated with public and private initiatives like museums and archaeological site development. Those major attractions will enable small businesses to grow around them.

Visitor's experience need to be upgrade in terms of understanding and enjoying the natural and cultural history of the Jordan valley. A great amount of

research about the Jordan Valley exists about its formation, natural and cultural history, contemporary life and others. There is more to research in order to better understand the Jordan Valley, but it is important to pass knowledge with the necessary and adequate communication methods like site presentation, museums, guiding and so on. This includes upgrading the visitor experience and appreciating and enjoying the tourism hospitality. Upgrading the accommodation capacity, food and beverage, transportation, guiding, banking, communications, health services, as well as cultural exchange forums like festivals are of most importance to be provided in the right distance from the tourist trail.

The Jordan Valley shall be promoted as a unique destination. "One valley-three countries" can make the Jordan valley a unique destination with an interesting experience in the three countries. This promotion campaign cannot be neglected in the near future. Nevertheless it is still the tourism industry will to promote the Jordan Valley and the Dead Sea as a destination in the context of the national tourism promotion of the region. The two directions will cause no contradiction as they will only create more access to different markets. In addition to the traditional tourism fairs and exhibitions and familiarization trips, using information and communication technology is proving to be an effective access to any destination.

Reaching these tourism development objectives require development of tourism trails around various themes including nature protection, faith based

experiences and rural sceneries, and cross border tourism attractions and trails such as new access sites along the Jordan River, a free tourism area at the northern head of the Dead Sea between Jordan and Palestine; and the Jordan River Peace Park between Jordan and Israel. It may also include linking the Baptism Sites to other tourism sites and trails in the valley, and creating synergies and stronger economic development opportunities.

Finally this will include development of hotels and strengthening urban and rural tourism accommodations, such as bed and breakfast, local restaurants, support of woman's center and community centers. Many of these investments are to be development and financed by the private sector, and will therefore depend on the tourism perspectives in the Jordan Valley. In developing tourism facilities, the challenge will also be to fulfill environmental standards and eco-labels, similar to the EU Ecolabel or the Green Globe Ecolabel, and may also include bio-climatic design practices and use of renewable building materials. Border crossings need to be eased, allowing for foot crossing rather than shuttle buses as presently required and visa and fee requirement should be reevaluated in order to promote regional cross border tourism.

## Sustainable Urban, Energy and Infrastructure Development

To facilitate the anticipated population and economic growth in the Jordan Valley, it will be crucial to develop sufficient urban housing and infrastructure facilities in the valley, and meanwhile increase traffic safety and public transport capacities. This is specifically relevant for the new State of Palestine and for Jordan. This may include improvement of main north-south roads through the valley, including bypass roads around major urban areas; improving traffic safety through traffic lights, lining and public signs; establishment of sidewalks and bicycle trails; prepare for urban planning and housing projects to accommodate the foreseen growing population and its welfare, and development of trans-boundary infrastructure facilities, such as opening up of the Damya Bridge and the Abdullah Bridge over the Jordan River.

### *Sustainable Economic Development*

In order to further boost sustainable economic development in the Jordan Valley and related living standards for its population, additional economic development and private sector initiatives have to be supported, including community development projects; agro-industry and tourism development and specific economic initiatives providing high outputs against low water requirements.

### *Sustainable Energy*

Sustainable economic development also requires promotion of the use of renewable energy sources, such as biogas; waste-to-energy; small scale solar

energy and wind energy potentials in the valley, as well as promoting sustainable energy co-operation in the region. The potentials to harness solar energy in the region are huge. Developing these potentials might lead a substantial level of independence from fossil energy sources both for Jordan and for Palestine. Linking this to vocational education and research facilities in the Jordan Valley will further boost regional co-operation and economic development. In addition, donor-subsidized solar energy generation can be promoted as a major vehicle for co-operation, sustainable development and peace in the region. See also the Water and Energy Nexus on the website of WEDO / EcoPeace.

# MEETING THE STRATEGIC PLANNING OBJECTIVES

## 4.1 The Interventions

A total of 127 interventions have been identified with a total investment value of 4.58 Billion USD until the year 2050. The full set of interventions is presented in annex 1 and grouped around the various strategic planning objectives. Interventions have been distinguished in terms of Israeli (ISR), Jordanian (JOR), Palestinian (PAL), or Regional (REG) interventions. The regional interventions are particularly important due to their potential to establish co-operation among the three core parties, and to strengthen the conditions for a permanent peace settlement between Israel and Palestine. However, specific Palestinian and Jordanian projects that have been identified in the national plans need to be executed in order to bring these countries on par with Israel in order for all three parties to benefit equally from the implementation of the Regional NGO Master Plan.

The Jordanian, Palestinian and Regional interventions have been identified and developed by the consultant in co-operation with the key Jordanian and Palestinian stakeholders in the valley. The Israeli interventions presented here

have mostly been identified by the Lower Jordan Drainage Authority and the Jordan Valley Regional Council as part of their governmental planning cycles, and relate to pollution control, water management, ecology and tourism only. In addition, the Roadmap for Rehabilitation of the Jordan River (Eco Peace, 2009) proposed a series of interventions as well with a total costs (including lost revenues) of 3.4 Billion NIS. These were the following:

1. Ceasing pumping from the Lower Yarmouk to the Sea of Galilee if the water level in the Sea of Galilee is above the Red Line. This will save pumping costs, and does not negatively influence the Sea of Galilee water levels
2. Transfer the brine of the Salt Water Carrier directly to the Dead Sea, using a 83 km long gravitational pipeline (see also intervention P05 ISR)
3. Transferring effluent from Kishon to AMWA and Harod, which requires a 15 km long pipeline
4. Further and faster decreasing pumping to the National

5. Water Carrier (NWC). In the current Master Plan it is assumed that by 2050 Israel will reduce pumping water from the Sea of Galilee out of the valley through the National Water Carrier to enable an annual outflow of 234 MCM / yr into the Lower part of the Jordan River. In addition, it is assumed that Israel will maintain supplying its domestic and agricultural water needs within the Jordan Valley from the Sea of Galilee and local water resources.
6. Changing 50% of the fish ponds through closed systems or by other agricultural activities, such as field crops and alfalfa, which will provide a direct economic benefit for 35 MCM of water / year, and this will reduce the reduce salinity levels in the Jordan River (see also P03 ISR)
7. Discharge effluents from the Kishon to the Harod River to reduce salinity levels and desalinate 1,5 MCM / yr of brackish water from the Salt Water Carrier for local water supply

The proposed pollution control related interventions focus on eliminating all sources of environmental pollution in terms of wastewater and solid waste in the Jordan Valley by 2025. This includes full and

adequate treatment and reuse of all wastewater flows in the valley and to fully integrated solid waste management. Proposals have been made to include waste collection, transportation; transfer; reuse and recycling of solid waste streams; sanitary landfilling and closing of existing non-sanitary dump sites.

The sustainable water management related interventions focus on establishing efficient domestic and agricultural water supply within a valley wide water balance. It also includes an Integrated Water Resources Management approach for the whole (Lower) Jordan River, based on international co-operation among Israel, Jordan and Palestine, supported with adequate water management tools (like WEAP) to ensure sustainable water supply and an increase of the baseflow and rehabilitation of the ecological values of the Jordan River.

The agricultural related interventions focus on improving water use and irrigation efficiencies and the economic outputs per unit of agricultural water used. It is assumed that the total water demands for the agricultural sector in the Jordan Valley will remain stable and that adequate tariff policies on water used for irrigation will be implemented, including enforcement, to stimulate more efficient use of water through for instance green house drip irrigation.

The governance related interventions include setting up a Palestinian Basin Authority, strengthening the Jordan Valley Authority and establishing a trans-national Jordan River Basin Organization (Israel, Jordan, Palestine) that will address water

management related issues from the valley perspective to the benefit of all stakeholders and inhabitants in the valley.

The ecological interventions focus on restoring the good ecological status of the Jordan Valley in general and the Jordan River particularly. This includes restoration of the flood plain and the ecological (flora, fauna) status of the river, based on environmental flows and good water quality; design and implementation of dedicated ecological restoration projects and eco-parks along the borders of the Jordan River; expansion of currently assigned nature reserves.

The proposed interventions in terms of tourism and cultural heritage focus on restoration and saving the intrinsic cultural heritage sites in the valley, as well as for boosting the tourism economy in the area, including parks, hotel facilities, museums and touristic routes through the valley, as well as tourism branding and promotion. The interventions aim at creating valley wide synergies and stronger economic development opportunities for the valley as a whole.

The proposed interventions in terms of urban and infrastructure development focus on developing sufficient urban housing and infrastructure facilities in the valley towards the year 2050, and meanwhile increase traffic safety and public transport capacities.

The interventions, including foreseen planning and related investment costs are presented below for each strategic objective.

**Table 29 – The Interventions**

(Annual investments in units x 100,000 USD)

ID	Project (USD)	Subtotal (MUSD)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	
P01	REG Jordan Valley Regional Coordination on Pollution Control	6.300.000					3,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	
P01	ISR Fish Ponds Short Term Pollution Control Improvement Project	20.000.000		70,0	70,0	60,0																																
P02	ISR Mine Fields Removal Project	1.100.000			1,0	10,0																																
P03	ISR Sustainable Fish Farming in the Jordan Valley	26.000.000		2,0	2,0	2,0	2,0	2,0	50,0	50,0	50,0	50,0	50,0																									
P04	ISR Betanva Tertiary Wastewater Treatment	26.000.000		10,0	250,0																																	
P05	ISR Betanva Desalination Plan and Afkim Reservoir Project	51.000.000				5,0	5,0	250,0	250,0																													
P01	JOR Solid Waste Management	28.700.000		3,0	60,0	59,0	55,0	55,0	55,0																													
P02	JOR Environmental Management and Public Awareness Program	4.400.000		7,0	7,0	10,0	10,0	10,0																														
P03	JOR Agricultural Pollution Control Project	2.100.000		5,0	4,0	4,0	4,0	4,0																														
P04	JOR Separate waste collection and reuse pilots	400.000		4,0																																		
P01	PAL Solid and Hazardous Waste Management Plan	30.000.000			10,0	90,0	100,0	100,0																														
P02	PAL Environmental Management Project	1.000.000				4,0	3,0	3,0																														
P03	PAL Wastewater collection and treatment	31.000.000		5,0	5,0	100,0	100,0	100,0																														
P04	PAL Fish farm Pollution control project	550.000				1,8	2,5	1,3																														
P05	PAL Land and Water quality Protection Project	200.000				0,5	1,5																															
P06	PAL Remediation of Military Bases and Mine Fields	10.300.000						3,0	50,0	50,0																												
	<b>TOTAL POLLUTION CONTROL</b>	<b>239.050.000</b>																																				
ID	Project (USD)	Subtotal (MUSD)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	
W01	REG Jordan Valley Water Demands Management Project	1.500.000						7,5	7,5																													
W02	REG Jordan Valley Regional Coordination on Water Management	6.300.000					3,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	
W01	ISR Yarmouk River Dredging and Cliff Protection Project	21.300.000		3,0	70,0	70,0	70,0																															
W02	ISR Western Drainage Basins Flood Management	2.100.000			1,0	7,0	7,0	6,0																														
W03	ISR Northern Sewerage Expansion Project	13.000.000				10,0	60,0	60,0																														
W04	ISR Springs Rehabilitation Project	2.600.000					1,0	12,5	12,5																													
W01	JOR Improved Lower Jordan River Basin Management Project	2.397.000					12,0	12,0																														
W02	JOR Wastewater collection, treatment and reuse project	42.007.000		2,8	100,0	105,8	105,8	105,8																														
W03	JOR Emergency Wastewater Management Project	22.701.000		1,4	56,4	70,5	70,5	28,2																														
W04	JOR Waste water reuse pilot projects	1.551.000			1,4	7,1	7,1																															
W01	PAL Wells Rehabilitation and drilling of new well in the Jordan Valley	2.450.000						6,9	8,8	8,8																												
W02	PAL Rehabilitation and Protection of Springs	2.790.000		2,2	8,6	8,6	8,6																															
W03	PAL Rehabilitation and construction of Domestic water networks	3.700.000				14,5	22,5																															
W04	PAL Desalination of Brackish wells	750.000		4,0	3,5																																	
W05	PAL Rehabilitation of Al Auja Springs	750.000		4,0	3,5																																	
W06	PAL Development of Water Traffic structure	100.000		1,0																																		
W07	PAL Utilization of off Al-Fashkha Spring	5.200.000		2,0	15,0	15,0	20,0																															
W08	PAL Development of a water conveyance system	12.500.000						5,0	60,0	60,0																												
W09	PAL Utilization of Jordan River	29.500.000						59,0	59,0	59,0	59,0	59,0																										
W10	PAL Artificial Recharge Scheme	11.000.000		10,0	20,0	20,0	20,0	20,0	20,0																													
W11	PAL Construction of Water networks	31.250.000		6,3	6,3	37,5	37,5	37,5	37,5	30,0	30,0	30,0	30,0	30,0																								
W12	PAL Hydro-Geological Assessment of the study Areas	1.000.000		10,0																																		
	<b>TOTAL WATER MANAGEMENT</b>	<b>216.446.000</b>																																				

ID	Project (USD)	Subtotal (MUSD)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050		
A01	REG Jordan Valley Agricultural Water Efficiency	1,500,000							7.5	7.5																														
A02	REG Jordan Valley Regional Coordination on Agriculture	6,300,000						3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
A01	JOR Jordan Valley Greenhouses Expansion Project	3,000,000				2.0	7.0	7.0	7.0	7.0																														
A02	JOR Jordan Valley Extension Services Improvement Project	2,171,400				1.4	5.1	5.1	5.1	5.1																														
A03	JOR Jordan Valley Drip Irrigation Improvement Project	12,690,000				0.0	14.1	22.6	22.6	22.6	45.1																													
A04	JOR Jordan Valley Post Harvesting Support Project	2,326,500				0.0	1.4	4.4	4.4	4.4	8.7																													
A05	JOR Jordan Valley Irrigation Efficiency Improvement Project	3,877,500				0.0	0.0	7.1	6.3	6.3	19.0																													
A06	JOR Jordan Valley Authority Support Project	3,102,000				1.4	14.8	14.8																																
A01	PAL Shifting in Cropping Patterns	800,000							3.0	5.0																														
A02	PAL Rehabilitation and upgrading of water systems	17,000,000							7.0	81.5	81.5																													
A03	PAL Water Right Policies and Regulation	150,000				1.5																																		
A04	PAL Operate and expand the Agro-Industrial Park	2,000,000							2.0	18.0	0.0																													
A05	PAL construction of Agricultural Roads	1,000,000							4.0	6.0																														
A06	PAL enhancement of Palm Production	1,600,000							6.0	10.0																														
A07	PAL Development and Support livestock Sector	3,995,000							1.5	19.3	19.3																													
A08	PAL Support to Women organizations and Bedouin Communities	650,000				2.6	3.9																																	
A09	PAL Land Rehabilitation	152,000,000							20.0	300.0	400.0	400.0	400.0																											
A10	PAL Strengthening of Extension Services	100,000				1.0																																		
A11	PAL Promotions of Farmers Cooperative	500,000				1.0	2.0	2.0																																
A12	PAL Jordan valley Credit Program	1,098,000				1.5	1.6	1.6	1.6	1.6	1.6	1.6																												
A13	PAL LEISA Reseach certification	525,000				0.8	2.3	2.3																																
A14	PAL Establish an Agro-Industrial Zone in the Northern JV	12,000,000							2.5	2.5	57.5	57.5																												
A15	PAL Hand over of Settlements Agricultural Lands	16,000,000							10.0	75.0	75.0																													
<b>TOTAL SUSTAINABLE AGRICULTURE</b>		<b>244,385,400</b>																																						
IC01	REG Jordan River Basin Organization (JORBO)	4,150,000							1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
IC01	PAL Jordan Valley Authority Development Program	1,000,000							6.6	3.4																														
<b>TOTAL LOWER JORDAN BASIN GOVERNANCE</b>		<b>5,150,000</b>																																						
<b>ID</b>	<b>Project (USD)</b>	<b>Subtotal (MUSD)</b>																																						
E01	REG Jordan River Environmental Flows Project	5,000,000							5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		
E02	REG Jordan River Ecological Restoration Project - Regional	30,500,000							5.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	
E03	REG Jordan River Fisk Stock Restoration Project	5,500,000							5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
E04	REG Nature Protection Areas and Management Plan	5,500,000							5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
E05	REG International Accreditation of the Lower Jordan River Valley	1,500,000				5.0	5.0	5.0																																
E06	REG Jordan Valley Regional Coordination on Ecology	6,300,000						3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		
E01	ISR Jordan River Ecological Restoration Project - Israel	3,100,000							1.0	10.0	10.0	10.0																												
E01	JOR Ecological Corridors around Valleys and Dams	7,800,000				8.0	14.0	14.0	14.0	14.0	14.0																													
E02	JOR Wetlands and Aquatic Fauna Restoration Project	2,130,000				7.1	7.1	7.1																																
E03	JOR Ecological Monitoring and Management Project	3,550,000				7.1	7.1	7.1	7.1	7.1																														
E04	JOR Jordanian Eco-parks and Protected Areas Project	28,910,000							7.1	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	
E01	PAL Nature Protection Areas and Management Plan	5,500,000							5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
<b>TOTAL ECOLOGICAL REHABILITATION</b>		<b>105,290,000</b>																																						



ID	Project (USD)	Subtotal (MUSD)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050		
C01	REG Jordan River Mouth Tourism Information Center	2,200.000						2,0	5,0	5,0	5,0	5,0																												
C02	REG Jordan River Baptism Site Improvement Project	4,100.000						1,0	10,0	10,0	10,0	10,0																												
C03	REG Jordan River Peace Park Improvement Project	4,100.000						1,0	10,0	10,0	10,0	10,0																												
C04	REG Jordan River Regional Routes	2,000.000							5,0	5,0	5,0	5,0																												
C05	REG Cultural and Historic Museum for the Lower Jordan Valley	3,000.000							7,5	7,5	7,5	7,5																												
C06	REG Jordan Valley Regional Coordination on CH and Tourism	6,300.000						3,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	
C01	ISR Tsemach to Naharaym Tourism Development Project	26,000.000					5,0	5,0	50,0	50,0	50,0	50,0	50,0																											
C02	ISR Gesher to Bezeq Stream Tourism Development Project	26,000.000					5,0	5,0	50,0	50,0	50,0	50,0	50,0																											
C01	JOR Pella Tabagat Fahl Site Improvement Project	3,102.000			2,8	14,1	14,1																																	
C02	JOR Abu Ubaydah Tomb Improvement Project	775.500			0,7	3,5	3,5																																	
C03	JOR Cultural and Historic Museum for the Lower Jordan Valley	3,080.850							0,3	0,2	30,3																													
C04	JOR Archaeological Landmarks Development Project	4,935.000							12,3	12,3	12,3	12,3																												
C01	PAL Cultural Heritage Protection and Management Plan	1,700.000	2,0	6,0	6,0	3,0																																		
C02	PAL Tourism Branding and Promotion	500.000	5,0																																					
C03	PAL Museum of Natural and Cultural History of the Rift valley	42,750.000							27,5	100,0	100,0	100,0	100,0																											
C04	PAL Rehabilitation of the Catchment of Ancient Jericho	12,600.000		6,0	30,0	30,0	30,0	30,0																																
C05	PAL Rehabilitation of salt industry sites, Rusheideyeh	4,300.000		3,0	10,0	10,0	10,0	10,0																																
C06	PAL Rehabilitation of Antient Jericho	4,300.000		3,0	10,0	10,0	10,0	10,0																																
C07	PAL Rehabilitation of Hisham's Palace	3,700.000			1,0	12,0	12,0	12,0																																
C08	PAL Rehabilitation of Tel Abu El Alayek	4,733.333			4,3	4,3	4,3	4,3	10,0	10,0	10,0																													
C09	PAL Rehabilitation of Khirbet El bivadat or Tel Ouja	5,800.000			3,0	11,0	11,0	11,0	11,0	11,0																														
C10	PAL Rehabilitation of Khirbet El Makhrouq	5,800.000			3,0	11,0	11,0	11,0	11,0	11,0																														
C11	PAL Rehabilitation of Tel El Hamma	5,300.000				3,0	10,0	10,0	10,0	10,0	10,0																													
C12	PAL Archaeological Landmark Features	1,500.000				3,0	6,0	6,0																																
C13	PAL Spa, Thalasso therapy and Balneo therapy Center	3,300.000				3,0	7,5	7,5	7,5	7,5																														
C14	PAL Jesus Village	3,500.000				2,0	7,0	7,0	7,0	6,0	6,0																													
C15	PAL Hiking trail Development	2,000.000							4,0	4,0	4,0	4,0	4,0																											
C16	PAL Sport and Adventure Center	18,000.000							10,0	10,0	32,0	32,0	32,0	32,0																										
C17	PAL Travelers Centers	5,200.000							7,0	15,0	15,0	15,0																												
C18	PAL Hotel Rooms 4 Stars (Resort)	80,000.000							15,0	85,0	100,0	150,0	150,0	150,0	150,0																									
C19	PAL The Mud Brick Youth Village	5,100.000							1,0	10,0	10,0	10,0	10,0	10,0																										
C20	PAL Youth and Guest houses	4,200.000								2,0	10,0	10,0	10,0	10,0																										
<b>TOTAL SUSTAINABLE TOURISM AND CH DEVELOPMENT</b>		<b>299.876.683</b>																																						

ID	Project (USD)	Subtotal (MUSD)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050		
U01	REG Non-fossil, Renewable Energy Development Project	3,000,000						6,0	6,0	6,0	6,0	6,0																												
U02	REG Adam / Damia Bridge Rehabilitation Project	90,000,000										10,0	140,0	150,0	300,0	200,0	100,0																							
U03	REG King Abdullah Bridge Rehabilitation Project	30,000,000										10,0	140,0	150,0																										
U04	REG Efficient Border Bridges Crossings	10,000,000						3,0	47,0	50,0																														
U05	REG Jordan Valley Regional Coordination on Urban and Infra Dev.	6,300,000						3,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0	2,0		
U01	ISR Center of Excellence at Kinneret College	10,500,000						2,0	3,0	20,0	20,0	20,0	20,0	20,0																										
U02	ISR Eden Regional Agricultural Research and Training Center	21,100,000						1,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0		
U01	JOR Infrastructure Development Project	267,900,000										30,0	69,0	200,0	200,0	200,0	200,0	200,0	200,0	200,0	200,0	200,0	200,0	200,0	200,0	180,0														
U02	JOR Urban and Infrastructure development Master Plan	1,424,100,000									10,0	600,0	600,0	750,0	750,0	581,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0	550,0		
U03	JOR Higher Education and Vocational Development Project	30,000,000							10,0	90,0	100,0	100,0																												
U04	JOR Non-fossil, Renewable Energy Development Project	285,000,000										15,0	15,0	300,0	300,0	210,0	210,0	210,0	210,0	200,0	200,0	200,0	200,0	200,0	200,0	90,0	70,0	20,0												
U01	PAL Urban and Infrastructure development Master Plan	1,019,900,000						9,0	190,0	250,0	300,0	450,0	300,0	650,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	450,0	400,0	350,0	250,0	100,0								
U02	PAL Educational and Vocational Needs Assessment	250,000						2,5																																
U03	PAL School building Program	4,900,000						10,0	19,0	20,0																														
U04	PAL Higher Education and vocational Training Program	10,300,000						3,0	20,0	20,0	20,0	20,0	20,0																											
U05	PAL Health Care services Development Project	10,100,000						11,0	30,0	30,0	30,0																													
U06	PAL Electricity and Telecommunications Development Project	202,000,000						20,0	50,0	70,0	90,0	120,0	110,0	210,0	200,0	200,0	210,0	200,0	180,0	160,0	100,0	60,0	40,0																	
U07	PAL Develop Renewable Energy Resources	22,000,000						20,0	50,0	50,0	50,0	50,0																												
U08	PAL Import and Export Logistics Center	2,000,000						5,0	15,0																															
U09	PAL Utilization of Dead Sea Minerals for economic production	23,500,000						15,0	55,0	55,0	55,0	55,0																												
<b>TOTAL URBAN AND INFRASTRUCTURE DEVELOPMENT</b>		<b>3,472,850,000</b>																																						
<b>GRAND TOTAL, all investments</b>		<b>4,583,048,083</b>	0	140	563	807	904	1049	1611	2352	2351	2725	2903	2784	2464	1983	1862	1752	1717	1639	1579	1539	1504	1464	1334	1134	1084	1014	964	912	812	662	562	532	492	362	262	12		

**Table 30 – Pollution Control related interventions**

P01	REG	Jordan Valley Regional Coordination on Pollution Control
P01	ISR	Fish Ponds Short Term Pollution Control Improvement Project
P02	ISR	Mine Fields Removal Project
P03	ISR	Sustainable Fish Farming in the Jordan Valley
P04	ISR	Betanya Tertiary Wastewater Treatment
P05	ISR	Betanya Desalination Plan and Afikim Reservoir Project
P01	JOR	Solid Waste Management
P02	JOR	Environmental Management and Public Awareness Program
P03	JOR	Agricultural Pollution Control Project
P04	JOR	Separate waste collection and reuse pilots
P01	PAL	Solid and Hazardous Waste Management Plan
P02	PAL	Environmental Management Project
P03	PAL	Wastewater collection and treatment
P04	PAL	Fish farm Pollution control project
P05	PAL	Land and Water quality Protection Project
P06	PAL	Remediation of Military Bases and Mine Fields

### Pollution Control and Sanitation

The pollution control related interventions have been designed to eliminating all sources of environmental pollution in the Jordan Valley by 2025.

The purpose of the regional coordination intervention setting up a regional coordination structure, or Steering Committee, among key Jordanian, Israeli and Palestinian governmental stakeholders for the implementation of the proposed national and regional interventions in the Jordan Valley with regards to the Pollution Control. The objective is that this Steering Committee will eventually be embedded in the structures of the

overall River Basin Organization for the Jordan Valley (ref. intervention IC01 REG Jordan River Basin Organization).

The Israeli intervention on short term pollution control of the fish ponds aims at changing operations of their wastewater discharge and releasing their wastewater during winter season into the Jordan River when water is high, or there are floods to reduce concentrations. It also includes construction of settling ponds before release into the river and expansion of two pilot projects that are currently being implemented. The Mine Fields Removal Project aims at removing all mine fields in

the Israeli part of the study area by 2016 or early 2017.

The Israeli project on sustainable fish farming in the Jordan Valley aims at developing fully sustainable closed systems without negative environmental impacts and minimized water use; and to remove fish farms from the region that cannot meet these criteria, either by changing them into bird reservoirs, or other type of less-polluting agriculture. This project consists of continued research on sustainable fish farming, including bio-pesticides; biological filtering and reusing of fish farm discharge water; including use of forced oxidation to maximize production; selection of higher revenue fish types like sea bass. Research has showed that this may result in only 10% of the water consumption compared to today; and no discharge of polluted water at all. Next, the aim is to transfer the research results to real scale model fish farms and change co-operative fish farms into these sustainable concepts.

The proposed Betaniya tertiary wastewater treatment project aims at expanding the current secondary treatment of Betaniya, and bringing the effluent to the downstream new Afikim reservoir (not part of this intervention), which will also receive desalinated water from the Salt Water Carrier, and next to reuse this water for agricultural purposes.

The proposed Betaniya Desalination Plant and Afikim Reservoir Project aims at constructing a desalination unit for much of the water from the Saline Water Carrier (SWC), to mix this water with

effluent from the Betaniya WWTP into the Afikim Reservoir, and to reuse this mixed water (3.5 MCM / yr) for agricultural purposes. The desalinated water will be used for drinking water purposes. In addition, the project aims at using 6 MCM / yr of brine (4000 ppm) for use in Fish Ponds near Bezeq, or alternatively, discharging this brine through a pipeline into Dead Sea (needing an additional 100 M NIS investment).

The proposed Jordanian Solid Waste Management intervention is in line with the National Solid Waste Management Plan that is currently (2014) prepared by the Ministry of Environment and new legislation currently being prepared for the municipalities. The project includes an integrated planning section dedicated to the Jordan Valley, cross boarder waste transfer; transfer of the landfill in North Shuneh into a transfer station, focusing on composting organic waste for composting, including household organic waste, agricultural waste of solid waste generated by olive mills and PPPs. However, the National SWM strategy will be elaborated on the levels of governorates, which overlaps parts of the area of the Jordan Valley. This proposed interventions under this Master Plan focused explicitly on the Jordan Valley, without waste management plans for other regions, such as the Syrian refugee camps currently located close to the border. Additional elements to be addressed are way of financing; increasing public and governmental awareness and participation; private sector involvement; source separation, and following environmental and social procedures for the preparation of landfills.

The proposed Jordanian integrated environmental monitoring, enforcement and public awareness program for the Jordan Valley includes monitoring of wastewater and solid waste major pollution sources, fish farms; ambient surface and groundwater quality; soil quality and air quality. The purpose of this program is to enabling JVA and related authorities to establish the environmental baseline of the Jordan Valley; to increase public awareness on environmental protection and water demands; and to monitor the impacts of pollution control measures, such as solid waste management and wastewater management interventions. The project will also include development of dedicated impact assessment tools for JVA, such as Strategic Environmental Assessments to be used to test new policies and strategies related to the Jordan Valley.

The Jordanian agricultural pollution control project aims to assist farmers and their organizations in applying sustainable agronomic practices, including minimized use of pesticides and fertilizers; regulation and distribution and types of pesticides on regional or national levels, and promotion of environmentally sustainable substances; stimulation of the reuse of organic agricultural waste as compost; improve the management of agricultural waste; improvement of the environmental performance of fish farms.

The Jordanian separate waste collection and reuse pilots aim to stimulate the reuse of resources/waste streams and limit the amount of waste to be land filled, in line with the National SWM Strategy that is currently being prepared. This includes research to

investigate the possibilities and bottlenecks for separate collection and reuse of certain waste streams.

The Palestinian SWM project aims at full collection and sanitary treatment of all solid waste streams and maximized reuse and recycling of waste streams, including waste to energy. And at the same time stimulate the reuse of resources/waste streams and limit the amount of waste to be land filled. The intervention includes construction of a central sanitary landfill for the area.

The Palestinian proposed integrated environmental management plan aim to Improvement of urban and environmental planning capacities and enhance environmental data collection, improvement of enforcement. It proposes to make one organization responsible for environmental issues in the Jordan Valley, to empower this organization and improve the public environmental awareness in the Valley.

The Palestinian wastewater collection and treatment project focuses on full scale, adequate and safe collection of waste water for all the communities in the study area by constructing wastewater collection networks, to treat the generated wastewater from the different communities and lay the ground for safe reuse of wastewater for agricultural purposes from the constructed wastewater treatment plant. This includes expansion of the sewer system in Jericho covering the whole city and connecting the system to the recently completed WWTP, and covering the remainder of the communities with adequate networks and treatment facilities. This

objective of this intervention is to reach a situation where all generated wastewater in Palestine is collection, treated and reused for agricultural purposes, or where better functioning sanitation systems using substantially smaller amounts of water are introduced, such as vacuum removal of toilet effluents, or electric incinerating toilets. As mentioned earlier, localized solutions are preferred, avoiding the use of extensive sewer systems throughout the Jordan Valley.

The Palestinian fish farm pollution control project focused on the current pilot fish farm and potential future fish farms in the Jordan Valley. The current four pilot fish farms in Jericho are not well lined against leakage. This project will assess the technical state of the fish farms and prepare for adequate lining and groundwater protection. The project will also focus on options for reusing the wastewater of the fish farms and on developing environmental standards for the management of current and future fish farms

The Land and Water quality management project aims at studying the vulnerability of the Jordan Valley against groundwater, soil and surface water contamination, to prepare vulnerability maps for the study area and to assign and restrict rank land use according to this vulnerability assessment.

Remediation of Military Bases and Mine fields will be required once Palestine has been established as an independent state. The aim of this intervention is to clean all mine fields and remediate the by then former Israeli military bases within the Palestinian

areas. This will include soil, waste and groundwater pollution assessment, remediation planning and implementation.

## Sustainable Water Management and River Rehabilitation

**Table 31 – Water Management related interventions**

W01	REG	Jordan Valley Water Demands Management Project
W02	REG	Jordan Valley Regional Coordination on Water Management
W01	ISR	Yarmouk River Dredging and Cliff Protection Project
W02	ISR	Western Drainage Basins Flood Management
W03	ISR	Northern Sewerage Expansion Project
W04	ISR	Springs Rehabilitation Project
W01	JOR	Improved Lower Jordan River Basin Management Project
W02	JOR	Wastewater collection, treatment and reuse project
W03	JOR	Emergency Wastewater Management Project
W04	JOR	Waste water reuse pilot projects
W01	PAL	Wells Rehabilitation and drilling of new well in the Jordan valley
W02	PAL	Rehabilitation and Protection of Springs
W03	PAL	Rehabilitation and construction of Domestic water networks
W04	PAL	Desalination of Brackish wells
W05	PAL	Rehabilitation of Al Auja Springs
W06	PAL	Development of Water Traffic structure
W07	PAL	Utilization of Al-Fashkha Spring
W08	PAL	Development of a water conveyance system
W09	PAL	Utilization of Jordan River
W10	PAL	Artificial Recharge Scheme
W11	PAL	Construction of Water networks
W12	PAL	Hydro-Geological Assessment of the study Areas

The interventions related to sustainable water management focus on overcoming the water scarcity related problems in the Jordan Valley, meeting the current and future domestic and agricultural water demands, preserving the water resources for future generations and for the environment, and establishing a clean Jordan river system that sustains a healthy ecosystem and the valley economy (see also annex 2 – Environmental Flows).

The total projected human water demands in the valley will have increased from about 694 MCM per year in 2010 to about 849 MCM / yr in the year 2050. However, the suggestions interventions in this valley plan will allow for full supply of these demands in 2050. Details are provided in section 5.3. "Water Demands and Supply Balance in 2050".

The Regional Jordan Valley Domestic and Tourism Water Demands Management Project aims at setting up a system for instituting, regulating and monitoring of water demands and water use efficiencies for the Domestic and Tourism Sectors in the Jordan Valley. This will require an assessment of current domestic and tourism water supply infrastructure, practices and policies in the valley and provision of information for better and more efficient water use in the domestic and tourism sectors.

The purpose of the regional coordination intervention is setting up a regional coordination structure, or Steering Committee, among key Jordanian, Israeli and Palestinian governmental

stakeholders for the implementation of the proposed national and regional interventions in the Jordan Valley with regards to the Water Management. The objective is that this Steering Committee will eventually be embedded in the structures of the overall River Basin Organization for the Jordan Valley (ref. intervention IC01 REG Jordan River Basin Organization).

The proposed Yarmouk River Dredging and Cliff Protection Project in Israel aims at improving drainage and flow of water through the Yarmouk River in Israel/Jordan section; to prevent collapsing of banks and cliffs into the river flow and to prevent flooding in the Yarmouk Flood Plain in co-operation with Jordan. The proposed Western Drainage Basins Flood Management Project in Israel aims at improving drainage of the four Israeli sub-basins of the Jordan Valley and preventing soil erosion from these basins into the Jordan River.

The proposed northern sewerage expansion project aims at connect all Israeli communities from Moshav Menahamia to Harod Stream in the Israeli section of Jordan Valley to the Beit Shean waste water treatment plant (WWTP), and to reuse the treated water for olive tree irrigation. The Israeli Springs Rehabilitation Project in the Jordan Valley aims at improving water flow and environmental quality of five springs in the Israeli Jordan Valley, increasing the related eco-tourism at these springs; and increasing the springs' discharge into the Jordan River with 3 – 4 MCM / yr.

The Jordanian interventions W01 – W04 shall be considered as one package, starting with the emergency and pilot projects W03 and W04, followed by W01 and W02. These projects aim at reaching a situation where generated wastewater is collection, treated and reused for agricultural purposes, or introduce better sanitation systems using substantially smaller amounts of water, such as vacuum removal of toilet effluents, or electric incinerating toilets. As mentioned earlier, localized solutions are preferred, avoiding the use of extensive sewer systems throughout the Jordan Valley.

These projects shall furthermore be linked to existing infrastructure and national wastewater (reuse) policies, and be performed in an economically and ecologically sound manner under the proximity principle.

The aim of the Jordan Valley Water Demands Management Project is set up a system for instituting, regulating and monitoring of water demands and water use efficiencies for the Domestic and Tourism Sectors in the Jordan Valley. The Jordanian improved Jordan Valley Management project aims to improve the basin water management in terms of operational and information management of the Jordan Valley, and to prepare for full collection, treatment and reuse of locally generated wastewater in the valley. This includes investment planning and a pilot wastewater collection and reuse scheme, to demonstrate to the inhabitants in the valley the advantages of reusing treated wastewater for agricultural purposes.

The proposed Jordanian wastewater collection, treatment and reuse project focuses on realizing adequate and safe collection of wastewater from all the communities in the study area by constructing wastewater collection networks for 540,000 people in 2025 and 607,000 people in 2050; and to treat the generated wastewater from the different communities, including full scale reuse of treated wastewater in the Jordan Valley: 25 MCM per year in 2025 and 33 MCM in 2050. Specific attention shall be given to treatment of wastewater originating from olive mills, which contain high BOD concentration and cannot be treated by regular domestic wastewater treatment plants.

Currently most wastewater in the Jordan Valley is collected in cesspits, which are partly in bad condition or irregularly emptied. This poses immediate threats for the public health and the environment. The aim of the Jordanian Emergency Wastewater Management Project is to make an assessment of the scope and extend of the current problems; to plan for a valley wide cesspits rehabilitation program; to increase capacities for emptying cesspits; to purchase additional tanker trucks for wastewater collection; to plan for related organization and operational aspects; and to implement these short term emergency measures.

In order to prepare for full scale reuse, a Jordanian pilot wastewater reuse project in the Jordan Valley is proposed as well, to serve as an example for the wider water and agricultural sector and as core for further expansion of local wastewater reuse throughout the valley. The pilot project shall be

linked to collection and treatment of wastewater from existing cesspits in the Jordan Valley.

The Palestinian Well rehabilitation project aims at increasing the water resources availability and enhancing water efficiency from 30 wells in the Jordan Valley, and drilling of new well in order to increase water supply for different purposes from these 30 wells. In addition it is proposed to increase water resource efficiency and reduce losses through leakage and evaporation from the springs and the main channels.

The Palestinian project for rehabilitation and construction of domestic water networks focuses on 30 km of water networks of different diameters. It includes installation of filling points, distribution of 1.5 m<sup>3</sup> plastic tanks and mobile water tankers with a variety of capacities, and rehabilitation of rainwater harvesting cisterns in marginalized communities.

The interventions related to desalination of Palestinian brackish wells aims at installation of small desalination units at 10 brackish water wells in the area, and rehabilitation of the related water network leading from these wells. The proposed rehabilitation of the Al Auja Spring includes rehabilitation of the main source of the spring and lining the 1 km stream from the source to prevent seepage of water into the subsurface.

The intervention related to the Palestinian water tariff structure focusing on developing a unified tariff structure for both domestic and agricultural water uses that will be used for the different water supply

provides, and includes related framework for inspection, enforcement and incentives. This activity shall be developed in close coordination with the Palestinian Water Regulatory Council.

The aim of the proposed Al-Feshka Spring project is to establish a conveyor for 10 MCM of water from Al Fashkha spring through a 15 km long 36" diameter pipe and the construction of a 5,000 m<sup>3</sup> reservoir to cultivate about 10 thousand dunums of agricultural land at the southern entrance of Jericho City.

The West Ghor water conveyance system aims to develop a temporary solution for conveying water from north to south through the West Bank area in the Jordan Valley to strategic water distribution. Under this Master Plan this intervention will be required until the three countries have developed a regional and peaceful basin water management framework, in which eventually the Jordan River will be used as the main strategic water conveyor through the Jordan Valley, and will at that stage replace under the vision of this Master Plan both this West Ghor water conveyor as well as the east Ghor / Kind Abdullah Canal. This final solution will require pumping stations on the River and the development of the necessary conveyance system to link to river to the main water demands in Palestine and Jordan. This temporary West Ghor water conveyor encompasses a water pipeline (20 inch diameter) about 60 km pipeline that goes from North to south through the Palestinian Jordan Valley.

The artificial recharge scheme is proposed to replenish the groundwater aquifers with access

water during the rainy season, which will enhance and increase the safe yield of the aquifer in addition to improving water quality and reduce desalinization rates and finally to mitigate any future impact from climate change. In addition, the construction of water networks is proposed to facilitate the future urban extension areas in Palestine.

Finally, it is proposed to develop a hydro geological study for groundwater in the Palestinian part of the Jordan Valley to better understand the behavior and development options of the aquifer system.

### Sustainable Agriculture

The interventions related to the sustainable agriculture focus on improving water use and irrigation efficiencies and economic outputs in the Jordan Valley, meanwhile limiting the agricultural water use in Israel and Jordan to the 2010 levels.

Increasing the agricultural value which is the focus of interventions which implies people making more money and water use is most efficient. This requires access to land and tenure security, access to water, and access to markets. The private sector is to play an important role in promoting these improved investments in agriculture, while the role of the government is to provide an enabling policy environment, including effectively monitor and force regulations with respect to water use and pollution prevention and support family farms that are focusing on the LEISA agriculture.

A01	REG	Jordan Valley Agricultural Water Efficiency
A02	REG	Jordan Valley Regional Coordination on Agriculture
A01	JOR	Jordan Valley Greenhouses Expansion Project
A02	JOR	Jordan Valley Extension Services Improvement Project
A03	JOR	Jordan Valley Drip Irrigation Improvement Project
A04	JOR	Jordan Valley Post Harvesting Support Project
A05	JOR	Jordan Valley Irrigation Efficiency Improvement Project
A06	JOR	Jordan Valley Authority Support Project
A01	PAL	Shifting in Cropping Patterns
A02	PAL	Rehabilitation and upgrading of water systems
A03	PAL	Water Right Policies and Regulation
A04	PAL	Operate and expand the Agro-Industrial Park
A05	PAL	construction of Agricultural Roads
A06	PAL	enhancement of Palm Production`
A07	PAL	Development and Support livestock Sector
A08	PAL	Support to Women organizations and Bedouin Communities
A09	PAL	Land Rehabilitation
A10	PAL	Strengthening of Extension Services
A11	PAL	Promotions of Farmers Cooperative
A12	PAL	Jordan valley Credit Program
A13	PAL	LEISA Research certification
A14	PAL	Establish an Agro-Industrial Zone in the Northern JV
A15	PAL	Hand over of Settlements Agricultural Lands

**Table 32 – Sustainable Agriculture related interventions**

In Jordan, the focus is on irrigation efficiency and economic output per unit of the crop per drop per water and on reuse of treated waste water. In the Palestinian, further development of irrigation is suggested allowed for four thousand hectares and

six thousand hectares currently irrigated by settlers will be transferred over to Palestinians.

Furthermore commitment from all three countries will be required to successfully implement the



proposed agricultural investments. The objective is that eventually there will be an integration and coordination of the three countries whereby each country uses its comparative advantage in terms of agricultural products.

Improving the agricultural water use efficiencies is an important goal under this strategic objective. This will require setting up a system for organizing, regulating and monitoring the water efficiencies in agriculture, based on the WEDO / EcoPeace Foot Print approach and international best practices. This requires assessment and analysis of current extension services and related flaws, based on field visits and interviews; provision of improved extension services to better manage and monitor water use and distribution; setting up a training center in the Jordan Valley- special focus on agricultural water efficiencies and water-related themes; and provision of services to optimize agriculture field water efficient crops.

The purpose of this regional co-ordination intervention setting up a regional coordination structure, or Steering Committee, among key Jordanian, Israeli and Palestinian governmental stakeholders for the implementation of the proposed national and regional interventions in the Jordan Valley with regards to the Agriculture. The objective is that this Steering Committee will eventually be embedded in the structures of the overall River Basin Organization for the Jordan Valley (ref. intervention IC01 REG Jordan River Basin Organization).

Further it will be required to expand the number of greenhouses in the LJR to increase agricultural production and revenues, particular in Jordanian agricultural areas PS 41 and PS 55, and to expand the use of drip irrigation in the northern part of the Jordan Valley and to increase the operations and efficiencies of drip irrigation of the southern part of the Jordan Valley.

In addition, this plan proposes to increase the quality of extension services to all Palestinian and Jordanian farmers in the JORDAN VALLEY, and linking these services to the existing 26 WUAs in the Jordanian part of the valley. Palestinian WUAs or farmer organizations have not yet been established. It is proposed to facilitate groups of Palestinian family farms to invest jointly in user self-provision of irrigation, processing and/or marketing services for high value export crops.

This also requires that credits will become available to the farmer, which requires setting up a credit program focusing on semi-subsistence family farms, to overcome financial bottlenecks they face in adapting GAP and LEISA agricultural practices, and investing in drip irrigation and green houses. This also requires research activities, such as for obtain LEIA certifications.

In order to raise the economic outputs of the agricultural sector, it will be required to improve the post-harvesting and marketing potentials of the farmers in the Jordan Valley. This requires organizing farmers within the Jordan Valley in product organizations; providing them with relevant

local and international market information; related product quality requirements, prices and logistic requirements; assisting the farmers with development of good business models and information of product processing and agro-industry, marketing approaches and access to export markets. Finally it is proposed to assisting the farmers with implementing joint pilot export initiatives for certain products.

Currently some large Jordanian farmers outsource their irrigation operations to specialized (private) operating organizations. These specialized firms apply computerized operating system linked to weather stations and dedicated operating software. It is proposed to expand these services to other farmers in the Jordan Valley as well.

This plan furthermore proposes to strengthen the capabilities of the Jordan Valley Authority in its role as authority and regulator of agricultural water supply in the Jordan Valley. This includes strengthening their water data collection and management and water sector planning capacities; improving the SCADA system and the operations of water storage and distribution networks in the Jordan Valley, and strengthening the role of JVA towards supervising the WUAs in the Jordan Valley.

For the Palestinian farmers it will be required to reduce their per dunum agricultural water demands through the adaptation of cropping pattern, and at the same time to increase their water availability by enhancing water efficiency from wells and pond in the Jordan Valley. This will also require that policies,

regulations and enforcement are developed to better organize agricultural water rights. Furthermore it is proposed to establish 100 dunums of male Palm trees farms and provide them with reproduction seeds, in addition to the construction of 1000 ton capacity packaging and storage centre

Since 2014 an agro-industrial park is under construction near the city of Jericho. This will contribute to strengthening the agricultural economic outputs considerably. The benefits of the agro-industrial park are to be maximized and expanded where possible, including development of a similar agro-industrial zone in Northern Part of the LJV. It is proposed to support and strengthen the Palestinian livestock sector through providing buildings, tools, milking machines, by improving health safety through the introduction of new yoghurt processing units and related measures. It is furthermore proposed to strengthen the Palestinian women organization programs, enhancing the economic conditions for women, including in the Bedouin communities.

The Palestinian agricultural sector is relatively small in size. It is therefore proposed to increase the irrigable Palestinian land by 40,0000 dunums, enhancing the agricultural production and increasing the food security in Palestine. Better and more agricultural roads need to be constructed to increase the accessibility to the different Palestinian agricultural areas, and upon independency of the Palestinian state the 60,000 dunums currently being irrigated by the Israeli settlers in the study area are to be handed over to the Palestinian.

### Jordan Valley Governance

Better coordination will be required to improve management of the valley's joint land and water resources, including water quality.

This Master Plan proposes establishing a trans-national Jordan River Basin Organization and creating a Palestinian Jordan Valley Authority in the Palestinian part of the Jordan Valley.

In preparation for a final peace agreement in the Jordan Valley, it is proposed to assess the feasibility and institutional set-up of a transboundary river basin organization (RBO) in line with the UN Watercourses Convention. The RBO's key objective is to ensure coordinated water resources and quality management between riparian countries Jordan, Israel and Palestine on a shared Jordan River Basin, while addressing the legitimate social and economic needs of each of the riparian states, and to enable joint development and management of water resources infrastructure between the riparians. The Organization may act as a coordinating body for the riparian countries of the LJR, fostering co-operation over water resources through a coordinated, transparent and democratic process, and might ultimately include the collaboration with Syria and Lebanon as well in the context of the whole Jordan River Basin. The objective is that the sector related Steering Committees will eventually be embedded in the structures of this overall River Basin Organization for the Jordan Valley.

The organization may be support by a technical support team, responsible for managing and exchange of transboundary water quantity and quality information, and development of a shared water databank among the three countries. The organization could also focus on joint management of trans-boundary infrastructure, tourism development, nature protection and urban expansion related issues. As reference earlier programs under EXACT – Water Data Banks Program can be looked at.

In addition, it is suggested establish a single Palestinian entity that is responsible for development planning and regulation of the Palestinian part of the Jordan Valley, similar to the JVA on the Jordanian side. This authority shall also address political, economic and environmental sustainability management issues.

## Ecological Rehabilitation

**Table 33 – Ecological Restoration related interventions**

E01	REG	Jordan River Environmental Flows Project
E02	REG	Jordan River Ecological Restoration Project - Regional
E03	REG	Jordan River Fisk Stock Restoration Project
E04	REG	Nature Protection Areas and Management Plan
E05	REG	International Accreditation of the Lower Jordan River Valley
E06	REG	Jordan Valley Regional Coordination on Ecology
E01	ISR	Jordan River Ecological Restoration Project - Israel
E01	JOR	Ecological Corridors around Valleys and Dams
E02	JOR	Wetlands and Aquatic Fauna Restoration Project
E03	JOR	Ecological Monitoring and Management Project
E04	JOR	Jordanian Eco-parks and Projected Areas Project
E01	PAL	Nature Protection Areas and Management Plan

The Lower part of the Jordan River used to flow freely for thousands of years from the Sea of Galilee to the Dead Sea creating a lush wetland ecosystem, rich in biodiversity. The proposed interventions focus on restoring the good ecological status of the Jordan Valley. This will benefit the environment, and will improve the level of eco-services to the people in the valley. The eco-services that the rehabilitation river system will provide, typically include: access to the river for recreation and tourism reasons; water conveyance and supply and minerals (from Dead Sea)

The ecological restoration interventions proposed below depend however on the condition that first the

pollution sources are to be removed from the valley, as discussed before. The aim of the Jordan River Environmental Flows Project is to restore the rehabilitate the Lower part of the Jordan River by increasing the water flow level in the river to an environmental efficient level that will aid in supporting not only the river riparian ecosystem services and biodiversity, but also the biodiversity of the valley in general. This project will depend on the gradual improvement of water quality, water supply and environmental flow into the river, and will include design and implementation of dedicated ecological restoration projects. The realization of this intervention is the corner stone for the success of most of the rest of interventions within this category.

The aim of the Ecological Restoration Project for the Lower part of the Jordan River is to restore the green character of the river again – supporting not only the riparian ecosystem services and biodiversity, but also the biodiversity of the region in general. This project will depend on the gradual improvement of water quality, water supply and environmental flow into the river, and will include design and implementation of dedicated ecological restoration projects and eco-parks along its borders, as well as detailed surface water quality and ecological protection and monitoring projects. One of these projects may relate to assigning “nitrate” vulnerability zones along the river, to prevent emissions of nitrate from farmer practices into the river system.

Such an important project shall contain various components, such as designate specific sections with valuable habitats along the river as “no-touch” zones; performing the ecological rehabilitation for several years while constantly monitoring the changes; expanding the river flood zone, including side wadis, rehabilitation of river banks; dredging the flow channel where needed, and protecting buffer zones between the cultivated agricultural lands and the habitat along the stream.

This project will also require enriching the diversity of natural vegetation with the expected improvement in water quality; treating and removal invasive species and restoring diverse original (native) habitats to increase biological diversity in accordance with their suitability and the

expected flow regime of the river. It furthermore requires preserving the stream meanders, including river bank protection and vegetation management.

Other requirements include landscaping and vegetation rehabilitation in river areas where fragmented, to enable continuous eco-zones, managing the environmental flow regimes in accordance with water availability, including regulated floods for the encouragement of vegetation development in riparian buffer zone and river maintenance in the first period after planting to prevent the overrun by common reed.

It is expected that maintenance and water quality monitoring can be reduced to a minimum after the vegetation is established. This project will be required to create sequences of ecological corridors along the stream including the possibility for the migration of fish upstream to the Yarmouk, development of specific touristic and hiking routes along the river and setting up a tri-partial river management structure for implementation and monitoring. Finally the project will preferably start with a pilot restoration project on each side, such as in Wadi Ziglab in Jordan.

The aim of the Jordan River Fish Stock Restoration Project is to restore and protect the natural fish stock of the river and to recreate the aquatic structure, meeting the future quantity and quality standards of the water flow in the river.

The aim of the proposed Nature Protection Planning project is to make a detailed assessment of the

nature and ecological status through the Jordan Valley, including the nature areas designated earlier by the Israeli Military Authorities in the West Bank, and will lead to defining plans and policies for nature preservation and protection areas, including grazing lands and parks, under Palestinian, Jordanian and Israeli Law, and development of ecological protection plans beyond.

The aim of obtaining international accreditation for the Jordan Valley with international organizations such as UNESCO World Heritage, Ramsar and IUCN Protected Areas is to draw substantially more international attention to the Jordan Valley and to create related ecological protection and economic growth opportunities. However, such accreditation will likely depend on a final peace settlement between Israel and Palestine, and appropriate integrated management structures for the valley.

The purpose of the regional co-ordination intervention is setting up a regional coordination structure, or Steering Committee, among key Jordanian, Israeli and Palestinian governmental stakeholders for the implementation of the proposed national and regional interventions in the Jordan Valley with regards to the Ecology. The objective is that this Steering Committee will eventually be embedded in the structures of the overall River Basin Organization for the Jordan Valley (ref. intervention IC01 REG Jordan River Basin Organization).

The aim of the Jordan River Ecological Restoration Project in Israel is to restore the ecology of the Jordan River Section between Sea of Galilee to

Naharayim (fully located in Israel) and between Naharayim and Bezeq (together with Jordan) as described in the regional intervention E01 REG. This intervention aims not only at the riparian aqua ecosystem services and biodiversity, but also the biodiversity of the region in general.

The aim of the Jordanian Ecological Corridors project around Valleys and Dams is to restore the natural vegetation in areas surrounding dams in the eastern Jordan Valley. This includes also restoration activities in areas surrounding the valleys that flow into the Lower part of the Jordan River. This intervention is designed to support riparian areas ecosystem services and biodiversity, which will have far reaching positive impacts on the biodiversity of the region in general. In addition, work on this intervention will include the improvement of side valleys channel systems and discharge channels; and the reintroduction to these areas the natural plants and forest species as part of a systematical ecological restoration of the eastern Jordan Valley.

The aim of the Jordanian Wetlands and Aquatic Fauna Restoration Project is to recreate the wetland and aquatic structure of the valleys flowing into the Lower Jordan and Yarmouk rivers. This intervention is intended to create a balanced ecological system in which wildlife and aquatic fauna is re-introduced in all relevant elements of the Jordan Valley. In particular, this intervention targets a select number of endemic dragonflies, reptiles, endangered and rare species of relevance to the Jordan Valley. Indirectly, this intervention will have a positive impact on the aquatic life and ecosystem services of the Lower part of the Jordan River as well.

The aim of the Jordanian Ecological Monitoring and Management Project is to protect and regularly monitor the reservoirs of the Arab, Ziglab, Shueib and Kafrein dams from pollution; to create a water management plan for the dams in order to stabilize the populations of natural fish, Bat, Fresh water turtle, Common Otter Egyptian fruit bat; and to declare areas around the Yarmouk and Jordan river as protected national rangeland or forest reserves: including Wadi Damya, Wadi Al Kharar, and King Hussein Bridge surrounding areas.

Finally, the Jordanian Eco parks and Protected Areas Project envisages protection of a number ecological parks and carefully selected special zones including a number of bird observation sites. These include designating the Bakoura area, unique for its natural and cultural values, as a National Park; designating the area of the Al Hujaija Tree as a National Natural Monument; designate the Karamah dam area as a National Park; setting a bird monitoring center at the Bakoura Park, Karamah dam area, and the Jordan River, and expanding the SHE ecological park in the westerly direction until reaching the Jordan River.

### Sustainable Tourism and Cultural Heritage Development

Sustainable tourism and cultural heritage development are **key** strategic objectives for saving the intrinsic cultural heritage and local culture values in the valley, as well as for boosting the economy

**Table 34 – Sustainable Tourism and Cultural Heritage related interventions**

C01	REG	Jordan River Mouth Tourism Information Center
C02	REG	Jordan River Baptism Site Improvement Project
C03	REG	Jordan River Peace Park Improvement Project
C04	REG	Jordan River Regional Routes
C05	REG	Cultural and Historic Museum for the Lower Jordan Valley
C06	REG	Jordan Valley Regional Coordination on CH and Tourism
C01	ISR	Tsemach to Naharayim Tourism Development Project
C02	ISR	Gesher to Bezeq Stream Tourism Development Project
C01	JOR	Pella Tabaqat Fahl Site Improvement Project
C02	JOR	Abu Ubaydah Tomb Improvement Project
C03	JOR	Cultural and Historic Museum for the Lower Jordan Valley
C04	JOR	Archaeological Landmarks Development Project
C01	PAL	Cultural Heritage Protection and Management Plan
C02	PAL	Tourism Branding and Promotion
C03	PAL	Museum of Natural and Cultural History of the Rift valley
C04	PAL	Rehabilitation of the Catchment of Ancient Jericho
C05	PAL	Rehabilitation of salt industry sites, Rusheideyeh
C06	PAL	Rehabilitation of Ancient Jericho
C07	PAL	Rehabilitation of Hisham's Palace
C08	PAL	Rehabilitation of Tel Abu El Alayek
C09	PAL	Rehabilitation of Khirbet El biyadat or Tel Ouja
C10	PAL	Rehabilitation of Khirbet El Makhrouq
C11	PAL	Rehabilitation of Tel El Hamma
C12	PAL	Archaeological Landmark Features
C13	PAL	Spa, Thalasso therapy and Balneo therapy Center
C14	PAL	Jesus Village
C15	PAL	Hiking trail Development
C16	PAL	Sport and Adventure Center
C17	PAL	Travelers Centers
C18	PAL	Hotel Rooms 4 Stars (Resort)
C19	PAL	The Mud Brick Youth Village
C20	PAL	Youth and Guest houses

and create jobs. This will require investments in regional and national projects of various kinds by both the public and private sector. Particularly the investments related to hotels, accommodations and touristic attractions will have to be taken up by the private sector.

The related challenges, as identified by the Palestinian National Strategic Master Plan, include better enforcement and updating existing laws, by laws and regulations; developing urban plans with a clear tourism development vision; more archaeological research; better natural and cultural heritage management, tourism product and infrastructure development and management and strengthening fund management capacities.

In addition it will be essential that the three core parties will develop a regional tourism development policy framework to facilitate and support private investments and take away related obstacles. For instance, the administrative procedures for obtaining visa for various nationalities will have to be simplified, the reputation of the valley as a safe and pleasant destination will have to be established, and the infrastructure, transportation means and accessibility of the valley will have to be improved.

The proposed regional projects include development of a regional Southern tourism center at the meeting point of the Jordan River with the Dead Sea, aiming at providing information and guidance to tourists and visitors to the Jordan Valley. The centre shall be linked to the main tourism related websites for Jordan, Israel and Palestine, and shall be linked to

the main tourism support centers. It also includes improving the tourism facilities at the Baptism site along the River Jordan, particularly with regard to establishing a good restaurant, a rest house, a bookshop and souvenirs shop on the Jordanian site, and a river walk, and integrating the Jordanian and Palestinian site into one concept.

Furthermore it is proposed to combine two eco-parks on both side of the river: Al Bakoura and Naharayim/Gesher into one Jordan River Peace Park'. Here already a small island was created at the junction of the Jordan and Yarmouk Rivers, and the Jeser Al Majama / Gesher site, known as the historical crossing point of the Jordan River Valley. This intervention aims at creating a single cross border tourism bubble with kayaking down the river, a bird park, visitors centers, use of the old railway line, accommodation centers, souvenir shops, and nature and river walks and paths.

Finally it is proposed to establish a coordinated authentic network of museums in the three countries on a regional level, each one complementing the other, and to provide information on the natural, historic and cultural history of the valley from different perspectives, including specific information on the pre-historic importance of sites throughout the valley and key natural and cultural heritage objects and artifacts. This network will support growth of the tourism sector in the valley.

The purpose of the regional co-ordination intervention is setting up a regional coordination structure, or Steering Committee, among key

Jordanian, Israeli and Palestinian governmental stakeholders for the implementation of the proposed national and regional interventions in the Jordan Valley with regards to the CH and Tourism. The objective is that this Steering Committee will eventually be embedded in the structures of the overall River Basin Organization for the Jordan Valley (ref. intervention IC01 REG Jordan River Basin Organization).

The Israeli tourism development interventions aim at developing the region between Tsemach and Naharayim and between Gesher to Bezeq. This includes rehabilitation of Tsemach Old Police Station into visitor information center; restoring the Zero Canal and its flow, to enable rafting and related water tourism; to create combined agriculture – tourism facilities into specific rural tourism concepts and to develop water sports facilities between Naharayim to Old Gesher.

It also includes further development of existing museums, like the Gordon, Pre-historic and agriculture museums; further development of hiking and bicycling tourism routes with various information themes along the river section between Tsemach and Naharayim; rehabilitation of various small sized archaeological sites and tels, and improvement of their tourism facilities and development of a third baptism religious site at Old Gesher as part of the Jordan River Peace Park..

The Israeli tourism development project also includes restoration of the old British Tegart police station at Gesher into a hotel and welcome facility,

to develop water sports facilities between Naharayim and Old Gesher; to build a promenade along the river near Yardena and to further develop the Beit Shean tourism center in the Ottoman Khan area and linking this center to the surrounding tels and the future river tourism along Harod and the Jordan River. It includes rehabilitation of old Flour Mills, construction of a Café and lookout over Jordan River near the Sheikh Hussein Bridge and expansion of Gane Khulda camping site along Harod (500 m from Jordan River) in addition to the current Mongolian tent facilities.

Finally, the Israeli tourism development project includes conversion of current Rupin Kibbutz Fish Pond near Bezeq Stream and Jordan River into a Bird Park; development of a Tourism Information Center within the joint Jordanian – Israeli Gateway Economic Park (3 km north of Bezeq), and linking this to existing facilities and museums; development of hiking and bicycling tourism routes with various information themes along the river section between Gesher and Bezeq, and rehabilitation of various small sized archaeological sites and tels, and improvement of their tourism facilities.

The Jordanian interventions include developing and improving the tourism facilities at Bakoura National Park, Pella and at Abu Ubaydah, particularly with regard to establishing motels, good restaurants, rest houses, bookshops and souvenirs shops, and link the sites to the 20 Decapolis cities. Furthermore it is proposed to develop a Jordanian Cultural and Historic Museum linked to the proposed valley wide network, including information on the natural,

historic and cultural history of the valley; specific information on the pre-historic importance of Deir Alla and presentations of key natural and cultural heritage objects and artifacts. Finally it is proposed to develop a series of important archaeological Tel landmarks in the Jordan Valley. This shall include visiting facilities, provision of touristic and historic back ground information. Finally it is proposed to linking the various sites by touring tracks for pedestrians and bicyclers, linking sites like Tell El Hammar; Tell Es Saidiyeh; Tell Es Sakhneh; Tell Kreinah; Tell North Shuna and Tell Umm Hammad.

The proposed Palestinian interventions include developing a cultural heritage protection and management plan focused on authentic tourism attractions that represent the value of the JV, including site development plans and a Cultural and Natural Heritage Preservation Center (CNHPC). Next it is proposed to promote and brand the Palestinian tourism sector internationally, to stimulate private enterprise growth and investments. Furthermore it is proposed to develop a Palestinian Natural and Cultural Museum linked to the valley wide network, including information on the natural, historic and cultural history of the valley; specific information on the pre-historic sites in the region and presentations of key natural and cultural heritage objects and artifacts.

In addition it is proposed to perform eight particular Palestinian cultural heritage rehabilitation projects, including Ancient Jericho and its surroundings; the salt industry sites at Rusheideyeh; the Hisham's Palace in Jericho Municipality; Tel Abu El Alayek;

Khirbet El Biyadat; Khirbet El Makhrouq and Tel El Hamma, as well as a series of valuable Water Mills, Water Sugar Mills, Water Aqueducts, Water Reservoirs and Watch Towers in the region. Furthermore it is proposed to develop a Jesus Village near Jericho and rehabilitate the Spa Thalassotherapy and Balneotherapy Centers into attractive religious and tourism destinations.

Furthermore it is proposed to develop attractive Palestinian hiking trails for tourists and for local people, particularly between Hezme and Jericho; Kofor Malek and Auja; Nablus and Jiftlik; Tubas Tayseer and Ein el Beida, and to develop a travel center and a Sports and Adventure Center for local, regional and international tourist, including camping facilities and recreation facilities for family based tourism.

In anticipation of the growing number of tourists, it will be required to expand the volume of hotels with an additional 1550 rooms in the region as well. In addition it is proposed to develop traditional mud brick compounds to provide for an authentic stay in a traditional JV village environment, and youth and guest houses to facilitate for low-budget travelers in the region.

## Sustainable Urban, Energy and Infrastructure Development

**Table 35 – Urban and Infrastructure related interventions**

U01	REG	Non-fossil, Renewable Energy Development Project
U02	REG	Adam / Damia Bridge Rehabilitation Project
U03	REG	King Abdullah Bridge Rehabilitation Project
U04	REG	Efficient Border Bridges Crossings
U05	REG	Jordan Valley Regional Coordination on Urban and Infra Dev.
U01	ISR	Center of Excellence at Kinneret College
U02	ISR	Eden Regional Agricultural Research and Training Center
U01	JOR	Infrastructure Development Project
U02	JOR	Urban and Infrastructure development Master Plan
U03	JOR	Higher Education and Vocational Development Project
U04	JOR	Non-fossil, Renewable Energy Development Project
U01	PAL	Urban and Infrastructure development Master Plan
U02	PAL	Educational and Vocational Needs Assessment
U03	PAL	School building Program
U04	PAL	Higher Education and vocational Training Program
U05	PAL	Health Care services Development Project
U06	PAL	Electricity and Telecommunications Development Project
U07	PAL	Develop Renewable Energy Resources
U08	PAL	Import and Export Logistics Center
U09	PAL	Utilization of Dead Sea Minerals for economic production

The interventions related to sustainable urban, energy and infrastructure aim at developing sufficient and affordable urban housing and roads, energy and telecom infrastructure and public facilities in the valley until 2050.

The regional energy development projects aims at creating renewable energy generation schemes in the Jordan Valley, leading towards a 50% renewable non-fossil energy share throughout the valley by 2050. The regional intervention aims at promoting the use of renewable energy sources, such as

biogas; waste-to-energy; small scale solar energy and wind energy potentials in the valley, as well as promoting sustainable energy co-operation in the region. Particularly this intervention aims at boosting the potentials in terms of solar energy, and linking this to vocational education and research facilities in the Jordan Valley.

Furthermore it is proposed to rehabilitate and open the Adam Bridge and Abdullah Bridge for agricultural goods and commercial traffic, as an additional outlet for imports and exports to or through Jordan; and to create more efficient border crossing regulations and procedures for all nationalities at the existing Allenby / King Hussein Crossing and Sheikh Hussein Crossing.

The purpose of the regional co-ordination intervention is setting up a regional coordination structure, or Steering Committee, among key Jordanian, Israeli and Palestinian governmental stakeholders for the implementation of the proposed national and regional interventions in the Jordan Valley with regards to the Urban and Infra Dev. The objective is that this Steering Committee will eventually be embedded in the structures of the overall River Basin Organization for the Jordan Valley (ref. intervention IC01 REG Jordan River Basin Organization).

The current route 65 in Jordan is the main north south road through the Jordan Valley, and crosses all major villages in the valley. However, traffic along the road is dense and relative dangerous, and intersected by many minor roads and used by



pedestrians, slow traffic and heavy traffic alike. It is proposed to support the plans of the Ministry of Transportation, who is responsible for Infrastructure, to rehabilitate this road for local traffic purposes only, including safe pedestrian sidewalks, signs and lighting, and safe crossings, bypasses, green corridors, related parks, and meanwhile constructing a new parallel North-South highway for heavy traffic that bypasses the urban centers.

The focus of the Israeli Center of Excellence at Kinneret College, located at the college southern campus, is on Water and Environment Innovation and Technology open for Israeli, Jordanian, Palestinian and international researchers and students. It aims at developing related research facilities, laboratories and study programs.

The Eden Regional Agricultural Research and Training Center in Israel aims at developing a regional center focused on crop management, improved water management and increase production quantities and qualities. This center is currently based on know-how developed in Israel and serves the Israeli farmers in the Jordan Valley; its activities are also attended today by Jordanian and Palestinian farmers. The aim is to expand this center for the benefit of all farmers in the Jordan Valley, including Israeli, Jordanian and Palestinian farmers.

The aim of the suggested Jordanian and Palestinian urban and infrastructure master plans is to develop detailed urban, infrastructure and physical land use plans for the LJV, taking into account the foreseen

population and economic projections of the Jordan Valley, and considering to foreseen growth of the population to over 600,000 people in Jordan and 500,000 people in Palestine. This requires about numerous housing or apartment units in 2050, including related infrastructure, transport, water, sanitation, electricity and IT related utilities, public services, schools and recreational areas and facilities.

These Jordanian and Palestinian schools and higher education and vocational development projects aims at establishing primary, secondary and university level education facilities in the Jordan Valley to accommodate (future) residents and to utilize hands on education and training to meet the developmental needs and the growing population, including agricultural and environmental research. Addition projects in Palestine are development of healthcare services, including centers and ambulances, and a dedicated import and export center.

The aim of the Palestinian Dead Sea Minerals Development project in to create a research and development centre and production facilities for the extraction of Dead Sea Minerals and Salts, which would be utilized for production of cosmetics and other production inputs, as well as for Palestinian export of raw materials for production by other countries.

## 4.2 Priority Setting

### Introduction

The implementation sequence and timing of the interventions presented above depends on various factors. First, those interventions that require full co-operation among the three riparian countries can only be implemented upon establishment of Palestine as an independent state, which for the sake of this NGO Master Plan was set as 2020.

Secondly, some interventions have a logical sequence, where the initiation of one intervention depends on the results of others. For instance, rehabilitation of the ecosystems in the Lower part of the Jordan River depends first on a successful removal of inflow of polluting substances into the river.

Thirdly, the sequence of the interventions depends on the sense of urgency felt by the key stakeholders considering the limited financial resources and absorption capacities of implementing organizations. In this context, the project organized a series of stakeholder meetings, where the long list of interventions were presented, discussed and prioritized in accordance with a pre-set list of evaluation criteria.

SIWI developed the criteria for prioritizing the interventions based on a quantifiable, cross-cutting approach that scores interventions according to how they contribute to WEDO / EcoPeace's vision for the

Jordan Valley, including:

- Prosperity: Interventions should create opportunities to lift residents off poverty and contribute to the region's economic development;
- Peace: Interventions should have a peace-dividend, contributing to the wider integration of the river basin and create space for constructive cooperation between the three riparians;
- Sustainability: Each intervention should aim to maintain a positive impact on the environment and avoid degradation of existing resources, maintain a positive impact on society and become self-sufficient financially within a specified period of time.

The stakeholders were asked to evaluate the interventions against the following considerations. To the extent that the interventions:

- Increase water availability, including drinking water and sanitation?
- Generate positive socio-economic impacts including peace prospects?
- Eliminate vector borne diseases and other health impacts?
- Improve habitats and ecosystems?
- Improve water quality?
- Are technical sound (e.g. ease of implementation, redundancy and robustness of the solution, flexibility to changing conditions, durability)?
- Are compatibility to existing plans and policies?

- Require costly investments?
- Receive political support?

### Short Term versus Long Term Interventions

As presented above, the interventions were prioritized and grouped into: (1) Short term interventions and (2) Long term interventions. Short term interventions are defined to possible be implemented before 2020, the suggested year of the establishment of an independent Palestinian State. Long term interventions depend on the outcome of others, or on the prior establishment of the Palestinian State. They can be implemented after 2020.

All proposed pollution control related interventions received high priorities, and can be implemented in the shortest possible notice. These interventions will have direct positive impacts in terms of environment, ecology and public health, and will pave the way for other interventions, such as restoration of the ecology in the valley and maximized reuse of treated wastewater. Next, the sequence and timing of the interventions related to pollution control depend on the financial resources and absorption capacities of implementing organizations. An exception is the suggested intervention related to remediation of mine fields and Israeli military bases, which depends on reaching a peace agreement between Israel and Palestine and should therefore be considered a Long Term intervention.

The proposed water management and river rehabilitation interventions include both short term and long term interventions. The short terms interventions include all projects related to wastewater treatment and reuse and rehabilitation of springs and wells. The long term interventions depend on regional co-operation or Palestinian access to area C, such as the development of the Jordan River as the natural conveyance systems, drilling new wells in area C and projects directly related to joint ecological and economic water management of the Jordan River.

The proposed agricultural interventions also received high priorities, since they have direct positive impacts in terms of water use efficiencies and increasing agricultural economic outputs. Most of the Jordanian interventions can be implemented in the shortest possible notice, with the exception of wastewater reuse actions, which depend on the realization of full collection and treatment of generated wastewater in the valley. The Palestinian agricultural interventions largely assume Palestinian control over area C, and are therefore mostly to be considered as Long Term Interventions. Some exceptions are policies and capacity strengthening interventions, such as supporting communities and organizations, promotion of farmer associations and strengthening the extension services in the valley.

The proposed basin governance interventions are by definition long term, since they depend on either full accessibility of the Palestinian Authority over the areas C, or on the establishment of Palestine as an equitable riparian partner. The proposed ecological

rehabilitation interventions are long term as well, since they depend on either on a successful removal of inflow of polluting substances into the river, or on full accessibility of the Palestinian Authority over Area C.

Some of the interventions on sustainable tourism and cultural heritage can be implemented in the short term, while others have a longer perspective. All Jordanian site specific interventions can be implemented in short term, and so can the proposed Palestinian site specific interventions in areas A. All projects with a regional component, such as establishment of a network of cultural and natural museums or regional tourism information centers, or project located in area C are considered to be long term interventions.

The proposed investments in Urban and Infrastructure Development assume a supportive economic development, which goes hand in hand with the realization of the above mentioned types of interventions. Also considering the fact that they are costly and require donor, public and private financing, and these interventions are all considered to be long term, although preparatory work might advance before 2020.

### 4.3 Disbursement and Finance

As presented in table 27, the totally required investments are 4.58 Billion US Dollars until the year 2050, excluding operation costs. The annually required disbursement schedule is shown below.

As shown above, the annual investment requirements gradually increase until the year 2025 and then gradually decline until the end of the planning period in 2050. During the short term period until 2020 the investment are still relatively modest, and mainly focus on pollution control,

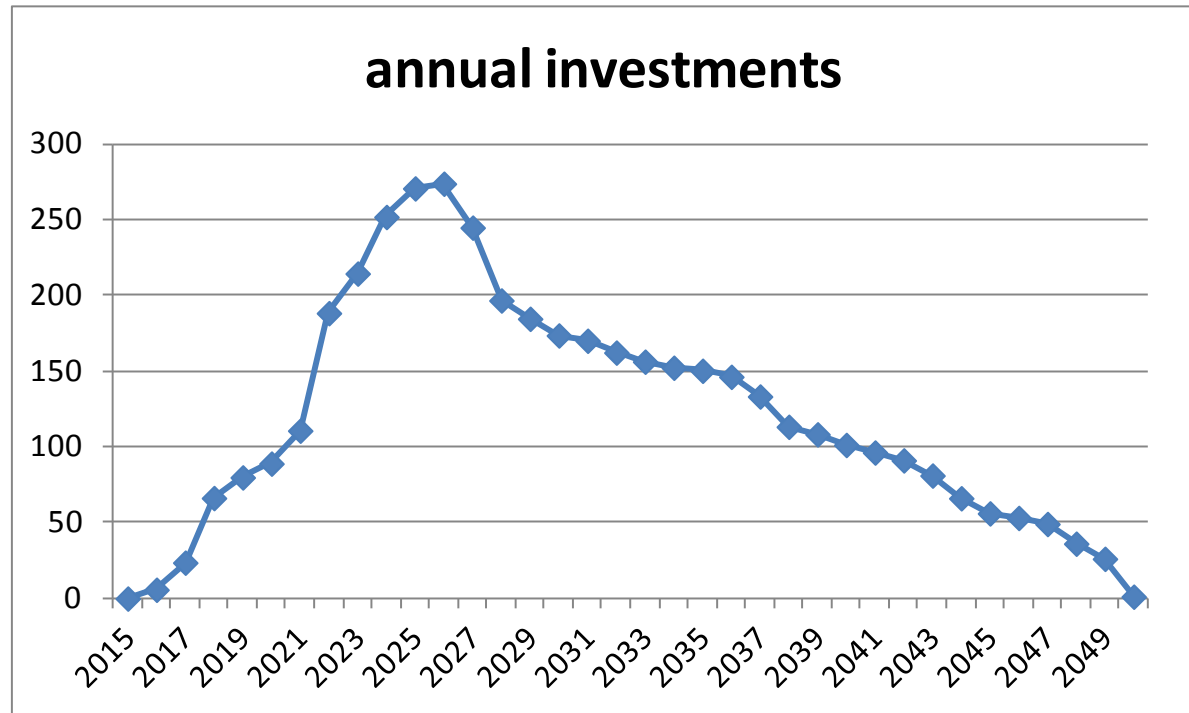
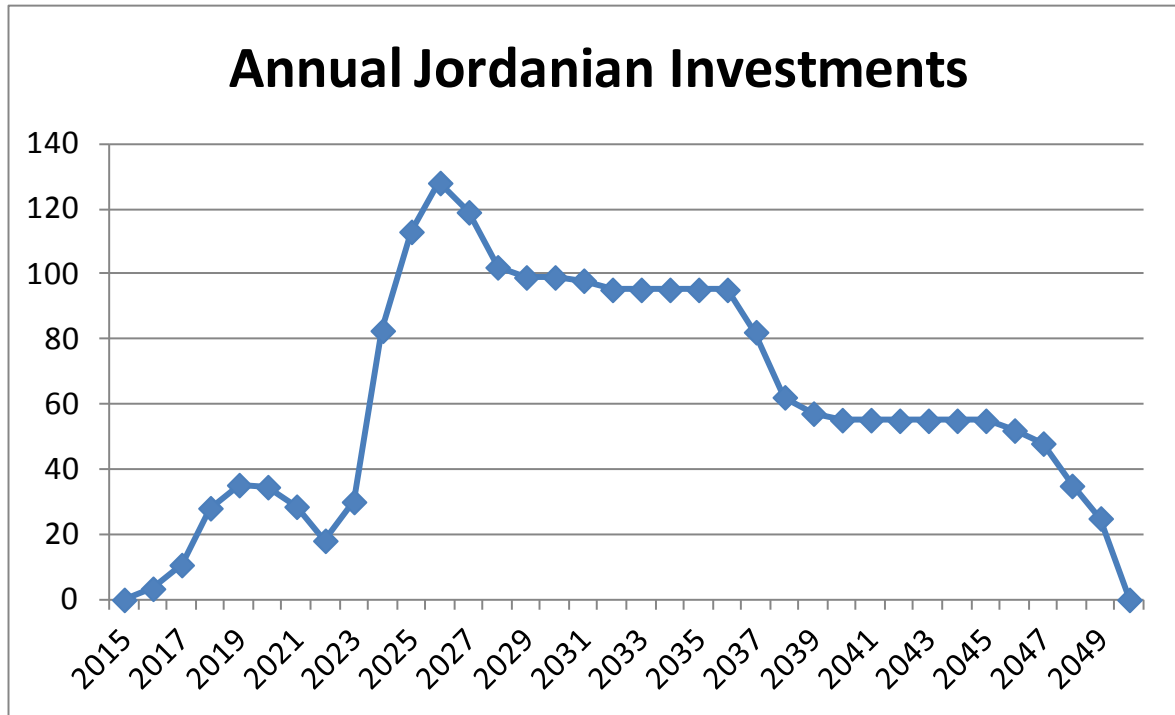


Figure 29 – Total Disbursement Requirements in MUSD per year



**Figure 30 – Jordanian Disbursement Requirements in MUSD per year**

water management, agriculture and the tourism sector. The bulk in the investment will be required in the Long Term from 2020 onwards and include urban and transportation development investments. The annual investments will reach its maximum in 2025, when about 260 MUSD of investments will be required, of which 76% relates to urban development and infrastructure investments.

The disbursement requirements for the national Jordanian, Israeli, Palestinian and regional interventions are presented below.

This Regional NGO Master Plan for the Jordan Valley does not provide a detailed financing model for the required investments. The philosophy of this Master Plan predicts that the investments proposed here will gradually increase the economy of the region in a sustainable manner that will benefit the

people, including related tax revenues, private savings, and eventually investment power; as well as the environment and the ecological status of the Lower part of the Jordan River itself. This will particularly be the case if regional co-operation among the three riparian countries will flourish in a peaceful and safe living environment, which will also lead to higher number of international tourists visiting the region.

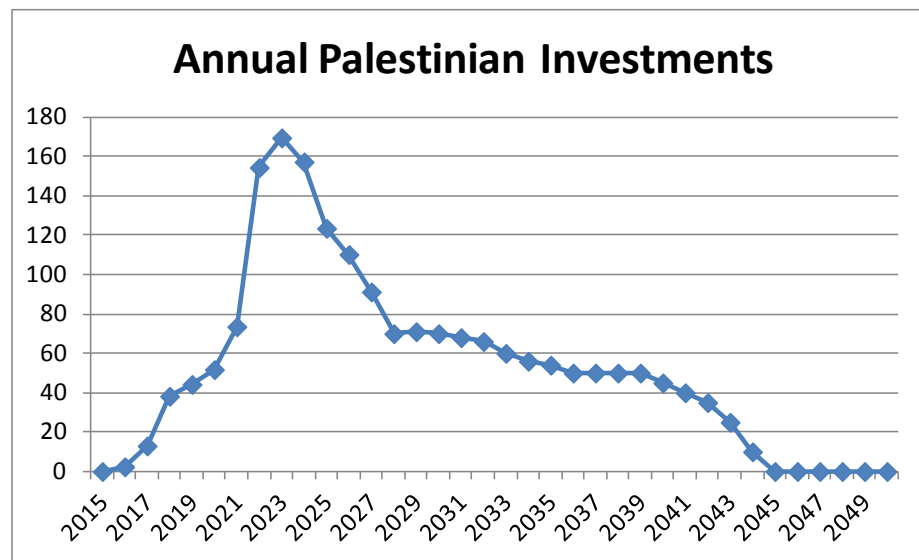
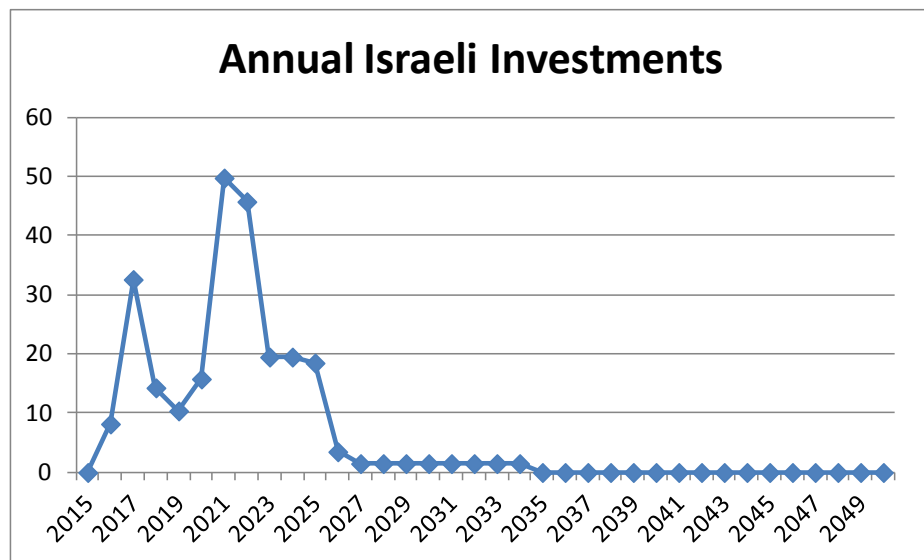
The Israeli financing requirements are to be provided by a combination of public and private Israeli investments. The type of financing required for Jordan and Palestine relates to the type of interventions, and will strongly depend, particularly during the initial 5 to 10 years of this Master Plan, on international donor funds. During this phase promotion and dissemination of this Master Plan and related investment plans will remain important to gain support from the international donor community. Particularly the NGO sector, including WEDO / EcoPeace may play a key role during this period.

It is expected that gradually the local and national Jordanian and Palestinian governments will gain finance strength as a result of economic growth and higher tax revenues, leading to a higher public sector participation in the required investments. The proposed Israeli national interventions will likely to be financed from the allocated governmental budgets and related private partnerships.

The private sectors in Jordan and Palestine will likely become increasingly important as well in contributing to the required investments, particularly

private sector join forces in those cases where this leads to win-win situations for both

and listed in table 27, separated for donor funds, public investments and private investments.



**Figure 31 – Israeli Disbursement Requirements in MUSD per year**

**Figure 32 – Palestinian Disbursement Requirements in MUSD per year**

for those projects that lead to healthy revenues against acceptable internal rates of return (IRR).

Examples may be the proposed water reuse projects; agricultural improvement projects, urban development projects and tourism – cultural heritage related investments. Also the farmers will be able to pay more "realistic" water prices once the basin economy grows and agricultural outputs improve. Combination may also be possible, such as Public – Private Partnership in which the government and the

In this Master Plan it is assumed that the required investments in the Jordan Valley, particularly in Jordan and Palestine will depend on international donor funds at least until 2030, reaching its peak by 2023 with about 150 MUSD donor investment requirements for that year. It is assumed that gradually national public investments and later on private investment will catch up due to increasing economic opportunities in the valley. This leads to the following investment scheme for the total package of interventions that have been proposed

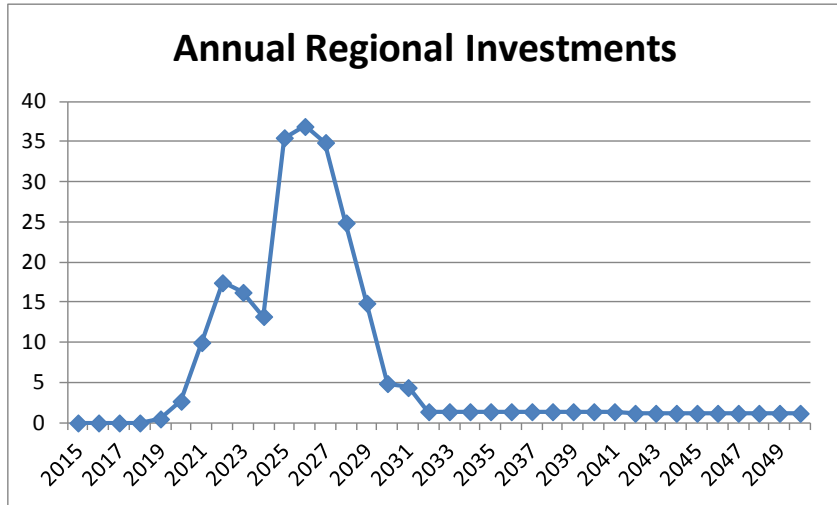
#### 4.4 Institutional and Governance Aspects

The aim of the proposed interventions in this Regional Master Plan for the Jordan Valley is to use it as an advocacy tool with national stakeholders, international financiers and various actors of the international community to increase political will for the adoption in full or in part of the proposed interventions. The interventions that have been described in annex 1 include a suggested

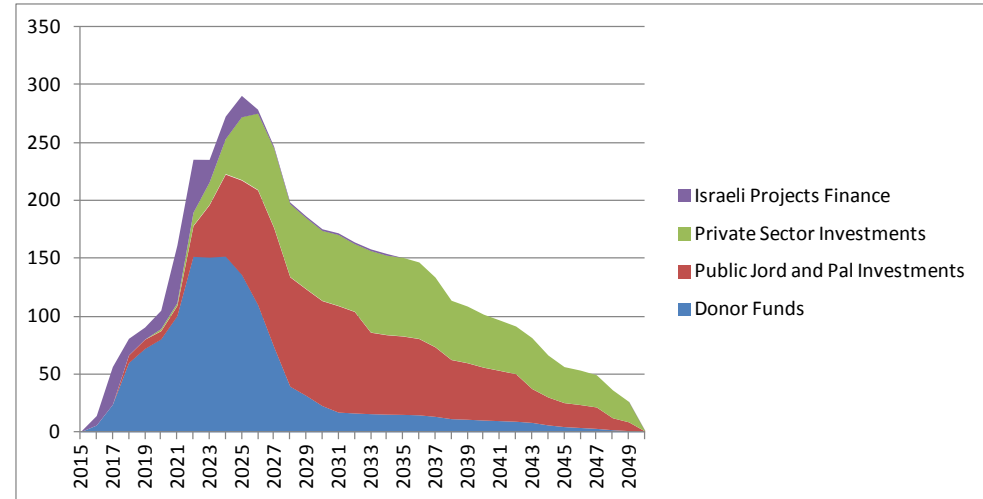
institutional setting for each. Financing for the proposed interventions has yet to be secured, and will require additional preparation and design

implementation of the suggested interventions, since they represent the local population living in the valley, and they play a key role in providing services

environmental protection activities, and engaging and organizing the local stakeholders in the further preparation and implementation of the proposed



**Figure 33 – Regional Disbursement Requirements in MUSD per year**



**Figure 34 – Funding Model for the Jordan Valley in MUSD per year**

activities, including elaboration of the proposed institutional and governance aspects, also depending on the specific requirements of the financiers, either nationally or internationally. However, it is foreseen that the national authorities will play the major role in implementation of most of the interventions, since its main task is the development, protection and improvement of the water and environment in the Jordan Valley.

The Municipalities and the civil community have to play an important role in the further preparation and

to these inhabitants in terms of water, wastewater collection and solid waste management. The subsidiary principle is again here relevant. In addition, proper Environmental and Social Impact Assessments, including stakeholder participation and if needed Resettlement Action Plans shall be part of all infrastructure preparation works.

Finally WEDO / EcoPeace Middle East is foreseen to play a key role in most of the interventions as one of the major NGO's active in the Jordan Valley, particularly with regard to organizing grass root

interventions. Furthermore, WEDO / EcoPeace as a unique organization at the forefront of the environmental peacemaking movement is therefore very well equipped to help promote trans-boundary co-operation and dissemination components of the proposed interventions.

# THE YEAR 2050

## 5.1 The Economy of the Jordan Valley in 2050

Under the scenario and strategy described in this Regional Master Plan, by 2050 the Jordan Valley will be a co-operative, confident and peaceful region with a healthy economy and strong development perspectives for the people living here. They will experience a clean and healthy environment and sufficient flows in the Jordan River to sustain healthy eco-systems. At the same time the river will act as natural water conveyor and source for water supply in the Jordan Valley. Water will be equitably shared among the three riparian countries and the valley will be freely accessible for all nationalities within an appropriate security framework. Local, private and foreign investments will be encouraged due to the stability in the region. In short, there will be an investment climate resulting from the reforms in general, and a conducive regulatory business environment that promotes sustainable development.

In 2050 the valley will house around 750,000 people in Jordan, 500,000 people in Palestine and 90,000 people in Israel, who will enjoy their living environment in terms of living, working and recreational conditions. They will live in a comfortable and sustainable urban setting with an average of about 3.5 people per household. There will be about 370,000 household units in the valley,

compared to about 65,000 today. This will be the result of substantial investments in urban and infrastructure projects in the range of 3 Billion US Dollar until 2050, with relative smaller housing units than existing today. Meanwhile the roads and infrastructure have been upgrade with adequate traffic safety measures, including efficient public transport, bypasses around urban centers, pedestrian and bicycle sideway capacities and more.

Due to investments in tourism, sustainable agriculture and agri-business, as well as in housing, infrastructure, higher education and public services the people in the valley will enjoy attractive job opportunities. The economy will become more service and high added value oriented, with a higher percentage of people being employed in the service sector. The average income will have risen substantially to about 14,000 USD per person or about 50,000 USD per household in Jordan and Palestine and to about 72,000 USD per person in Israel.

In 2050 the Palestinian economy will experience substantial growth, unrestricted by land use or access and sufficient water resources to meet their demands as described before. This will have

synergetic positive impacts on the valley economy at large, due to growth of export and import of goods and knowledge both from Israel and Jordan.

The valley economy in 2050 will strongly benefit from the expanding construction and real estate sector, responsible for the realization of the additionally required infrastructure and urban housing units. This in turn will have an economic spin off to related sectors, such as the stone and marble industries, public utilities, commercial sectors, telecommunication and more. In addition it is expected that land prices rises will contribute substantially to the overall economic growth. This will particularly be the case for the Palestinian land prices in (previous) area C. For instance the World Bank's economic analysis of area C and its future economy (Orhan Niksic et al, 2014) indicates that current cost per dunum in area C is around USD 2,000 to 5,000 compared to USD 150,000 per dunum in area A. These differences will gradually disappear in a future independent Palestine, leading to an increase of average land prices.

The tourism industry will be one of the cornerstones of the valley's economy in 2050 and will largely benefit for the full co-operation among the three riparian partners that is foreseen by then. Up to 5 –

10 Million of national, regional and international tourists per year will visit the cities, nature parks, the cultural and religious sites and a wide variety of museums established in the valley, leading to an economic growth in the range of 5 – 10 Billion USD per year. In addition, the expanded urban centers will provide wide variety commercial services. This leads to an estimated 6,000 people in Israel being employed in the tourism and commerce sectors, 40,000 people in Jordan and 33,000 people in Palestine.

By 2050, security related issues in the valley will be managed by a Security Coordination Body, representing key security officials of Israel, Palestine and Jordan. This body will assess and manage the security issues in the valley objectively and professionally, doing justice to the legitimate mobility rights of all people living in the valley, and the legitimate security rights of the people of Israel, Palestine and Jordan.

By 2050 agriculture in the valley has developed into a sustainable and agri-business oriented sector, making efficient use of the valuable water resources and generating high economic revenues as result of efficient extension services, high quality agricultural products and good access to regional and international markets. Due to efficiency measures, about 5% of the working force will be directly employed in agriculture.

The 2050 fiscal benefits for the riparian partners related to the projected economic growth, will be substantial, including VAT, income and corporate

profits related taxes. This will lead to about 10 Billion of tax revenues within the valley. As described earlier in section 4.3, part of these public revenues will be re-invested in public domain infrastructure, public utilities and buildings, education, health care and more. As a result of this, the required annual investment packages identified in this Master Plan will be provided fully by governmental budgets, replacing fully the international donor funds sometime between 2025 and 2030, following later by substantial private sector investments as well.

Finally, in 2050 the three riparian countries will have established an efficient transboundary River Basin Organization, which ensures coordinated water resources management between Jordan, Israel and Palestine on a shared Jordan River Basin, addressing the legitimate social and economic needs of each of the riparian states, to enable joint development and management of water resources infrastructure among the riparians. It will act as a coordinating water management body for the riparian countries of the LJR, fostering economic co-operation over water resources through a coordinated, transparent and democratic process. Projections of the main economic parameters for 2050 in the valley are presented in above table. The total combined valley economy will reach 73 Billion USD by 2050, compared to only around 5 Billion USD in 2010.

The presented economic projections for 2050 depend of many factors beyond the aspects of peace, co-operation and effective basin water

management described in this Master Plan. This may include factors like export opportunities, wider global economic and geo-political developments, future trade agreements, level of future education, availability of credits and more. However, assessing these developments would require elaborated regional and global geo-economic projections, which go beyond the scope of this Jordan Valley NGO Master Plan.



**Table 36 – Economic Parameters Jordan Valley by 2050**

<b>2050</b>	<b>Jordan</b>	<b>Israel</b>	<b>Palestine</b>
Average Household size (persons)	3,5	3,3	3,5
Average Income pppy, USD	14.000	72.339	14.000
Employment Agriculture (%)	5,00%	1,60%	5,00%
Employment Manufacturing / Constr	17,00%	16,50%	17,00%
Employment Tourism / Commerce	20,00%	19,50%	20,00%
Employment Transportation	3,80%	3,80%	3,80%
Employment Services / others	54,20%	58,60%	54,20%
GDP per person, USD	42.000	100.000	42.000
Total national Inhabitants	593.189	88.200	502.531
Total foreign population	150.000	0	0
Number of households	199.483	26.727	143.580
Buit up area requirements (km2)	107,0	35,7	78,8
Total Income (Billion USD / year)	9,35	6,38	7,04
Employees Agriculture	9.886	470	8.376
Employees Manufacturing / Constr	33.614	4.851	28.477
Employees Tourism / Commerce	39.546	5.733	33.502
Employees Transportation	7.514	1.117	6.365
Employees Services / others	107.170	17.228	90.791
GDP Jordan Valley (Billion / year)	29,9	20,4	22,5

**Table 37 – Projected Land Use (km2)**

Area (km2)	Israel	Jordan	Palestine	Total
<b>2010</b>				
Uncultivated / nature reserves	61.9	810.3	671.3	1,543.5
Agriculture	178.3	451.8	173.0	803.1
Built up area	19.6	44.6	25.3	89.6
Fish Farms	21.5	0.7	0.3	22.6
Water reservoirs	0.61	5.55	0.26	6.43
Wadis	5.3	24.2	13.8	43.24
<b>TOTAL</b>	<b>287.2</b>	<b>1,337.2</b>	<b>884.0</b>	<b>2,508.4</b>
<b>2050</b>				
Uncultivated / nature reserves	45.8	747.9	575.1	1,368.8
Agriculture	199.8	451.8	215.7	845.9
Built up area	35.7	107.0	78.8	221.5
Fish Farms	0	0.7	0.3	22.6
Water reservoirs	0.61	5.55	0.26	6.43
Wadis	5.3	24.2	13.8	43.24
<b>TOTAL</b>	<b>287.2</b>	<b>1,337.2</b>	<b>884.0</b>	<b>2,508.4</b>

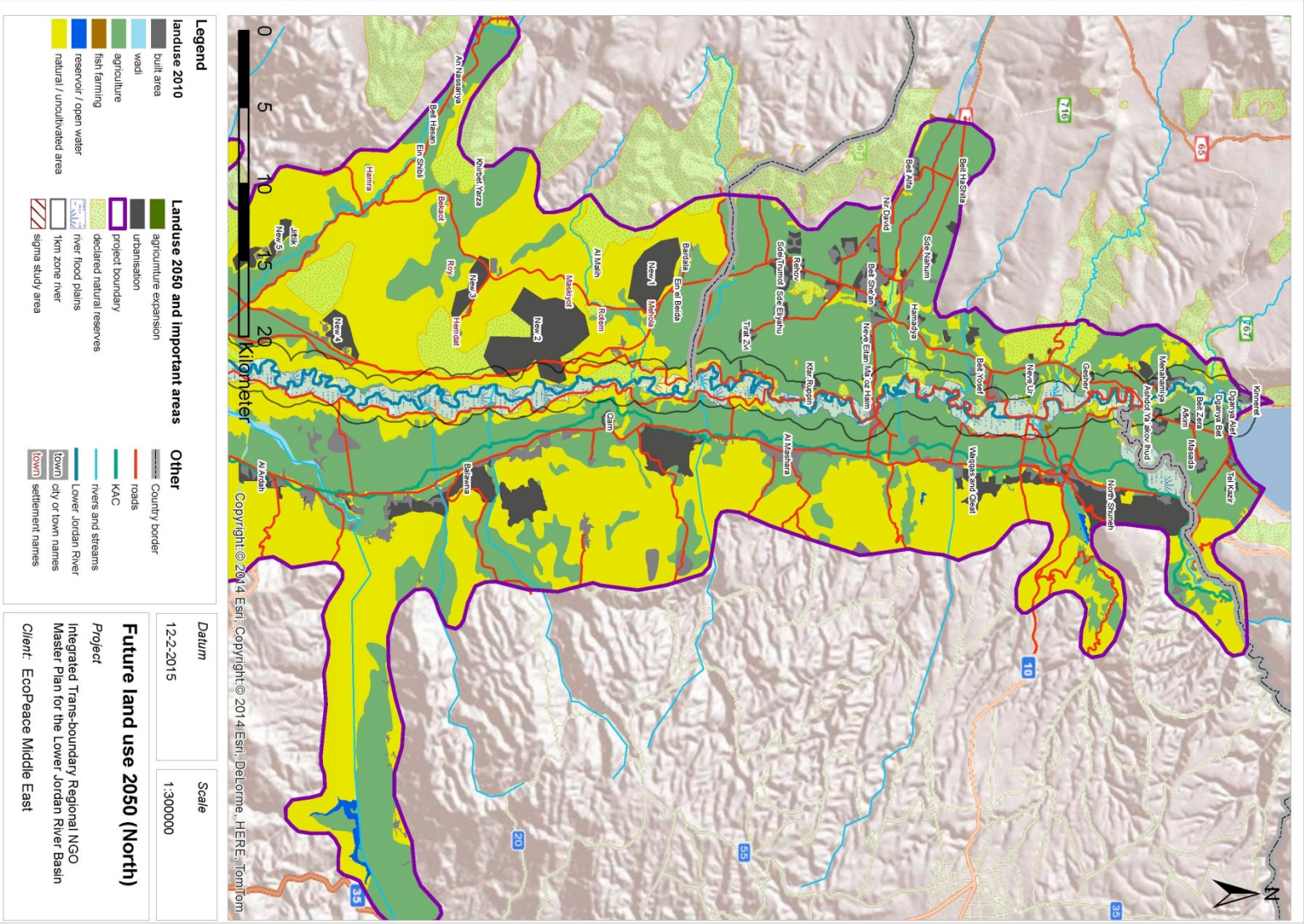


Figure 35 – Land Use Map 2050 for the Northern Part of the Jordan Valley

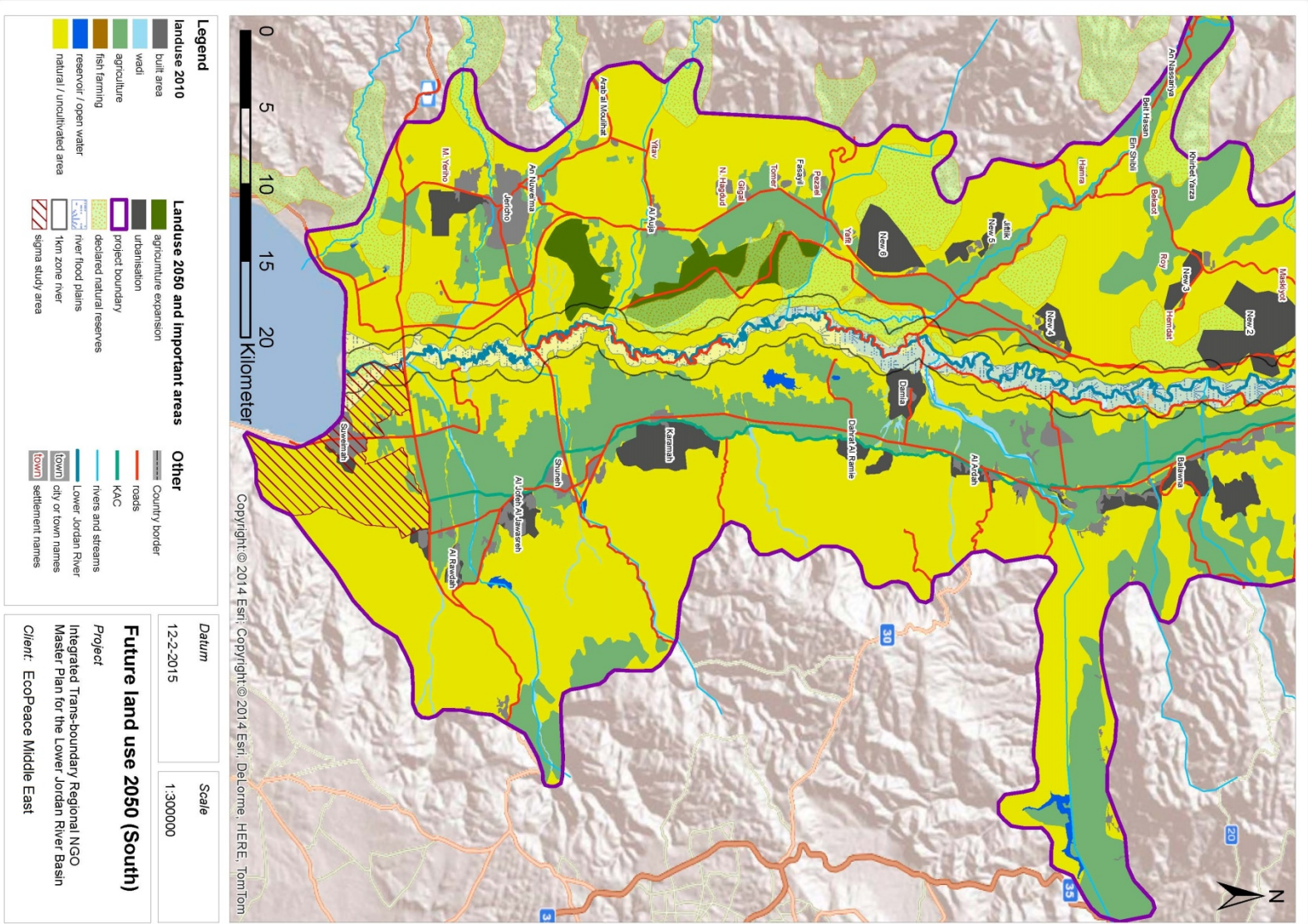


Figure 36 – Land Use Map 2050 for the Southern Part of the Jordan Valley

## 5.2 Land Use in 2050

The 2050 Land use plans have been developed on the basis of existing governmental land use allocation plans in Jordan and Israel, including the Israeli governmental northern district outline plan; and the Jordanian Jordan Valley Land Use Plan developed by JVA with support from the US Agency for International Development. Next, these plans have been modified on the basis of the 2050 population projections and related land additional land requirements. In Palestine no land use plans have yet been developed, and future plans have been developed after careful evaluation of current land use and various discussions with key stakeholders, including the Governorate and Municipality of Jericho.

Within this study, the following land types have been distinguished:

### **Uncultivated lands and nature reserves**

These lands have not been developed, and part is controlled and protected as nature reserves. In addition, these lands are important for reasons of groundwater infiltration, as pastures, for sustaining nature and wild life, for recreation purposes and natural landscapes values, and as archaeological potential areas.

For 2050 it is assumed that the nature reserves remain to be protected, in addition an extra 1 km zone on both sides of the Jordan River. This zone will serve as new aquatic eco-zone and flood plain connected to the rehabilitated Jordan River. In

addition, part of the non-protected uncultivated area will be developed in 2050 for urban expansion and infrastructure purposes as indicated in table 35. Furthermore, an additional 43 km<sup>3</sup> of uncultivated land in Palestine will be developed for agricultural purposes by 2050.

### **Agriculture**

The lands currently used for agriculture have since long been used for reasons of soil fertility and water availability. However, some of the palm plantations have been developed only recently and irrigated with slightly brackish water. In this master plan it is assumed that this agricultural land will also in 2050 remain available for this purpose, and that no additional land in Israel and Jordan has been developed for agriculture. The agricultural lands however will apply more efficient water usage and generate higher economic outputs per km<sup>2</sup> in 2050.

In Palestine, an additional 42.7 km<sup>2</sup> of uncultivated land will be added to the agricultural area, and will be supplied with water from the Jordan River in 2050 mainly for palm plantations. The agricultural areas will next be protected in accordance with the following categorization: cat 1: highest value agricultural land with a slope of less than 5%; cat 2 valued agricultural land with a slope between 5% and 20%; cat 3 valued agricultural land with a slope of more than 20%.

### **Built up area**

The built up area is defined here as space required for infrastructure and urban areas. The requirements for built up land will grow substantially until 2050 to

facilitate a population growth close to 750,000 people in Jordan and 500,000 people in Palestine. As mentioned earlier, it is assumed that the Israeli population will grow from 49,000 today to about 88,000 in the year 2050. See also table 21 above.

The proposed allocation of built-up area proposed in the 2050 land use plans are fully based on earlier developed land use plans by the responsible Jordanian and Israeli authorities. In Jordan, for instance, substantial urban expansion is foreseen in North Shuneh, near Waqqas and in the middle and southern regions near Qarn, Balawna and Karamah. In addition a new economic development zone, called the Sigma Study Area has been planned in near the Dead Sea. The total built-up area in Jordan will grow from 44.6 km<sup>2</sup> today to about 107 km<sup>2</sup> in 2050. In Israel the built up area will grow from about 20 km<sup>2</sup> to about 35 km<sup>2</sup> in 2050. These plans include expansion of secondary and primary roads, and linkage to national highway system and public transport requirements.

In Palestine no regional land use plans have been developed that facilitate a population growth up to 500,000 by 2050. However, the “Jericho Master Plan – A Model for Sustainable Development”, was developed in 2014 with support from the Italian Government. This urban master plan aims at preservation the unique historic and cultural tangible and intangible heritage of Jericho; preserve the cultural landscape of the oasis and of the natural landscape of the desert; enhance the role of Palestinian Gate towards Jordan and the rest of the

world; reinforce sustainable development and develop sustainable tourism in Jericho.

After careful evaluation of these existing plans, current land use and various discussions with key stakeholders, including the Governorate and Municipality of Jericho, it has been decided to locate the new urban areas in the Northern part of the West Bank. The cities are called “New 1; New 2 and New 3”. Furthermore three areas in the Middle section have been allocated for urban expansion, called “New 4, New 5 and New 6”. Finally the area south of Jericho has been allocated for urban growth. This area is already subject to land development projects, such as the Jericho Gate project and the agro-industrial park being developed here. Totally, the Palestinian built up area will grow from about 25.3 km<sup>2</sup> today (including settlements) to 78.8 km<sup>2</sup> in 2050 (no more settlements).

### **Fish Farms**

The foreseen land use by 2050 in Israeli part of the Jordan Valley is based on Israel's governmental northern district outline plan. This plan does not include extensive fish ponds anymore, since it is assumed that some turned into intensive closed system sustainable ponds with elimination of all pollution related problems, and some will have developed alternative agricultural activities instead.

### **Water reservoirs, wadi's**

In the proposed 2050 land use maps the lands allocated today for water reservoirs and wadi's will remain to be used for these purposes in 2050.

## **5.3 Water Related Impacts in 2050**

This section provides a description of the water model that has been developed for the Jordan Valley under this study. The model has been constructed using the “Water Evaluation and Planning” (WEAP) software. This model WEAP has been built upon earlier models that have been developed for the area, including the WEAP model for the Roadmap for the Rehabilitation of the Lower part of the Jordan River, the Harmonized Water Database for the Jordan Valley, the Model for Water Supply and Demand for Effective Water Management Allocation in the Jordan Valley, and the WEAP Model for an Integrated Approach to Sustainable Management of the Jordanian Water Resources under Global Change by Glowa.

WEAP is based on the principle of closing the water balance in a valley, in order to understand the balance between the total water resources on the one hand, and the total water consumption on the other hand, leading to a model for the monthly and annual flows in the Lower part of the Jordan River, as well as the salinity levels in the river. A preliminary step to develop future planning alternatives is creating a model of the present state, or current account.

General issues relate to the river modeling, including the timeframe, salinity, direct contact between groundwater and the LJR, runoff, and evapotranspiration from the LJR.

### **Time Frame**

The hydrological year taken in evaluation is the year 2050, from October 1<sup>st</sup> 2049 until September 30<sup>th</sup> 2050 of the next year, with monthly model steps in between. The hydrological data include the projections of available water resources against protected climate impacts, including reduction in rainfall and increased evaporation rates.

### **Projected Water Demands**

The projected water demands that have been considered within valley are presented in the next table. Details of these demands have been presented before.

As shown below, the proposed water resources will be more or less sufficient to provide the required water demands throughout the Jordan Valley by the year 2050.

**Table 38 – Total Water Demands in the Jordan Valley**

<b>Total Domestic Water Demands LJRB (CM)</b>				
		<b>2010</b>	<b>2025</b>	<b>2050</b>
	Jordan Domestic	22.239.720	29.843.979	51.955.104
	From LJR Basin To Amman , North Gov.	60.000.000	80.000.000	100.000.000
	Israel Domestic	4.410.000	5.197.920	7.056.000
	Palestine Domestic	3.922.890	9.903.915	40.202.480
	<b>TOTAL</b>	<b>90.572.610</b>	<b>124.945.814</b>	<b>199.213.584</b>
<b>Total Agricultural Water Demands LJRB (CM)</b>				
		<b>2010</b>	<b>2025</b>	<b>2050</b>
	Jordan Agriculture	276.258.306	276.258.306	276.258.306
	Israel Agriculture	151.652.000	151.652.000	151.652.000
	Palestine Agriculture	85.170.469	125.170.470	125.170.470
	<b>TOTAL</b>	<b>513.080.775</b>	<b>553.080.776</b>	<b>553.080.776</b>
<b>TOTAL WATER DEMANDS LJR BASIN</b>		<b>603.653.385</b>	<b>678.026.589</b>	<b>752.294.360</b>
<b>Total Water Resources (MCM / yr)</b>		<b>506,18</b>	<b>658,67</b>	<b>744,34</b>
<b>Total Deficit (MCM / yr)</b>		<b>97,47</b>	<b>19,35</b>	<b>7,95</b>

**Table 39 – Jordanian Water Demands and Supply in the Jordan Valley**

Total Domestic Water Demands		2010	2025	2050
		JMD 1	Agwhar Shamaliyah	6.536.580
JMD 2	Deir al Alla / Balqa	4.075.500	6.552.796	13.041.600
JMD 3	Shoonah / Janoobiyah	4.217.640	6.781.336	13.496.448
JMD 4	Foreign population	7.410.000	6.000.000	4.500.000
JMD 5	to Amman (and northern governorate)	60.000.000	80.000.000	100.000.000
<b>TOTAL</b>		<b>82.239.720</b>	<b>109.843.979</b>	<b>151.955.104</b>
Total Agricultural Water Demands		2010	CM / yr 2025	2050
		JAD1-4	Zone 1 (115,300 dunum)	103.596.865
JAD5-8	Zone 2 (74,959 dunum)	107.169.170	107.169.170	107.169.170
JAD9-16	Zone 3 (120,835 dunum)	65.492.271	65.492.271	65.492.271
<b>TOTAL</b>		<b>276.258.306</b>	<b>276.258.306</b>	<b>276.258.306</b>
<b>Total Water Demands (CM / yr)</b>		<b>358.498.026</b>	<b>386.102.285</b>	<b>428.213.410</b>

This water is will be supplied to: 2050				
Total Domestic Water Supply (CM / yr)		2010	2025	2050
JMD 1	Agwhar Shamaliyah	6.536.580	10.509.846	20.917.056
JMD 2	Deir al Alla / Balqa	4.075.500	6.552.796	13.041.600
JMD 3	Shoonah / Janoobiyah	4.217.640	6.781.336	13.496.448
JMD 4	Informal population (according to JVA)	7.410.000	6.000.000	4.500.000
JMD 5	to Amman / Northern Governorate	60.000.000	80.000.000	100.000.000
<b>Domestic Subtotal</b>		<b>82.239.720</b>	<b>109.843.979</b>	<b>151.955.104</b>
Total Agricultural Water Supply		2010	CM / yr 2025	2050
JAD1-4	Zone 1 (87,000 dunum in 2010)	81.841.523	103.596.865	103.596.865
JAD5-8	Zone 2 (74,959 dunum in 2010)	71.803.344	97.577.530	104.489.941
JAD9-16	Zone 3 (70,041 dunum in 2010)	32.746.135	55.733.922	60.252.889
<b>Agriculture Subtotal</b>		<b>186.391.003</b>	<b>256.908.317</b>	<b>268.339.695</b>
<b>TOTAL SUPPLY</b>		<b>268.630.723</b>	<b>366.752.296</b>	<b>420.294.799</b>

Total Water Resources Jordan LJRB	2010	2025	2050
	Tiberias Carrier Pipe	47,00	100,00
Purchased DW to Amman	9,00	9,00	9,00
Groundwater wells in LJR Jordan	26,74	25,95	24,68
Yarmouk River	15,21	14,76	14,04
Import of Treated WW (Irbid and Amman)	0,00	14,00	29,00
Mukheiba Well Field	27,70	26,88	25,57
Wadi Arab Dam	10,98	10,66	10,14
Wadi Ziqlab Dam	3,06	2,97	2,82
Wadi Al Jurum	2,30	2,23	2,12
Wadi Abu Ziad	0,25	0,24	0,23
Wadi Yabis Diversion	0,84	0,82	0,78
Wadi Kufrina	2,43	2,36	2,24
Wadi Rajib	1,66	1,61	1,53
Zarqa Carrier 1 / King Talal Dam	52,95	52,95	52,95
Zarqa Carrier 2 / King Talal Dam	50,00	50,00	50,00
Shouib Dam	6,25	6,07	5,77
Kafreen Dam	11,51	11,17	10,62
Wadi Hisban	0,78	0,76	0,72
Local WW Reuse in LJR Jordan	0,00	11,94	33,25
WW Reuse in LJR from Amman / Northern GV	0,00	22,40	44,80
<b>TOTAL (MCM / yr)</b>	<b>268,66</b>	<b>366,75</b>	<b>420,27</b>
<b>Deficit</b>	<b>89,84</b>	<b>19,35</b>	<b>7,95</b>



**Table 40 – Israeli Water Demands and Supply in the Jordan Valley**

Total Domestic Water Demands Israel (CM / yr)				
		2010	2025	2050
	Emek Hayarden	990.000	1.166.880	1.584.000
	Emek Hamaayanot	990.000	1.166.880	1.584.000
	Beit She'an	1.530.000	1.803.360	2.448.000
	Hagilboa	900.000	1.060.800	1.440.000
	<b>TOTAL</b>	<b>4.410.000</b>	<b>5.197.920</b>	<b>7.056.000</b>
Total Agricultural Water Demands Israel		CM / yr		
		2010	2025	2050
	Jordan Valley WA	21.237.000	21.237.000	21.237.000
	Afikey Main WA	52.015.000	52.015.000	52.015.000
	Harod WA	22.000.000	22.000.000	22.000.000
	Fish ponds	56.400.000	56.400.000	56.400.000
	<b>TOTAL</b>	<b>151.652.000</b>	<b>151.652.000</b>	<b>151.652.000</b>
	<b>Total Water Demands</b>	<b>156.062.000</b>	<b>156.849.920</b>	<b>158.708.000</b>
Total Water Resources Israel LJRB				
		2010	2025	2050
	Groundwater wells (NE Mountain Aquifer)	22,00	20,00	18,00
	Lake of Tiberias / Jordan River	45,06	45,77	50,00
	Local wells (LJR Basin) Israel	0,00	0,00	0,00
	Harod Stream	54,00	46,00	32,00
	Tavor Stream	2,00	2,00	2,00
	LJR Valley Springs	23,00	21,00	18,00
	<i>Wastewater reuse in LJR Israel</i>	<i>2,82</i>	<i>3,33</i>	<i>4,52</i>
	<i>Wastewater reuse from outside sources</i>	<i>0,00</i>	<i>0,00</i>	<i>14,19</i>
	<i>Fish ponds reuse for agriculture in LJR</i>	<i>7,00</i>	<i>18,00</i>	<i>20,00</i>
	<b>TOTAL (MCM / yr)</b>	<b>155,88</b>	<b>156,10</b>	<b>158,71</b>
	<b>Deficit (MCM / yr)</b>	<b>-0,18</b>	<b>-0,75</b>	<b>0,00</b>

Table 41 – Palestinian Water Demands and Supply in the Jordan Valley

Total Domestic Water Demands Palestine (CM / yr)				
		2010	2025	2050
<i>Palestinians</i>				
PMD 1	Bardala Cluster MD	315.540	1.184.575	5.649.520
PMD 2	Al-Bassariya Cluster MD	273.840	1.105.090	5.470.400
PMD 3	Al-Jiftlik Cluster MD	389.940	1.326.325	5.969.200
PMD 4	Fasayil Cluster MD	69.420	715.575	4.592.080
PMD 5	Al-Auja Cluster MD	265.380	1.088.990	5.434.000
PMD 6	Jericho MD	2.046.720	4.483.360	13.087.280
<b>Subtotal Palestinian</b>		<b>3.360.840</b>	<b>9.903.915</b>	<b>40.202.480</b>
<i>Settlements</i>				
IMD 1	Cluster North MD	128.250	0	0
IMD 2	Cluster Central MD	356.400	0	0
IMD 3	Cluster South MD	77.400	0	0
<b>Subtotal Israeli Settlers</b>		<b>562.050</b>	<b>0</b>	<b>0</b>
<b>TOTAL</b>		<b>3.922.890</b>	<b>9.903.915</b>	<b>40.202.480</b>
Total Agricultural Water Demands Palestine		CM / yr		
		2010	2025	2050
<i>Palestinians</i>				
PAD 1	Bardala Cluster	10.558.755	13.658.850	13.658.850
PAD 2	Al-Bassariya Cluster	5.240.855	14.396.297	14.396.297
PAD 3	Al-Jiftlik Cluster	5.400.437	24.555.879	24.555.879
PAD 4	Fasayil Cluster	1.173.919	20.329.361	20.329.361
PAD 5	Al-Auja Cluster	3.991.597	23.147.039	23.147.039
PAD 6	Jericho	11.082.381	29.083.044	29.083.044
<i>Settlements</i>				
IAD 1	Cluster North AD	3.100.095	0	0
IAD 2	Cluster Central AD	36.621.768	0	0
IAD 3	Cluster South AD	8.000.662	0	0
<b>TOTAL</b>		<b>85.170.469</b>	<b>125.170.470</b>	<b>125.170.470</b>
<b>GRAND TOTAL WATER DEMANDS</b>		<b>89.093.359</b>	<b>135.074.385</b>	<b>165.372.950</b>

Total Water Resources Palestine LJRB				
		2010	2025	2050
Local wells (LJR) Palestine		32,00	63,11	46,64
Water Import (Mekorot)		29,46	0,00	0,00
Local Springs (Fara, Auja, Jericho, Paza)		19,00	25,00	25,00
WW Reuse Import from West Bank		0,00	17,00	17,00
West Bank Floods		1,00	1,00	1,00
<i>Jordan River (agriculture) Palestine</i>		<i>0,00</i>	<i>25,00</i>	<i>50,00</i>
<i>Wastewater reuse in LJR Palestine</i>		<i>0,00</i>	<i>3,96</i>	<i>25,73</i>
<b>TOTAL (MCM / yr)</b>		<b>81,46</b>	<b>135,07</b>	<b>165,37</b>
<b>Deficit</b>		<b>7,63</b>	<b>0,00</b>	<b>0,00</b>

**Table 42 – Summary of proposed water resources to meet the projected water demands (MCM)**

Total Water Resources Total LJR Basin	2010	2025	2050
	Tiberias Carrier Pipe to Jordan	47,00	100,00
Purchased DW to Amman	9,00	9,00	9,00
Groundwater wells in LJR Jordan	26,74	25,95	24,68
Yarmouk River	15,21	14,76	14,04
Import of Treated WW (Irbid and Amman)	0,00	14,00	29,00
Mukheiba Well Field	27,70	26,88	25,57
Wadi Arab Dam	10,98	10,66	10,14
Wadi Ziglab Dam	3,06	2,97	2,82
Wadi Al Jurum	2,30	2,23	2,12
Wadi Abu Ziad	0,25	0,24	0,23
Wadi Yabis Diversion	0,84	0,82	0,78
Wadi Kufrina	2,43	2,36	2,24
Wadi Rajib	1,66	1,61	1,53
Zarqa Carrrier 1 / King Talal Dam	52,95	52,95	52,95
Zarqa Carrier 2 / King Talal Dam	50,00	50,00	50,00
Shouib Dam	6,25	6,07	5,77
Kafreen Dam	11,51	11,17	10,62
Wadi Hisban	0,78	0,76	0,72
<i>Wastewater Reuse in LJR Jordan</i>	<i>0,00</i>	<i>11,94</i>	<i>33,25</i>
<i>Wastewater Reuse from Jordan</i>	<i>0,00</i>	<i>22,40</i>	<i>44,80</i>
Groundwater wells (NE Mountain Aquifer)	22,00	20,00	18,00
Lake of Tiberias / Jordan River	45,06	45,77	50,00
Harod Stream	54,00	46,00	32,00
Tavor Stream	2,00	2,00	2,00
LJR Valley Springs	23,00	21,00	18,00
<i>Wastewater reuse in LJR Israel</i>	<i>0,00</i>	<i>2,08</i>	<i>4,52</i>
<i>Wastewater reuse from Israel</i>	<i>0,00</i>	<i>0,00</i>	<i>14,19</i>
<i>Fish ponds reuse for agriculture in LJR</i>	<i>10,00</i>	<i>20,00</i>	<i>20,00</i>
Local wells (LJR) Palestine	32,00	63,11	46,64
Water Import (Mekorot)	29,46	0,00	0,00
Local Springs (Fara, Auja, Jericho, Pazael)	19,00	25,00	25,00
WW Reuse Import from West Bank	0,00	17,00	17,00
West Bank Floods	1,00	1,00	1,00
<i>Jordan River (agriculture) Palestine</i>	<i>0,00</i>	<i>25,00</i>	<i>50,00</i>
<i>Wastewater reuse in LJR Palestine</i>	<i>0,00</i>	<i>3,96</i>	<i>25,73</i>
<b>GRAND TOTAL</b>	<b>506,18</b>	<b>658,67</b>	<b>744,34</b>
* part of these resources are brackish, and can only be reused for specific purposes			

## 5.4 The Jordan River in 2050

### Assumptions

In the vision for 2050 the Jordan River will play a crucial and multi-functional role. This implies that the water in the river will serve different important functions at the same time, in terms of sustaining ecology, supporting tourism and related economic development, and conveying and supplying water throughout the valley, particularly for Jordan and Palestine. However, the Jordan River is a dynamic natural water body, in which water flow and quality depend on a complex and time dependent interaction between inflow, abstractions, evaporation and groundwater flows.

To sustain the ecological conditions in the river, WEDO / EcoPeace would ideally like to see a non-polluted flow in the Jordan River with a minimum of 400 MCM / yr, including the outflow into the Dead Sea.

In order to meet the water demands presented above, and to reach the flow targets in 2050, the following assumptions have been made:

- By 2050 some 238 MCM / yr of water will be released into the Jordan River from the Sea of Galilee. This implies that Israel will have reduced pumping water from the Sea of Galilee into the National Water Carrier, and will have replaced this by other resources, such as desalinated seawater. However, it is assumed that Israel will maintain supplying its domestic

and agricultural water needs in the valley from local water resources. The monthly sequence of this release shall be managed in line with the river annual flow predictions (see table 40) and the annual water demands

- Meanwhile the Sea of Galilee will be kept on a medium water level between the top and bottom red lines (What is called now the "green line" by the IWA)
- All pollution flowing into the Jordan River will have ceased by 2025. This implies fully treatment of all wastewater, full sanitary solid waste management in the Jordan, Israel and Palestine parts of the valley, and diverting salt water flows around the main part of the river. However, termination of all wastewater and waste pollution sources in the Israeli stretch from the Sea of Galilee to Naharyim is already foreseen by 2017 and in the stretch from Naharyim to the Harod Stream by 2020.
- By 2050 Jordan will use the Jordan River as its main water conveyor for water supply purposes instead of the current King Abdullah Canal. This implies that Jordan would stop diverting water from the Yarmouk and other tributaries into the KAC, and instead diverts this water to the Jordan River to the possible extent.
- By 2050 Amman will not only receive 60 MCM / yr from the Jordan Valley, as today, but will

return an additional 60 MCM of treated wastewater back to the Jordan Valley.

- The river has a natural tendency to become increasingly saline in southern direction, mainly due to brackish groundwater inflow near the Dead Sea. This implies that fresh water can only be supplied from the upper stretch of the river and more brackish water from the lower stretch of the river. Quality requirements for different types of consumption are the following:
  - Raw drinking water quality <400 mg/l
  - Low Salinity / Semi Fresh irrigation water quality <600 mg/l
  - Dates irrigation water quality <1500 mg/l
- In 2050 Palestine will receive from the Jordan River totally 50 MCM / yr.
- In 2050 an additional 50 MCM / yr of treated wastewater from the West Bank / East Jerusalem will be diverted into the Palestinian section of the Jordan Valley
- Climate change will result by 2050 in a linear decrease of 20% of all water sources and increase in evaporation by 8%.

### Salinity

In the WEAP model, salinity is the only indicator of water quality. Designated salinity values of water sources are mentioned below and are documented in the model itself. The calculations of Chloride (Cl)

concentrations in the different reaches are based on simple mass balance with no decay mechanisms: Salinity of all the water sources is fixed throughout the year, except for the springs that nourish the Saline Water Carrier (SWC):

- Particularly, the salinity of the SoG does not change with water level and is fixed at 280 mg/L;
- Runoff salinity is 50 mg/L;
- Salinity of return flow from irrigation is 800 and 1500 mg/L for fresh and saline water respectively;
- Salinity of Israeli Sewage is 350 mg/L;
- Effect of evaporation on salinity in the Lower part of the Jordan River itself is neglected.

### Groundwater contribution

#### *Groundwater Israel*

Direct contribution of groundwater to the LJR from Israel (north of Bezeq Stream) was calculated according to Holtzman, who quantified groundwater in two segments of the LJR, between the Yarmouk and Harod Stream. The model simulates groundwater contribution, by adding groundwater inflow in two reaches: below the Yarmouk and below Issachar. The annual contribution of groundwater into the LJR was estimated to be 18 MCM, with an average salinity of 1150 mg/L.

#### *Groundwater Palestine*

For the West Bank (south to Bezeq stream) the current WEAP model assumes that groundwater inflow is constant throughout the year and is about 5-6 MCM/month. The salinity levels have been

assumed to be similar range as measured by Farber et al.

#### *Groundwater Jordan*

In the southern part of East Bank, the shallow groundwater system consists of lacustrine sediments and Clastic fluvial components. The aquifer has been developed largely since the 1960ies, and many shallow wells have been drilled, largely for irrigation purposes. Consequently, groundwater levels have dropped and salinity levels increased substantially. Where historically groundwater flow in the Eastern Jordanian valley area had a westwards direction, today more water is abstracted that recharged naturally. In this model it has therefore been assumed that there is no annual contribution of groundwater into the LJR from the southern Jordanian side.

### Water Supply Assumptions

#### WEAP Modeling Assumptions

The aim of the Full Cooperation Scenario is to turn the LJR into the main water conveyor in the Jordan valley, turning the river into a multiuse water body, where its ecological integrity is maintained.

The following conditions were assumed:

- Urban and domestic water will be provided mainly by local wells, springs and dams to ensure water quality standards and reliability.
- Agricultural water will be provided through the reuse of treated wastewater, through the King

Abdullah Canal and West Ghor pipeline on the short term; and through the Jordan River on the long term

- Israel will substantially reduce pumping water from the Sea of Galilee to the National Water Carrier
- Israel will maintain present agricultural consumption in the valley.
- By 2025 Jordan will stop diverting water from the Yarmouk and other tributaries to the KAC and have started using the LJR as main conveyor instead, to the possible extent.
- By 2050 Palestinian irrigation requirements will be supplied through wastewater reuse from within the Jordan Valley and from outside towns such as Ramallah and Nablus (totally about 43 MCM/yr) , and from the Jordan River (50 MCM / yr) and from local water resources (32 MCM / yr)
- Amman will consume 100 MCM/Yr of potable water from the KAC and provide some 80 MCM/Yr of effluents (of which 70% will be used in the LJV).
- Irbid will produce 13 MCM/Yr of effluents, of which some 9 MCM/Yr will be used in the LJV.
- Water demands are in accordance with the above presented tables.
- Sea of Galilee is to be kept on a medium water level between the top and bottom rend lines (What is called now the "green line" by the IWA)
- All pollution from the river, with possible exception of fishponds groundwater leakage, will be removed from the LJR by 2025.

- All locally produced municipal wastewater will be treated and reused for irrigation.
- Water quality demand with respect to mg/l of Chlorides is:
  - Drinking water - 400 mg/l
  - Fresh irrigation - 600 mg/l
  - Dates irrigation - 1500 mg/l
- Water sources in the west bank amount to 85 MCM/Yr which include the Eastern mountain aquifer and springs.
- Climate change will result by 2050 in a linear decrease of 20% of all water sources and increase evaporation by 8%.

### **Main water supply assumptions**

Within WEAP model run for 2050 the LJR will be largely divided into 4 zones. The following assumptions have been made:

- Water of drinking quality within the valley will be supplied from the Sea of Galilee to upstream of the confluence with Harod.
- Water for fresh irrigation quality purposes will be provided from the confluence with Harod to upstream of the confluence with Zarqa.
- Water for Dates irrigation quality purposes will be provided from the confluence with Zarqa to the confluence with Wadi Qilt
- From the Confluence with Wadi Qilt to the Dead Sea the river water quality will not be rehabilitated.

The brine water resources in the valley will be conveyed to the lower stretch of the Jordan River, at the confluence with Wadi Qilt and from there

through the river into the Dead Sea. At this point the river will receive brine from two sources:

- Western Brine Carrier - A new conveyor west to the LJR that will carry water of the Saline Water Carrier, brine originating from desalination, and from fishponds discharges.
- Brine from the Abu Zeighan desalination plant

In addition, three major pumping points will be established as follows:

#### ***Pumping to the KAC***

Pumping to the KAC upstream the confluence with Harod - The KAC will be used from this point on as a conveyor of drinking water quality to Jordan. It will convey 170 MCM/Yr from the LJR, of which 70 MCM will be supplied to JAD1 (irrigation), 22 MCM to JMD 1 (municipal) and 70 MCM will be transferred southwards. A reservoir network with a capacity of 30 MCM will be built to support supply to JAD1 and facilitate storage from winter to summer. The rest of the water to JAD1 will come from Mukheiba well and treated WW from JMD1 and Irbid.

#### ***Pumping for Irrigation at Zarqa***

The water pumped upstream of the confluence with Zarqa for irrigation purposes will be distributed as follows:

12 MCM to a network of Palestinian reservoirs with a storage capacity of 40 MCM. The backbone of the system will be the existing Tirza reservoirs that will now serve for fresh irrigation. The reservoirs will also receive 32 MCM of treated local wastewater, 32

MCM of effluents from eastern Jerusalem, 18 MCM from local aquifer/springs and 1 MCM of floods from Wadi Fara'a to sustain Palestinian agriculture

60 MCM to Jordan as follows: (1) 55 MCM to JAD2. A reservoir network of 20 MCM will be built to support supply to JAD2 and facilitate storage from winter to summer. JAD2 will also receive 9 MCM of effluents from JMD2; (2) 5 MCM to JAD3. The bulk of supply to JAD3 will come as 55 MCM of treated WW from JMD3 and Amman. For that a reservoir of 10 MCM will be required.

#### ***Pumping from the Jordan River***

The pumping of 50 MCM / yr from the Jordan River for Palestinian agriculture in the west bank will be concentrated in the winter so a network of reservoirs with a capacity of 40 MCM will have to be built.

**Table 43 – Anticipated Flows in the Lower part of the Jordan River (2050)**

Location on LJR	MCM month min	MCM month max	Avg mg/l Cl	Calculated * MCM/Yr	Estimated** MCM/Yr (incl additional 210 MCM reuse inflow from wider region)
Alumot	17	27	280	238	238
Yarmouk inflow	17	33	265	274	274
Withdrawal to KAC	18	35	320	291	291
Withdrawal to Tirza/JAD2	4	21	700 <sup>7</sup>	138	230
Withdrawal to Palestinian dates	2	16	1350 <sup>8</sup>	105	238
After last withdrawal	0	10	1350	55	215
After brine inflow	3	14	3050	90	287
Outflow into the Dead Sea				90	300

\* Major inflows into the LJR that are above 5 MCM/Yr are the following:

- Sea of Galilee – 238 MCM / yr
- Groundwater inflow, spread along the entire river – 45 MCM / yr
- Western Brine Carrier (inflow at Wadi Qelt) – 35 MCM / yr
- Yarmouk – 34 MCM / yr
- Valley of Springs – 12 MCM / yr
- Harod Stream – 8 MCM / yr
- Wadi Arab – 8 MCM / yr

\*\* assuming additional 197 MCM / yr of treated wastewater diverted into the river from the wider regions in Jordan, Israel and Palestine, possibly generating hydropower at the same time

<sup>7</sup> in Nov-Apr, when most of the water is being taken, salinity is less than 600 mg/l. In the summer it is higher though, and that emphasizes the need for large reservoirs to facilitate more extraction in winter and also dilution of water.

<sup>8</sup> In summer and autumn salinity can top 1500 mg/l, which again necessitates reservoirs

## Impacts on Flows in the Jordan River

The presented data and assumptions lead to the above flow regime of the Lower part of the Jordan River.

The calculated water balance will provide all demands in the valley by 2050, and the related flow in the Jordan River will reach in maximum just before the KAC withdrawal, with 291 MCM / yr. Next it will reduce towards the Dead Sea (90 MCM / yr outflow into the Dead Sea). If one would aim at an outflow of 300 MCM / yr into the Dead Sea instead, this would require an additional inflow of 210 MCM / yr, including for instance a future contribution of Syria of 100 MCM / yr and additional 110 MCM / yr of inflow into the valley from wider sources of treated wastewater.

Detailed assessment of these alternative and additional resources goes beyond the scope of this study. However, in line with earlier studies, including those of the World Bank Study on Alternatives related to the Red – Dead Sea Water Conveyance Project, it may be assumed that this water can be identified in 2050 as inflow of additional treated wastewater into the valley from the wider regions in Jordan, Israel and Palestine.

Such additional release of water into the Dead Sea will come at a certain cost, which may be directly compared to economic benefits of the Dead Sea economy by 2050. It should be noted though that flows required for stabilizing the Dead Sea Water levels are substantially higher than 400 MCM / yr,

and may reach to more than 800 MCM / yr. These could be met according to WEDO / EcoPeace if industry in the south of the Dead Sea were to replace their evaporation ponds with the use of membrane technology to extract Dead Sea minerals.

The Palestinian fresh irrigation demands will be met from treated wastewater (32 MCM locally produced and the rest imported from upper Palestine. Here to, a reservoir network of 35 MCM will be required as wastewater supply is constant but the agricultural demand fluctuates. The backbone of the system will be the existing Tirza reservoirs that will now serve for fresh irrigation. The existing pumps on the Jordan River to Tirza reservoirs will serve as backup, but will not be used regularly.

The above water balance relies on natural resources only. Future water demands however, can be met, on average, via optimal usage of natural sources. Meeting the demand will become increasingly difficult though, with water quality problems throughout summer and autumn. For that reason large reservoirs (with a total capacity of nearly 150 MCM on both sides of the river) may be considered to facilitate storage from winter to summer. Alternatively part of this storage requirement might be realized through groundwater recharge and storage facilities. This would lead to less evaporation, and would require detailed hydrogeological assessments in terms of availability and suitability of shallow aquifer systems.

The above is true for average and wet years only. In dry years, which are frequent in this region, local water and WW will not be able to quench the demand. The 150 MCM of reservoirs will not mitigate shortage in dry years, as that storage volume is seasonal, from winter to summer, and not annual. There is little point in adding even more storage capacity as consecutive dry years are common and thus, water from wet years cannot be stored for future dry years (much less considering evaporation).

Hence, the solution is either reducing demand, or relying on a stable external water source. Calculations show that additional 120 – 190 MCM/Yr from an external source will be required to meet the environmental goals set by WEDO / EcoPeace, on average. In dry years, the environmental goals will not be met in full though. The added water will also enable reliable water supply for consumers across the valley, except for the most extreme dry years<sup>9</sup>. That water will also allow reducing the required storage capacity, as more water will be pumped in the summer, when it is needed most.

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<sup>9</sup> 2014 was the driest year in recorded history, to the extent that the natural water balance of the Sea of Galilee was negative, meaning that even if no water would have been pumped from the lake, its level would still go down that year. In such an extreme case, the Sea of Galilee cannot sustain a release of 250 MCM and so, water will be in short supply. Such a year however is infrequent.



Various alternative measures from outside the study area may be considered in this respect, such as presented in the World Bank Study on Alternatives for the Read – Dead Sea Program, Sept 2012.

1. Additional sources of generated wastewater from regions outside the Jordan Valley, but still located within the watershed area may be treated and conveyed to the Jordan Valley for agricultural applications.
2. The agricultural water demands in the Jordan Valley may be further reduced through water efficiency measures and / or by limiting certain lower priority agricultural activities. This may lead to a reduction of the total agricultural demands in the study area from 557 MCM / yr as assumed above, to 490 MCM /yr instead
3. Replacing the 60 MCM / yr supply of water from the Jordan Valley to Amman by other water sources or measures, such a Red Sea desalination, increasing DISI aquifer supply; maximization of wastewater reuse within the urban context, or lowering unaccounted for water percentages within the city
4. Conveying desalinated water from the Mediterranean to the upper part of the Jordan Valley
5. Or a combination of above four measures

## 5.5 Environmental Flows by 2050

### Introduction

Rehabilitation of the ecological values connected to the Jordan River depends not only on restoring good quality water and protection against external pollution sources, but also on a flow regime in the river that sustains the ecological water needs various seasons.

The concept of environmental flows includes setting conditions for an average flow along different sections of the river, and on conditions related to floods and droughts. For instance, during extreme low flows, native species may out-compete exotic species that have not adapted to these circumstances, while during periods of more stable low flows, feeding and spawning activities of fish and recreational activities may be supported. On the other hand, minor floods may prevent vegetation from invading river channels and can wash out plants, delivering large amounts of sediment and organic matter downstream in the process, while large floods may even change the flow path of a river and create flood plains that provide new nutrient-rich niches for certain habitats. One can predict that the more a flow event deviates from the average annual flow, in terms of floods or drought intensities, the rarer it will be.

Defining the optimized environmental flow condition for the Jordan River is subject to the specific ambitions one has in terms of ecological restoration, and remains subjective to the extent that certain flow

regimes may be beneficial for specific species and be less beneficial for others.

However, the substantial reduction of flow in the Jordan River since the 1950-ies resulted in a narrower and more canalized river ecosystem. Less water resulted in much slower velocities, reducing the habitats depending of flows, such as falls, cascades and rapids. Smaller flows also mean less dilution with inflowing polluted water, such as brackish (ground) water or wastewater. This resulted in higher pollution concentrations in the river stream. As a result, the ecology of the Jordan River is now reduced to pockets of high resistant and medium to slow velocity habitats. Reduction in water flows, but also dams in the river and its tributaries, resulted also in smaller river's sediment loads. Slower velocities carry far less sediment with smaller grain sizes. The formation of streamside water bodies, such as deserted meanders, has stopped, and related habitats have disappeared from the river's ecosystem.

If healthy freshwater ecosystems are to be restored, it is important to address the quality of the water; the seasonable fluctuation of the flow; the frequency and the duration and variability of floods and droughts.

## Environmental Flow Alternatives

In May 2010 WEDO / EcoPeace issued a report called: "Towards a Living Jordan River: An Environmental Flows Report on the Rehabilitation of the Lower part of the Jordan River". This report presents four alternatives strategies for restoration of viable environmental flows in the Lower part of the Jordan River and related ecological values of the river system:

- (1) Full Ecological Restoration;
- (2) Partial Restoration;
- (3) River Rehabilitation;
- (4) Flow Enhancement.

### "Full Restoration" Alternative

Under this strategy the pollution sources into the Jordan River are to be removed, including treatment of all wastewater generated in the valley and saline water from the Saline Water Carrier. The salinity of the water in the Jordan River shall not exceed 250 ppm in the winter and 350 ppm in summer and in the southern section it should not exceed 750 ppm. The saline water of the Sea of Galilee's salty springs shall be diverted away from the Jordan River, for instance through desalinization and removal of its brine from the Jordan Valley.

Full restoration would also mean that the original pre- 1950 flows are to be restored to 1200 – 1400 MCM per year. This very ambitious objective implies that for instance 500 – 600 MCM is to be released extra from the Sea of Galilee into the Jordan River,



**Figure 37 – Lower part of the Jordan River**

and approximately 500 - 600 MCM per year from the Yarmouk River. This Full ecological restoration strategy also requires at least 3 minor floods (c.a. 20-50 m<sup>3</sup>/sec) per year, to be achieved for instance by fully opening the dams for 24 hours, three times

every winter and 1 major flood (c.a. 200 m<sup>3</sup>/sec) every 3 years. In order to bring back the original habitats of the river, also the shape and flow path of the river is to be restored, including reconstruction of meanders, cascades and waterfalls. Clearly this very ambitious strategy would require high

investments, a revolutionary change in the water regimes of particularly Israel and Jordan, and would be globally the first full river restoration in its kind. This strategy will lead to recovery of a healthy water related eco system comparable to the historic situation of the area.

*"Partial Restoration" Alternative*

Partial restoration of the river is defined here as removal of the pollution sources into the Jordan River, including treatment of all wastewater generated in the valley, and dilution of the saline water in the Jordan River from the Saline Water Carrier with fresh water, so that the water in the Jordan River shall not exceed 500 ppm in the winter and 750 ppm in summer and in the southern section it should not exceed 1,500 ppm. For this purpose the saline water of the Sea of Galilee's salty springs could for instance be mixed with fresh water originating from the Sea of Galilee and the Yarmouk River.

Partial restoration is also defined here as generating flows of 600 – 800 MCM per year. This ecological restoration strategy also requires at least one minor flood (c.a. 20-50 m<sup>3</sup>/sec) per year, to be achieved for instance by fully opening the dams for 24 hours every winter. In order to bring back the original habitats of the river, also the flow bed of the river is to be widened to 50-70 m in the north and 25 – 40 m in the south, with flood plains on both sides. New meanders, cascades and waterfalls are to be constructed to some extent. This strategy would require considerable investments and a substantial change in the water regimes and national water

policies of particularly Israel and Jordan. This strategy will lead to recovery of healthy water related eco systems.

*"River Rehabilitation" Alternative*

The river rehabilitation strategy is less ambitious than the two strategies described above. It is defined as full treatment of all wastewater generated in the valley, and allowing discharge of treated wastewater into the Jordan River to maximum 25% of the river's base flow. The water in the Jordan River shall not exceed 750 ppm.

River Rehabilitation is also defined here as generating flows of 400 – 600 MCM per year. This ecological restoration strategy requires again at least one minor flood (c.a. 20-50 m<sup>3</sup>/sec) per two years, to be achieved for instance by fully opening the dams for 24 hours every other winter. In order to bring back the original habitats of the river, also the flow bed of the river is to be widened to 50-70 m in the north and 15 - 30 m in the south, with flood plains on both sides. New meanders, cascades and waterfalls are to be constructed to some extent. This strategy would require investments and a substantial change in the water regimes of particularly Israel and Jordan. This strategy will lead to significant recovery of the water related eco systems.

*"Flow Enhancement" Alternative*

The Flow Enhancement strategy is defined as enhancing the base flow of the Jordan River only the basis of treating all domestic and fishpond related wastewater, and discharging the treated effluent into

the Jordan River, without depending on additional release from the Sea of Galilee or the Yarmouk River. Under this strategy the saline water carrier would continue to flow into the Jordan River, leaving the salinity levels at 3000 ppm in the winter and 4000 ppm in summer. In the southern section it should not exceed 10,000 ppm, which is 1% salt content.

The Flow enhancement is also defined as generating flows of 300 – 400 MCM per year, to be generated all from treated wastewater. This implies that all generated wastewater shall be treated and discharged into the river, without being reused for agricultural or other purposes. On the other hand, this also implies that no additional water is required from the Sea of Galilee or the Yarmouk River. This ecological restoration strategy requires again at least one minor flood (c.a. 20-50 m<sup>3</sup>/sec) per two years, to be achieved for instance by fully opening the dams for 24 hours every other winter. In order to bring back the original habitats of the river, also the flow bed of the river is to be widened to 50-70 m in the north and 15 - 30 m in the south, with flood plains on both sides. New meanders and cascades are to be constructed to some extent, but no waterfalls. This strategy would require a substantial change in specifically the water regimes in the valley itself. This strategy will lead to substantial, but restricted recovery of the water related eco systems.

*WEDO / EcoPeace's Preferred Alternative*

Based on an assessment of these alternatives and comments and feedback received by participants of the Study's National and Regional Advisory Committee, WEDO / EcoPeace recommends a flow release of approximately 100 cubic meters/ second from Alumot dam for a 24 hour period (less than 9 MCM) to cause an initial flood to make a significant ecological difference without flooding surrounding properties. The release should take place during the winter months to simulate natural seasonal flooding and would act to flush fine sediment and pollutants and provide significant habitat improvement in the short term. According to WEDO / EcoPeace this "re-start" should then be followed by the allocation of fresh water resources to halt the river's continuing deterioration, leading to a water flow of 400 MCM annually, including one minor flood annually and a reduction of salinity levels to no more than 750 ppm.

### Environmental Flow Regime for 2050

Within the framework of this Master Plan the following Environmental Flow Strategy has been assumed. The 2050 Environmental Flow regime is based on a multi-functional river approach. This means that the river will be used for both ecological, economic / tourism and water conveyance purposes, as such maximizing the flow within the river itself, and maximizing the ecological / economic value of the water flow. This implies that all sources of pollution have been mitigated and that the river water will have reclaimed a natural water quality,

only affected negatively by the natural salt inflow from the southern brackish aquifer systems.

In accordance with the study's water modeling calculations this will require that by 2050 some 238 MCM / yr of water will be released into the Jordan River from the Sea of Galilee. In addition, the river will receive 12 MCM / yr from the Valley of Springs, 8 MCM / yr from the Harod Spring and 8 MCM / yr from Wadi Arab. It will also receive 18 MCM / yr as natural groundwater outflow in the Israeli part of the valley, and 5-6 MCM / yr in the Palestinian part of the valley. No groundwater contribution from the Jordanian side is foreseen. However, it is assumed that by 2050 Jordan will use the Jordan River instead of the King Abdullah Canal for conveying water from north to south to the point where brackish groundwater naturally infiltrates into the Jordan River, near the Harod Stream.

In addition it is proposed to have at least one minor flood (c.a. 20-50 m<sup>3</sup>/sec) per two years, to be achieved for instance by fully opening the Damya dams for 24 hours every other winter. In order to bring back the original habitats of the river, also the flow bed of the river will be widened to 50 m in the north and at least 15 m down to Wadi Qelt, with flood plains on both sides. This includes construction of new meanders and cascades.

This measure will lead to an average flow of up to 300 MCM / yr in the upper section of the river, and around 100 MCM / yr of water flowing into the Dead Sea. The average salt content will be between 300 – 700 ppm in the upper section and around 1350 ppm

in the lower section, which is highly acceptable from an ecological point of view. The final southern stretch of the river, below Wadi Qelt will see higher concentrations up to 3000 ppm due to brackish groundwater seepage and discharge of the Saline Water Carrier.

In order to reach a minimum flow of at least 400 MCM of fresh water per year throughout the major stretch of the Jordan River, one depends on an additional contribution of 100 MCM / yr from Syria by 2050 through the Yarmouk River; and an additional inflow of 100 MCM / yr of treated wastewater into the Jordan River from the wider region in Israel, Jordan and Palestine around the Jordan Valley. However, these options will come against certain costs of probably not below 30 MUSD / yr, which is to be assessed in a detailed cost-benefit analysis, for instance during the feasibility assessment phase of such interventions.

In all, the model calculations show that a sustainable and environmentally friendly water regime can be created in the Jordan Valley by 2050 that creates a clean and healthy river system and facilitates the interests all riparian states appropriately, including the future independent state of Palestine,

### 5.6 Sensitivity Analysis

The above economic projections are subject to a series of assumptions as part of the 2050 Vision for the Jordan Valley. These assumptions include full realization of the three-state co-operation scenario.

Palestine will become an independent state, and an equitable partner to both Israel and Jordan. It is assumed that the three together will have established the Jordan River Basin Management Organization, responsible for river basin management, overseeing the agreed water supply frameworks and jointly managing the Jordan River as the major natural and multi-functional surface water body in the region.

Another assumption is that the three parties will have agreed on a joint security management framework that ensures maximized security against external threats against all Israeli, Palestinian and Jordanian people living in and around the Jordan Valley. It is assumed that this security framework will be based on unbiased, professional and joint assessment of security risks, and mitigation plans that effectively address these risks.

If these conditions will not be met, this will have a direct negative impact on the socio-economic status of the Jordan Valley as projected above, including very limited economic development perspectives for the Palestinian people, and limited synergetic economic impacts for Israel and Jordan. In addition, most of the proposed regional interventions cannot be implemented, such as joint and optimized development of the Jordan River and joint development of the regional economy, including the tourism sector. This will lead to much lower economic development projections for 2050, which will likely not very much exceed the economy under the current status quo.

The above economic projections also assume that by 2020 all pollution sources will have been mitigated or removed from the Jordan Valley, including wastewater, saline water and solid waste related pollution sources. Furthermore, it is assumed that all regionally generated wastewater will be treated and reused for agricultural purposes.

If these conditions will be met, this will have large impacts on the water economy in the valley. Ongoing pollution will lead to continuous contamination of the Jordan River, which will block all interventions related to sustainable development of the river, including tourism and economic development, ecological restoration of the river ecosystem, and using the river as natural water conveyor. Moreover, ongoing pollution will continue to be a threat for public health, particularly for the Jordanians and Palestinians, with related negative private investment and economic growth potentials. Not treating and reusing the locally generated wastewater will furthermore have a serious impact on the 2050 water balance, particularly for the agricultural sector. This Master Plan assumes that by 2050 the total agricultural water demands in the Jordan Valley will be around 752 MCM / yr, of which about 142 MCM / yr, or 19% if provided through reuse of treated wastewater. A similar reduction in agricultural economic outputs may be expected if treatment and reuse of wastewater would not take place.

The majority of investments foreseen in the Jordan Valley relate to urban and infrastructure development, about 3.4 Billion USD, or 80% of the

total investments. This package is crucial for reaching the economic growth assumed in this Master Plan, and to provide the Jordanian and Palestinian needs in terms of housing, roads, education, medical care and utilities. Moreover, these interventions will attract private investors necessary for creating the economic dynamics in the Jordan Valley, required for sustainable growth and prosperity.

If these investments will not materialize, much of the foundation under the economic growth projections presented in this Master Plan will be absent. The economic activities, including the construction, services and tourism sectors would not grow to the extent presented here, or may even shrink further. The total valley economy, depending on which negative scenarios will be adopted, would likely be stuck somewhere between 5 – 20 Billion USD in 2050, instead of the foreseen 73 Billion USD economy under this Master Plan. Moreover, the Palestinian economy and partly the Jordanian economy will remain largely dependent on the international financial donor community for many years to come.

Climate change will likely have an important impact on the water balance in the Jordan Valley. This study's Baseline Report indicates that the northern part of the East Bank of the Jordan Valley (Jordan) will be impacted most negatively by climate change, with a foreseen substantial reduction of annual and winter rainfall, although the summer rainfall will increase slightly. The southern part of the East Bank will see a slight improvement of rainfall conditions,

both annually as during the summer. The Western part of the Jordan Valley seems to be impacted to a smaller degree, and may also experience some positive impacts with slightly increasing rainfall gradually shifting southwards, both annually as well as during the winter period. The Jordan Valley in the lower part of the West Bank remains to be a very dry region. In addition, the evaporation rates will increase throughout the valley as result of increasing average annual temperatures, leading to more losses in terms of evaporation from surface waters like the Sea of Galilee, the Jordan River, reservoirs and open fishponds, and of more losses due to evapotranspiration by vegetation, mainly within the agricultural sector.

It has been assumed in this Master Plan that the average annual reduction in water resources due to Climate Change by 2050 will be 0.2%, leading to an accumulated reduction of 7.7% of the locally generated water resources by 2050 compared to the year 2010, or about 18 MCM / yr. The projected water balance presented in this Master Plan has been calculated accordingly. Assuming that the climate impacts will be more severe, say around 15% reduction of locally generated water resources by 2050, this will lead to an additional loss of 17 MCM / yr by 2050 (or a total climate change inflicted loss of 35 MCM / yr) compared to 2010. If this extra loss would be fully at the expense of the agricultural sector, this would lead to a reduction of 2.3% of agricultural outputs by 2050. If instead this extra loss would be directly linked to the Jordan River flow, this will lead to a flow reduction of 8.5% in the upper reach of the Lower part of the Jordan River, and

about 17% in the downstream section the Lower part of the Jordan River.

The current geopolitical context in and around the Jordan Valley today is complex. The Peace process between Israel and Palestine is still in a dead log, and the political turmoil in the neighbor countries, particularly in Syria and Iraq is strong. In august 2014 the United Nations had registered 619,000 official refugees from Syria in Jordan, with over 80,000 registered in the refugee camp Za'atri, located just outside the study area. In this Master Plan it has been assumed today a total foreign population of about 250,000 lives in the Jordanian part of the study area.

In this Master Plan it is assumed that by the Peace Process will be concluded positively, leading to an independent Palestinian State by 2020. By 2050 this will lead to close and effective co-operation among the three riparian states on all key issues related to joint economic development, water management and security management. In addition, this Master Plan assumes that in Jordan the high number of foreign inhabitants in the valley will gradually decline to 150,000 people by 2050 as a result of assumed improving geopolitical and economic conditions in their countries of origin, including Syria, Iraq and Egypt.

If the regional geopolitical context will not evolve towards this positive direction, one may expect that the number of foreign inhabitants in the valley will remain high. Assuming that the current numbers of 250,000 people will remain, this will lead to higher

demands for instance in terms of household water supply (about 3 MCM / yr extra compared to the projections in this Master Plan), and to higher demands in terms of public services and utilities.

High geopolitical uncertainties will also put more emphasis on the need for an effective and joint security shield against external threats. One may also raise the question whether more severe external geopolitical uncertainties would lead to more isolationistic behavior of the three riparian countries in the future, and therefore to reduce willingness to strive towards peace and regional co-operation. If so, this will clearly lead to direct negative impact on the socio-economic status of the Jordan Valley as projected here, including very limited synergetic economic impacts for the three riparian states.

In the vision for 2050 the Jordan River will play a crucial and multi-functional role. This implies that the river will serve different important functions at the same time, in terms of sustaining ecology, supporting tourism and related economic development, and conveying and supplying water throughout the valley. Without additional external sources, the flow in the Jordan River will reach a maximum of 291 MCM / yr, and will be reduced to 90 MCM / yr near the outflow into the Dead Sea by 2050. The average salt content will be between 300 – 700 ppm in the upper section of the river and around 1350 ppm in the lower section. Assuming that these flow targets will not be achieved, or using the river as the natural water conveyor will fail, this will lead to considerable

smaller flows in the river and higher salt concentrations. This again will impact the potential of the river in terms of economic and tourism development. Continued use of engineered water conveyance systems such as the current East Ghor or a future West Ghor Canal will also lead to higher operation and maintenance costs. But maybe most importantly, continued flow reduction and higher salt concentrations will lead to serious limitation in terms of restoration of aquatic ecosystems and related eco-tourism, including continued loss of floristic and faunal biodiversity and the loss of opportunity to achieve a fair to high ecosystem integrity and health.

## FINAL CONCLUSIONS & RECOMMENDATIONS

This Regional NGO Master Plan for Sustainable Development of the Jordan Valley aims at identifying feasible interventions that will restore the valley's environmental and ecological values within a realistic financial and economic framework, in which a future State of Palestine will be recognized as one of the three riparians, side by side with Israel and Jordan with all three nations entitled to an equitable share of the valley's resources. The plan assumes furthermore free access to the valley for all people within appropriate and negotiated security arrangements. This plan addresses interventions on a regional and national scale in the areas of water management, pollution control, agriculture development, tourism and cultural heritage, land use, governance, sustainable energy, urban development and infrastructure. It will be used by WEDO / EcoPeace and partners as an advocacy tool towards Jordanian, Israeli and Palestinian decision makers and the international community for the implementation of the proposed interventions.

Based on the population projections made by the Jordanian, Palestinian and Israeli Departments of Statistics, an assessment has been made of the total population in the valley in the years 2025 and 2050. This includes natural growth of the autonomous population to 0.92% in 2050. In addition, this Master Plan assumes that in Jordan the high number of foreign inhabitants in the valley

will gradually decline as a result of assumed improving economic conditions in their countries of origin, including Syria, Iraq and Egypt. It is assumed that all Israeli settlements in the Palestinian part of the Jordan Valley will be removed, and that the Independent Palestinian State created will see a growth towards an estimated 500,000 people living in the Palestinian section of the Jordan Valley by 2050. It assumes natural population growth under strong economic development conditions in Israel. These assumptions lead to a total projected population in 2050 of 1.048 Million people living in the Jordan Valley, from the southern tip of the Sea of Galilee to the northern edge of the Dead Sea.

The key challenge facing the NGO Master Plan is to strike the right developmental balance between a healthy economic developmental path for the valley and its people on the one hand, and a Jordan River with sufficient environmental flows to sustain a healthy eco-system on the other hand. To meet this objective there is a need to ensure that the river serves as a natural water conveyor and source for water supply for residents in and outside the Jordan Valley. Sustainable development is seen as a catalyst to peace building between Israel and Palestine and the deepening of cooperation between Jordan, Palestine and Israel as a means to achieve prosperity for their residents in the valley. A key

condition for meeting this challenge is that Palestine is recognized as a full riparian to the Jordan River, entitled to have access to its fair share of water resources and sovereignty over its lands in the valley.

A total of 127 interventions have been identified, aiming at addressing all strategic objectives of the Master Plan, with a total investment value of 4.58 Billion USD. The full set of interventions is presented in annex 1 and grouped around the various strategic planning objectives. Interventions have been distinguished in terms of Regional (REG), Israeli (ISR), Jordanian (JOR) and Palestinian (PAL) interventions. The interventions have been elaborated at pre-feasibility level. This implies that indeed more details are to be elaborated during the next stage following the completion of this study, such as detailed feasibility studies, financing plans and more. It is not unlikely that during this follow-up phase additional ideas and interventions will be proposed and developed to further fine tune the actions required.

The majority of investments foreseen in the Jordan Valley relate to urban and infrastructure development, about 3.4 Billion USD, or 80% of the total investments. This package is crucial for reaching the economic growth assumed in this Master Plan, and to provide the Jordanian and



Palestinian needs in terms of housing, roads, education, medical care and utilities. Moreover, these interventions will attract private investors necessary for creating the economic dynamics in the Jordan Valley, required for sustainable growth and prosperity.

By 2050, when these interventions have been implemented, the Jordan Valley will have turned into a co-operative, confident and peaceful region with a healthy economy and strong development perspectives for the people living here. They will experience a clean and healthy environment and sufficient flows in the Jordan River to sustain healthy eco-systems. At the same time the river will act as natural water conveyor and source for water supply in the Jordan Valley. Sufficient water will be equitably shared among the three riparian countries and the valley will be freely accessible for all nationalities within an appropriate security framework. Local, private and foreign investments will be encouraged due to the stability in the region. In short, there will be an investment climate resulting from the reforms in general, and a conducive regulatory business environment that promotes sustainable development.

This vision for 2050 is subject to a series of assumptions, including full realization of the three-state co-operation scenario. Palestine will become an independent state, and an equitable partner to both Israel and Jordan. It is also assumed that by 2020 all pollution sources will have been mitigated or removed from the Jordan Valley, including wastewater, saline water and solid waste related

pollution sources. A sustainable and environmentally friendly water regime has been created in the Jordan Valley by 2050, including a clean, healthy and multi-functional river system and facilitates the interests all riparian states appropriately, including the future independent state of Palestine.

By 2050 all regionally generated wastewater will be treated and reused for agricultural purposes. It is also assumed that the three together will have established the Jordan River Basin Management Organization, responsible for river basin management, overseeing the agreed water supply and regional economic development frameworks and jointly managing the Jordan River as the major natural and multi-functional surface water body in the region. It is also assumed that the three parties have agreed on a joint security management framework that ensures maximized security against external threats against all Israeli, Palestinian and Jordanian people living in and around the Jordan Valley. This security framework will be based on unbiased, professional and joint assessment of security risks, and mitigation plans that effectively address these risks.

This Regional NGO Master Plan will be presented at an international conference scheduled for June 2015. It will be used as an advocacy tool by WEDO / EcoPeace and its partners towards national and international decision makers and the international community for the implementation of the proposed interventions.

Finding international and national partners for implementing the most urgent interventions is the next challenge. We trust that the depth of the analysis presented here and the consistency in the applied planning approach will convince these future partners that it makes sense to embark on implementing this plan, including continued co-operation on valley level within the Lower part of the Jordan River among the Jordanian, Israeli and the Palestinian neighbors.

#### ***What can move forward now?***

Within the total set of interventions a series of *short term interventions* have been identified, which can be initiated as soon as possible, pending the final peace accord between Israel and Palestine. In addition, preparation for the Jordan Valley Regional Coordination interventions on all strategic objectives can be advanced at this time. They represent a total investment value of 495 MUSD, including 165 MUSD of Israeli interventions and 330 MUSD of donor supported Jordanian and Palestinian interventions in the areas of pollution control, water management, tourism and cultural heritage development, agriculture and ecological restoration. These interventions aim at improving the baseline situation in the Jordan Valley substantially, particularly in Palestine and Jordan, resulting in a strong foundation for the establishment of the independent Palestinian State and for effective regional co-operation among the three riparian states as geopolitical conditions allow.

These short term investments are the following:

2020 Target: Remove major pollution sources from the Jordan Valley

P01	ISR	Fish Ponds Short Term Pollution Control Improvement Project
P02	ISR	Mine Fields Removal Project
P03	ISR	Sustainable Fish Farming in the Jordan Valley
P04	ISR	Betanya Tertiary Wastewater Treatment
P05	ISR	Betanya Desalination Plant and Afikim Reservoir Project

P01	JOR	Solid Waste Management
P02	JOR	Environmental Management and Public Awareness Program
P03	JOR	Agricultural Pollution Control Project
P04	JOR	Separate waste collection and reuse pilots

P01	PAL	Solid and Hazardous Waste Management Plan
P02	PAL	Environmental Management Project
P03	PAL	Wastewater collection and treatment
P04	PAL	Fish farm Pollution control project
P05	PAL	Land and Water quality Protection Project

2020 Target: Prepare for sustainable water management and supply in the Jordan Valley, including ecological rehabilitation of the Jordan River.

W01	ISR	Yarmouk River Dredging and Cliff Protection Project
W02	ISR	Western Drainage Basins Flood Management
W03	ISR	Northern Sewerage Expansion Project
W04	ISR	Springs Rehabilitation Project

W01	JOR	Improved Lower Jordan River Basin Management Project
W02	JOR	Wastewater collection, treatment and reuse project
W03	JOR	Emergency Wastewater Management Project
W04	JOR	Waste water reuse pilot projects

W02	PAL	Rehabilitation and Protection of springs
W03	PAL	Rehabilitation and construction of Domestic water networks

W04	PAL	Desalination of Brackish wells
W05	PAL	Rehabilitation of Al Auja Spring
W06	PAL	Development of Water Traffic structure
W07	PAL	Utilization off Al-Fashkha Spring
W10	PAL	Artificial Recharge Scheme
W11	PAL	Construction of Water networks
W12	PAL	Hydro-Geological Assessment of the study Areas

2020 Target: Development of a framework for sustainable development of the agricultural sector in the Jordan Valley with an efficient water use.

A01	JOR	Jordan Valley Greenhouses Expansion Project
A02	JOR	Jordan Valley Extension Services Improvement Project
A03	JOR	Jordan Valley Drip Irrigation Improvement Project
A04	JOR	Jordan Valley Post Harvesting Support Project
A05	JOR	Jordan Valley Irrigation Efficiency Improvement Project
A06	JOR	Jordan Valley Authority Support Project
A03	PAL	Water Right Policies and Regulation (internal issues to Palestine)
A08	PAL	Support to Women organizations and Bedouin Communities
A10	PAL	Strengthening of Extension Services
A11	PAL	Promotions of Farmers Cooperative
A12	PAL	Jordan Valley Credit Program
A13	PAL	LEISA Research certification

2020 Target: Development of a sustainable ecological management and restoration framework in the Jordan Valley

E05	REG	International Accreditation of the Lower Jordan River Valley
E01	JOR	Ecological Corridors around Valleys and Dams
E02	JOR	Wetlands and Aquatic Fauna Restoration Project
E03	JOR	Ecological Monitoring and Management Project

2020 Target: Development of a sound foundation for protection of cultural heritage and tourism development in the Jordan Valley

C01	ISR	Tsemach to Naharaym Tourism Development Project
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C02	ISR	Gesher to Bezeq Stream Tourism Development Project
C01	JOR	Pella Tabaqat Fahl Site Improvement Project
C02	JOR	Abu Ubaydah Tomb Improvement Project
C01	PAL	Cultural Heritage Protection and Management Plan
C02	PAL	Tourism Branding and Promotion
C04	PAL	Rehabilitation of the Catchment of Ancient Jericho
C05	PAL	Rehabilitation of salt industry sites, Rusheideyeh
C06	PAL	Rehabilitation of Ancient Jericho
C07	PAL	Rehabilitation of Hisham's Palace
C08	PAL	Rehabilitation of Tel Abu El Alayek
C09	PAL	Rehabilitation of Khirbet El biyadat or Tel Ouja
C10	PAL	Rehabilitation of Khirbet El Makhrouq
C11	PAL	Rehabilitation of Tel El Hamma
C12	PAL	Archaeological Landmark Features
C13	PAL	Spa, Thalasso therapy and Balneo therapy Center
C14	PAL	Jesus Village

## COLOPHON

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Author	: Jeroen Kool
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