Aqaba-Amman Water Desalination and Conveyance (AAWDC) Project

2025 Environmental and Social Impact Assessment

Chapter 10: Cumulative Impact Assessment

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10.1 Introduction

Cumulative impacts result from the successive, incremental and/or combined effects of a project or activity, when added to other past, existing, planned and/or reasonably anticipated future ones. They have the potential to occur when projects (and their effects) occur in close spatial or temporal proximity.

This Chapter of the 2025 AAWDC Project ESIA presents the rapid Cumulative Impact Assessment (CIA) completed for the Project, undertaken in accordance with international best practice as set out in the International Finance Corporation (IFC) Performance Standards (2012), European Bank of Reconstruction and Development (EBRD) Environmental and Social Policy (ESP) (2024) and associated guidance. In particular, the CIA presented within this Chapter has been completed following the six-step CIA approach defined in the IFC Good Practice Handbook: Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (August 2013).

The key objectives in undertaking a CIA include the need to:

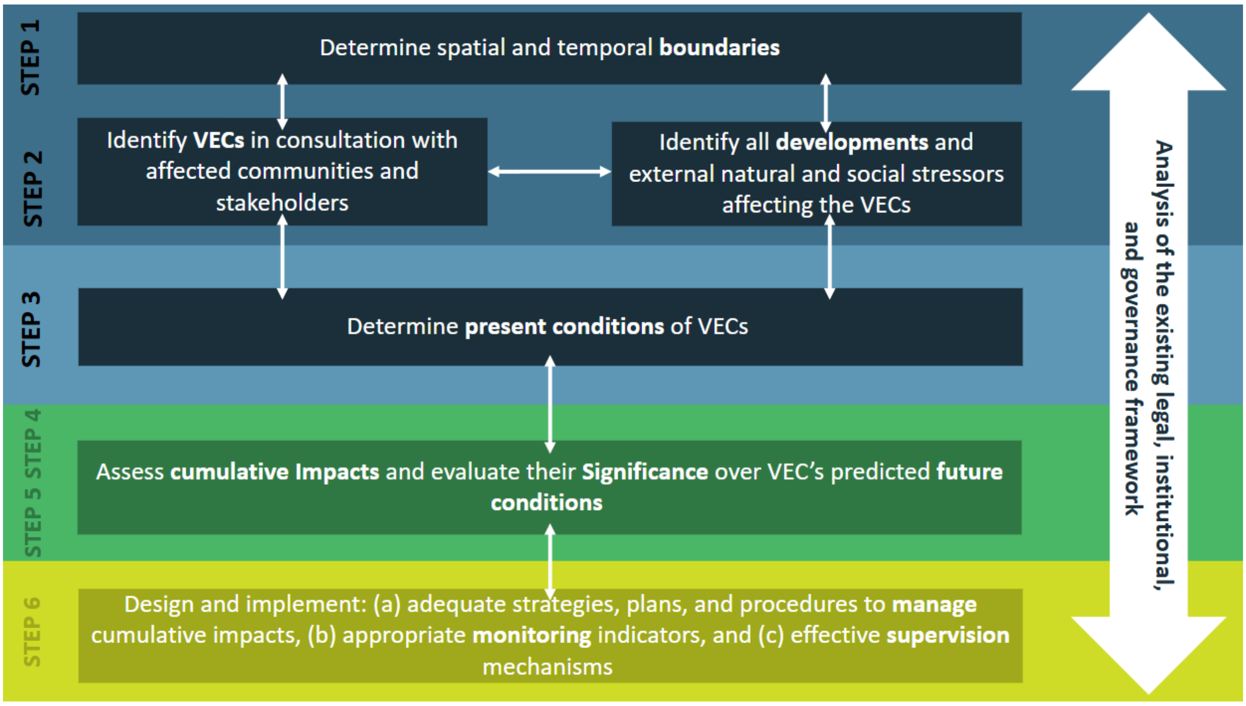
1. "*Assess the potential impacts and risks of a proposed development over time, in the context of potential effects from other developments and natural environmental and social external drivers on a chosen VEC.*
2. *Verify that the proposed development's cumulative social and environmental impacts and risks will not exceed a threshold that could compromise the sustainability or viability of selected VECs.*
3. *Confirm that the proposed development's value and feasibility are not limited by cumulative social and environmental effects.*
4. *Support the development of governance structures for making decisions and managing cumulative impacts at the appropriate geographic scale (e.g., airshed, river catchment, town, regional landscape).*
5. *Ensure that the concerns of affected communities about the cumulative impacts of a proposed development are identified, documented, and addressed.*
6. *Manage potential reputation risks*" (IFC, 2013).

The concept of Valued Environmental and Social Components (VEC) is key to the CIA approach and is defined within IFC Good Practice Handbook (2013) *"environmental and social attributes that are considered to be important in assessing risks; they may be:*

- *Physical features, habitats, wildlife populations (e.g., biodiversity),*
- *Ecosystem services,*
- *Natural processes (e.g., water and nutrient cycles, microclimate),*
- *Social conditions (e.g., health, economics), or*
- *Cultural aspects (e.g., traditional spiritual ceremonies)."*

In alignment with the IFC CIA guidance (IFC, 2013), the steps followed to undertake the rapid CIA for the AADWC Project are shown within Figure 10-1 below and described in further detail in the sections below.

Figure 10-1: Rapid Cumulative Impact Assessment (RCIA) Six Step Approach



10.2 Cumulative Impact Assessment

10.2.1 Step 1: Define Spatial and Temporal Boundaries

The first step of the CIA involves defining the geographic area over which potential impacts from the Project, Project associated facilities and cumulative impacts may be experienced, taking into account the potential for additive and in combination effects on the valued environmental and social components (VECs) identified within Step 2. For the AAWDC Project the definition of area was developed initially from the ESIA Study Area as described within Chapter 3 and subsequently refined to consider:

- The Project construction and operational activities and the Project temporary and permanent facilities as defined within Chapter 5 of this ESIA and their associated extent and area of impact as defined through the assessments presented in Chapter 9
- The electrical and transmission works including the OHTL and substations to be completed by third parties as defined within Chapter 5 of this ESIA and their associated extent and area of impact as defined through the assessments presented in Chapter[1]
- The location of cumulative sources of impact that can be reasonably defined and that have the potential to cumulatively affect the valued environmental and social components (VECs) impacted by the Project and the associated facilities (see Sections 10.2.2.1 and 10.2.2.2 below)

[1] The potential upgrades that may be required to the existing water storage reservoirs, if any, are not finalised. It is currently understood that it is most probable that, at least, the Al Muntazah storage reservoir will require expansion although the works required have not been defined

The temporal boundary is defined based on the anticipated duration of Project activities and the resulting duration of any impact on each VEC, as well as the extent of current knowledge of the sources, types, and scales of impact from cumulative projects for which details are available. For the majority of impacts considered, the temporal scale is assumed to be for the duration of Project construction (approximately 4 years in total) with additional consideration given to VECs where impacts may continue once the impact source or stressor has been removed. This may include reinstatement/recovery effects which may occur over a further period of time (which may be weeks to years, particularly with respect to physical impacts in the marine environment). Impacts during operation are considered over a duration of 30 years, which is the period of the Project Agreement signed between the National Carrier Project Company (NCPC) and the Government of Jordan, represented by the Ministry of Water and Irrigation (MWI).

10.2.2 Steps 2 and 3: Identify VECs, Baseline Conditions and Cumulative Impact Sources

10.2.2.1 Identification of VECs and Baseline Conditions

In accordance with the IFC Good Practice Handbook, the following criteria were adopted to identify the VECs to be considered within this rapid CIA:

- Considered as important and/or sensitive in the ESIA
- Identified as important and of scientific concern by international and/or national experts and the scientific community
- Considered to be important or sensitive by stakeholders consulted by the Project

The identification of key features, habitats, conditions and aspects as described under the VEC definition, and their sensitivities, has been informed through the development of this ESIA, which has included secondary data collection and review, stakeholder consultation as described in Chapter 8, and ongoing involvement and consultation with the national scientific community.

This has involved consultation with, among others:

- The Jordan Marine Science Station (MSS)
- The Royal Society for the Conservation of Nature (RSCN)
- The Jordan Department of Antiquities
- The UNESCO Representative for the Wadi Rum Protected Area (WRPA)
- The members of the marine and terrestrial expert groups who supported the marine and terrestrial critical habitat assessments (CHA), the national and international scientists involved the baseline data collection, surveys and preparation of this ESIA and representatives from regulatory authorities including Aqaba Special Economic Zone Authority (ASEZA) and the Ministry of Environment (MoEnv).

The initial review of VECs was undertaken based on a preliminary list, which was then refined in conjunction with a review of the potential cumulative impact sources (see Section 10.2.2.2 below) to scope out those VECs where potential for cumulative impacts was considered unlikely or impacts would be insignificant. This review considered the geographic and temporal extent of impacts based on the assessments presented in Chapter 9 and the baseline condition of the VECs, as defined within Chapters 6 and 7 of this ESIA and within the marine and terrestrial CHAs (appended to this ESIA).

In each case, where required, the spatial and temporal extent of both the impact and the baseline was reviewed in the context of the IFC CIA guidance to ensure it was suitably defined for the purpose of the CIA. Those VECs identified through this process were subjected to a second review to select priority VECs based on their importance, existing concerns, and/or potential cumulative impacts. The priority VEC identified comprises the following:

- Critical habitat and priority biodiversity features in the marine environment as defined within Marine Critical Habitats Assessment (refer to Table 10-1)
- Communities, businesses, farmers and herders in the vicinity of the Conveyance Pipeline construction activities, specifically between Hasa and Qatraneh

The respective baseline condition, importance and key sensitivities for each VEC is discussed within Chapters 6 and 7 respectively.

Table 10-1: Summary of Marine Critical Habitat (CH) and Priority Biodiversity Feature (PBF) and Their Qualifying Species

Biodiversity Value	Species
Turtles (PBFs)	Hawksbill (*Eretmochelys imbricata*) Green (*Chelonia mydas*)
Marine Mammals (PBFs)	Indian Ocean humpback dolphin (*Sousa plumbea*) Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) Pantropical spotted dolphin (*Stenella attenuate* (subspecies: *S. attenuata attenuata*))
Elasmobranchs (PBFs)	Spotted eagle ray (*Aetobatus ocellatus*) Coach whipray (*Himantura uarnak*) Spinetail devil ray (*Mobula mobular*) Oceanic manta ray (*Mobula birostris*) Panther torpedo (*Torpedo panthera*) Pink whipray (*Himantura fai*) Shortfin Mako (*Isurus oxyrinchus*) Tiger shark (*Galeocerdo cuvier*)
Teleosts (Bony fish) (CH)	Humphead wrasse (*Cheilinus undulatus*) Sky emperor (*Lethrinus mahsena*) Red Sea coral grouper (*Plectropomus marisrubri*)
Clams (CH)	Giant clam (*Tridacna squamosina*)
Coral habitat (CH)	All coral reef habitat
Seagrass habitat (CH)	All seagrass habitat

It should be noted that, based on the review of the cumulative impact sources, terrestrial biodiversity and associated potential VECs were scoped out of the CIA. This includes protected and designated areas, terrestrial critical habitat and Priority Biodiversity Features (PBFs). This is because the cumulative sources identified (as described in Section 10.2.2.2 below) include existing ongoing activities in areas that have already been established and future projects and activities that are geographically and temporally remote from the AADWC Project works. Hence, the potential for cumulative impacts (in combination with the Project impacts) and effects on the long-term sustainability or viability of these VECs is unlikely. This also aligns with the consultation outcome, where no significant concerns were raised regarding cumulative, in-combination, or overlapping impacts on terrestrial biodiversity. In addition, cultural heritage and community health and safety VECs are scoped out on the basis of the cumulative sources identified and the lack of potential for additive and in combination effects to the Project affected communities and tangible and intangible cultural heritage receptors. Social aspects are considered primarily in terms of potential for cumulative disturbance sources.

10.2.2.2 Identification of Cumulative Impact Sources

Sources of cumulative impact were identified through various methods, including review of secondary data sources and stakeholder engagement. The following sources are considered within this assessment:

- Current and planned third-party activities interacting with the marine environment within approximately 2km of the planned Project intake and outfall infrastructure facilities, specifically:
  - Existing third-party intake and outfalls and ongoing development activities associated with the Floating Storage and Regasification Unit (FSRU)
- Current third-party activities associated with the phosphate mining facilities operated by Jordan Phosphate Mines Company, located between Hasa and Al-Abiad (south of Qatraneh) to the immediate east of Highway 15 within 500m to 1km of the planned Project conveyance pipeline route (taking into account the re-routes in these locations) (see Figure 10-2)

These are described in more detail in the sections below.

Third-party projects and development that were identified but scoped out of the assessment include the following:

- Disi-Aqaba pipeline:

  This project comprised the construction of a new 68km water pipeline from Disi to Aqaba, including two pressure break tanks. The pipeline was intended to supply an additional 12 million cubic meters (MCM) of water per year to Aqaba City by 2030. An ESIA was prepared for this project, and consultation activities were undertaken. However, ultimately, the Jordanian Water Authority decided to cancel the project with the capacity the Disi-Aqaba pipeline would have provided, instead providing it through the AAWDC Project
- Eastern Jafr 3D Seismic Survey

  In April 2025, a 3D seismic survey programme covering approximately 4,285 square kilometres (km2) was understood to have commenced in the Maan Governorate near Jafr. The survey is being conducted in partnership with the Arabian Geophysical and Surveying Company (ARGAS), a subsidiary of Saudi Arabia’s Public Investment Fund, as part of Jordan’s Economic Modernisation Vision (2023–2025), which aims to enhance Jordan’s energy and mining sectors. The survey is planned to take eight months, with a further 24-month period to analyse the results. The location of the survey area and current progress are unknown; however, it is anticipated that the survey will be completed in Q1 2026, before AAWDC Project activities are anticipated to commence. The impacts from seismic survey activities are typically minor, with no significant effects on flora or fauna anticipated, and other impacts are temporary and short-lived. The extent to which the area surveyed overlaps with the AADWC Project facilities, in particular the Conveyance Pipeline route, is not known; however, the pre-construction surveys to be undertaken by the Project prior to construction will ensure that any changes that may have occurred due to the seismic survey activity are captured within the pre-construction Project baseline

- Rail project linking the phosphate mining activities with the Port of Aqaba

  This development comprises a future initiative at an early stage. The project could involve a new rail network of approximately 360 kilometres, linking the phosphate and potash mines across Jordan to the Port of Aqaba. While initial feasibility studies have commenced, this project is at the very earliest stages of development. It is understood that routing options are being investigated; however, the assessment is at a preliminary stage and involves key stakeholders, including the Jordanian Ministry of Transport. Details of the project, including potential implementation timing, are not sufficiently advanced to be considered in this CIA. In the event the rail project progresses, the Project will engage with the relevant stakeholders to ensure potential cumulative impacts (both environmental and social) are identified, assessed and managed as required

- Initiatives under the ASEZA Urban Development Master Plan (2024-2040)

  Development within the Aqaba Industrial Zone falls under the responsibility of the Aqaba Special Economic Zone Authority (ASEZA) with projects identified under the ASEZA Urban Development Master Plan (2024-2040), which aligns to Jordan's Economic Modernization Vision. The Master Plan includes a broad range of initiatives and projects across 8 sector strategies with timeframes for implementation ranging from the short term 2025-2030 to mid to long term, 2030-2040. The definition of the projects and timescales are not currently sufficiently developed to enable an analysis of impacts, however, based on the information available, no other large scale desalination projects or projects that involve large scale seawater extraction are planned within the vicinity of the AAWDC Project marine infrastructure. The Project will continue to engage with the relevant stakeholders within the Aqaba Industrial Zone to ensure potential cumulative impacts (both environmental and social) relating to development activities are identified, assessed and managed as required

In addition, the CIA does not directly assess the potential implications of the Project on the national water and wastewater infrastructure. This is, however, discussed within Section 10.3 below in a national context.

<u>Third Party Marine Intake and Outfalls and FSRU Development</u>

The Project intake and outfall infrastructure facilities are planned to be installed adjacent to the coastline of the Aqaba Industrial Zone, which comprises numerous industrial facilities and infrastructure as described within Chapter 6 of this ESIA. A number of these facilities are known to abstract seawater and discharge effluents. These include:

- KEMAPCO Arab Fertilisers & Chemicals Industries Ltd, a subsidiary of the Arab Potash Company, which abstracts seawater for desalination processes
- Phosphate and Fertiliser Industrial Complex operated by the Jordan Phosphate Mines Company (JPMC) and Aqaba Thermal Power Station, both abstracting seawater for cooling operations with subsequent discharge of cooling water into the Gulf of Aqaba
- Sheikh Sabah Al-Ahmad Al-Jaber Al-Sabah LNG Terminal, which has been operating a Floating Storage and Regasification Unit (FSRU) that abstracts seawater. The FSRU uses seawater for heating during regasification, adhering to ASEZA's Cooling Water Instructions No. 159 of 2014 and then returns the used seawater to the marine environment

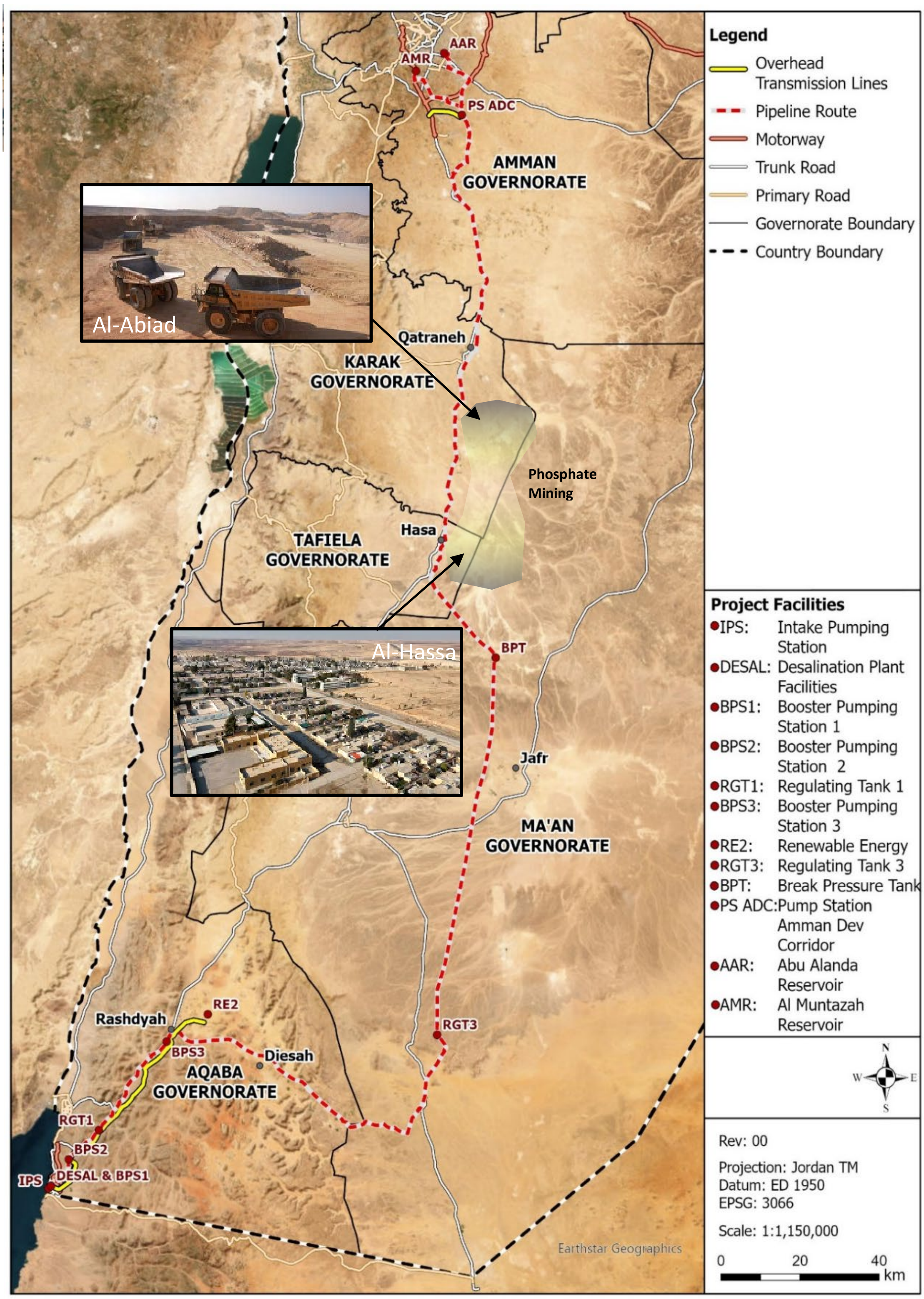
At the time this ESIA was developed, precise details regarding these discharges were not available. Professional judgement and assumptions have been used to estimate the type and scale of the discharges and thus estimate the potential interaction between the Project and third-party intakes and discharges (see Section 10.2.3.1 below).

With respect to the FSRU facility, a project is currently in progress to replace the existing FSRU with an Onshore Regasification Unit (ORU) and a leased Floating Storage Unit (FSU), collectively known as the 'Aqaba LNG ORU Project'. The ORU will be constructed on land within the existing LNG terminal's boundary. The FSU will be used to store LNG in cryogenic tanks prior to unloading. The effect of the Aqaba LNG ORU Project will be to move the regasification process from the current FSRU to onshore, and thus the current seawater discharge from the floating unit will no longer occur. Details are not currently available regarding the onshore regasification process or any potential new discharges resulting from it. The Project will engage with the relevant stakeholders to ensure potential cumulative impacts (both environmental and social) relating to Aqaba LNG ORU Project are identified, assessed and managed as required.

Phosphate Mining Activities (Hasa and Al-Abiad)

The Jordan Phosphate Mines Company (JPMC) operate three phosphate mines in Jordan; the Eshidiya Mine, which is located more than 10km from the planned Conveyance Pipeline route in the Ma'an Governate, and two large, interconnected facilities which comprise the Al-Hassa and Al-Abiad Mines, which are located in close proximity to the route, as shown in Figure 10-2. These mines, which have been operational since the 1960s and 1970s, cover a significant land area from which phosphate deposits are mined using open-cast techniques, followed by screening and crushing. Further products are produced through the concentration of phosphate ore and the use of drying units. The phosphate products are then transported from the mines to the industrial and port facilities at Aqaba either by rail or road or to the facilities at Eshidiya to be used in the production of phosphoric acid. In 2024, the Al-Hassa and Al-Abiad mines produced 1,939 and 2,077 ktonnes of phosphate, respectively, and employed a total of 330 people across both operations (JPMC, 2025).

Figure 10-2: Al-Hassa and Al-Abiad Phosphate Mines



10.2.3 Steps 4 and 5: Cumulative Impact Assessment, Mitigation and Monitoring

10.2.3.1 Assessment of Cumulative Impacts to the Marine Environment

The Aqaba Thermal Power Plant has been operating since 2000 and has an integrated management system that covers HSSE, which is certified to the ISO and OHSAS standards. Operational monitoring of discharges is undertaken to ensure compliance with applicable regulations and standards with ambient routine monitoring undertaken by the ASEZA and the Marine Science Station (MSS). The results of the National Monitoring Program (NMP) which cover 18 sites spanning the whole length of the Jordanian coastline are summarised within Chapter 6.

Based on the results from the survey station located nearest to the intake and outfall location (at the phosphate loading facilities) there is some evidence to suggest that water quality in this location has been influenced by restricted water exchange, potentially including discharges and anthropogenic effects with fluctuations observed in physical properties and inorganic nutrient concentrations in seawater. Sediment quality, however, is largely similar to that at other monitored sites, with no significant contamination identified.

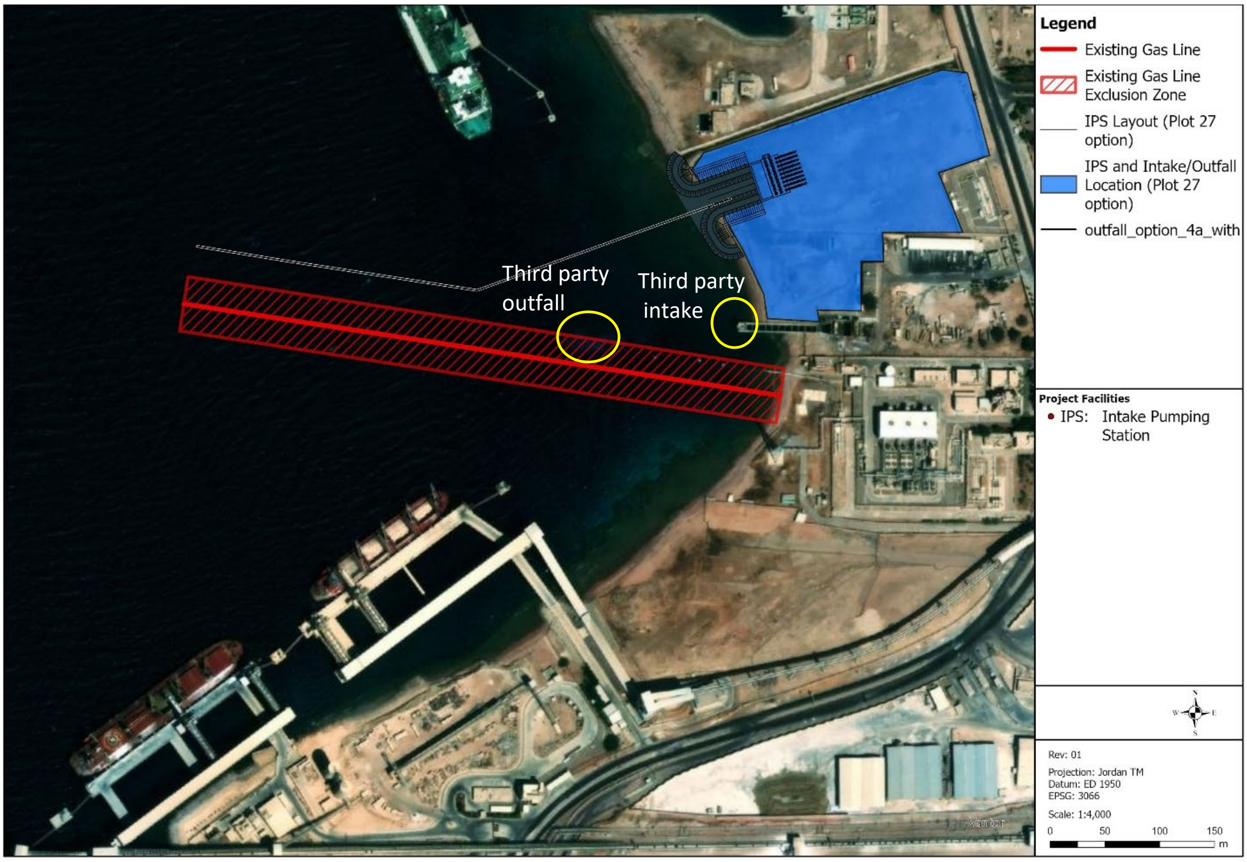
With respect to benthic habitats, as summarised within Chapter 6, surveys undertaken in the vicinity of the ESIA study area have identified the presence of macrobenthic organisms including corals, bivalves, hydrozoans, echinoderms, sponges and macroalgae with evidence of disturbance and modification noted primarily due to construction activity and ongoing ship and port activity. Typically, corals and other biotic indicators, except seagrass, showed higher abundance at the deeper transects compared to the shallower. The results of the 2025 benthic habitat survey in the vicinity of the Project showed that coral was present across the survey area. Coral communities were shown to transition from sparse, sediment-tolerant massive forms in the shallows to diverse, abundant branching and massive assemblages on the mid-depth reef, and finally to low-diversity, low-relief massive and plating corals in deeper, low-light environments. Seagrass beds were shown to be broader, denser and more continuous in shallower waters and largely absent in deeper waters.

To assess the potential for cumulative impacts, a number of assumptions were made regarding the Aqaba Thermal Plant intake and outfall, based on diver observations during the 2025 benthic habitat survey. These are provided in Table 10-2 and the assumed intake and outfall locations shown in Figure 10-3.

Table 10-2: Assumed Third Party Intake and Outfall Parameters

Aspect	Description/Parameter
Type of Plant	Power Plant
Outfall Location	Refer to Figure 10-3
Outfall Type	Single port close to the seabed slightly inclined upwards, diameter of 1 m (estimated)
Discharge rate	Assumed velocity of about 2 m/s in the pipeline results in a discharge rate of about 1.5 m^3/s
Excess temperature	+8 °C (typical excess temperature)
Excess Salinity	n/a
Intake Location and Depth	Refer to Figure 10-3. Assume depth-averaged withdrawal

Figure 10-3: Location of Closest Third-Party Intake and Outfall to Project Facilities



A review of the third-party intake and outfall was undertaken for the rapid plume dispersion modelling as presented in Appendix 9A.1 and based on the assumed parameters presented in Table 10-2 It was considered that the discharge from the third-party Aqaba Thermal Plant would not significantly interact with the Project effluent discharge, with the main effect being a slight increase in the water temperature at the AAWDC Project intake. This was considered to result in a minor impact on water density at the outfall, which, in turn, will only slightly affect the outfall plume behaviour. To confirm this, the existing discharge was incorporated into the modelling completed for the Project outfall for the cases considered (which included a number of different intake configurations), and it was shown that the buoyant nature of the effluent resulted in the highest recirculation under the westerly wind modelling scenario. This is because the buoyant plume reaches the surface and is more susceptible to wind forces acting in the area. Overall, the modelling concluded there was no predicted interaction between the AADWC Project discharge and the existing Thermal Power Plant discharge.

This result, in combination with the modelling outcomes for the AADWC Project route and non-routine effluent discharge, indicates no significant cumulative impacts on the marine environment and the associated VECs are anticipated. This will be confirmed through the ongoing monitoring programmes already in place and through the planned mitigation for the AADWC Project, as presented in Chapter 9, with respect to the Project intake and outfall infrastructure design, construction, and operation.

10.2.3.2 Assessment of Cumulative Impacts to the Physical Environment and Communities

The main impact from the mining operations at the Al-Hassa and Al-Abiad Mines, where there is potential for cumulative impacts, is dust generation as both a nuisance and a health issue. This was raised as a major concern during the Project stakeholder consultation. The activities at the mining sites are undertaken in line with international standards, with management systems in place that align with ISO 9001 for quality management, ISO 45001 for occupational health and safety, ISO 14001 for environmental management, and ISO 31000 for risk management. JPMC, who operate the mines, undertake sustainability reporting to relevant national and global standards including Global Reporting Initiative – Mining Standard, MSCI - Mining Industry Sustainability Indicators and United Nations - Sustainable Development Goals (UN SDGs) and recognise such reporting holds *"particular significance for the mining industry due to its substantial environmental impact, health and safety risks, effects on local populations, and governance complexities involving regulatory adherence and ethical practices."* (JPMC, 2025). The sustainability reports produced by JPMC include key performance metrics for aspects such as energy and water use, waste generation, employment, number of incidents etc. and include environmental, social and community initiatives planned and implemented at the company sites and in the surrounding communities, as well as an overview of the community engagement processes in place.

Dust is acknowledged as a key concern, particularly during dry seasons. Initiatives have been identified to look at approaches and technology to control this in collaboration with Royal Scientific Society (RSS) including ongoing PM_{10} and $PM_{2.5}$ air monitoring programmes, regular watering of internal roads and operational zones to reduce dust dispersion, application of dust suppressants in high-traffic areas, and the establishment, upkeep of vegetation buffers where feasible and reviews of preventive maintenance programs for mining equipment to minimize dust emissions caused by mechanical faults.

PM_{10} and $PM_{2.5}$ monitoring undertaken across Jordan, as reported in Chapter 6, indicates frequent exceedances of relevant limit values, with spikes recorded during sandstorms that can occur over several days and affect entire regions. The lowest concentrations of PM10 and PM2.5 have been recorded at the two monitoring stations within the Tafiela Governorate, including a rural station located at Hasa, where the 2024 annual average concentrations met the applicable PM_{10} and $PM_{2.5}$ limit values. This suggests that dust comprising PM_{10} and $PM_{2.5}$ (i.e., with an aerodynamic diameter of less than 10 and 2.5 microns (µm)), which poses a health concern, may be less of an issue in more rural locations. However, this does not imply the absence of particulate matter with a larger aerodynamic diameter, which can create a nuisance. Furthermore, dust dispersion is highly affected by meteorological conditions, particularly wind speed and direction. The location of the Hasa monitoring station relative to the mining activities and the influence of meteorological conditions is not known.

The cumulative impact of dust generated by both third-party mining activities and the Project construction activities, particularly associated with the Conveyance Pipeline installation between Hasa and Qatraneh, will occur over the duration of the Project construction activities and will be temporary, as the pipeline is installed along the route. Mitigation to minimise the potential for dust impacts from the Project is presented in Chapter 9. It will include a dust monitoring program, the identification and implementation of dust management practices, and ongoing consultation with potentially affected sensitive receptors. To further mitigate dust impacts, it is recommended that consultation be undertaken with the mining facilities to collaborate and coordinate efforts around both practical measures to control dust and consultation undertaken with the affected communities, such as to leverage the local and regional experience already held by the mining facilities and respond proactively to the community concerns. Given the relatively short duration of the Project activities and the identified control measures, it is considered that cumulative impacts will not be significant and will be adequately mitigated.

10.3 Implications of the Project on National Water and Wastewater Infrastructure

This section presents a summary of the implications and impacts of the AAWDC Project on the wider national water and wastewater infrastructure and the measures to be implemented to manage these potential impacts under the National Conveyance Project (NCP) Infrastructure Readiness Program.

10.3.1 Existing National Water Infrastructure

- The bulk water system is defined as the national system responsible for producing, treating, and transferring municipal water to the three regional utilities:
- Jordan Water Company (Miyahuna) serving Amman and the middle governorates
- Yarmouk Water Company (YWC) serving the northern governorates
- Aqaba Water Company (AW) serving the southern governorates

Jordan's bulk system consists of five main supply systems that together provide almost half of the country's municipal water: Disi Aquifer System, Zai Treatment Plant System, Zara Ma'in System, Za'tari System, and Wadi Al-Arab System. These are operated under different management frameworks: Disi under a BOT arrangement supervised by WAJ; Zai and Zara Ma'in managed by Miyahuna; and Za'tari and Wadi Al-Arab managed by YWC. The remaining municipal supplies come from smaller systems operated directly by the utility companies.

Nationally, water-supply coverage is high, reaching 94 % of the population (2021). Each governorate's system comprises local wells, reservoirs, pumping stations, and distribution networks.

Miyahuna manages the middle governorates; these systems, covering Amman, Zarqa, Balqa, and Madaba, account for more than 63 % of total national consumption. Except for Amman, most networks are ageing, with significant pressure fluctuations, high non-revenue water (NRW), and low energy efficiency. In 2021, NRW ranged from 47% in Amman to 72% in Balqa, averaging 52%.

YWC manages the northern governorates; the systems of Irbid, Mafraq, Jerash, and Ajloun are generally old and lack proper pressure zoning, making NRW control difficult. Most household connections are outdated, leading to tertiary-level leakage. In 2021, the northern region supplied about 21% of Jordan's total water, with NRW ranging from 40% (Irbid) to 68% (Mafraq), averaging 50%.

As for AW, in addition to Aqaba, it manages the southern governorates' water systems, covering Karak, Tafilah, and Ma'an. These systems are old, and their transmission and distribution mains have no pressure management. Additionally, most customers' meters are inoperative. The water system in Aqaba governorate within ASEZ is very advanced and highly automated, including smart metering solutions. In 2021, the southern governorates' water systems supplied around 15% of Jordan's total water supply. NRW ranged from 33% (Aqaba) to about 74% (Ma'an), with a weighted average of 58%.

10.3.2 Existing National Wastewater Infrastructure

Jordan operates 32 wastewater treatment plants (WWTPs), including six septage facilities. The total treatment capacity is around 600,000 m³/day (≈220 MCM/year) and is expected to reach 800,000 m³/day (≈290 MCM/year) by 2028 after completion of ongoing projects. The largest facility, As-Samra WWTP, has a capacity of 365,000 m³/day, followed by South Amman WWTP with 52,000 m³/day. As-Samra, located in Zarqa, serves both Amman and Zarqa and, in 2021, treated about 68% of the national wastewater flow.

Wastewater networks comprise collection sewers, pumping stations, transmission mains, and treatment plants, collectively handling 220 MCM/year (2021). National sewer coverage connects about 66 % of the population.

- Middle Governorates: Sewer coverage is relatively high (81 % of total national wastewater), reflecting the region's urban character. Some trunk lines in Amman and Zarqa experience seasonal overflows, particularly in winter, due to illegal connections to stormwater systems. Many old networks in Amman, Zarqa, and Balqa require rehabilitation
- Northern Governorates: Coverage ranges from 17 % in Mafraq to 50 % in Irbid, served by five WWTPs treating about 12 % of national wastewater. Expanding to unserved areas is constrained by limited system capacity
- Southern Governorates: Sewer coverage is 20 % in Tafilah and 85 % in Aqaba, collectively treating about 6 % of national wastewater. Outside Aqaba, systems cover only urban centers; significant investment is required to expand coverage to rural communities, particularly in Ma'an. Expansion plans will be guided by cost–benefit and environmental impact analyses, with a focus on groundwater protection

10.3.3 Potential Impacts of the Project on Water and Wastewater Infrastructure

The commissioning of the AAWDC Project, which will supply an additional 300 MCM/year of desalinated water, will represent the most significant shift in Jordan's municipal water system since the construction of the Disi project. While this new resource will substantially improve national water security and supply reliability, it will also create major technical, operational, and institutional challenges, particularly for the middle and northern governorates, where most of the water will ultimately be consumed.

10.3.3.1 Water Supply Implications

Approximately 250 MCM/year of the desalinated water will be allocated to the middle and northern governorates, with Amman serving as the main distribution hub through the Abu Alanda and Muntazah reservoirs. This sudden increase in supply volume could place considerable strain on the existing bulk and distribution networks, which were originally designed for smaller flows and intermittent supply.

Key impacts may include:

- Hydraulic Overload Risks: Transmission pipelines, storage reservoirs, and booster stations within Amman, Zarqa, and Irbid requiring upgrades to accommodate higher pressures and continuous operation. Without these reinforcements, the system could face bursts, pressure imbalances, and reduced efficiency
- Non-Revenue Water (NRW) Challenges: The middle and northern networks already suffer from high NRW levels, averaging 52 % and 50 %, respectively. Increased flow through aging infrastructure without parallel rehabilitation could worsen physical losses, offsetting a portion of the new water gains
- Energy Demand Increase: Pumping and pressure management requirements will rise significantly, raising both operational costs and energy dependency. Integrating energy-efficient pumps and smart pressure management systems will be essential to maintain sustainability

- Service Expansion: The additional water will allow utilities (Miyahuna and YWC) to extend service coverage and move toward continuous (24-hour) supply. However, this will require upgrading reservoirs, control valves, and SCADA systems to ensure stable distribution and equitable pressure management across the highlands and densely populated urban zones

10.3.3.2 Wastewater Supply Implications

The additional 300 MCM/year of potable water is expected to generate a proportional increase in wastewater, estimated at 210 MCM/year, assuming about 70 % of domestic consumption returns to the sewer network. This will place unprecedented pressure on the existing wastewater infrastructure and treatment capacity in the middle and northern regions.

Key impacts may include:

- Treatment Plant Overloading: As-Samra and South Amman WWTPs, which already handle nearly 70 % of the national wastewater flow, would experience significant loading increases. Without capacity expansion, estimated at +150,000 m^3/day for As-Samra and +25,000 m^3/day for South Amman, these plants could exceed their design limits, risking partial treatment or bypass discharges
- Trunk Sewer Constraints: Main collectors in Amman and Zarqa already experience seasonal surcharging and infiltration during storms. The higher baseflow from increased domestic discharge would likely accelerate deterioration and may trigger localised overflows, especially where stormwater is illegally connected to the wastewater system
- Reuse Opportunities: The increased effluent volume presents an opportunity to strengthen treated wastewater reuse programs for irrigation in the Jordan Valley and potentially in northern highlands. However, this will require parallel investment in reuse conveyance infrastructure and quality monitoring systems
- Groundwater Protection Risks: Without adequate expansion of sewer coverage, particularly in peri-urban and rural areas of Mafraq, Jerash, and Ajloun, higher domestic water use may lead to more cesspit discharges, increasing the risk of groundwater contamination

The magnitude of these anticipated impacts underscores the critical role of the NCP Infrastructure Readiness Program, which was conceived precisely to address these downstream challenges.

10.3.4 NCP Infrastructure Readiness Program

The NCP Infrastructure Readiness Program aims to ensure that the national water and wastewater systems are hydraulically, operationally, and institutionally prepared to receive and distribute the 300 MCM/year of desalinated water from the AAWDCP without overloading existing infrastructure. Through targeted investments in transmission pipelines, storage reservoirs, pumping stations, wastewater treatment capacity, and reuse systems, the Readiness Program bridges the gap between the new desalinated supply and the end users across the middle, northern, and southern governorates. In essence, it transforms the AAWDC Project from a standalone supply project into a fully integrated component of Jordan's water security system, linking desalination, conveyance, and downstream service delivery into one cohesive national framework. The Readiness Program is a complementary national initiative led by the Ministry of Water and Irrigation (MWI) and the Water Authority of Jordan (WAJ) to prepare Jordan's downstream water and wastewater systems to effectively receive, transmit, and utilize the 300 MCM/year of desalinated water that will be produced under AAWDCP.

The National Water Strategy (2023–2040) calls for integrated water–wastewater management, desalination, reuse, and NRW reduction. The MWI Strategic Plan (2025–2027) prioritises readiness for NCP integration, while the Middle Governorates Water Master Plan (2025) identifies 272 MJD of prerequisite investments related to transmission, pumping, and storage capacity expansion.

10.3.4.1 Water Transmission and Distribution

While the AAWDCP focuses on desalination, conveyance, and terminal delivery at Abu Alanda and Muntazah reservoirs, the Readiness Program ensures that this new water can be efficiently transmitted, distributed, and reused across the Kingdom without overwhelming existing systems.

The program covers 11 bulk water projects across Jordan, with a combined investment cost of approximately USD 840 million. It spans both water transmission and wastewater readiness components. Details are provided in Table 10-3 below.

Table 10-3: Details of the 11 Bulk Water Systems

Project	Main Components	Water Quantities (MCM/Year)
Priority 1		
Bulk 1: Transmission Middle Governorates, Amman & Zarqa. Abu Alanda – Tareq	• New 50,000 m^3 Tareq reservoir • New 28,000 m^3 Juraiba reservoir • 1,400 mm transmission pipeline from AA2 to Tareq (19.6KM) • 800 mm transmission pipeline connection to Juraiba (11.8KM)	• 45 MCM/Year to Tareq reservoir • 12 MCM/Year to Juraiba reservoir
Bulk 2: Transmission Amman Muntazah – Dabouq	• New 70,000 m^3 terminal reservorir and 30,000 m^3 future reservoir at Muntazah site • New PS at Muntazah site (6,000 m^3/hr) • 1200 mm transmisision pipeline from Muntazah to Dabouq (21.52KM)	52 MCM/Year to Dabouq reservoir
Bulk 3: Transmission Amman Abu Alanda – Khaw	Detailed design scope under review with CDM Smith	57 MCM/Year to Hofa
Bulk 4: Transmission North. Khaw – Hofa		
Bulk 5: Primary System – New – Middle	Detailed design will commence in November 2025	--
Bulk 6: Transmission and Delivery Point – Aqaba	TBD	50 MCM/Year
Priority 2		
Bulk 7: Primary System Reinforcement – Middle	TBD	--
Bulk 8: Transmission System New - North Governorates (Jerash / Hofa-Samad/ Samad-Ras Moneef)	Detailed design scope under review with NWMP	--

Project	Main Components	Water Quantities (MCM/Year)
Bulk 9: Primary Reinforcement for North	Detailed design scope under review with NWMP	--
Bulk 10: Transmission and Primary -Southern Governorates - Ma'an	TBD	TBD
Bulk 11: Transmission and Primary -Southern Governorates - Karak and Tafila	TBD	TBD

10.3.4.2 Wastewater Transmission and Distribution

To accommodate the increased domestic wastewater expected from higher water availability, the program includes:

- Expansion of major WWTPs: As-Samra expansion with a capacity of 48,000 m^3/day, North Aqaba WWTP expansion with a capacity of 12,000 m^3/day, and Ramtha WWTP with a capacity of 11,000 m^3/day
- Establishment of new WWTPs: Wadi Zarqa WWTP with a capacity of 350,000 m^3/d, in addition to WWTPs in Deir Alla and Naour areas, and Ain Al Basha WWTP in Baqa'a area instead of Balqa WWTP
- Construction of new collection networks in unserved and peri-urban areas
- Upgrading reuse conveyance systems to deliver treated effluent to the Jordan Valley, supporting irrigation of up to 25,000 hectares
- Integration of treated effluent quality monitoring and reuse standards under the Wastewater and Reuse Master Plans (anticipated in Q2 2026)

The implementation of the programme is designed to ensure the full benefit of the AAWDC Project is realised, optimise water reuse, and strengthen resilience under the National Water Strategy.

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