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EcoPeace Middle East Desk Study of the economic and geo-political feasibility of a large-scale desalination plant in the Gaza Strip and its incorporation into the regional water supply system

ECO PEACE MIDDLE EAST

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EcoPeace Middle East

This project was carried out by **EcoPeace Middle East.**

EcoPeace Middle East is a unique organization at the forefront of the environmental peacebuilding movement. As a trilateral organization that brings together Jordanian, Palestinian, and Israeli environmentalists, our primary objective is the promotion of cooperative efforts to protect our shared environmental heritage. In so doing, we seek to advance both sustainable regional development and the creation of necessary conditions for lasting peace in our region. EcoPeace has offices in Amman, Ramallah, and Tel-Aviv. For more information on EcoPeace or to download any of our publications please visit: www.ecopeaceme.org

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Executive Summary

ES1. The Concept

The population of the Gaza Strip suffers from extreme water scarcity. With limited natural water resources, desalination will have to play a central role in providing a path for political stability and potential prosperity in any post-war development scenario for the territory. EcoPeace has proposed an initiative that envisions a large-scale desalination facility in Gaza that would produce water not only for the population of Gaza, but also for that of the West Bank and Jordan as well. This would entail integration of water (and likely energy) at a regional level, including with Israel, and serve as a cornerstone of broader regional cooperation initiatives, promoting both stability and economic development. This study presents a preliminary assessment of the technical, economic and geopolitical feasibility of such a project, and outlines potential broader regional and international partnerships that could advance such an initiative.

ES2. The Context

Palestine, Jordan and Israel all suffer from acute water scarcity, with limited natural sources and growing populations. Nowhere is this scarcity more drastic than in the Gaza Strip, for which much of the limited resources are of poor quality, and which has had limited ability to develop infrastructure. While Israel has already developed significant desalination capacity, all three countries are depending on extensive development of desalination to meet future demand.

Several regional and national desalination projects have been proposed, but which have yet to materialize for a variety of reasons. Below is a list of some of the most relevant to the proposed project.

- A large-scale desalination project, within the context of the **Red-Dead canal** project, was eventually abandoned, due in large part to high costs and disputes over cost-sharing, as well as questions about potential environmental impacts. Though it was never implemented, the project did highlight the potential benefits and cost efficiencies involved in regional water infrastructure projects. It also highlighted both the importance of having an independent national water source (in the case of Jordan), as well as the cost-efficiency and potential win-win options of regional water swaps.
- **The Gaza Central Desalination Plant (GCDP)** – an independent Gazan desalination facility and necessary supporting infrastructure that was to produce 55 million cubic meters (mcm) of water annually for use with the Gaza Strip – was not completed prior to the outbreak of war in Gaza in 2023. The project encountered several challenges including obtaining permits from the Israeli military to import materials, as well questions among funders regarding its long-term financial sustainability. The project was expected to be more expensive than alternative options, such as purchasing water from nearby desalination facilities in Israel, but was preferred by Palestinian officials, for purposes of water security, and decreasing, rather than increasing dependency on Israel. In contrast to the GCDP, which envisioned domestic desalination capacity only for the

Gaza Strip, the initiative envisioned by EcoPeace would provide a domestic source for the West Bank and Jordan as well.

- A few **small-scale desalination facilities** had been functioning in Gaza prior to the outbreak of war in 2023. Some Palestinian officials have advocated for expansion of decentralized small-scale facilities, rather than a large-scale one, such as the GCDP or the project envisioned by EcoPeace. Smaller facilities diversify risk, but do not take advantage of economies of scale. Also, they may encounter difficulty securing finance, given the low probability of cost recovery for projects entirely in Gaza.
- **Project Prosperity** – an agreement between Israel, Jordan and the United Arab Emirates (UAE) under which Israel is to supply desalinated water to Jordan and Jordan is to supply Israel with renewable energy[1] – is currently suspended due to the ongoing war in Gaza.
- The **Aqaba-Amman Water Desalination and Conveyance Project" (AAWDCP)** is a large-scale project currently being developed to bring desalinated water from Aqaba to Amman. The Jordan is advancing this project, despite costs much higher than those projected for water via Project Prosperity given the greater distances and changes in topography, in large part out of concern for water security to be provided by an independent source of desalination supply. The project will help alleviate, but not eliminate water scarcity in Jordan. Thus, the option of water from Project Prosperity and/or the proposed Gazan desalination plant could help meet excess demand, and at a lower cost than the AAWDCP.
- The **India-Middle East Europe Economic Corridor (IMEC),** is an initiative planned to bolster economic development between South Asia, the Gulf States and Europe. India, the E.U, the U.S, and several Gulf States signed an MoU in 2023 to work towards integration of infrastructure that would facilitate inter-regional trade. The Gazan desalination project proposed by EcoPeace is a core element in the organization's "Peace Triangle" program to be integrated within EcoPeace (2025). The IMEC Peace Triangle.

Experience with these projects provides several insights of relevance to the initiative proposed by EcoPeace. These include: the importance of having a domestic desalination capacity, the need for a financially sustainable business model, the additional challenges and costs involved in working in the Gaza Strip, and the potential gains to be had from regional cooperation and integrated infrastructures, as well as the risks involved in such.

[1] This arrangement was based on previous work proposed by EcoPeace which included Palestinian partnership in the water-energy swaps (see, for example, EcoPeace, 2017).

ES3. Technical Feasibility

The initiative evaluated is a desalination facility located in the Gaza Strip with a capacity of 200 mcm per year (mcm/y).[2] For the purpose of the analysis, it was envisaged that half of this amount would be sent to Jordan, while the other half would be split evenly between the Gaza Strip and the West Bank, though other allocations are possible. For a reverse-osmosis plant, currently the most cost-effective commercially proven technology, a land area of roughly 10-12 hectares would be needed for the facility and an additional 5 hectares for the reception facility. In addition, this study assumed the plant would use a dedicated power plant with a capacity of roughly 120MWe.[3]

Two possible scenarios are evaluated for distribution of water outside of the Gaza Strip**:** **Scenario 1,** a dedicated pipeline through Israel to one off-take location in the West Bank and one in Jordan; and **Scenario 2,** integration within Israel's national water system, allowing for "swaps" of water which would eliminate the need for long distance pumping and transportation. The latter option is dependent on the capacity of the Israeli network to take in such a large amount of water. According to officials at the Israeli Water Authority, based on current plans for expansion of the existing Israeli network, the scenario is technically feasible.

ES4. Financial Assessment

In estimating costs, for our base case, we assume a 6% interest rate as a cost of capital, and a 25-year payback term. We also assume rates of electricity currently prevailing in Israel. For sensitivity analysis we also make estimates assuming a 0% cost of capital and a significantly lower cost of electricity (roughly 20% lower than the base case).[4] For our base case, the necessary capital expenditures (CAPEX) for the project are estimated at US$1.1 - 1.6 billion. This includes the cost of both the desalination plant and the dedicated power plant, as well as necessary associated infrastructure, including pipelines connecting the desalination facility to an off-take point in Israel. Operating expenditures (OPEX) are estimated at US$111 - 220 million annually, depending on case assumptions. CAPEX and OPEX figures for the base case are presented in Table ES.1.

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[2] The analysis assumes that investment in repairing the highly damaged water distribution network within Gaza will be necessary regardless of the proposed initiative and therefore, does not explicitly account for this herein.

[3] Other possible energy sources, including purchases from outside suppliers, are possible and are mentioned in the report, but are not included in the base case analysis.

[4] The figure for electricity was taken from projections given in EcoPeace Middle East, 2025. A 0% cost of capital would be relevant only if all capital costs were paid by donors as grants, rather than loans.

Table ES.1. Estimated Capital and Operating Expenses (Base Case)

	Program Item	CAPEX (million US$)		OPEX (million US$/year)	
		Scenario 1	Scenario 2	Scenario 1	Scenario 2
1	Desalination Facility (200 mcm/y) (not including energy)	749.6	749.6	34.6	34.6
2	Energy from Power Plant (120 MW and 114 MW respectively)	152.7	145	55	52.5
3	Central reception and distribution facility in Gaza Strip (not including energy)	90.1	90.1	3.2	3.2
4	Conveyance system within Gaza Strip – (3 x 15km pipelines & pumping)	28.8	28.8	2.3	2.3
5	Conveyance system to the Gazan-Israeli Border (delivering 150 mcm/year) – pipeline and pumping	-	31.3	-	2
6.1	Conveyance system to the West Bank – pipeline, booster stations and pumping	126.8	-	10.8	-
6.2	Conveyance system to the West Bank via Israeli network – wheeling/swap charges		-	-	41[a]
7.1	Conveyance system to Jordan – pipelines, booster stations and pumping	443	-	18.7	-
7.2	Conveyance system to Jordan via Israeli network – wheeling/swap charge	-	-	-	82[a]
8	Program management costs	45.1	45.1	2.8	2.8
	TOTAL:	**1636**	**1089.9**	**127.5**	**220.4**

[a] The incremental cost of delivery of water to the West Bank and Jordan from water supplies in the Israeli system, a "wheeling fee", was based on a quote from the Israeli Water Authority, which cited similar fees currently charged to Israeli municipalities. The fees cover infrastructure development services (for existing infrastructures and for additional ones still to be developed to fit the purpose), and the operational costs (primarily energy) of the network.

Per unit water production costs for desalinated water at the facility in Gaza are estimated at roughly US$0.75 per cubic meter under the base case, as indicated in Table ES2.[5] Costs for desalinated water delivered within the Gaza Strip are estimated at US$0.88-0.89 via pipelines to a single off-take point in the West Bank and Jordan (Scenario 1) are estimated at US$1.22 and US$1.34/m^3 respectively. Delivery via the Israeli water system (Scenario 2) was estimated at US$1.64/m^3. This higher figure reflects the higher OPEX. It is important to note, however, that the cost figures for Scenario 2 are for water delivery to the end consumers in the case of the

[5] This figure is somewhat higher than for costs at facilities in Israel, but well within the range of cost estimates for saltwater reverse osmosis desalination facilities (see Appendix B).

West Bank and to a location closer to Jordanian populations, likely in the northern Jordan Valley, for water delivered to Jordan. As such, Scenario 2 may be the more cost-effective option.

Table ES2. Estimated Cost of Desalination Water by Destination (Base Case & Alternative Cases)

	Water Cost in US$/m3			
Annual Interest Rate: 6%. Payback: 25 years.	**Scenario 1**		**Scenario 2**	
	Current Electricity Cost	**Low** Electricity Cost	**Current** Electricity Cost	**Low** Electricity Cost
Water at exit of the desalination plant (200 mcm/y)	**0.756**	**0.707**	**0.743**	**0.707**
Water delivered within Gaza (50 mcm/y)	**0.899**	**0.846**	**0.885**	**0.846**
Water delivered to West Bank off-take (50 mcm/y)	**1.221**	**1.126**	**1.643**	**1.606**
Water delivered to Jordan off-take (100 mcm/y)	**1.340**	**1.253**	**1.643**	**1.606**
Annual Interest Rate: 0%. Payback: 25 years.	**Scenario 1**		**Scenario 2**	
	Current Electricity Cost	**Low** Electricity Cost	**Current** Electricity Cost	**Low** Electricity Cost
Water at exit of the desalination plant (200 mcm/y)	**0.612**	**0.564**	**0.600**	**0.564**
Water delivered within Gaza (50 mcm/y)	**0.716**	**0.664**	**0.702**	**0.664**
Water delivered to West Bank off-take (50 mcm/y)	**0.963**	**0.868**	**1.475**	**1.438**
Water delivered to Jordan off-take (100 mcm/y)	**1.011**	**0.923**	**1.475**	**1.438**

The proposed initiative faces several challenges and risks that will have to be addressed in order for it to be attractive to international lenders, investors, and contractors. These include the risk of damage and/or supply disruption due to renewed conflict, low cost-recovery rates within the water sectors, lack of a domestic energy supply, and issues regarding the credit-rating of the parties involved. Given these circumstances, any project would need financial guarantees from the parties involved. Contractors may also seek Engineering Procurement and Construction (EPC) or turnkey type contracts rather than the Build-Operate-Transfer (BOT) contracts typical for desalination facilities built elsewhere. Given the uncertainty and risks involved, a dedicated trust arrangement is recommended.

ES5. Geopolitical al Assessment

The proposed initiative is motivated by the desire to develop a **domestic Palestinian desalination capacity**. Rather than simply address local Gazan needs, it would also provide the West Bank with an independent source of water and would augment Jordanian supplies at a cost lower than what Jordan will pay for its own domestically produced desalinated water. It is difficult to overstate the **importance of such an initiative in terms of self-determination and sovereignty**. The project would increase water security for both Palestinians and for Jordanians. In addition, it would promote regional integration and could be a vehicle for trust-building and further regional cooperation.

A number of **enabling conditions** are necessary in order for such a project to move forward. First and foremost, it would need a **stable governance structure in place in the Gaza Strip**. As both materials and the desalinated water itself would cross through Israeli territory, it would also need the **approval of and coordination with Israeli authorities**. Given the history of conflict in the region, as well as the economic risk involved, the project would also need **security and financial guarantees** from all parties involved. In addition, it would require **independent monitoring** of both construction and operations.

As mentioned, the project will need substantial international funding, both for CAPEX, and in the case of the Gaza Strip, also for OPEX, at least for an initial period. Recent global geopolitical shifts, including most prominently, the shift in American foreign and trade policy, has meant not only a reduction in American aid, but also more competition for European funding, which is likely to decline as European nations try to fill the funding gaps, and develop their own military capabilities. Thus, the proposed initiative will need to look beyond these traditional sources of investment.

An obvious alternative source of investment is the Gulf states, including most prominently Saudi Arabia. These countries are already invested in the development of the region, have the financial resources, have an interest in regional stability, and have expertise in the desalination and energy sectors in the region.

The proposed initiative could be incorporated as part of a broader Gaza redevelopment scenario, or even as a part of a broader regional normalization and/or political integration process. This would increase international support for the project and help guarantee its successful implementation. It would also help leverage necessary investment.

ES6. Conclusions

The proposed initiative is a bold one that can lay the foundation for regional development and cooperation. It would provide Palestinians, in both Gaza and the West Bank, with a domestic source of water and would provide Jordan with additional water supplies at a price below the cost of domestic desalination. As such, it would help address basic human and economic development needs in the region. Inclusion of supplies to the West Bank and Jordan would also improve the financial viability of the project and may increase donor interest.

Beyond its direct benefits in terms of regional water security, the project has the potential to further regional economic integration as well as scientific, technical and environmental cooperation more generally. It could serve as a significant element within larger regional normalization and/or development programs, thereby also promoting political and economic stability.

Such an initiative faces several challenges and unknowns, technical, economic, and political. For this reason, this initial assessment should be viewed as a preliminary assessment to be followed by a more detailed feasibility study undertaken in consultation with representatives of the relevant governmental and private sector actors.

1. Introduction

The purpose of this report is to present an initial assessment of the technical, economic and geo-political feasibility of a large-scale desalination plant in the Gaza Strip and its incorporation into a regional water network including the West Bank and the Kingdom of Jordan. As envisioned by EcoPeace Middle East, such a facility would not only address water scarcity in the region, but also potentially be a driver of economic development and regional integration and security. This report will estimate the projected costs of such a project, its potential benefits, conditions necessary for its implementation, and potential obstacles and risks such a project may face. It will also assess the roles and interests of various potential stakeholders who could play a role in the advancement of such a project.

In order to undertake such a study in a reasonable timeframe, it was necessary to make several assumptions. These include that the project will be feasible only once a stable political situation exists in the Gaza Strip, that the area has a functional water supply network, and that necessary building materials will be allowed in. We do not take into consideration in this report the costs or time-frames necessary for achieving such conditions; rather, we take them as given. In terms of technology, we evaluate a plant that will use reverse-osmosis technology of the sort commercially available and proven.[6] In looking at the integration of the supply of desalinated water to the West Bank and Jordan, we assume delivery to a single off-take location in each, and do not analyze the costs and infrastructure needs associated with distribution within these areas.

The report proceeds as follows: Section 2 provides context for this study including a description of the proposed project, a review of other relevant major water projects proposed for the region, and a brief analysis of the ways that the proposed large-scale desalination facility in Gaza would differ from previous initiatives. Section 3 provides a review of the technical requirements for such a facility, including the necessary associated infrastructure. Section 4 presents an estimate of the capital and operational costs involved in implementing such a project, as well as insight into possible mechanisms and conditions for financing such an initiative. Section 5 offers an assessment of the geopolitical conditions that would potentially facilitate or challenge implementation of the initiative. Section 6 reviews relevant aspects of the legal and regulatory frameworks in the countries involved and highlights legal and institutional conditions necessary for advancement of the project. Section 7 provides an overview of potential opportunities for regional collaboration in a project of this scale and nature. Section 8 lists various potential stakeholders in such an initiative and maps their respective interests, and Section 9 looks at potential phases of development for such a project, including prioritizing steps necessary for project implementation.

[6] While there are continuous innovations in the field of desalination, including within reverse-osmosis (e.g., improvements in membrane technologies, energy recovery, etc.), any assumptions regarding the pace of such developments and their costs would be speculative. For this reason, we assume adoption of technologies currently in widespread use at current prices.

2. Context

2.1. Project Description

As per EcoPeace's call for proposals (RFQ-ECOPAL-2024-022) this study will consider the construction and operation of a large-scale desalination plant to be built in the Gaza Strip. The proposed production capacity of the facility would be at the scale of roughly 200 million cubic meters (mcm) of product water annually. For context, this is larger than the largest of the currently operating desalination plants in Israel (Sorek 1, with an annual production capacity of 150 mcm), but in line with other facilities currently planned for the region (e.g., Israel's Sorek 2 (200 mcm/y) and Jordan's proposed National Water Carrier project (300 mcm/y)).

Regarding the allocation of the water produced, for the purposes of this report we analyze a scenario in which roughly 50 mcm of desalinated water would be for use in the Gaza Strip, roughly 50 mcm would be delivered for use in the West Bank and roughly 100 mcm would be transferred for use in Jordan. This scenario is for illustrative purposes only and other distributions may be more cost effective or desirable for other reasons.

2.2. Need for Desalination to Address Water Scarcity

The three countries that would necessarily be directly involved in the proposed project, Palestine, Israel and Jordan, all face acute water scarcity. According to the Falkenmark Index, a commonly used metric for measuring water scarcity at the national level, countries with less than 1700 cubic meters per capita per year ($m^3/c/y$) of renewable freshwater are considered to face water stress. Those with less than 1000 $m^3/c/y$ are considered to face water scarcity and those with less than 500 $m^3/c/y$ are considered to deal with absolute or acute scarcity. All three of the countries that would be directly involved in this project are far below this standard for acute scarcity, even when including Israel's significant desalination capacity and its extensive use of reclaimed wastewater, as shown in Table 1 below.

Nowhere is this scarcity felt more than in the Gaza Strip. Not only does it have the lowest per capita freshwater availability in the region, but most of the water that it does have is contaminated. According to multiple sources, roughly 97% of the freshwater supplies in the Gaza Strip did not meet World Health Organization standards for drinking water (e.g., OCHA, 2022). This is due both to historical overpumping[7] leading to saltwater intrusion into the coastal aquifer that supplies the Gaza Strip, as well as to a lack of wastewater treatment and irrigation with poor quality water, leading to leaching of contaminants into groundwater supplies.[8]

Prior to the ongoing war, the Gaza Strip's water supply was dependent primarily on pumping from the coastal aquifer. In addition, Gaza also has three short-term low-volume (STLV)

[7] According to the Palestinian Water Authority (PWA, 2022), over 190 mcm of groundwater was pumped from Gaza's aquifer in 2020, despite renewable supplies being estimated at just 50-60mcm.

[8] According to Dr. Ahmad Yaqubi, former director of the PWA in Gaza, average salinity of groundwater in Gaza is 900 milligrams of chlorides per liter (mg/l). For reference, 250 mg/l is a common standard for drinking water for bodies, in use in the European Union and the United States.

seawater desalination plants with an annual total production capacity of 13 mcm/y (Abualtayef et al., 2019), however, as of 2022 actual production from these facilities was estimated at roughly 6mcm/y (PWA, 2022). These supplies were augmented by roughly 18 mcm of water per year from three pipelines from Israel. As a result of the war currently ongoing in the Gaza Strip, much of the local water infrastructure has been damaged, including local desalination facilities, and from Israel have been severely restricted.

Table 1. Water Scarcity in the Region

	Population (as of 2020) (millions)	**Renewable Freshwater Supplies** (mcm/y)	**Renewable Freshwater Supplies Per Capita** (m^3/cap/y)
Falkenmark Index			
Water Stress			**<1700**
Water Scarcity			**<1000**
Acute Water Scarcity			**<500**
Israel (freshwater only)	9	1200	130
(w/desal & recycled wastewater)		2300	250
Jordan	10.5	800-1000	75-95
Palestinian Territories	4.8	240	50
West Bank	2.8	180	64
Gaza	2	60	30

Notes: Figures based on 2020 data available from World Bank World Development Indicators, UN Population, Israeli Water Authority, Jordan's Ministry of Water and Irrigation, the Palestinian Water Authority, and Salameh et al., (2018). Israeli settlers in the West Bank are included in the population figures for Israel. Palestinians in Jerusalem are considered in the figures for the West Bank. The figure for Jordanian population represents residents, rather than citizens. Water figures for the West Bank and Gaza Strip are based on supplies as of 2020, and are not meant to imply any claims regarding rights to shared waters. Population figures vary among sources, as do estimates of renewable water resources. Thus, the figures should be viewed as representative but not authoritative.

In addition, all populations in the region are experiencing rapid population growth, with rates of between 2-3.6% (WDI, 2025). This growth is increasing pressure on the already limited water resources. In addition, climate change is further increasing stresses on the region's water availability. According to the Israeli Meteorological Service (IMS, 2024), the region is likely to experience a decrease of 20-30% in annual rainfall and an average temperature increase of 3.5°C by the end of the century, as well as a sharp increase in days of extreme heat. In addition, sea level rise is expected to increase rates of saltwater intrusion into the coastal aquifer supplying both the Gaza Strip and Israel (IPCC, 2022). In sum, the region is already dealing with acute water scarcity and the pressures on these limited supplies are expected to increase. As such, additional water supplies are in dire need. Seawater desalination is the primary option available for addressing this need and all three parties have plans for developing desalination capacity.

2.3. Prior Large-scale Regional Water Projects

This section will review several planned and existing large-scale regional water projects In order to understand both the relative merits of and options for developing the proposed desalination project, as well as challenges and obstacles facing such a project. We review relevant projects which were completed or for which planning was in advanced stages.

2.3.1. Gaza Central Desalination Project and Associated Works Program (GCDP)

The Gaza Central Desalination Project and Associated Works Program (GCDP) calls for the development of a large-scale desalination facility, with an annual production capacity of 55mcm (eventually to be expanded to 110mcm). Along with the desalination plant itself, a dedicated power plant would be built. Also included in the project was a set of "associated works" including a north-south conveyance system to deliver the water, and investment in reduction of leakages and other causes of non-revenue water in the Gazan water system. The project was the central element of a larger Gaza Sustainable Water Supply Program (GSWSP) that aimed to provide good quality drinking water to Gaza and reduce the pressure on the coastal aquifer.

The project, which was scheduled to be completed in 2030 (World Bank, 2019), was estimated to cost between €560-580 million (US$ 685-710m) in 2018 prices (PWA, 2018; Office of the Quartet, 2019). Of this, the desalination plant itself was estimated to cost €215m, the power plant just under €90m, and the associated works €160m. Also included in the cost estimates were subsidies for operational costs for the first five years, estimated at €46m (PWA, 2018). The project was to be financed by a combination of support from the European Investment Bank (EIB), the United States Agency for International Development (USAID), the Islamic Development Bank (IsDB), the Kuwait Fund, the World Bank, and individual donor countries and the Palestinian Water Authority (PWA) itself. As of 2019, donors had pledged nearly €500m, over 80% of the total amount needed (Office of the Quartet, 2019).[9]

The projected costs for water from the GCDP desalination plant ranged between US$ 0.85 and US$ 1.5 per cubic meter. Unspecified subsidies were planned to assist the local population to afford the cost of water, at least for the initial years of production (PWA, 2018). Energy supply was a significant factor in determining overall project costs. According to initial plans, renewable energy, primarily solar, was to supply 12% of peak power capacity (OCHA, 2017).[10]

The planned capacity of 55mcm per year was expected to reduce, but not eliminate, overuse of groundwater. If expanded to an eventual capacity of 110 mcm the facility could, together with renewable groundwater, supply enough to meet current (prior to 2023) water withdrawals by Gazans, assuming blending of water sources.

[9] This figure is the amount pledged by potential donors and investors, but not actually allocated.
[10] A study by the European Union identified possible options to expand the share of renewable supplies up to 80% (OCHA, 2017). Such levels, however, have not been achieved in any commercial scale desalination facility and are not considered technically feasible at present.

The GCDP was at advanced stages of planning, and initial implementation of some elements of the Associated Works projects had begun. However, ultimately the initiative did not move forward. Among the primary obstacles were restrictions placed by the Israeli government on necessary construction materials, much of which they designated "dual use" (i.e., civilian and military). In addition, the project faced other challenges, including securing a reliable and affordable energy supply, and the need to transport large equipment, given that Gaza lacks a commercial marine port. There were also delays in securing the pledged finance from some donors, and some donors also raised concerns regarding the security of the facility, given the history of conflict, and the long-term financial sustainability of the project beyond the first 5 years. This is due to low rates of cost recovery for current water supplies, even at highly subsidized rates.[11]

2.3.1.1. Centralized vs. decentralized desalination

Prior to the outbreak of war in 2023, officials in the Gaza Strip, within the PWA, and among the donor community, debated the merits of large-scale desalination versus smaller-scale decentralized systems. This debate is likely to continue with any recovery plan for Gazan reconstruction. Table 2 below presents a schematic presentation of relative advantages for centralized vs. decentralized desalination facilities. Primary benefits to centralized systems include economies of scale, ease of oversight, and less need for approvals, supervision and management resources. Primary benefits to smaller decentralized systems include a diversification of risks, greater possibility of a modular, adaptive approach, and likely a shorter timeline for initial implementation.

Table 2. Relative Advantages of Centralized vs. Decentralized Desalination Facilities

Advantages	Large-Scale / Centralized	Small-scale / Decentralized
Economies of scale	X	
Reduced financial requirements	X	
Reduced supervision & management needs	X	
Reduced number of stakeholders & contracts	X	
Reduced number of approvals needed	X	
Reduced workforce	X	
Risk diversification		X
Possibility of a modular, gradual approach allowing for a learning curve		X
Reduced pumping and delivery costs due to the ability to locate closer to end-consumers		X
Quicker initial implementation schedule		X

[11] According to Ahmad Yaqubi, former head of the PWA in Gaza, prior to the current war, cost recovery rates were less than 25%, even with water fees of roughly 1 shekel per cubic meter.

Relative to an **international** project such as that being proposed by EcoPeace, small decentralized systems may also encounter difficulty finding finance, given the low probability of cost recovery for a project entirely in Gaza. In EcoPeace's proposed project much of the expected finance for would come as payments from the Palestinian Authority in the West Bank and from Jordan, providing a more secure future income stream.

Implications from the GCDP for the project proposed by EcoPeace:

1) **Funding for such a project will necessitate government guarantees, with donor funding to cover much of the capital expenditures, as well as operating expenses, at least for Gaza's share of the consumption.**
2) **Substantial investment in basic Gazan infrastructure (water and power grids) is necessary as a precondition for advancement of large-scale desalination.**
3) **An agreement on the introduction and supervision of "dual use" construction materials, as well as other equipment, chemicals and replacement parts, is necessary prior to project initiation.**
4) **The primary advantages of a large-scale, regional desalination project relative to decentralized facilities are economies of scale, reduced management burdens, and greater financial stability by incorporating non-Gazan consumers.**
5) **The lack of a commercial marine port in Gaza, at least at present, necessitates transport of equipment from Egypt or Israel, requiring approvals and potentially increasing costs.**

2.3.2. Red Sea–Dead Sea Water Conveyance Study Program (Red-Dead)

In 2013, Israel, Jordan and the Palestinian Authority (PA) signed a Memorandum of Understanding (MoU) to support a mega-project dubbed the Red Sea–Dead Sea Water Conveyance Study Program (the Red-Dead project). This project was planned to produce roughly 850mcm/y of desalinated water from the Gulf of Aqaba, primarily for consumption in Jordan, with a slightly larger amount of brine from the desalination process conveyed to the Dead Sea to compensate for falling sea levels there. The project encountered objections from the environmental community and others, especially due to concern over the impact of the brine on the composition of the Dead Sea waters, but was ultimately supported by the three governments. The project also included a share of the desalinated waters to be delivered to the West Bank.

Feasibility studies and environmental and social assessments were conducted with the support of the World Bank, as was a study of possible alternatives to the Red-Dead project (Allan et al., 2014). The cost was estimated at over $10 billion in 2013 prices (World Bank, 2013). The project was intended to proceed in stages, with the first stage involving roughly 80-100 mcm/y of desalinated water produced. Also included in the first stage was a plan for water swaps, with a portion of the water produced in Aqaba transferred to communities in southern Israel in exchange for an increase in water supplied by Israel to Jordan in the Lower Jordan basin near the Sea of Galilee. This would obviate the need for long-distance pumping of water in both countries and thus would be a cost-effective win-win situation.

Funding for the feasibility studies was given by the World Bank, the EIB, and the French Development Agency (AFD). Project funding was to be from these organizations as well as other donor countries and development banks, as well as substantial funding from both Jordan and Israel.

The project was in advanced stages of planning, and contract bidding processes had begun. However, in 2021 Jordan officially announced it was ending its support for the project. As Jordan was the primary beneficiary and driver of the project, this essentially meant the end of the initiative. Reasons for the project's demise included the high costs, a lack of consensus over cost-sharing, and, according to Jordanian sources, a dwindling of support within Israel (Times of Israel, 2021). In Israel, critics of the project pointed to the high costs, to the fact that Israel stood to gain relatively little in terms of project benefits, and to potential environmental concerns regarding the project. Some also pointed out that, according to the World Bank's study of alternatives (Allan et al., 2014), a pipeline from the Mediterranean through Israel would be cheaper and more cost effective than one originating in the Red Sea and advocated for advancing such a plan instead.

Despite not moving forward, the Red-Dead project offers several lessons for regional water projects.

Implications from the Red-Dead for the project proposed by EcoPeace:

a) **Including a regional partnership is important in advancing projects in the area. Jordanian and international donor support for the project was possible only after inclusion of the Palestinian as a co-beneficiary.**
b) **The concept of a regional water management approach, with water swaps can be a cost-efficient win-win option.**
c) **The fact that Jordan was advocating a Red-Dead design rather than an objectively cheaper Med-Dead one, highlights the willingness to pay a premium for increased water independence.**
d) **The project will have more support if all sides have a substantial material interest in project success. In the case of Israel and Palestine, the primary interests were basically political (for Israel, having a joint regional project with an Arab partner, and for Palestine, gaining official recognition of their status as a riparian of the Dead Sea and being integrated into regional infrastructure). However, neither stood to gain much materially from the agreement.**
e) **Agreement on cost-sharing is critical for project advancement.**

2.3.3. Project Prosperity (Water-Energy Swaps)

In 2021 the governments of Israel and Jordan signed a cooperation agreement, with support from the United Arab Emirates (UAE) and to some extent the United States that would involve Israel supplying Jordan with up to 200 mcm/y of desalinated water and in exchange, Jordan supplying Israel with solar energy from a 600MW capacity dedicated solar field. The project would allow both countries to take advantage of their relative comparative advantages: Israel is a leader in desalination technologies and has access to the Mediterranean, while Jordan has ample open spaces available for utility-scale solar fields and has experience with building and operating low-cost solar facilities.

In 2022, the parties signed a Memorandum of Understanding to promote the initiative, dubbed "Project Prosperity" (with the renewable energy and desalination projects sometimes referred to as Prosperity Green and Prosperity Blue respectively (MFA, 2022)). The project is to incorporate the private sector in a leading role and, unlike the GCDP, was not envisaged to be donor led and operated, though UAE firms were expected to lead the development and operation of the solar fields.

The project is based on a proposal initially developed by EcoPeace Middle East, which conducted a pre-feasibility study investigating the economic, environmental, and geopolitical merits of the initiative (EcoPeace, 2017). The EcoPeace study envisioned a more regional approach, which incorporated Palestine and potentially the development of desalination in the Gaza Strip as well. The EcoPeace study also looked at the provision of water from the Mediterranean to Jordan, but also noted that the possibility of water swaps (i.e., Israel developing desalinated water along its coast for its own use, and releasing more natural freshwater to Jordan from the Jordan Basin), would potentially be cost-effective.

The Project Prosperity agreement did not incorporate the State of Palestine. The lack of a Palestinian partnership turned out to be a weakness of the agreement. Following the outbreak of the war on October 7, 2023, the Jordanian government announced that it was suspending its involvement in Project Prosperity as it was not willing to advance new agreements with Israel as long as the war was ongoing. It did not want to be seen as abandoning the Palestinian cause and was weary of how it would look to advance a new large-scale project with Israel while Gaza was under siege. The war also highlighted the risks of dependence on Israel for water supplies, given that Israeli policy during the first days of fighting (and in later stages) was to cut supplies of water and energy to the Gaza Strip.

At present, the status of Project Prosperity is unclear. Israel, however, is currently planning on building a large-scale desalination plant in the Emek Hefer region, with the expectation that 200 mcm/y would be produced for supply of water to Jordan, which it expects will reengage with the project after the current war in Gaza.[12] The Israeli position is based on Jordan's overall water

[12] This assessment is based on personal communication with Israeli Water Authority officials.

needs, and the fact that existing water sale agreements between Israel and Jordan have been extended, despite the war.

Implications from Project Prosperity for the project proposed by EcoPeace:

a) **Introduction of mutual interdependencies can offer win-win situations.**
b) **Leadership by outside regional parties can be important in advancing regional agreements.**
c) **The risks of dependency on water transfers are real and need to be taken into account.**
d) **A regional approach that includes Palestinian partnership may be more difficult to negotiate, but ultimately may facilitate the advancement of large-scale projects in the region.**
e) **Water agreements are vulnerable to regional volatility and hostilities, but there is also precedent for them to survive even under such conditions.**

2.3.4. Aqaba-Amman Water Desalination and Conveyance Project – National Water Carrier

Since withdrawing support for the Red-Dead project, Jordan has begun to advance the "Aqaba-Amman Water Desalination and Conveyance Project" (AAWDCP), also referred to as the "Jordanian National Water Carrier Project" (Ministry of Water and Irrigation, 2023). This project envisions the production of 300mcm of desalinated water annually from the Red-Sea to the country's population centers in the north of the Kingdom. The AAWDCP was originally scheduled to be completed in 2028 (Vidon, 2023), but more recent announcements have stated that construction is only likely to begin in 2029 (The Jordan Times, 2024). The project is expected to cost between €3-4 billion (US$ 3.4-4.6 billion) (Vidon, 2023, The Jordan Times, 2024, Ministry of Water and Irrigation, n.d.). It is expected to be a public private partnership (PPP). The government signed an MoU with an international consortium led by Meridiam Suez to construct the project. Initial investors in the planning process include the EIA and USAID, as well as various national governments and the Jordanian government itself. It is still unclear, however, where the bulk of project finance will come from. The cost of water supplied by the AAWDCP is estimated to be 2.7 Jordanian Dinar (JD) (roughly US$ 3.8) per cubic meter. This is substantially more than the current cost of water supplied in Jordan from Israel from the Sea of Galilee or than that of desalinated water supplies within Israel. The AAWDCP's high cost is due to the substantial conveyance costs, as well as the need for additional conveyance infrastructure.

The AAWDCP is a central component of the Kingdom's National Water Strategy 2023–2040. As with Gaza, Jordan has high rates of leakage and non-revenue water.[13] Reduction of non-revenue water rates is an important national goal in and of itself and is also a necessary precondition to secure private sector funding for the National Water Carrier. For this reason, the government

[13] According to the Ministry of Water and Irrigation (2023) non-revenue water in Jordan accounts for 50% of all water withdrawn.

has developed a National Water Conservation Roadmap (Ministry of Water and Irrigation, 2024) and has dedicated a substantial sum (450m Jordanian Dinar (€590m)) for investment towards this goal (Jordan News, 2024).

The AAWDCP will substantially increase Jordan's freshwater supplies. However, even with the water supplied by the project, and a substantial reduction in non-revenue water, Jordan will still face water scarcity. As such, it may be willing to import additional supplies.

Implications from the AAWDCP for the project proposed by EcoPeace:

a) **Jordan is willing to pay a high price for freshwater supplies and for a modicum of water independence.**
b) **Investment in infrastructure improvements is a necessary prerequisite for attracting investment in large-scale water projects.**
c) **The project will alleviate, but not eliminate, water scarcity in Jordan.**
d) **It may increase Jordan's willingness to purchase water under Project Prosperity and/or the proposed Gazan desalination plant, given that there will still be excess demand and the costs of desalinated water from the Mediterranean are estimated to be lower than those from the AAWDCP.**

2.3.5. Other relevant water development projects

In addition to the initiatives presented above, several other actual and potential initiatives are relevant in order to provide context for the evaluation of EcoPeace's proposed project.

2.3.5.1. Increased water sales from Israel

Under the Oslo Accords, signed in 1995, Israel is obligated to supply the Gaza Strip with 5mcm/y. The Accords were intended to serve as a five-year interim agreement, and in the 30 years that have passed, Gazan population and water needs have increased substantially. Prior to the ongoing war, Israel had increased the amount of water it was supplying to Gaza (initially to 10 mcm/y and later to 18 mcm/y) and deducted the costs from tax monies designated for the PA. Israel has offered to increase sales of water to Gaza. Given that it currently operates a desalination plant in Ashkelon, the capacity of which could be expanded, and already has three water pipelines into the Gaza Strip, this would be a cost-effective option to address local water shortages. A dedicated desalination plant in Israel is also possible. Such an option would also be less likely to be damaged in the event of a renewed outbreak of violence in Gaza. However, the PWA, emphasizing "water security" (PWA, 2016), has indicated that it prefers to have an autonomous supply of water, as evidenced by the GCDP plans, rather than to increase its dependency on Israel. This rationale is likely even stronger given the actions by Israel to restrict water supplies since the outbreak of hostilities in October 2023.

2.3.5.2. Desalinated water supplies from Egypt

For over two decades various proposals have been floated to build desalination facilities in Sinai, Egypt to supply the Gaza Strip. Following the destruction of water infrastructure and restrictions on energy imports into the Gaza Strip during the current hostilities, the UAE installed six small-scale desalination plants with a combined daily capacity of just over 4500 cubic meters (or roughly 1.6.-1.7mcm/year) for supply to Rafah (Al-Shouq, 2024). The operation of those facilities stopped following the Israeli military operations and presence in the Rafah area.

A large-scale desalination plant is currently being built in El-Arish in Sinai, roughly 50 kilometers (km) from the border with the Gaza Strip. This plant will have an estimated capacity of 36mcm/y, expandable up to 110mcm/y. From project descriptions, it appears that the purpose of the facility is to augment local water supplies and there is no indication at present that output would also serve the Gaza Strip. The project is being financed by a loan from the Saudi Fund for Development (Ministry of Planning, Economic Development and International Cooperation, 2023).

The advantages to supplying desalination from Egypt are that it would not be subject to the restrictions on materials that are imposed on Gaza, it would not be vulnerable to damage should conflict renew in Gaza, and it would not require land in Gaza which is in short supply. The primary disadvantage is that it too would not provide Gaza (or Palestine more generally) with its own sovereign desalination capacity. As such, it has not been widely promoted as an option to date.

2.3.5.3. The Arab Proposal for Gaza Reconstruction

In March 2025, several Arab countries, led by Egypt, submitted a program for post-war reconstruction and development in Gaza, officially titled “Early Recovery, Reconstruction, and Development of Gaza” (Presidency (Egypt), 2025). This is a wide-ranging plan covering a range of topics involving an estimated $53 billion in needed investments. The plan specifically calls for construction of “2 Desalination plants with a capacity of 220,000 cubic meters per day” (~75mcm/y), as well as related infrastructure projects such as power plants and repair of water and electricity distribution grids. It does not, however, outline specific costs associated with the proposed desalination projects or provide any other details.

2.3.5.4. Israel’s Reverse National Water Carrier

Prior to the advent of large-scale seawater desalination, the major water infrastructure in Israel was the National Water Carrier (NWC). Inaugurated in 1964, the large pipeline brought water from the Sea of Galilee in the country’s north to the coastal regions and Israel’s population centers. Since the adoption of large-scale desalination along the coast, most of the capacity of the NWC was left unused. Moreover, because of changes in precipitation patterns over the past decades, the Sea of Galilee was often unable to supply even local in-basin water demand. To address this, the Israeli national water company, Mekorot, which operates the NWC, engineered the pipeline system to pump desalinated water from the coastal area to the Sea of Galilee in order to augment natural water inflows. The project began operation in 2023. While the "Reverse NWC" is not a regional project, it has regional implications, in that it will make transfers of water from northern Israel to Jordan more feasible. It was seen as critical in reducing the costs of water to be supplied to Jordan via Project Prosperity.

Implications from these other projects for the project proposed by EcoPeace:

a) **Options for water supply to Gaza include from external sources (e.g., Israel and Egypt), which would reduce pressure on Gazan land, would not be subject to Israeli restrictions on materials, and would be less likely to be targeted in renewed warfare. However, they would not provide Gaza specifically and Palestine more generally with sovereign and independent water supplies, and would increase Palestinian dependence on external water sources.**
b) **Jordan's investment in its own National Water Carrier demonstrates its desire for increased water supplies, as well as water independence, even at a very high economic cost. Even with this project, however, Jordan will still face water scarcity and will need additional supplies.**
c) **The Arab world recognizes the integral role that desalination will have to play in the eventual reconstruction of the Gaza Strip.**
d) **Israel's "Reverse NWC" demonstrates the ability for Israeli water infrastructure to deliver large amounts of water across the country, which would be necessary for the proposed project. By reducing stress on the Sea of Galilee, it increases the options for cost-effective water transfers to Jordan.**

2.3.6. Other regional development initiatives

2.3.6.1. The **India-Middle East Europe Economic Corridor (IMEC)**

The **India-Middle East Europe Economic Corridor (IMEC),** is an initiative planned to bolster economic development between South Asia, the Gulf States and Europe. India, the E.U, the US, and several Gulf States signed an MoU in 2023 to work towards integration of infrastructure that would facilitate inter-regional trade. The project envisages connected rail and other transport networks between India and the Middle East, and the use of Mediterranean ports for shipping of goods between India and Europe.

EcoPeace has proposed a "Peace Triangle" initiative within the framework of IMEC: EcoPeace (2025). The IMEC Peace Triangle. The envisioned regional desalination project would be one of three core elements in the Peace Triangle initiative, together with development of renewable energy production, using renewable energy to produce electricity and green hydrogen for eventual transmission to Europe, as well as an integrated, renewable powered rail network between the Gulf states and the Levant.

3. Technical Feasibility

The proposed project envisages the development of a large-scale desalination plant in Gaza that includes also a dedicated powerplant, and a central reception and distribution facility in Gaza and their incorporation into the Palestinian Gaza and West Bank Water Sector and regional export of water to Jordan ("**the concept**"). This section aims to cover the technical components related to the project, and to evaluate: i) concept's technical feasibility; ii) possible scenarios to connect the plant to Gaza water reconstruction plans post war; iii) the supply of product water via Israel to the West Bank and to Jordan; and iv) energy requirements.

3.1. Main Desalination Project Components

3.1.1. **Basic Project Parameters**

The following project components, parameters and characteristics are assumed and guide the rest of the analysis: The large-scale Gaza Strip Seawater Desalination Facility project comprises the design, construction, supply, installation and long-term on-site operation and maintenance of a **Seawater Reverse Osmosis (SWRO) desalination facility** capable of producing **200 mcm per year of product water** from the Mediterranean Sea. The quality of the product water shall comply with the World Health Organization (WHO) drinking water quality standards and requirements.

The desalination facility will include all required equipment, materials, works, infrastructures and auxiliaries, such as its seawater supply and pre-treatment, backwash sludge treatment, brine and overflow discharge, the desalination segment with isobaric energy recovery, membrane cleaning and flushing systems, energy supply subsystem, product post-treatment, product delivery, instrumentation and controls, piping and fittings, storage tanks, laboratory facilities, spare parts, chemicals, mechanical and electrical workshops, etc. The overall system operational logic will be controlled by a programmable logic controller (PLC) system with critical shutdown alarms for its protection.

The seawater feed supply is based on two (2) offshore sea intake structures (installed at a point where the water column is approx. 12 - 15 meters). The large amount of seawater needed for the process (about 60,000 m^3/hour) together with the very low hydraulic conductivity that characterizes the porous media in the area, means that use of subsurface intake systems or beach wells are not feasible. Seawater will be drawn from the suction heads up to the pumping station located on the SWRO plant site by two large diameter pipes (OD - 120"). One brine outfall pipeline equipped with special outfall diffusers (to provide better diffusion, diluting and mixing conditions of the brine with the seawater) will be installed up to a depth of approx. 20 m' and at a safe distance from the intake suction structures, thus preventing short-circuits between the brine discharge and the feed intake suction heads.

The implementation of the "concept" shall be conducted with responsibility towards the environment, shall comply with international environmental laws, rules and regulations applicable to the facility in all its phases and shall promote the use of technologies and approaches that avoid or mitigate potential environmental impacts.

3.1.2. Land Requirements

Based on the above assumed parameters, the proposed **SWRO facility will need an area of 10 – 12 hectares (ha)**. If conditions allow, the plot location shall preferably be close to the seashore. This is not mandatory, and the plot can be inland, but this would increase costs. This plot of land would likely also accommodate a **dedicated power plant** with a capacity of roughly 120 MWe (a breakdown of energy requirements and possible supply scenarios is detailed in Section 3.4 below).

A **central reception and distribution facility in Gaza demands an area of 5 ha** to be located in the vicinity of the desalt plant, and shall be capable of absorbing the whole production capacity of the desalination plant, and discharging the product water to three main consumers: i) Gaza Strip local distribution facilities (50 mcm/y); ii) a central distribution location in the West Bank (50 mcm/y); and iii) a central distribution location in Jordan (100 mcm/y). This facility shall comprise two (2) storage tanks with a total capacity of 150,000 m^3 (roughly 6 hours production of the desalination plant), high-capacity pumps and motors, electrical rooms, monitoring, command and control systems.

3.1.3. Conveyance Infrastructure Requirements

This subsection outlines the technical parameters of conveyance

3.1.3.1. Conveyance Infrastructure Requirements for Gaza Strip

The almost complete destruction of infrastructure in the Gaza Strip as a consequence of the ongoing war, will require significant investment in reconstruction. The discharge of product water to Gaza demands the construction of dedicated infrastructure like a north-south water carrier, booster stations, storage reservoirs for transport of desalinated water, and for blending the desalinated water with water from other sources (primarily groundwater). As such infrastructure will need to be redeveloped regardless of the proposed desalination initiative, we do not consider their costs in this study.

We do estimate the investment for the implementation of **three main branches of pipelines** (32" diameter, 15 km each), necessary to deliver product water allocated to Gaza (50 mcm/year). We assumed a location for the desalination facility in the vicinity of Deir El-Balah for the purposes of our calculations, though an exact location should be determined after weighing alternatives.

3.1.3.2. Conveyance Infrastructure Requirements for the West Bank and Jordan

As for product water conveyance to the West Bank and Jordan, we consider two basic scenarios:

- **Scenario 1: Dedicated lines for delivery of water to a single off-take location in each area (West Bank and Jordan), and**
- **Scenario 2:** Integration within the Israeli national water system, with water delivered to the West Bank and Jordan coming from proximate water system locations.

Under **Scenario 1** water would be delivered from the Gaza Strip to a single location within the West Bank and within Jordan respectively. The two parties would then be responsible for delivery of the water through their own water infrastructure systems. The assumed "**landing or off take points**" of the conveyance lines (Scenario 1) are:

- **Idhna for the West Bank**
- **Feifa for Jordan**

The approximate conveyance routes are presented in the map in Figure 1 below.

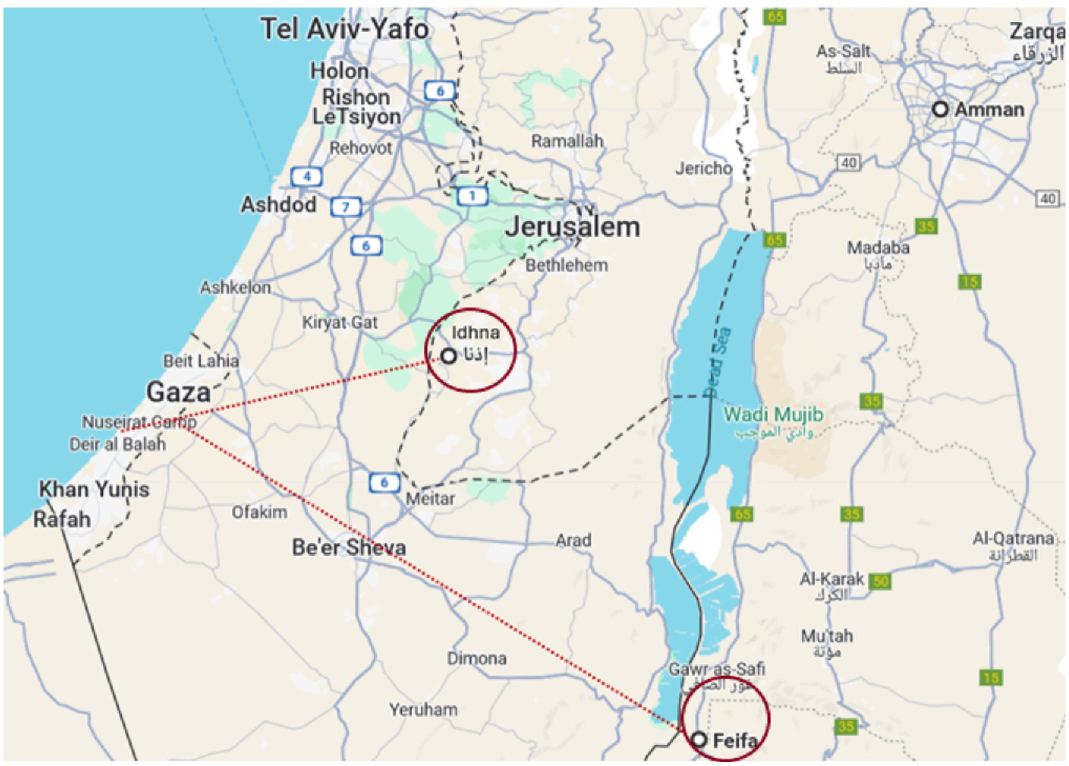

Figure 1. Approximate locations of suggested desalination off-take locations

Both locations were chosen after consultation with experts familiar with the water distribution systems in both countries. Idhna was chosen as a location relatively close to the Gaza Strip (roughly 60 km from Deir El-Balah), and one that is integrated into existing Palestinian water infrastructure. Idhna is at an elevation of roughly 500m above sea level, meaning that significant pumping would still be needed for water to reach urban centers such as Hebron and Bethlehem.

In the case of the off-take point in Jordan, local experts recommended a location either near Wadi al-Arab and/or Zara Ma'in (near Wadi Mujib). However, topographic constraints and the very large distances for the suggested landing points, and the need to by-pass the Dead Sea rendered them infeasible. Therefore, for this study, we consider the closest landing point in Jordan south of the Dead Sea, at the intersection of roads #65 (Jordan Valley Highway) and #60 (At-Tafila Highway), near Feifa. The selected landing point is close to the envisaged route of the AAWDCP. We therefore assume that the Gazan water conveyance could be integrated into the AAWDCP system.

The discharge of product water to the West Bank and to Jordan demands 52" and 72" diameter pipelines for distances of 60 and 130 km respectively, until their connection to reception facilities at each location. Due to the length of the pipelines, 2 and 5 booster stations respectively would be needed along the routes.

Under **Scenario 2,** in which the water would be integrated into the Israeli national system, the above pipelines and corresponding booster stations would not be necessary. Rather, only a connection from the desalination facility in Gaza to a connection point in the Israeli side of the Gaza-Israel border would be required. Such a connection would need an 84" diameter pipeline, up to 8 km in length, capable of delivering 150 mcm/year of product water. In this scenario, the water would be delivered to proximate locations within Israel, while an equal amount of water from other sources would be delivered from the Israeli system to water systems in the West Bank and a suitable location in Jordan. In contrast to Scenario 1, which envisions a single off-take point in both the West Bank and Gaza, Scenario 2 would involve the delivery of potable water to the end consumers in the West Bank, and to a location in Jordan that is closer to population centers and existing water infrastructure, such as the northern Jordan Valley.

Given that under Scenario 2 the water delivered to the West Bank and Jordan would not originate in the Gaza desalination facility, acceptable water quality parameters would have to be agreed upon by the IWA, the PWA and JWA respectively.

The basic parameters and assumptions used for this study are summarized in Table 3 below.

Table 3. Basic Project Parameters

	Parameter	Specifications
Desalination Facility	Desalination capacity (product water)	200 mcm/y
	Offshore Intake Structures	2 at a water column depth of 12-15m
	Desalination facility land needs	10-12 ha
Central Reception Facility	Reception storage capacity	2 tanks with capacity of 150,000 m^3
	Reception facility land needs	5 ha
Conveyance Infrastructure	Assumed water deliveries	Gaza: 50 mcm/y West Bank: 50 mcm/y Jordan: 100 mcm/y
	Conveyance within Gaza	3 branch lines (including to border with Israel for export)
	(Scenario 1) Dedicated delivery lines to West Bank (~60km) & Jordan (~130km)	1 off-take location each: ● West Bank: Idhna ● Jordan: Feifa
	(Scenario 2) Single delivery line for into Israeli national conveyance system (~8km)	1 off-take location along border between Gaza-Strip and Israel

3.2. Technical Feasibility: Logistical, Procedural & Contractual Requirements

The "**concept**" envisaged by EcoPeace provides a solution to address water security in Gaza and West Bank, and to provide Jordan an additional water source that could close **their demand-supply gap**. The technologies comprising the proposed project are **all long-term proven technologies** that have been implemented worldwide on similar scales, as well as in Gaza, on a smaller scale.

A project of such capacity and multi-disciplinary complexity demands experienced engineering, procurement, and construction (EPC) contracts and operations and maintenance (O&M) contractors. The selection process should include a Pre-Qualification (PQ) stage where prospective contractors present their capabilities and proven experience in similar ventures. Following the PQ stage, a tender process would then be implemented.

The procurement process should be conducted according to international rules and standards, supported by well-known and reputable entities and experts. The incorporation of the EPC and O&M contractors as key stakeholders in the Business – Contractual – Financing structure of the enterprise is covered in Section 4 of this report covering the financial analysis. A Program Administration and Implementation structure was suggested to steer such a type of venture in the case of the GCDP (see PWC, 2018, for an example), and could be a model for the proposed project discussed here.

In the initial stages of the EPC works, several studies will need to be conducted: geo-technical, marine, civil & architectural, environmental and others. These would be under the EPC contractor's responsibility, with support of local/regional subcontractors. Local/regional subcontractors shall also be involved in site construction activities (like civil works, including foundation and major buildings), installation & assembly of electro-mechanical pretreatment/post-treatment systems, assembly of desalination and other process equipment (including membranes' section, pumps, energy recovery system and process piping and instrumentation), auxiliaries and others, functional dry/wet tests (pre-commissioning), commissioning, functional and completion testing.

The disciplines cover a broad range of sectors: water treatment/chemistry, electrical and mechanical, instrumentation & automation, hydraulics, production planning, computing, control room operations, health & safety, and others. During commissioning and start-up of the facilities, a complete training session should be organized for the staff of the O&M company. This training should comprise both theoretical and practical on-site training, covering all disciplines. During the O&M period, all would need to be given sufficient training to ensure that they carry out their required duties in a safe and effective manner. The training will therefore include technical, operational and interpersonal aspects.

3.3. Desalination Connection Scenarios

Governance of Gaza post-war is uncertain. Regardless of what form it takes, **Gaza's reconstruction will involve major infrastructure projects such as desalination and power plants and repair of water and electricity distribution grids**. At the present stage, none of the plans suggested (e.g., those by Egypt, UAE, USA and the Palestinian Authority) outline specific details about water projects and their associated works or any cost estimates.

In this study, we assume that Gaza's water reconstruction plans post war will include the construction and repair of dedicated infra-structures like a north-south water carrier, booster stations, storage reservoirs for transport of desalinated water, and for blending the desalinated water with water from other sources (primarily groundwater).

In terms of a larger, regional initiative wherein Gaza serves as a source of water for the West Bank and Jordan via Israel, several potential options exist. **We limit our analysis to two basic scenarios:**

1) **Dedicated lines to a single off-take location in each area, and**
2) **Integration within the Israeli national water system, with water delivered to the West Bank and Jordan coming from proximate water system locations.**

Israel currently supplies fresh water to both the PWA and Jordan, under the framework of existing regional water agreements. According to the Director of the IWA Planning Division, Israel has plans for significantly increasing water supply to both by 2030 (Micky Zeide, personal communication). As well, he indicated that Israel's water system is, in principle, capable (or if needed, can be developed to become capable) of supporting and absorbing the specified amount of product water (150 mcm/y) from Gaza, and delivering it to the West Bank and Jordan. Thus, water delivery using the Israeli network is technically feasible. Once Gaza's desalinated water would be injected into the Israeli water grid, it would be impossible to isolate it from the water flowing in the Israeli national system. In this regard, it is imperative to pinpoint the following constraints and risks, as well as some possible solutions.

Possible Constraints:

- Water Security: Israeli authorities may be reluctant to inject/blend Gaza's product into the Israeli water network.
- Risks of injuring/endangering Israeli water network quality when injecting "out-of-specs" quality product water from the Gaza Strip.
- Limitations of Israeli infrastructure to absorb 150mcm/y (~25,000 m^3/hour) and the possible need for further development for such purposes.
- Pumping and other O&M charges to convey Gazan water eastward

Proposed Solutions:

- For the first two points above, rigorous and continuous control and comprehensive online monitoring of Gaza's plant water quality would be necessary before integrating it into the Israeli grid. The water from Gaza could initially enter a "buffer" reservoir with a retention capacity of 6 – 8 hours, where it would be further checked, monitored and controlled.
- Regarding the latter two possible constraints listed above, these will need to be checked more accurately in a future study, so that conveyance charges for Scenario 2 (presented in Section 4.5.1) can be fine-tuned and the relative merits of alternative conveyance scenarios evaluated.

3.4. Energy Requirements

The energy requirements of the project differ slightly based on which of the two conveyance scenarios (i.e., dedicated lines or integration in the Israeli national water system) are chosen.

Under the **first scenario**, a **power plant with at least 120 MWe capacity -** would need to supply the project. For the case base analysis we assume a dedicated natural gas-powered plant built adjacent to the desalination facility. The rationale for such a dedicated source being to assure the facility's long-term sustainability and independence, with the lowest generated power cost. Such dedicated power plants are common in large-scale desalination projects. Later in the study (in sub-section 4.1.3.2), we also consider a scenario in which the desalination facility obtains its power from an outside supplier.

Scenario 1 energy requirements are as follows:

- **83 MWe** is the necessary capacity **to operate the SWRO facility and to pump product water** to a central reception and distribution facility in Gaza nearby**.**
- **39 MWe** is **the <u>total</u> estimated power requested to pump product water within Gaza, and to the West Bank and Jordan.** Of this:
    - o **2.0 MWe** is to pump product water t**o Gaza Strip** (the three main branches of pipelines described in sub-section 3.1.3 above)
    - o **8.6 MWe** is for the first segment of each pipeline for delivery of product water **from** the central reception and distribution facility in Gaza until the 1^{st} booster station in each one of the 2 conveyance pipelines.
    - o **28.4 MWe** is for pumping from the 1st booster station in each one of the conveyance pipelines **to the West Bank and Jordan**.
- **26.4 MWe** is **excess capacity for redundancy purposes** (~30%).[14]

Regarding the 28.4 MWe energy for conveyance within Israel (i.e., the energy required to feed the booster stations along the 2 conveyance pipelines crossing Israel), we assume that the O&M entity operating the central reception and distribution facility in Gaza will enter an energy purchasing agreement with one of the Israeli power producers. This would result in a total energy purchase of 225 GWh per year from Israeli sources for booster purposes.

It is important to note that the route of the pipeline carrying the water to Jordan passes through the Rotem Plain, which is located at an altitude of approximately 750 m above sea level. As the route continues east, there is a drop of over 1000 m, to the southern Dead Sea region. It is therefore possible to utilize the elevation differences to generate energy through a small

[14] The figure of 26.4 MWe represents the total capacity of the power plant (120 MWe), less the expected consumption of the desalination process and the delivery of product water to the central reception and distribution facility in Gaza (83MWe), as well as the energy requirements for conveyance within the Gaza Strip and from the central reception and distribution facility in Gaza until the first booster station in each one of the two conveyance pipelines to the West Bank and Jordan (10.6 MWe).

hydroelectric plant, thereby reducing the total energy consumption of the transmission to Jordan by approximately half. This was taken into account in the water cost estimations presented in Chapter 4 of this report.

Under the **second scenario** (integration within the Israeli national water system), the dedicated power plant capacity could be reduced to about **114 MWe** capacity (including redundancy). The energy requirements under Scenario 2 are as follows:

- **83 MWe** is the necessary capacity **to operate the SWRO facility and to pump product water** to a central reception and distribution facility in Gaza nearby**.**
- **2.0 MWe** is the amount of energy necessary to pump product water t**o Gaza Strip** (the three main branches of pipelines described in sub-section 3.1.3 above)
- **2.5 MWe** is the energy needed to pump the product water allocated to the West Bank and Jordan (150 mcm/year) to the border with Israel, where it would enter the Israeli water network.
- **26.5 Mwe is excess capacity for redundancy purposes (~30%).**

4. Financial Analysis

4.1. Methodology

4.1.1. Definition of Terms

The financial analysis includes assessments of:

1. **Capital (construction) expenditures (CAPEX)**
2. **Operating expenditures (OPEX)**
3. **Funding /Concession Types**
4. **Financial Projections**

Capital expenditures (CAPEX) cover direct costs of construction of project's main components: the proposed desalination facility, the dedicated power plant, the central reception and distribution facility in Gaza, and the transmission lines of product water to Gaza proper, the West Bank and to Jordan. Our CAPEX evaluation **excludes** the investments necessary for off-take facilities in Gaza Strip, the West Bank and in Jordan.

Operating expenditures (OPEX) cover production costs such as energy, consumables (chemicals, membranes, cartridge filters, spare parts, etc.), human resources, corrective and preventive maintenance and repairs, and general and administrative costs (quality control, monitoring, training, back office, accounting, auditors/legal services, security, etc.).

4.1.2. Reference Cases and Benchmarking

The financial analysis is based on similar-sized projects that have been implemented in the region, e.g. Sorek I and Sorek II, and considers estimations for the GCDP program that were particular to the Gazan case. The **assessment methodology** considers the impacts of the following parameters: economies of scale, the exchange rates of three currencies (NIS, US$ and Euro)[15] relevant for the proposed project, and the Consumer Price Indexes (CPIs) of these 3 currencies reflecting inflation.

Sorek I, a facility in Israel with a capacity of 150 mcm/y (which became successfully operational in 2013), **serves as the main benchmark for the cost estimates given here.** This facility is of a similar capacity to the envisioned facility in Gaza and includes a dedicated power plant. It is considered one of the most technologically advanced facilities in the world, producing water at one of the lowest costs in the industry.

The analysis also takes into account two factors that have impacted the execution and costs of two similar-sized desalination facilities in Israel: Sorek II, with a planned capacity of 200 mcm/y and Ashdod with a capacity of roughly 100 mcm/y. These factors are **a)** a disruption of the

[15] The other relevant currency, the Jordanian Dinar is pegged to the U.S. dollar, and thus, there is no separate value fluctuation.

supply chain, which occurred following the outbreak of the coronavirus pandemic in 2020, and **b)** the unstable political/economic environments and the precarious infrastructure conditions in Gaza, that have been greatly exacerbated by the ongoing war in Gaza since 2023.

Sorek II, of identical capacity as the envisaged desalination facility in Gaza, could be a good benchmark for the present analysis. However, the project is behind schedule and over-budget. While some of this can be explained by disruptions due to COVID and to the war in Gaza, it was widely acknowledged during the bidding process that the estimated costs for the project as evidenced by the tender submitted, substantially underestimated actual costs. In this study, we have attempted to use best practices to accurately estimate true costs.

An analysis of cost estimates for the GCDP indicates that estimated costs for the proposed facility were higher than other similar sized projects located outside of the Gaza Strip. As the project proposed by EcoPeace is significantly larger than the GCDP (200 mcm/y vs. 55 mcm/y), it can be expected to benefit somewhat from economies of scale, helping to reduce the per unit cost of water. However, many costs for materials and equipment have increased since the GCDP costs were estimated.

The cost estimations for the central reception and distribution facility in Gaza, the conveyance system and associated booster stations are based on available data from recent similar projects, mainly from Mekorot (Israel's National Water Company).

The technical and financial assessments assume the implementation of best available technologies and approaches for avoiding or mitigating potential environmental impacts. The specific mitigation measures represent the 'state-of-the-art' with respect to environmental management of desalination facilities and ensure compliance with applicable environmental legislation.

4.1.3. Sensitivity Analysis

In order to account for changing future conditions, we undertake **sensitivity analysis** to present a range of costs. Specifically, we examine **two primary parameters** that impact costs: **interest rates** on capital investments and **cost of energy**. The first primarily relates to CAPEX, while the latter is relevant primarily in terms of OPEX.

4.1.3.1. Interest rates

As desalination facilities require large up-front costs with long-term expected returns, interest rates on capital can have a significant effect on overall financial viability. For our basic analysis, we assume an **interest rate of 6%**, reflecting current practice in the industry. This would be a realistic case if the project finance is built around loans and/or is to involve a large role of private sector actors. We assume an **operational period of 25 years,** as is common in many build-operate-transfer (BOT) or build-operate-own (BOO) desalination projects worldwide.

Should the project capital expenses be funded primarily by donors offering grants, without an expected return, use of such an interest rate would inflate costs. For this reason, we also calculate costs using an **interest rate of 0%**. While it is unlikely that all capital expenditures would be financed in such a manner, excluding interest costs entirely represents a lower-bound estimate for potential capital costs.

4.1.3.2. Energy Costs

The energy costs represent a significant share of overall costs of water production by reverse osmosis desalination plants (typically between 40-50% of total water costs (e.g., Sepahvand, 2023; Shokri and Fard, 2023). In this analysis, energy costs represent roughly 37% of total water production costs assuming current prices, as a result of the dedicated power plant. In addition to water production costs, energy costs are a primary element of the cost of delivery. This is especially the case in projects such as the one being considered here, that necessitate pumping across long distances and high elevations.

As electricity costs fluctuate based on a number of factors, we estimate costs in this study for two different cases. **In the base case, we assume costs similar to those currently paid by desalination plants in Israel**. This represents a realistic case for estimates should a bidding process be initiated in the near future.

These costs are summarized below:

- **Electricity cost from dedicated power station:**
    - o **0.0843 US$/KWh for a 120 MW Power Station**. This corresponds to 0.3084 NIS/KWh, i.e., **~22% lower** than Israel's current High-voltage Load-and-Time weighted tariff (TAOZ) of 0.39513 NIS/KWh.
    - o **0.0804 US$/KWh for a 114 MW Power Station**. This corresponds to 0.2942 NIS/KWh, i.e., **~25% lower** than Israel's current High-voltage Load-and-Time weighted tariff (TAOZ).
- **The cost of "the balance energy" for conveyance boosters located along the pipelines in Israel**: **0.1004 US$/KWh**, a 7% discount of the TAOZ generation component tariff (0.108 US$/KWh).

Recognizing that energy costs may decrease, we also calculate project costs assuming a lower price for electricity. For this case, we use figures provided by a recent study commissioned by EcoPeace and conducted by Qamar Energy (2025), that addresses the feasibility of utilizing renewable electricity and hydrogen generated in the "Sunrise Region" around north-eastern Egypt, Jordan and north-western Saudi Arabia, and that can be shared between these countries and exported to Europe via hubs in Palestine (Gaza Strip), Egypt, and Israel. The study suggested that all-in costs of delivered energy (generation plus conversion (if required) plus transport) may be lower than those of on-site generation in Palestine, Israel and Europe.

The study concluded that the delivered cost of renewable electricity in Europe (i.e., inclusive of the expensive marine transmission cabling from Gaza/Israel shoreline to Europe) would be in the range of € 63-68/MWh initially, falling towards €43-53/MWh as the renewable cost component of the project falls (mostly due to lower cost of capital). For our analysis, we ignore the delivery cost of renewable electricity at the Gazan/Israeli shoreline and assume a delivery cost at the low range of the above figures, i.e. € 63/MWh. This results in a per unit cost of electricity of **US$ 0.0693 per KWh**.

For all calculations, we assume a total specific energy consumption: 3.264 KWh per cubic meter of water produced, including both for the desalination process and for the delivery of the product water to the nearby central reception and distribution facility. This is at the low-range of what is currently commercially viable and was deemed reasonable in light of continued improvements in energy efficiency in the industry.

4.2. CAPEX

Estimates for project capital expenses are given in Table 4 below. Such estimates are based on a Lump-Sum Turn-Key EPC basis, and they include contingencies as per customary practice in the industry. Estimations are as per April 2025 indexes.

Table 4. Estimated CAPEX

#	Program Item	CAPEX (million US$)	
		Scenario 1	Scenario 2
1	Desalination Facility (200 mcm/y)	749.6	749.6
2	Dedicated Power Plant (120 MW and 114 MW respectively)	152.7	145.0
3	Central Reception and Distribution Facility in Gaza Strip	90.1	90.1
4	Conveyance System within Gaza Strip (3 x 15km pipelines)	28.8	28.8
5	Pipeline to the Gazan-Israeli Border (capable of delivering 150 mcm/y)	-	31.3
6	Conveyance System to the West Bank (pipeline and booster stations)	126.8	-
7	Conveyance System to Jordan (pipeline and booster stations)	443.0	-
8	Program Management Support Consultants(1)	7.7	7.7
9	Program Implementation Consultants(2)	24.0	24.0
10	Program Management Team(3)	9.6	9.6
11	Trust Funds Management(4)	3.8	3.8
	Total:	1636.0	1089.9

(1) 4 International consultants for 4 years (Construction)

(2) 50 Experts, part-time (3 months/y each)

(3) 10 Highly qualified experts in different areas

(3) 4 Highly qualified officials, partial time

As can be seen, under Scenario 2, in which the existing Israeli network is used instead of dedicated pipelines to the West Bank and Gaza, CAPEX costs are significantly lower (roughly 2/3rds of total CAPEX costs). This figure, however, does not include any alterations or expansions to the Israeli network that might be required.

Regarding the costs of the power plants, these costs are embedded in the cost of electricity as OPEX. Thus, purchase of electricity from outside suppliers, rather than from a dedicated plant, would reduce project CAPEX costs, but would not result in a lower per unit cost for water.

4.3. OPEX

Estimates for annual project operating expenses are given in Table 5 below. They comprise among others: chemicals for the desalination process (pre and post treatment, cleaning and others), membranes', cartridge filters', sand & gravel periodical replacements, equipment/structures preventive/corrective maintenance, spare parts, warehouse, workshops equipment and tools, manpower, general & administrative expense, accounting, bonds and guarantees, insurance, quality control & monitoring services, advisory services (legal, technical, auditors).

Table 5. Estimated OPEX

#	Program Item	OPEX (million US$/year)	
		Scenario 1	Scenario 2
1	Desalination Facility (200 mcm/y)	34.6	34.6
2	Dedicated Power Plant (120 MW and 114 MW respectively)	55.0	52.5
3	Central Reception and Distribution Facility in Gaza Strip	3.2	3.2
4	Conveyance System within Gaza Strip – (3 x 15km pipelines)	2.3	2.3
5	Pipeline to the Gazan-Israeli Border (capable of delivering 150 mcm/y)	-	2.0
6.1	Conveyance System to the West Bank – pipeline, booster stations and pumping (3)	10.8	-
6.2	Conveyance System to the West Bank via Israeli network – wheeling/swap charges (4)	-	41.0
7.1	Conveyance System to Jordan – pipelines, booster stations and pumping (3)	18.7	-
7.2	Conveyance System to Jordan via Israeli network – wheeling/swap charge (4)	-	82.0
8	Program Management Support Consultants (5)	0.4	0.4
9	Program Implementation Consultants (6)	0.7	0.7
10	Program Management Team (7)	1.2	1.2
11	Trust Funds Management (8)	0.5	0.5
	Total:	127.5	220.4

1) Power Station CAPEX has been considered here in order to estimate the yearly energy component of the water cost when energy is generated by the power station
2) O&M of pipelines and energy demanded for pumping (from power plant)
3) O&M for conveyance and energy requested for pumping (from power plant - first segment, and from an independent power provider for the remaining segments of the conveyance)
4) Wheeling/swap charges are presented in sub-section 4.4 below
5) 2 International consultants part time (6 months each)
6) 6 Experts part time (3 months/y each)
7) 5 highly qualified experts
8) 4 highly qualified officials, part-time

For calculating the financing projections, the operational costs are split into "fixed" and "variable" components, and presented in terms of costs per cubic meter of product water, as follows in Tables 6.A. and 6.B.

Table 6.A. Fixed & Variable Costs - Scenario 1

#	Program Item	Fixed (US$/m^3)	Variable (US$/m^3)
1	Desalination Facility (200 mcm/y) (not including energy)	**0.052**	**0.121**
2	Energy from Power Plant (120 MWe) (CAPEX & OPEX)	**0.077**	**0.198**
3	Central Reception and Distribution Facility in Gaza (not including energy)	**0.016**	**0.000**
4	Conveyance System within Gaza Strip (pipelines & pumping)	**0.032**	**0.015**
5	Conveyance System to Gaza-Israel Border (O&M + Energy)	**N.A.**	**N.A.**
6	Conveyance System to the West Bank (pipeline & booster stations)	**0.059**	**0.156**
7	Conveyance System to Jordan (pipelines & booster stations)	**0.060**	**0.127**
8	Program Management Support Consultants	**0.002**	**0.000**
9	Program Implementation Consultants	**0.004**	**0.000**
10	Program Management Team	**0.006**	**0.000**
11	Trust Fund Management	**0.002**	**0.000**

Table 6.B. Fixed & Variable Costs - Scenario 2

#	Program Item	Fixed (US$/m^3)	Variable (US$/m^3)
1	Desalination Facility (200 mcm/y) (not including energy)	**0.052**	**0.121**
2	Energy from Power Plant (114 MWe) (CAPEX & OPEX)	**0.073**	**0.189**
3	Central Reception and Distribution Facility in Gaza – w/o energy	**0.016**	**0.000**
4	Conveyance System within Gaza Strip (pipelines & pumping)	**0.031**	**0.014**
5	Conveyance System to the Gaza-Israeli Border (150 mcm/y)	**0.008**	**0.006**
6	Conveyance System to the West Bank via Israeli network - wheeling/swap charges	**0**	**0.820**
7	Conveyance System to Jordan via Israeli network - wheeling/swap charges	**0**	**0.820**
8	Program Management - Support Consultants	**0.002**	**0.000**
9	Program Implementation – Consultants	**0.004**	**0.000**
10	Program Management Team	**0.006**	**0.000**
11	Trust Fund Management	**0.002**	**0.000**

4.4. Financial Projections – Cost of Water

Based on the CAPEX and OPEX estimations presented above, **Table 7 presents cost estimates for the final cost of water produced assuming a case in which interest rates are set at 6% and energy costs are similar to current costs**. Costs are given for each stage of the process, from water at the desalination plant itself, to the three different end destinations in the Gaza Strip, West Bank, and Jordan. Note that the estimates for the West Bank and Jordan include delivery only to a central off-take location. They do not include additional costs for delivery to the eventual destination of consumption.

The costs are dependent on several factors including the quality of the water delivered which would be impacted by the percentage of desalinated water included. An initial appraisal of these costs of supplying via the Israeli national system given by the IWA suggests a cost of between 0.77 – 0.82 US$/$m^3$ (2.8 – 3.0 NIS/m^3) for delivery (wheeling/swap) charges. This cost is similar to the cost assessed to Israeli utilities receiving water from the system and is in addition to the cost of desalination itself. Such a figure covers "infrastructure development services" (for existing infrastructures and for additional ones still to be developed to fit the purpose), and the "operational costs" (mainly energy) to "wheel" the water in the network.

As can be seen from Table 7, the estimated cost of water increases as a function of distance from the facility. Under **Scenario 1**, the cost of water within the Gaza Strip would range from US$0.76 per cubic meter for water directly from the desalination facility, to nearly US$0.90 for water distributed within the Gaza Strip. The cost of water delivered to a central off-take location in the West Bank, near Idhna, would be roughly US$1.22/$m^3$, while that for water delivered to a central off-take location in Jordan south of the Dead Sea would be roughly US$1.34/$m^3$.

Under **Scenario 2**, due to the slightly smaller power station, the cost of water within the Gaza Strip would range from US$0.74 per cubic meter directly from the desalination facility, to just under US$0.89 for water distributed within the Gaza Strip. The cost of water delivered to a central suitable off-take location in both the West Bank and in Jordan would be roughly US$1.64/$m^3$. This per unit cost of water would be identical for both off-take locations because the estimate for the wheeling service charge provided by the IWA was identical in both cases. The swap scenario results in a more expensive per unit cost for water than the calculated costs with direct delivery via dedicated pipelines. This is due to a relatively high per unit service cost as given by IWA. However, the IWA figure would include delivery to the end consumers in the West Bank, and perhaps to a more convenient location the Jordan Valley in Jordan. Thus, Scenario 2 may, in fact, be the more cost-efficient option. This suggests that further, more detailed study is needed to better understand the rationale and breakdown for the figure given by the IWA, as well as the cost of delivery within the West Bank and Jordan. This could improve the accuracy of the estimates and the ultimate feasibility of such an option.

Table 8 presents similar estimates for the final cost of water, assuming an **annual interest rate of 0 % and energy costs at current prices.**

The merits of the desalinated product water prices at the exit of the envisaged desalination facility in Gaza as estimated above under Scenarios 1 and 2 can be compared to desalinated water prices in nearby off-take agreements, as presented in **Annex B.**

Table 7. Projections for Cost of Product Water (Interest rate: 6%)

	Scenario 1			Scenario 2		
	Fixed	Variable	Total (US$/m^3)	Fixed	Variable	Total (US$/m^3)
Water at the exit of the desalination plant (200 mcm/y)						
CAPEX (million US$)	749.586			749.6		
Capital Cost (US$/m^3)	0.293		0.293	0.293		0.293
OPEX (US$/m^3)	0.143	0.319	0.462	0.140	0.310	0.450
Total Cost (US$/m^3)	**0.437**	**0.319**	**0.7556**	**0.433**	**0.310**	**0.7429**
Water Cost at the exit of the Central Reception Facility (200 mcm/y)						
Add CAPEX (million US$)	90.1			90.1		
Added Capital Cost (US$/m^3)	0.035		0.035	0.035		0.035
Add OPEX Reception Facility (US$/m^3)	0.016	0.000	0.016	0.016	0.000	0.016
Total Cost (US$/m^3)	**0.488**	**0.319**	**0.8069**	**0.484**	**0.310**	**0.7942**
Desalinated Water Cost to Gaza (50 mcm/y)						
Add CAPEX (million US$)	28.8			28.8		
Added Capital Cost (US$/m^3)	0.045		0.045	0.045		0.045
Add OPEX Conveyance to Gaza (US$/m^3)	0.032	0.015	0.047	0.031	0.014	0.046
Total Cost (US$/m^3)	**0.565**	**0.334**	**0.899**	**0.560**	**0.325**	**0.885**
Desalinated Water Cost at the Gaza-Israel Border						
Add CAPEX (million US$)	NA			31.3		
Added Capital Cost (US$/m^3)	NA			0.016		0.016
Add OPEX Conveyance to Gaza-Israel Border (US$/m^3)	NA	NA	NA	0.008	0.006	0.013
Total Cost (US$/m^3)	NA	NA	NA	**0.508**	**0.316**	**0.824**
Desalinated Water Cost to the West Bank (50 mcm/y)						
Add CAPEX (million US$)	126.763			0		
Added Capital Cost (US$/m^3)	0.198		0.198	0		0.000
Add OPEX Conveyance to the West Bank (US$/m^3)	0.059	0.156	0.215	0	0.820	0.820
Total Cost (US$/m^3)	**0.746**	**0.475**	**1.221**	**0.508**	**1.135**	**1.643**
Desalinated Water Cost to Jordan (100 mcm/y)						
Add CAPEX (million US$)	443.0			0		
Added Capital Cost (US$/m^3)	0.347		0.347	0		0.000
Add OPEX Conveyance to Jordan (US$/m^3)	0.060	0.127	0.187	0	0.820	0.820
Total Cost (US$/m^3)	**0.894**	**0.447**	**1.340**	**0.508**	**1.135**	**1.643**

Table 8. Projections for Cost of Product Water (Interest rate: 0%)

	Scenario 1			Scenario 2		
	Fixed	Variable	Total (US$/m^{3})	Fixed	Variable	Total (US$/m^{3})
Water at the exit of the desalination plant (200 mcm/y)						
CAPEX (million US$)	749.586			749.6		
Capital Cost (US$/m^{3})	0.150		0.150	0.150		0.150
OPEX (US$/m^{3})	0.143	0.319	0.462	0.140	0.310	0.450
Total Cost (US$/m^{3})	**0.293**	**0.319**	**0.6124**	**0.290**	**0.310**	**0.5997**
Water Cost at the exit of the Central Reception Facility (200 mcm/y)						
Add CAPEX (million US$)	90.1			90.1		
Added Capital Cost (US$/m^{3})	0.018		0.018	0.018		0.018
Add OPEX Reception Facility (US$/m^{3})	0.016	0.000	0.016	0.016	0.000	0.016
Total Cost (US$/m^{3})	**0.327**	**0.319**	**0.6464**	**0.324**	**0.310**	**0.6337**
Desalinated Water Cost to Gaza (50 mcm/y)						
Add CAPEX (million US$)	28.8			28.8		
Added Capital Cost (US$/m^{3})	0.023		0.023	0.023		0.023
Add OPEX Conveyance to Gaza (US$/m^{3})	0.032	0.015	0.047	0.031	0.014	0.046
Total Cost (US$/m^{3})	**0.382**	**0.334**	**0.716**	**0.378**	**0.325**	**0.702**
Desalinated Water Cost at the Gaza-Israel Border						
Add CAPEX (million US$)	NA			31.3		
Added Capital Cost (US$/m^{3})	NA			0.008		0.008
Add OPEX Conveyance to Gaza-Israel Border (US$/m^{3})	NA	NA	NA	0.008	0.006	0.013
Total Cost (US$/m^{3})	NA	NA	NA	**0.339**	**0.316**	**0.655**
Desalinated Water Cost to the West Bank (50 mcm/y)						
Add CAPEX (million US$)	126.763			0		
Added Capital Cost (US$/m^{3})	0.101		0.101	0		0.000
Add OPEX Conveyance to the West Bank (US$/m^{3})	0.059	0.156	0.215	0	0.820	0.820
Total Cost (US$/m^{3})	**0.488**	**0.475**	**0.963**	**0.339**	**1.135**	**1.475**
Desalinated Water Cost to Jordan (100 mcm/y)						
Add CAPEX (million US$)	443.0			0		
Added Capital Cost (US$/m^{3})	0.177		0.177	0		0.000
Add OPEX Conveyance to Jordan (US$/m^{3})	0.060	0.127	0.187	0	0.820	0.820
Total Cost (US$/m^{3})	**0.564**	**0.447**	**1.011**	**0.339**	**1.135**	**1.475**

With **no interest rates on capital**, **costs for water at the desalination plant are** US$0.61 and U$0.60 for Scenarios 1 and 2 respectively, or roughly **19% less** than the cost estimates assuming a 6% cost of capital. Under an assumption of no interest on capital, the associated **per unit costs for water delivery within Gaza, and to the West Bank and Jordan**, **are between 20-25% lower under Scenario 1**, and just **10-20% lower under Scenario 2**.

We conducted the above financial assessments of project CAPEX and OPEX, including the derived cost projections, **assuming lower energy costs** (as detailed in the methodology section: 4.1 above). These are not reflective of current market conditions. The detailed figures are presented in Annex A. A summary of the per unit costs for water under different scenarios and assumptions about interest rates and energy are presented in Table 9 below. In general, it was found that, should energy costs drop to the levels suggested in the Qamar Energy report, **per unit water prices would decrease by roughly US$0.04-0.09**.

Table 9. Summary of Water Costs under various assumptions

	Water Cost in US$/m3			
Annual Interest Rate: 6%. Payback: 25 years.	**Scenario 1**		**Scenario 2**	
	Current Electricity Cost	**Low** Electricity Cost	**Current** Electricity Cost	**Low** Electricity Cost
Water at exit of the desalination plant (200 mcm/y)	**0.756**	**0.707**	**0.743**	**0.707**
Water delivered within Gaza (50 mcm/y)	**0.899**	**0.846**	**0.885**	**0.846**
Water delivered to West Bank off-take (50 mcm/y)	**1.221**	**1.126**	**1.643**	**1.606**
Water delivered to Jordan off-take (100 mcm/y)	**1.340**	**1.253**	**1.643**	**1.606**
Annual Interest Rate: 0%. Payback: 25 years.	**Scenario 1**		**Scenario 2**	
	Current Electricity Cost	**Low** Electricity Cost	**Current** Electricity Cost	**Low** Electricity Cost
Water at exit of the desalination plant (200 mcm/y)	**0.612**	**0.564**	**0.600**	**0.564**
Water delivered within Gaza (50 mcm/y)	**0.716**	**0.664**	**0.702**	**0.664**
Water delivered to West Bank off-take (50 mcm/y)	**0.963**	**0.868**	**1.475**	**1.438**
Water delivered to Jordan off-take (100 mcm/y)	**1.011**	**0.923**	**1.475**	**1.438**

4.5. Funding Analysis

Many of the large-scale seawater desalination facilities built in the past years, or presently under construction, are delivered under a public-private-partnerships (PPP) framework. Most of these projects are implemented by the adoption of a Build-Operate-Transfer (BOT) business structure. The reason for the preference of municipalities and public utilities for the BOT structure relies mainly on the benefits associated with its cost-effectiveness, affordability (deferment of upfront costs) and efficiency, as well as the clear transfer of risks from public to private sectors.

When PPPs are adopted to deliver large-scale desalination projects, they are often project financed with non- or limited recourse debt that is secured entirely by the project assets and the Water Purchasing Agreement (WPA). Rather than relying on the developer's assets and creditworthiness, the lenders rely solely on the project cash flow for repayment of the senior debt, while the project assets are pledged to the lenders and serve as security.

On the other hand, the developer also needs the guarantee that the sale of the water will be remunerated. This guarantee comes from a take or pay contract. The payment structure considered in a WPA is based on the ability of the plant to meet water output requirements as requested (quantity and quality); the off-taker pays a Capacity Payment under the assumption that the facility is available to meet these requirements and pays the output payment as compensation for the plant's variable costs of dispatch.

A basic assumption of the present study is that Gaza will be led by and for Palestinians with an administration that has a working relationship with both the Israeli government and the international community. Nevertheless, **several factors are likely to influence possibilities for and conditions of project finance in the post-war Gaza Strip, each which would need to be addressed** for an initiative such as the one in question in this study to advance. These include:

- **Political stability**. Given the recent and historical volatility in the region, and the potential for renewal of conflict, private sponsors will likely be hesitant to invest out of concern for political stability and continuity over the concession period. This situation will also likely affect the costs of insurance for the proposed project. As such, lenders and private sector actors will likely demand guarantees and other support from governments and/or international financial institutions.

- **Effective securities.** Each of the parties involved would need to provide effective securities / collateral to lenders/investors. At present the Palestinian Authority does not have a credit rating by major credit rating agencies. This will likely affect the terms at which lenders will provide project funding.

- **Political and financial infrastructure and statutory and regulatory frameworks**. Legal regimes can minimize legal uncertainty in connection with the award and implementation of BOT schemes. In particular they i) allow the BOT granting authority;

ii) allow developers and lenders to contractually allocate risks among themselves; iii) consider the interests of lenders to ensure effective security over a project; thus, enhancing the bankability and the viability of BOT projects. Given the lack of a stable legal regime in the Gaza Strip, it would be necessary to ensure that a future legal regime there is capable of providing the framework necessary for overseeing and regulating such projects.

- **Tariff structure and cost-recovery regime.** Desalination projects in general, and BOT projects in particular, are dependent on cost recovery for water supply that is robust enough to meet debt service requirements. This entails full-cost pricing and high payment rates among consumers. Both Palestine and Jordan have a poor track record in this respect. This is likely to impact the attractiveness of the project to lenders and to the private sector. As such, again, government (sovereign) guarantees for payment would also likely be necessary.

- **Physical Access.** The Gaza Strip does not have a port, and therefore there would be a dependency on Israel or Egypt regarding the unloading, storage, transportation, entrance of construction materials, heavy machinery, electro-mechanical equipment, chemicals, etc. Guarantees of access would need to be provided by either Israel or Egypt (or both), along with contracts stipulating responsibilities and compensation should access be disrupted.

- **Energy sources**. Similar to the previous item, at present the Gaza Strip does not have sufficient domestic sources of energy and will be dependent on imported sources, at least for the short and medium term. Again, legally binding contracts with supplying companies and countries would be needed stipulating the responsibilities of the respective parties and compensation should access be disrupted.

Given the above conditions, the limited funding resources and higher risk profile in the Gaza Strip will immediately affect three important parameters: a) the interest rate; b) the gearing (e.g., a high debt to equity ratio); and c) the loan tenor (repayment period). This will, without doubt, have an impact on finance options and ultimately on the desalted water price.

Both construction and operating costs are influenced by the cost of financial capital. The capital cost of such a project is a function not only of current and expected interest rates in international lending markets, but also assessment of the project risk, including the credit rating of the various parties involved. Higher risk (of damage, delays, lack of repayment, nationalization, etc.) is one of the reasons that the estimated costs for the GCDP were significantly higher than for similar sized desalination projects in other locations. In the current situation in Gaza, it is not clear who the responsible parties will be. Regardless of who eventually governs, they will lack established credit ratings. This will likely increase the cost of capital and insurance.

Given these circumstances, traditional private sector-led investment such as is common in other desalination projects is unlikely in the case considered here. In terms of financial guarantees from the parties involved, contractors may seek Engineering Procurement and Construction (EPC) or turnkey type contracts, in which they are responsible only for planning and construction, rather than the Build-Operate-Transfer (BOT) contracts typical for desalination facilities built elsewhere.

To overcome/by-pass the above-mentioned constraints, and boost program feasibility, a potential model for a PPP Business – Contractual - Financing Structure is presented in Figure 2 below. This envisaged structure would govern the development and implementation of the project and the relationships between the enterprise's key stakeholders.

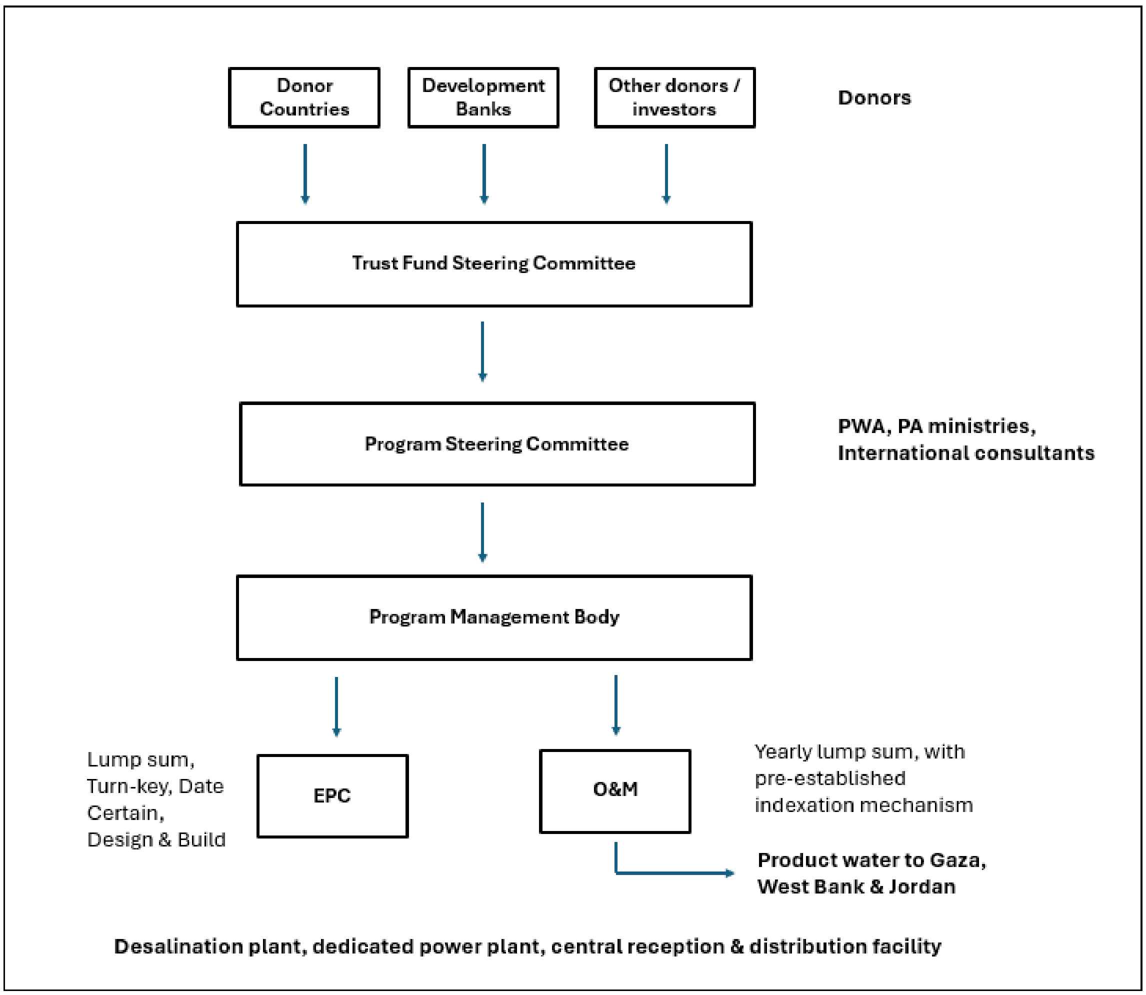

Figure 2. Model organizational management structure

Given the possible involvement of many donors, a Trust Fund Steering Committee and management structure would coordinate administration and the disbursement of funds. The managers of the Trust Fund would ensure that disbursement and financial reporting are carried out in line with international best practices. The Program Management Body would be responsible for the direct management of the program from the tendering phase to the construction and later the operational management phase of the desalination plant. The Program Management Body would be supported by a team of experienced international consultants.

The EPC and O&M procurement would be conducted according to international rules and standards, supported by well-known and reputable entities and experts. The EPC contractual structure is based on a lump sum, turn-key, date certain design and build contract. The EPC contractor/s (for the different components of the program) would provide the Program Management Body customary guarantees and performance bonds. The construction period is estimated to take 36 – 48 months.

An O&M contractor would be procured to operate the desalination plant and the associated facilities. Due to the current lack of local O&M experience in the Gaza Strip for such plants, the award of an external O&M contractor should ensure the immediate availability and involvement of experienced staff to ease the implementation of this challenging project. The expected initial tenure for the O&M contractor would be three - five years. To attract qualified firms to work in the Gazan environment, the financing for the O&M contract should be confirmed **up-front and be visible to interested bidders**. The O&M Contractor would provide the Program Management Body customary guarantees and performance bonds.

The sale and distribution of product water would be managed by the O&M contractor under close supervision of the Program Management Body. A detailed water sale and distribution agreement to Gaza, the West Bank and Jordan would be developed by the Program Management Body.

4.6. Financial Risk Assessment & Mitigation

The following elements were analyzed in assessing the risks associated with large-scale and multi-disciplinary projects: i) Political; ii) Financial/economic; iii) Infrastructure and Site related; iv) Statutory and Regulatory frameworks: v) Legal and Contractual; and vi) Construction and Operation.

The suggested management structure presented in Figure 2 accommodates many of the risks associated with aspects i) – v) above mentioned and should enhance the likelihood of prospective EPC and O&M contractors' willingness to be involved in the project. The proposed lump-sum, turn-key design and build EPC and O&M contractual structures, with pre-agreed milestones and a clear pre-agreed indexation mechanism provide a degree of certainty regarding payments. Customary guarantees and performance bonds should be supplied by the EPC and O&M contractors.

The following is an appraisal of the construction and operation risks and risk management strategy. The risk management strategy is based on the principle of a reasonable risk allocation to the party most capable to handle it.

- **Development Phase:**
  - No costs overruns risk due to delays in obtaining approvals for Notice to Proceed (e.g. approvals for construction).
  - No economic, funding costs, nor currency risks.
  - Risks are borne by the Program Management Body (unless caused by contractor failure).

- **Construction Phase:**
  - No costs overruns risk due to non, late or interrupted availability of the site, or site risk – delays due to unknown Infrastructure problems. Risks are borne by the Program Management Body.
  - Contractual Risks: costs increase/overruns – the Lump-sum, turn-key design and build EPC contractual structure provides pre-agreed milestones and a clear pre-agreed indexation mechanism.
  - Technical Risks: delays in construction and/or failure to meet key-indicators (water quantities and quality, energy consumption, etc.) at Acceptance Test[16] after commissioning of facility – obligation to make good, liquidated damages[17] to be borne by the contractor. Risk management strategy would seek the engagement of experienced and pre-qualified contractors.

- **Operational Phase:**
  - Technical Risks: no meeting key-indicators (plant availability, water quantities and quality, etc.) after EPC's Completion Tests – obligation to make good, liquidated damages applicable and to be borne by the O&M Contractor.
  - Technical Risks: Increase in consumables/energy, etc. consumption - O&M contractor bears risks after Completion Tests within the agreed O&M fee.
  - Technical Risks: Technical Failure of a Major component - Making good the obligation of the "EPC" contractor or major component vendor (if applicable); otherwise, O&M contractor to perform sensitivity analysis before end of EPC's liability period that shows good resistance in case of increased operating expenditure.
  - Economic/Financing Risks: costs increase/overruns, currency changes – The O&M contractual structure provides a clear pre-agreed indexation mechanism.

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[16] The Acceptance Test is a series of verifications to ensure that the facilities meet the specifications mandated in the contract.

[17] Liquidated damages are a predetermined sum of money specified in a contract that one party agrees to pay the other in the event of a breach, such as failing to meet contract obligations or specifications.

- **Other Risks:**
  - Program Management Body defaults under the Contractual Agreements: agreed upon dispute resolution mechanism as per contractual terms; termination.
  - Force Majeure: Compensation paid by Program Management Body (based on direct costs to be set out in the EPC and O&M Agreements – i.e. Transparency with "EPC", O&M Agreement provisions). All Force Majeure events that can be insured shall be properly insured.

5. Geopolitical Considerations

This section presents an overview of some of the most critical geopolitical variables that would likely affect the proposed desalination project. Geopolitical factors are clearly central both to the rationale and to the feasibility of the initiative proposed by EcoPeace. These include considerations of **sovereignty, security, development and stability**, **which in turn influence factors such as finance, access, monitorability** and others. Given the expected role of international donors and investors in such a project, relevant geopolitical factors extend far beyond the region itself. While any project involving Gaza would be affected by larger geopolitical factors, a broad-ranging one such as the one considered here, that envisions integration across borders and would necessitate partnerships with numerous parties, is particularly sensitive to larger geopolitical circumstances.

The most basic political condition for advancement of the project is the approval of the Palestinian, Jordanian and Israeli leadership. First and foremost, project approval would be contingent on the governance structure in Gaza. Israel, and likely a significant portion of the international community, would not be willing to approve and/or fund a project in which Hamas continues to govern in Gaza.[18] As such, the absence of Hamas political leadership in Gaza is considered as a starting assumption for this study's analysis and the rest of this section.

Should the initiative gain the support of the governments involved, it would still be vulnerable to a number of geopolitical and economic risks, as will be elaborated in this section. **In order to overcome such potential supply threats, a clear set of legally binding guarantees would need to be agreed upon by the parties, anticipating such contingencies and laying out responsibilities, obligations and cost-sharing for each party in the event that disruptions occur**. In addition, the parties, as well as donors and investors, would likely require an agreement on a **dispute resolution mechanism**. We do not expand on the nature or details of such guarantees or mechanisms here. Rather, we simply list these as issues to be addressed in order to mitigate risks entailed in the geopolitical factors listed below.

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[18] The removal of Hamas from positions of power in Gaza is the formal position of the Israeli government. Furthermore, in interviews with representatives from the Israeli Water Authority for this study, this criterion was made explicit for approval of any water from Gaza to Israel.

5.1. Water Security

5.1.1 National Sovereignty Issues

A primary rationale for development of a desalination plant in Gaza is to secure a degree of Palestinian water security. As mentioned in section 2, other options for supplying desalinated water to Gaza have been discussed for decades, e.g., imports from Israel or Egypt. A decision to site a desalination specifically in Gaza, despite the numerous challenges in doing so, is first and foremost to provide Palestinians with a domestic source of water. Israel already has its own desalination sources and Jordan is planning the AAWDCP. Jordanian investment in the AAWDCP, despite its high costs, is a clear indication of the value it places on having a source of desalinated water in its own territory. The differential between the cost of supply from Israel via Project Prosperity and the cost of the AAWDCP can be seen as a "water independence premium" that Jordan is willing to pay to have its own desalination capacity. The proposed project will also involve such a premium.

The GCDP also had as its primary goal the provision of desalination capacity to Gaza. The proposed project, however, is envisioned at both at a much larger scale than the GCDP and goes beyond the borders of Gaza. An economic case can be made for the larger capacity of the proposed project based both on need and economies of scale. The rationale for integrating output into the supply of water to the West Bank and Jordan is for both financial and geopolitical reasons. Firstly**, an integrated project provides a Palestinian source of water for the West Bank**, helping reduce its dependency on Israel for water supplies **and helps supplement Jordan's water supplies**, which will continue to be insufficient to meet demand, even with the AAWDCP and Project Prosperity. Secondly, potential donors and investors raised serious questions about the long-term financial viability of the GCDP model, given the low rate of cost recovery. **Integrating a Gazan desalination plant as a supplier of water to the West Bank and Jordan, which have a greater capacity to pay for water, helps diversify the sources cost recovery for operational costs**.

5.1.2. Potential Supply Disruptions

While such a project would provide some degree of additional water security for Palestine and Jordan, these supplies would be subject to numerous potential sources of disruptions and/or contamination. Transferring water, either directly or via swaps, necessitates transport of water via Israel. Israeli water officials indicated that they would **require both continuous online monitoring of water from the facility as well as international oversight of the facility itself** in order to allow for the water to enter Israel, especially if it is to be integrated into the existing national water distribution network. A continuous system of monitoring water quantities and quality would be necessary also for supplies to the West Bank and Jordan, especially given the lack of trust among potential partners.

Water supplies from the proposed project could be disrupted for a number of reasons, both intentional and unintentional. Intentional reasons could include:

- **decisions by authorities governing in the Gaza Strip to cease deliveries**
- **decisions by Israel not to allow water to enter Israel**
- **decisions by Israel not to transfer water to West Bank and/or Jordan**
- **decisions by Israel not to supply electricity and/or fuel to Gaza**

Unintentional reasons could include:

- **damage to facility or pipelines (incidental or targeted)**
- **technical or mechanical failure of facility or pipelines**
- **lack of replacement parts or technical capacity to make repairs**
- **disruptions to energy supplies**

Disruptions of supplies of natural resources have occurred on numerous occasions in the region. Israel restricted supplies of water, electricity and fuel to Gaza during the current war, supplies of natural gas to Israel and Jordan were cut off following numerous acts of sabotage on pipelines from Egypt following the Arab Spring in 2011, Israel reduced supply of electricity to Gaza in 2017, after the PA refused to pay after it itself did not receive payment from Hamas, and since 2023, Israel has halted gas supply to Egypt several times during the last two years due to security concerns regarding production facilities.

Such supply threats could potentially harm all parties; however, given that the project would be the primary source of water for the Gaza Strip, but only a supplementary one for the other partners, **Gaza would be the most vulnerable to supply disruptions**. This may not be obvious given that Gaza is the first link in the supply of water, however, its ability to produce this water is dependent on secure supplies of energy, materials and equipment. **The fact that the project would be international, and not just for internal Gazan supply, should make Israel less likely to impose restrictions or damage the facilities in the event of future hostilities or tensions.**

5.2. Energy Security

The energy requirements for the proposed project are significant. Gaza, at present, does not have independent energy sources sufficient to operate a desalination plant at the scale envisioned in this project. Such a facility would need a constant power source. Gas reserves off the Gazan coast (the Gaza marine gas field) are a domestic energy source that could potentially supply local energy for the project, however, they have yet to be developed. The most recent discussions over development of the gas fields involved potential connections to Egypt and/or Israel for processing, given the lack of capacity to receive and process the gas in the Gaza Strip itself (Ezrahi, 2025).[19] Thus, **in order to power the facility, Gaza would need to substantially develop renewable capacity and/or to receive energy supplies from outside sources, at least in the short to medium term**.

[19] Egypt has a vested interest in a stable Gaza Strip, and has taken the lead in presenting the Arab Plan for Gaza reconstruction. Egypt is unlikely to be a source of funding for the project, but could play a role in potentially supplying energy via pipelines as well as other resources via Rafah.

A detailed evaluation of the technical, financial and geopolitical aspects of gas supply is beyond the scope of this study. Here we note just that previous efforts to supply gas from Israel to Gaza (dubbed the "Gas for Gaza project") reached advanced stages. This included passing extensive planning and permitting processes in Israel, as well as commitments from the government of the Netherlands who helped facilitate negotiations (NCEA, 2022). This included pledges of funding from Qatar and the European Union (Rabinovitch and Al-Mughrabi, 2021).[20] The project is not moving forward due to the recent outbreak of war. However, due to this previous work, many of the technical and bureaucratic hurdles to such an initiative have already been dealt with. This would likely expedite future negotiations, should an attempt be made to renew such an avenue of supply.

5.3. International Involvement

Like other regional water projects that have been promoted in the region, such as the GCDP and Project Prosperity, **the proposed initiative will almost certainly need involvement from outside of the three primary countries involved. Outside parties are likely to play a leadership role, as well as providing finance and supplies. In addition, at the implementation phase, they would also likely play a role in oversight and monitoring, as well as potential dispute resolution.**

Outside financial resources will be necessary both for capital expenses, and in the case of Gaza, also operating expenses, at least for an initial period. The **current environment for traditional aid development is likely to be challenging**, given recent policy shifts of the current U.S. administration. According to statements by American officials, U.S. aid international aid policy is to be restricted for projects that advance U.S. economic interests. Furthermore, the administration has indicated that it will reduce aid to support both Ukraine and the North Atlantic Treaty Organization (NATO). Both of these last measures make it likely that less European funding will be made available for outside projects, as Europe moves to make up the funding shortfall created by U.S. policy.

While Western sources of finance may be currently more difficult to access than for previous projects, there are a number of potential **sources of political and financial support that could come from within the Middle East**. The United Arab Emirates took a leading role in advancing Project Prosperity, Qatar agreed to serve as the primary funder of the Gas for Gaza initiative, and both Kuwait and Saudi Arabia had a planned role in financing the GCDP. The proposed project aims to provide water to the Palestinian and Jordanian populations, and not to the Israeli one. Therefore, Arab governments, including those who have declared that they will not normalize relations with Israel until an Israeli-Palestinian agreement has been reached, may still be willing to invest in the project.[21] That said, while donor countries would not necessarily have

[20] The funding pledged for the Gas for Gaza initiative was primarily for capital costs. Plans for covering the operating costs were never clarified. Sources involved in the planning of the project indicated that the assumption was that Gazans would cover the operating expenses themselves.

[21] Given a perception among many of the Qatari regime being close to Hamas, it is unlikely that Israel would agree to Qatar taking a substantial role in advancing the project. It could still possibly play a role as a co-funder.

to reach an agreement directly with Israel, all donors and investors, regardless of region, would likely demand sufficient guarantees from Israel that it would allow the initiative to proceed.

Incorporation of the project as an element within a broader geopolitical initiative would increase the likelihood of support by governments both within the region and outside of it. The project could be incorporated into an expanded Project Prosperity agreement, especially under a scenario of water swaps. It also could be included as part of the Arab Proposal for Gaza Reconstruction or as part of a broader international program, such as the India-Middle East Europe Economic Corridor (IMEC) (see section 7). Incorporation of the project as part of a normalization plan with other governments in the region, particularly the Saudi government, would dramatically increase the likelihood of Israel supporting the initiative. This would also add an element of security to the project as a whole, as Israel would have a greater interest to ensure project implementation.

Private sector actors, both within the region and from outside, can play an important role in project implementation and potentially also project finance. Given the significant risks to large-scale long-term projects in the region, state-backed guarantees would be necessary to ensure interests such as sufficient returns on investment, rights to restitution, and guaranteed minimum payments. Various state-owned enterprises, especially within the Middle East, may be able to take a lead in this respect if their respective governments are invested in the initiative.

In addition to funding, international partners will need to cooperate in overseeing the entrance of materials and fuel into Gaza and verification that they are indeed being used for the project. Given the past history of appropriation of materials intended for development, including for water-related infrastructure, in order to gain Israeli approval, the monitoring will have to either include Israelis or be undertaken by international observers authorized by the Israeli government. Egypt and/or the Gulf States, together with other international partners, could also potentially play a role in monitoring of facilities and project activities within Gaza.

6. Legal and Regulatory Framework

Given the complexity of the proposed project, it is necessary to understand the regional governance structures. This section presents a brief overview of the primary regulatory bodies and legal frameworks that are likely to govern such a project in the three recognized governments (Palestinian, Jordanian and Israeli).

6.1. Palestinian Regulatory and Legal Framework

6.1.1. The Palestinian Authority's Regulatory Framework

The **primary agency overseeing water in both the West Bank and Gaza is the PWA**. It is responsible for planning, standard-setting, permitting, monitoring and reporting on water resources. Its authority over water comes from Presidential Decree No. 90 of 1995 and the Water Act of 1996. Subsequent laws in 2002 and 2014 (Water Acts 3 and 14 respectively) further refined the responsibilities of the PWA and reduced regulatory overlap with other government agencies. In addition to the PWA, several local water authorities are in charge of water distribution, collection and treatment.

The Office of the Prime Minister, as well as the Negotiations Affairs Department and Negotiations Support Unit, are responsible for negotiations vis-à-vis Israel. These bodies, together with the Ministry of Foreign Affairs and Expatriates, are responsible for overall relations with other governments. In the sphere of water, however, because it is considered a relatively technical issue, much of the relations with foreign partners is conducted directly by the PWA.

The Ministry of Finance (MoF) oversees funding of the PWA as well as other government agencies and national infrastructure projects, and thus, has significant input into decision-making in large-scale projects. The MoF receives funding in part from taxes collected by Israel on goods and services consumed in the West Bank and Gaza. The Israeli government deducts from these funds the costs of services and supplies given by Israel to the PA and Gaza. This includes the costs of water and energy, as well as the treatment by Israeli treatment plants of wastewater originating in the West Bank. While Israel claims such an "offset mechanism" is within the framework of the interim 1995 peace agreement (Oslo II) its legality has been challenged by the PA.

The Ministry of Public Works oversees tenders for state projects, including water projects, acting under the Public Tenders Law for Public Works and as stipulated in Article 7 of the Public Works Law No 6, 1999 (Aman – Transparency Palestine, 2008). Thus, they would likely be responsible for contracts for infrastructure development, at least for the off-take and distribution within the West Bank. In addition, the Ministry of Planning is the public institution that signs agreements with donor countries and oversees the implementation of most donor-funded projects. In the case of water projects, as they tend to be technical, often the PWA has direct contact with donors and is itself responsible for monitoring and reporting.

The Ministry of Planning and International Cooperation is responsible for spatial planning, cross-sector planning, interministerial coordination and coordination of donor projects.

Other governmental agencies with designated authorities over water in the PA's "National Water Policy for Palestine 2013-2032" (PWA, 2013) include the

- Ministry of Agriculture
- Environment Quality Authority
- Ministry of Local Governorates
- Ministry of Health
- Water service providers and their representative associations

These parties are of less relevance to the project proposed by EcoPeace.

Article 40 of the interim peace agreement of 1995 (Oslo II) established a **Joint Water Committee (JWC)** to oversee water infrastructure development and decision-making regarding shared waters in the West Bank and Gaza. The JWC, which has representatives from both the PWA and the Israeli Water Authority, has been functioning on and off since its inception. Both parties must approve decisions regarding matters such as infrastructure, drilling and permitting. Such a consensus-based approach is common in transboundary governance structures. However, in the case of the JWC, this essentially gives Israel veto power over all PWA activities in the West Bank. This imbalance in power has led to much criticism of the JWC and calls for reform (e.g., World Bank, 2009; Selby, 2013), however, no actions have been taken to alter the current structure.

In addition to the JWC, the **PWA must coordinate with the Coordinator of Government Activities in the Territories (COGAT**), a unit in the Israeli Ministry of Defense responsible for overseeing civilian policy in the West Bank, as well as facilitating coordination of all logistics between Israel and the Gaza Strip. This includes any activities in which Israel has authority over military affairs (i.e., Areas B and C according to Oslo II). In practice this means that the PWA and JWC must get COGAT approval for most pipelines and other infrastructure projects, including maintenance and repairs.

6.1.2. Gazan Regulatory Framework

The eventual post-war regulatory status of Gaza is uncertain. Prior to October 2023, Hamas was the primary governing body and had its own government ministries. However, the primary governing agency overseeing water in Gaza has been the PWA,'s local office, as it maintained the expertise and connections with international donors and investors. It has been responsible for planning and monitoring Gaza's water resources, as well as setting regulatory standards. The **Coastal Municipalities Water Utility (CMWU)** was established as an autonomous water utility. It has been responsible for operations and maintenance of water-related infrastructure as well as treatment and delivery of water and wastewater in Gaza.

Future governance structures in Gaza are unknown, with multiple competing proposals being considered. Regardless of the eventual regulatory system put in place, the primary bodies overseeing water in the Strip are likely to remain.

6.1.2.1 Critique of Palestinian Water Regulatory Framework

The Water Governance Facility (WGF), a joint initiative of the Stockholm International Water Institute (SIWI) and the United Nations Development Programme (UNDP), issued an assessment of challenges to water governance in Palestine (SIWI, n.d.). Among the challenges listed were:

a) Poor coordination and lack of clear authorities among government agencies
b) Insufficient internal controls, lack of integrity, and weak accountability
c) Weak law enforcement, especially of the Water Law (2014) and on laws on water taxation
d) A lack of trained/skilled workforce especially in the governmental sector
e) Unclear tariff system for water and water-related infrastructure

If unresolved, such issues would represent a challenge for financing and implementing a large-scale infrastructure project such as the project proposed by EcoPeace. Thus, they should be addressed in early stages of project planning.

6.2. Israeli Regulatory and Legal Framework

Israel has a very centralized national water system. The primary governmental agency responsible for regulating water in Israel is **the Israeli Water Authority (IWA).** It is responsible for planning, permitting (including allocations of water to the agricultural sector), monitoring, and reporting. The Water Council is a separate body that decides on water pricing. It is composed of representatives of the IWA as well as other relevant government agencies and a representative of the public. The primary law governing water resources in Israel is the Water Law of 1959. According to this law, all freshwater resources belong to the public and are to be managed by the government on behalf of the public. Thus, there are no private water rights in Israel. The Water Law also incorporated previous laws that mandate that all permits and metering are required for all water extraction.[22]

Operations and ownership of water infrastructure are undertaken by other bodies. **Mekorot** is the national water company and is responsible for delivering 70% of the country's water. Mekorot primarily delivers water to a single point within each service area. From this point, the water is delivered to the final consumers by private municipal water utilities, local authorities or agricultural water districts. Mekorot operates the National Water Carrier and is responsible for the "reverse" carrier, bringing water to the Sea of Galilee.

[22] The Water Metering Law of 1955 and the Supervision of Water Drilling Law of 1955.

With the advent of large-scale desalination in Israel, the private sector became a large supplier of freshwater.[23] The contracts for five of six currently operating large seawater desalination facilities in Israel are build-operate-transfer (BOT) contracts, under which the private sector builds and operates the plants for a period of time (20-30 years depending on the contract) after which they transfer ownership to the country.[24] In order to maintain control over the country's water supply, the desalination plants operate in a monopsony (single buyer) environment, meaning they must sell the produced water to Mekorot, which then integrates it into the national water supply. Any integration of water from Gaza to the West Bank or Jordan, including the possibility of water swaps, would almost certainly have to be coordinated with Mekorot via IWA.

The IWA also participates in the JWC as well as a joint water committee with the Jordanians, which meets on an ad hoc basis to address issues as needed. In addition to the IWA, other relevant government agencies include the

- Ministry of Finance, which oversees the national budget, sits on the Water Council, and is responsible for implementing the tax offset mechanism mentioned above,
- Ministry of Defense, which must approve all major projects and which oversees COGAT,
- Ministry of Foreign Affairs, which is responsible for overseeing all international agreements,
- Ministry of Regional Cooperation, which is tasked with promoting cooperative projects between Israel and the PA and Jordan,
- Ministry of Health, which determines drinking water quality standards and monitors compliance.

Other government ministries responsible for aspects of water management include the Ministry of Energy and Infrastructures (under which the IWA officially sits as an autonomous agency), the Ministry of Environment, and the Ministry of Agriculture and Rural Development. The role of these other ministries in the project proposed by EcoPeace is likely to be minor and, therefore, is not elaborated on here.

6.3. Jordanian Regulatory and Legal Framework

The primary institution responsible for water management in Jordan is **the Ministry of Water and Irrigation (MWI),** which oversees the developing and implementation of national water policies and regulates water resources. It is tasked with setting priorities for water use, regulating supply and distribution, permitting/licensing and monitoring. The **Water Authority of Jordan (WAJ)** is the main entity responsible for the operational aspects of water distribution and wastewater treatment in the country, and for regulating the pricing of water services. The Jordan Valley Authority (JVA) is a government agency primarily responsible for development of

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[23] At present, seawater desalination capacity in Israel is at 700mcm/y. This represents over 30% of total freshwater consumption annually, and 80% of municipal consumption. This percentage will increase in the near future, as Israel already has contracted for two additional large-scale seawater desalination plants.
[24] One contract, for the Palmachim plant, the smallest of the six, is a Built-Operate-Own (BOO) contract.

agricultural and rural areas along the Jordan Valley. The JVA manages several of the country's dams and the King Abdullah canal, which brings water southward from the Yarmouk basin through the Jordan Valley.

In addition to the government agencies Jordan has three utility companies, Miyahuna, Yarmouk Water Company and Aqaba Water, that are responsible for management and operation of water treatment, water services, wastewater collection and treatment, and distribution of treated wastewater for reuse (Ministry of Water and Irrigation, 2023).

The primary law regulating water management in Jordan is the Water Authority Law of 1988, which established the WAJ and outlines the legal framework for water distribution, groundwater extraction, and pollution control.[25] This law, which was amended by Law No. 22 of 2014, established that all water resources are considered state-owned property and cannot be used or transferred except in compliance with conditions outlined in the law. Other laws include the Groundwater Management Law of 2002, which regulates the use of groundwater resources, including providing guidelines for the licensing and monitoring of groundwater wells, and the Jordan Valley Authority Law from 1977, which designated the JVA as responsible for the management and development of the Jordan Valley, and empowered it to oversee irrigation systems, groundwater extraction, and the protection of water resources in the valley.

The Ministry of Water and Irrigation has published periodic National Water Strategy documents. The latest, the National Water Strategy 2023-2040, published in 2023, highlights priorities for the water sector in Jordan. These include the development of the National Water Carrier, ambitious targets for reduction of non-revenue water (leaks and illegal connections), and a broad program for demand management. It should be noted, however, that previous National Water Strategy documents also had reducing non-revenue water as an objective, but no substantial progress was made on this front. Given the high estimated costs of water from the AAWDCP, Jordan may intensify its efforts to reduce non-revenue water, which will also improve the attractiveness of the initiative proposed by EcoPeace.

6.4. Regional Agreements

Legally, **relations between Israel and the PA are governed by Article 40 in the interim peace agreement (Oslo II) of 1995**, **while those between Israel and Jordan are governed by Article 6 in the peace agreement of 1994**. Both of these agreements commit the parties to work together to develop additional water resources, including via desalination. They also lay out protocols for cost-sharing for water transfers. Though the Oslo II agreement was intended as a five-year interim agreement, as no final status agreement was negotiated, it remains the primary legal framework regulating relations between the two parties.

[25] https://form.jordan.gov.jo/wps/portal/Home/GovernmentEntities/Ministries/Ministry/Ministry%20of%20Water%20and%20Irrigation/Water%20Authority

Specifically regarding transfers of water from Israel to Jordan, significant precedent exists, including procedures outlined under the peace agreement, as well as protocols established in additional water purchase agreements between the two countries.

Though not legally binding, the various memorandums of understanding (MoUs) and other agreements between the parties on major water infrastructure projects, such as GCDP, the Red-Dead canal, Project Prosperity and others, including the Northern Gaza Emergency Sewage Treatment (NGEST) Project, offer insight as to legal procedures and assurances given to facilitate project implementation. These agreements all have in **common assurances of the parties regarding cost-sharing, notification procedures, and guarantees regarding movement of goods, services and personnel**. Analysis of international agreements also indicates that more stable agreements also have agreed upon dispute resolution mechanisms (Dinar et al, 2016; 2019). The peace agreements did have such mechanisms, but, at least in the case of water, they have not been utilized to resolve disputes between the parties.

Failure to establish agreed upon protocols for water quality and quality monitoring has been a point of contention between Israel and Jordan in the past. Thus, any future agreement within the framework of **the proposed project would need to specify water quantities, quality, and timing, as well as compensation mechanisms**, should agreed upon criteria not be met. Transported water would have to meet standards for all parties and such standards should be incorporated upfront into any contract. In addition to water-related issues, standard international contract law would apply to the proposed EcoPeace project.

6.5. International Water Law

International law is only binding on countries ratifying a treaty or other agreement, and in any case often lacks any enforcement mechanisms. However, international law can still play an important role in setting norms and expectations among actors. In terms of **transboundary water law**, the primary international agreement in effect is the United Nations' Convention on the Law of Non-Navigational Uses of International Watercourses (the **UN Water Convention**) of 1997. The Convention outlines legal principles for management of shared waters, both surface and groundwater, including mandating the principles of "**equitable and reasonable use**" and "**no significant harm**". The Convention went into force in 2014. Jordan and the State of Palestine are among the 40 countries who have ratified the agreement. Israel has neither signed nor ratified the Convention.[26]

Legal scholars have noted that **legal principles governing natural freshwater may not cover desalinated water, which is treated more like a manufactured good rather than a natural endowment or public good** (Larson, 2012). As such, international water law, including the UN Water Convention, is unclear on the obligations of parties concerning the role of desalination in management of shared resources (Katz, 2021).

[26] Several other important actors have also not ratified the agreement, including the U.S., China, India, Pakistan, Russia, Turkey and others. This has led many to question the force the Water Convention actually has (e.g., Eckstein, 2021).

Both human rights law and international law on warfare (i.e., the Geneva Agreements) are also relevant**. Human rights law mandates ensuring that all people receive at least a minimum supply of water for existence**. In transboundary settings, this obligates riparians or those sharing aquifers, to ensure water supply beyond national borders. The **Geneva Agreements forbid the intentional targeting of water infrastructure and water-related Infrastructure, as well as attacks against the personnel working for water infrastructure and water-related infrastructure**. It also forbids indiscriminate attacks on infrastructure when a party is unable to distinguish between military and non-military objectives (Tignino & Irmakkesen, 2020). The events in the region and in other ongoing war zones, however, have demonstrated that such principles are not always adhered to and are difficult to enforce, especially in highly populated areas such as Gaza. Furthermore, water infrastructure, including pipelines and energy stations, is often a casualty of warfare, even if unintentionally.

7. Regional Development & Partnerships

This section presents possible areas for partnerships that the initiative would offer. These include work in the technical, financial, and political spheres.

7.1. Technical Cooperation Needs

Given the potential for integration of the project into larger regional programs, this section will briefly review some of the potential partnerships within the region and outside of the region that could play an important role in advancing the project. **The first and most basic level of cooperation is between the water authorities, i.e., the PWA, the IWA, and the Ministry of Water and Irrigation and the WAJ**. In practice, a working relationship already exists between these bodies. With this project, however, the nature of the PWA-IWA relationship would shift, as the Gaza Strip would be a supplier of water rather than simply a consumer. Beyond the coordination needed between the government bodies overseeing water, there would also need to be coordination between the bodies responsible for actual operations, including whatever entity would run the desalination facility and CMWU, Mekorot, and one or more of the Jordanian water utilities.

Similarly, there would have to be cooperation between the desalination plant, the Gazan authority responsible for power generation, and whatever entity ends up providing Gaza with the required energy. In negotiations for Gas for Gaza, the pipeline was coordinated between the Palestinian Energy and Natural Resources Authority (PENRA) and the Israeli Prime Minister's Office and the Ministry of Energy and Infrastructure. The Israel Natural Gas Lines (INGL), a private company, is responsible for development of the infrastructure and delivery of gas from Israel to Gaza.

7.2. Regional Political and Financial Cooperation Potential

Beyond the need for technical cooperation, the proposed initiative represents an opportunity not only to address water security, but more generally to advance regional cooperation in trade, science, and technology, as well as environmental protection. As such, the potential for more extensive collaboration in the proposed project is immense. In terms of foreign governmental actors, potential partners include those partners that have been involved with infrastructure and development projects in Palestine, Israel and Jordan in the past, especially in the water sector, including the **E.U. and individual E.U. member states, the U.S.,[27] Japan, and the U.A.E**.

Beyond these established partners, the project could be a starting point for **broader regional collaboration including with Gulf states**, such as Saudi Arabia, Bahrain, Oman, Kuwait and possibly Qatar. Saudi Arabia is the largest of the potential partners. It has a highly developed desalination sector and has been active in investing in desalination elsewhere in the region, e.g., El-Arish. It is also said to be interested in normalization of relations with Israel, should an acceptable resolution of Palestinian national aspirations be found. Bahrain already has relations with Israel and there are several existing initiatives of Israeli-Bahraini collaboration on water-related applied research. Oman also has expertise in desalination and hosts the Middle East Desalination Research Center (MEDRC), which conducts training and research on desalination throughout the Middle East. It would likely also be interested in normalizing relations with Israel should the Saudis move forward first. Kuwait may also fall in that category. Kuwait also already pledged funding for the GCDP through the Kuwait Fund and thus would be a natural partner for a new desalination project in Gaza.

A coalition of Gulf states would represent a partner with both the financial and technical resources needed, and thus, ensure financial stability. But it **would also help ensure physical and logistical security**, as Israel would be hesitant to disrupt a key feature of broader regional integration. Furthermore, such a coalition would **open up funding opportunities and help leverage other funders** who might be hesitant to invest without matching funds.

International financial institutions that could play a role include **development banks**, such as the World Bank, the Islamic Development Bank (IsDA), and the European Bank for Reconstruction and Development (EBRD), all of whom have already invested in water projects in the region. The World Bank Group, through several of its constituent agencies, was a funder of the Red-Dead project, the GCDP and associated works projects, and several other water projects in the region. Both IsDA and EBRD have invested in the AAWDCP. In addition to international development banks, **other banks** would be natural partners, including the European Investment Bank (EIB), which was one of the lead financial institutions in the GCDP,

[27] At present, USAID does not appear to be likely to invest in such a project, but should the administration change, or should the project be included in a broader regional peace agreement, U.S. funding may also play a role, as it has in past water projects in the region.

the Kuwait Fund, and possibly the Saudi Fund for Development, which has invested in water projects around the world, including in El-Arish. The Global Environment Facility (GEF) is another potential project finance partner.

The involvement of regional partners would also open up **opportunities for participation by government corporations and private sector initiatives from countries in the region**, such as the Saudi Arabia's Saline Water Conversion Corporation (SWCC), or the U.A.E.'s Masdar, which is involved in several international renewable energy projects, including for desalination. Private companies active in Israeli desalination, as well as **international corporations** active in the AAWDCP, would also likely be eager to cooperate in the project should it be tendered**. Private foundations** such as Gates Foundation's Water, Sanitation & Hygiene program, may also potentially be interested in contributing to such an initiative.

In addition to funding agencies, **other international organizations would also potentially play a role in facilitating the project and lending expertise.** UNDP has played a role in several water initiatives in the region and would likely play a role in any large-scale initiative in Gaza both directly and through its Water Governance Facility. Other waters-specific initiatives, such as the Global Water Fund, the Global Water Partnership-Mediterranean, are also potential partners.

It is also possible that the proposed project could be **incorporated into even broader international development initiatives, for instance, the IMEC initiative described above**. While the primary focus of IMEC and its "Partnership for Global Infrastructure Investment" is integration of transportation networks, the proposed desalination project could potentially be included in such integration planning. Integration of the desalination project, for instance, is a core element of EcoPeace's Peace Triangle initiative within the framework of IMEC (EcoPeace (2025).

In sum, the project has the potential not only to address critical water scarcity needs, but also to serve as a basis and building block for broader regional economic, scientific, technical and environmental cooperation.

8. Stakeholder Mapping

Based on the assessment above several different stakeholders would or could potentially be involved in the proposed initiative. Stakeholder mapping involves identifying different stakeholders or stakeholder groups and highlighting their comparative interests and roles in a project or policy. In a recent report on stakeholder mapping, the World Bank recommended distinguishing between internal and external stakeholders (World Bank, 2023). Internal stakeholders are those involved in project implementation, while external stakeholders are those affected by the project but who do not participate. The primary beneficiaries of the proposed Gaza desalination project include the public at large in both Palestine and Jordan, especially the population of Gaza, that will gain access to freshwater. In this section we limit our analysis to the primary internal stakeholders, i.e., actors that would be likely to play a role in advancing the proposed project.

A commonly used matrix for stakeholder mapping involves ranking parties based on two parameters: **interest and influence**, often done on a two-dimensional matrix, where each axis ranges from low to high. While such a system is imprecise, it can be helpful in identifying which stakeholders are most critical. At this preliminary stage of the analysis, it would be premature to speculate regarding the level of interest of various stakeholders in the proposed project. Thus, for this analysis we simply list prominent stakeholders in each of the countries involved as well as key international stakeholders and potential stakeholders and indicate their level of potential influence over the proposed initiative (Table 10). This list will be updated following discussions with various actors.

Table 10. Stakeholder Interest Map

Palestinian	Influence	**Jordanian**	Influence	**Israeli**	Influence	**International**	Influence
Office of the Presidency	**High**	King Abdullah	**High**	Office of Prime Minister	**High**	Saudi government	**High**
PWA	**High**	MoWI	**High**	IWA	**High**	Other Gulf state governments	**High**
MoFA	Medium	MoFA	**High**	MoFA	**High**	Traditional donor countries	**High**
PENRA	Medium	WAJ	**High**	MoRC	Medium	Development banks	**High**
CMWU	Medium	MPIC	Medium	MoEI	Medium	Other regional investment banks	**High**
MPIC	Medium	AAWDCP management	Low	Mekorot	Medium	Private sector developers & contractors	Medium
		Jordan Valley Authority	Low	IN	Low	International & intergovernmental organizations	Low
						Commercial banks	Low

Acronyms used:

AAWDCP – Aqaba Amman Water Desalination and Conveyance Project
CMWU – Coastal Municipalities Water Utility
IWA – Israeli Water Authority
INGL – Israel Natural Gas Lines
MoEI – Ministry of Energy and Infrastructures
MoFA – Ministry of Foreign Affairs
MoRC – Ministry of Regional Cooperation
MPIC - Ministry of Planning and International Cooperation
PENRA – Palestinian Energy and Natural Resources Authority.
PWA – Palestinian Water Authority
WAJ – Water Authority of Jordan

Note: Ministries of Finance and other bodies controlling national budgets may also have influence, as may regulatory authorities responsible for zoning and licensing. These are not listed here.

9. Development Phases

A project of such a magnitude and technical, financial and geopolitical complexity requires several advanced planning stages. The following represents estimates of required phases and their expected time frames:

- **Programming (6 – 9 months)**
  The purpose of this initial phase is to identify and clarify the vision, strategy and objectives that the various stakeholders have over a specific timeframe, and thus to provide a framework within which the project can be prepared. The programming phase develops an initial idea, core assumptions, and creates an outline of the business case and its implementation schedule. This present Desk Study is one of the tools meant to support "**the concept**" strategy formulation.

- **Identification (3 – 6 months)**
  The purpose of this phase is to identify project ideas that are consistent with the development priorities and to assess their relevance and feasibility. In this phase, the project developers and promoters shall assess the first reactions to the concept's proposal, the envisaged strategic investment and business planning, and the conceptual development of the project.

- **Feasibility Study (6 – 9 months)**
  In this phase, the project's overall potential viability is examined using data and information gathered in a feasibility study. The **feasibility study** helps to decide on the optimal investment approach by answering the following question: *is the project feasible in terms of economic and financial sustainability, environmental and regulatory compliance and acceptance by the public?*
  The feasibility study consists of a **technological-technical assessment and analysis**, a location analysis, an organizational analysis, and the analysis of economic and financial indicators. A detailed financing proposal outlining project costs, funding requirements, and potential sources of financing shall be created at this phase. Prospective donors/investors shall be identified, approached and introduced to the concept at this stage, aiming to seed their interest in supporting the project.

- **Project Structuring, Planning and Coordination (2 – 4 months)**
  In this phase the promoters develop a robust project structure, planning and coordination methodology, defining roles, responsibilities, and legal frameworks. They prepare an action plan that determines the steps needed to achieve the project's goals. They also conduct thorough due diligence to identify and mitigate risks and ensure project credibility for investors/donors. In parallel, the promoters shall seek regulatory approvals, navigating regulatory processes to obtain necessary approvals and permits for project execution.

- **Procurement (9 – 15 months)**
  A project of such capacity and multi-disciplinary complexity demands experienced EPC and O&M contractors. The selection process should include a Pre-Qualification (PQ) stage where prospective contractors shall present their capabilities and proven experience in similar ventures. Following the PQ stage, a tender process would be implemented. The procurement process shall be conducted according to international rules and standards, supported by well-known and reputable entities and experts.

- **The Financing Phase (6 – 9 months)**
  The financing phase is characterized by the transition from planning to execution. It involves the crucial steps of financial modeling to project future outcomes, negotiating with donors/investors, and drafting legal documentation, culminating in the achievement of financial close where all funding and approvals are secured. This stage marks the turning point where the project becomes financially backed and ready for implementation.

- **Implementation - Project construction (36 – 48 months)**
  In this phase the project takes shape. It is during implementation that the project becomes visible to outsiders, to whom it may appear that the project has just begun. The implementation phase starts with the signature of the contract (commencement date) and ends with the "take-over" of the goods and works requested and the following exploitation/operation period (installation life cycle).

The timing (and to some extent even the order) of these scenarios will be dependent on larger post-war infrastructure reconstruction plans. As the likelihood of large-scale investment under conditions of high uncertainty are low, the stages of development will be from the cessation of the current war, though some initial scoping and planning may be possible immediately.

10. Conclusions

The proposed initiative to develop a large-scale desalination facility in the Gaza Strip that would supply not only the Gazan population, but also that of the West Bank and Jordan is a bold one that can lay the foundation for regional development and cooperation. It would provide Palestinians with a domestic source of water and would provide Jordan with additional water supplies at a price below the cost of domestic desalination. As such, it would help address basic human and economic development needs in the region. Inclusion of supplies to the West Bank and Jordan would improve the financial viability of the project relative to a project limited only to supplying water within the Gaza Strip. It also is likely to increase donor interest.

Beyond its direct benefits in terms of regional water security, the project has the potential to further regional economic integration as well as scientific, technical and environmental cooperation more generally. It could be incorporated in larger regional normalization and/or development programs, thereby also promoting political and economic stability. Other regional development initiatives, such as Project Prosperity and IMEC, highlight the potential for such a broad and ambitious approach to resource management, and the proposed project could be incorporated into these or other such initiatives.

This initial technical and economic analysis shows that such a project seems feasible, though important details need further research, including technical and financial implications of distribution of water supplies within Gaza, the West Bank, and Jordan. The study did not investigate the needs for basic water infrastructure within the Gaza Strip, nor indeed what regulatory structure would eventually oversee such a project. Nor did it investigate technical parameters and costs of distribution of water within Jordan, which clearly would have to be factored into any decision-making process. Therefore, this study can be seen as a pre-feasibility study that highlights issues of interest that should be addressed by a more detailed, full feasibility study.

In order to come to fruition, the project would also need the approval and support of the governments involved, as well as the international investment community. It would also need negotiations regarding commitments, procedures and compensation mechanisms for contract violations, and agreed on conflict resolution mechanisms. Given these needs, the large number of potential partners and stakeholders, and the significant potential obstacles that such an ambitious initiative would face, engagement with both governmental, intergovernmental and private sector actors at an early stage is recommended.

In sum, enhancing water security is critical for the stability, health, and prosperity of the region in general and Gaza in particular. A proposed regional desalination plant is an ambitious goal, but if achieved, could be an essential element in both addressing this critical need and in promoting regional development more generally.

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Annex A: Additional Projections and Water Cost Summary

The following calculations included in Annex A provide estimates for CAPEX, OPEX and per unit produced water costs assuming an electricity cost of 0.0693 US$/KWh, as per projections given in the Qamar Energy report submitted to EcoPeace.

Table A.1: Estimated CAPEX

#	Program Item	CAPEX (million US$)	
		Scenario 1	Scenario 2
1	Desalination Facility (200 mcm/y)	749.6	749.6
2	Dedicated Power Plant (120 MW and 114 MW respectively)	N.A.	N.A.
3	Central Reception and Distribution Facility in Gaza Strip	90.1	90.1
4	Conveyance System within Gaza Strip - (3x 15km pipelines)	28.8	28.8
5	Pipeline to the Gazan-Israeli Border (capable of delivering 150 mcm/y)	-	31.3
6	Conveyance System to the West Bank (pipeline and booster stations)	126.8	-
7	Conveyance System to Jordan (pipeline and booster stations)	443.0	-
8	Program Management Support Consultants(1)	7.7	7.7
9	Program Implementation Consultants(2)	24.0	24.0
10	Program Management Team(3)	9.6	9.6
11	Trust Funds Management(4)	3.8	3.8
	Total:	**1483.3**	**944.9**

(!) 4 International consultants for 4 years (Construction)

(2) 50 Experts, part-time (3 months/y each)

(3) 10 Highly qualified experts in different areas

(4) 4 Highly qualified officials, partial time

Table A.2: Estimated OPEX

Scenario 1 Operational Costs				
#	Program Item	Fixed (US$/m^3)	Variable (US$/m^3)	Annual Cost (MUS$/y)
1	Desalination Facility (200 mcm/y) (not including energy)	**0.052**	**0.121**	34.6
2	Energy Component based on 0.0693 US$/kWh	**0**	**0.226**	45.2
3	Central Reception and Distribution Facility in Gaza (not including energy)	**0.016**	**0**	3.2
4	Conveyance System within Gaza Strip (pipelines & pumping)	**0.026**	**0.017**	2.1
5	Conveyance System to Gaza-Israel Border (O&M + Energy)	**N.A.**	**N.A.**	N.A.
6	Conveyance System to the West Bank (pipeline & booster stations)	**0.045**	**0.124**	8.5
7	Conveyance System to Jordan (pipelines & booster stations)	**0.054**	**0.094**	14.8
8	Program Management Support Consultants	**0.002**	**0**	0.4
9	Program Implementation Consultants	**0.004**	**0**	0.7
10	Program Management Team	**0.006**	**0**	1.2
11	Trust Fund Management	**0.002**	**0**	0.5
	TOTAL			111.4

Scenario 2 Operational Costs				
#	Program Item	Fixed (US$/m^3)	Variable (US$/m^3)	Annual Cost (MUS$/y)
1	Desalination Facility (200 mcm/y) (not including energy)	**0.052**	**0.121**	34.6
2	Energy Component based on 0.0693 US$/kWh	**0**	**0.226**	45.2
3	Central Reception and Distribution Facility in Gaza (not including energy)	**0.016**	**0**	3.2
4	Conveyance System within Gaza Strip (pipelines & pumping)	**0.026**	**0.017**	2.1
5	Conveyance System to Gaza-Israel Border (O&M + Energy)	**0.005**	**0.007**	1.8
6	Conveyance System to the West Bank (pipeline & booster stations)	**0**	**0.820**	41
7	Conveyance System to Jordan (pipelines & booster stations)	**0**	**0.820**	82
8	Program Management Support Consultants	**0.002**	**0**	0.4
9	Program Implementation Consultants	**0.004**	**0**	0.7
10	Program Management Team	**0.006**	**0**	1.2
11	Trust Fund Management	**0.002**	**0**	0.5
	TOTAL			212.4

Table A.3. Cost of Product Water (Interest rate: 6%, Electricity Cost: 0.0693 US$/KWh)

	Scenario 1			Scenario 2		
	Fixed	Variable	Total ($\text{US\$/m}^3$)	Fixed	Variable	Total ($\text{US\$/m}^3$)
Water at the exit of the desalination plant (200 mcm/y)						
CAPEX (million US$)	749.6			749.6		
Capital Cost ($\text{US\$/m}^3$)	0.293		0.293	0.293		0.293
OPEX ($\text{US\$/m}^3$)	0.066	0.347	0.414	0.066	0.347	0.414
Total Cost ($\text{US\$/m}^3$)	**0.360**	**0.347**	**0.707**	**0.360**	**0.347**	**0.707**
Water Cost at the exit of the Central Reception Facility (200 mcm/y)						
Add CAPEX (million US$)	90.1			90.1		
Added Capital Cost ($\text{US\$/m}^3$)	0.035		0.035	0.035		0.035
Add OPEX Reception Facility ($\text{US\$/m}^3$)	0.016	0.000	0.016	0.016	0.000	0.016
Total Cost ($\text{US\$/m}^3$)	**0.411**	**0.347**	**0.758**	**0.411**	**0.347**	**0.758**
Desalinated Water Cost to Gaza (50 mcm/y)						
Add CAPEX (million US$)	28.8			28.8		
Added Capital Cost ($\text{US\$/m}^3$)	0.045		0.045	0.045		0.045
Add OPEX Conveyance to Gaza ($\text{US\$/m}^3$)	0.026	0.017	0.043	0.026	0.017	0.043
Total Cost ($\text{US\$/m}^3$)	**0.482**	**0.364**	**0.846**	**0.482**	**0.364**	**0.846**
Desalinated Water Cost at the Gaza-Israel Border						
Add CAPEX (million US$)	NA			31.3		
Added Capital Cost ($\text{US\$/m}^3$)	NA		NA	0.016		0.016
Add OPEX Conveyance to Gaza-Israel Border ($\text{US\$/m}^3$)	NA	NA	NA	0.005	0.007	0.012
Total Cost ($\text{US\$/m}^3$)	NA	NA	NA	**0.433**	**0.354**	**0.787**
Desalinated Water Cost to the West Bank (50 mcm/y)						
Add CAPEX (million US$)	126.8			0		
Added Capital Cost ($\text{US\$/m}^3$)	0.198		0.198	0		0.000
Add OPEX Conveyance to the West Bank ($\text{US\$/m}^3$)	0.045	0.124	0.169	0.0	0.820	0.820
Total Cost ($\text{US\$/m}^3$)	**0.655**	**0.471**	**1.126**	**0.433**	**1.174**	**1.606**
Desalinated Water Cost to Jordan (100 mcm/y)						
Add CAPEX (million US$)	443.0			0		
Added Capital Cost ($\text{US\$/m}^3$)	0.347		0.347	0		0.000

Add OPEX Conveyance to Jordan (US$/m^3)	0.054	0.094	0.148		0.0	0.820	0.820
Total Cost (US$/m^3)	**0.812**	**0.441**	**1.253**		**0.433**	**1.174**	**1.606**

Table A.4. Cost of Product Water (Interest rate: 0%, Electricity Cost: 0.0693 US$/KWh)

	Scenario 1				**Scenario 2**		
	Fixed	**Variable**	**Total (US$/m^3)**		**Fixed**	**Variable**	**Total (US$/m^3)**
Water at the exit of the desalination plant (200 mcm/y)							
CAPEX (million US$)	749.6				749.6		
Capital Cost (US$/m^3)	0.150		0.150		0.150		0.150
OPEX (US$/m^3)	0.066	0.347	0.414		0.066	0.347	0.414
Total Cost (US$/m^3)	**0.216**	**0.347**	**0.564**		**0.216**	**0.347**	**0.564**
Water Cost at the exit of the Central Reception Facility (200 mcm/y)							
Add CAPEX (million US$)	90.1				90.1		
Added Capital Cost (US$/m^3)	0.018		0.018		0.018		0.018
Add OPEX Reception Facility (US$/m^3)	0.016	0.000	0.016		0.016	0.000	0.016
Total Cost (US$/m^3)	**0.250**	**0.347**	**0.598**		**0.250**	**0.347**	**0.598**
Desalinated Water Cost to Gaza (50 mcm/y)							
Add CAPEX (million US$)	28.8				28.8		
Added Capital Cost (US$/m^3)	0.023		0.023		0.023		0.023
Add OPEX Conveyance to Gaza (US$/m^3)	0.026	0.017	0.043		0.026	0.017	0.043
Total Cost (US$/m^3)	**0.299**	**0.364**	**0.664**		**0.299**	**0.364**	**0.664**
Desalinated Water Cost at the Gaza-Israel Border							
Add CAPEX (million US$)	NA				31.3		
Added Capital Cost (US$/m^3)	NA		NA		0.008		0.008
Add OPEX Conveyance to Gaza-Israel Border (US$/m^3)	NA	NA	NA		0.005	0.007	0.012
Total Cost (US$/m^3)	NA	NA	NA		**0.264**	**0.354**	**0.618**
Desalinated Water Cost to the West Bank (50 mcm/y)							
Add CAPEX (million US$)	126.8				0		
Added Capital Cost (US$/m^3)	0.101		0.101		0		0.000
Add OPEX Conveyance to the West Bank (US$/m^3)	0.045	0.124	0.169		0.0	0.820	0.820
Total Cost (US$/m^3)	**0.397**	**0.471**	**0.868**		**0.264**	**1.174**	**1.438**

Desalinated Water Cost to Jordan (100 mcm/y)							
Add CAPEX (million US$)	443.0				0		
Added Capital Cost (US$/m^3)	0.177		0.177		0		0.000
Add OPEX Conveyance to Jordan (US$/m^3)	0.054	0.094	0.148		0.0	0.820	0.820
Total Cost (US$/m^3)	**0.482**	**0.441**	**0.923**		**0.264**	**1.174**	**1.438**

Water Costs Summary

Table A.5: Water Costs Under Different Energy Cost Scenarios

	Water Cost in US$/m3			
Annual Interest Rate: 6%. Payback: 25 years	**Scenario 1**		**Scenario 2**	
	Current Electricity Cost	**Low** Electricity Cost	**Current** Electricity Cost	**Low** Electricity Cost
Water at exit of the desalination plant (200 mcm/y)	**0.756**	**0.707**	**0.743**	**0.707**
Water at the exit of the central reception facility (200 mcm/y)	**0.807**	**0.758**	**0.794**	**0.758**
Water delivered within Gaza (50 mcm/y)	**0.899**	**0.846**	**0.885**	**0.846**
Water at the Gaza-Israel border	**N.A.**	**N.A.**	**0.824**	**0.787**
Water delivered to West Bank off-take (50 mcm/y)	**1.221**	**1.126**	**1.643**	**1.606**
Water delivered to Jordan off-take (100 mcm/y)	**1.340**	**1.253**	**1.643**	**1.606**
Annual Interest Rate: 0%. Payback: 25 years	**Scenario 1**		**Scenario 2**	
	Current Electricity Cost	**Low** Electricity Cost	**Current** Electricity Cost	**Low** Electricity Cost
Water at exit of the desalination plant (200 mcm/y)	**0.612**	**0.564**	**0.600**	**0.564**
Water at the exit of the central reception facility (200 mcm/y)	**0.646**	**0.598**	**0.634**	**0.598**
Water delivered within Gaza (50 mcm/y)	**0.716**	**0.664**	**0.702**	**0.664**
Water at the Gaza-Israel border	**N.A.**	**N.A.**	**0.655**	**0.618**
Water delivered to West Bank off-take (50 mcm/y)	**0.963**	**0.868**	**1.475**	**1.438**
Water delivered to Jordan off-take (100 mcm/y)	**1.011**	**0.923**	**1.475**	**1.438**

Annex B: Desalinated water prices in Israeli off-take agreements

For purposes of comparison we present here prices for desalinated water from Israeli off-take agreements (Table B-1 below). Comparison with other desalination facilities in the region are less informative for various reasons. Comparison with facilities in Saudi Arabia and the Gulf states is complicated by the fact that energy prices are often subsidized, for instance, while costs from agreements in Cyprus reflect the fact that facilities are smaller and do not benefit from economies of scale. In general, in recent years, typical per unit costs for desalinated water produced by saltwater reverse osmosis plants world-wide range from US$0.50 to US$1.20 (Shokri and Fard, 2023). These costs are dependent on a number of factors, including local regulations, energy costs, and others.

Facility	Start of Operation	Capacity (MCM/y)	Price (US$/m^3)
Ashkelon	**2005**	**120**	**0.81**
Palmachim[(1)]	**2007 / 2011**	**45 / 90**	**0.88 / 0.66**
Hadera	**2009**	**127**	**0.73**
Sorek I	**2013**	**150**	**0.54**
Ashdod[(2)]	**2013**	**100**	**0.65**

Source: Israel Water Authority

[(1)] Plant capacity has been extended in 2011

[(2)] Plant construction delayed by approx. 2 years

The prices presented above were at bid-stage submission, thus subject to indexations as per the several off-take agreements. These indexations take into account factors such as foreign currency fluctuations, inflation indices, and the cost of energy. Thus, for instance, the price of desalinated water from Sorek I, for which the base price was US$0.54, is currently approximately US$ 0.62/m^3.

It should be noted that Israel's large-scale desalination facilities have exceptional cost efficiency, especially when compared with similar facilities abroad. The main reasons for that are:

- Political stability and low risk profile of the off-taker, thus providing plenty of comfort for both developers and lenders;
- Israel's high credit rating, thus increasing lenders' appetite to provide financing support with reduced charges and margins;
- A good understanding among all stakeholders involved of their respective roles, assignments, commitments and associated risks under the BOT structure;
- Government policy and statutory and regulatory frameworks are in place, thus enabling long-term desalted water sales under a BOT scheme. This implies a balanced contractual structure, with clear allocation of the identified risks to the party best capable and more incentivized to handle and control these risks.