Case Study 6: Jordan

Tala Bay wastewater treatment plant and water reuse by hotels and resorts

Loay Froukh

Acronyms

ADC	Aqaba Development Corporation
ASEZ	Aqaba Special Economic Zone
ASEZA	Aqaba Special Economic Zone Authority
AWC	Aqaba Water Company
JPTD	Jordan Projects for Tourism Development
USAID	United States Agency for International Development
WAJ	Water Authority of Jordan
WWTP	Wastewater Treatment Plant

History and project justification

Aqaba is a city in southern Jordan on the Red Sea, close to the Saudi Arabian border and Egypt. It is popular with tourists who come to enjoy its many attractions including its marine life and coral reefs, warm weather in the winter season and proximity to the famous historical city of Petra.

Tala Bay Hotels and Resorts complex (hereinafter Tala Bay Resort) was the first resort and lifestyle complex to be developed in Jordan (Figure 6.1). On the shores of the Red Sea, 14 km south of Aqaba, it occupies an area of 2.7 million m^2 (JPTD 2022). It extends along 7 km of shoreline and its hillside position gives visitors panoramic views of the marina and Mount Sinai.

Tala Bay Resort's development was carried out as part of the Aqaba Special Economic Zone (ASEZ) – a low tax, duty-free, multi-sector development zone inaugurated in 2001 (ASEZA 2001; ADC 2022; AWC 2022). Its management and development come under the responsibility of the Aqaba Special Economic Zone Authority (ASEZA) (ASEZA 2001; ADC 2022). Being part of ASEZ has made Aqaba attractive to investors including Jordan Projects for Tourism Development (JPTD), one of the investors in the Tala Bay Resort.

The resort was constructed on Aqaba's southern beach, which has no wastewater collection system. As is the case with all developed projects in areas with no wastewater collection system in place, the developers needed to construct a WWTP. This requirement also provides an opportunity to supply recycled water from the plant for use around the complex to irrigate the landscaped spaces, for example, green areas and gardens. Tala Bay Wastewater Treatment Plant (Tala Bay WWTP) started operations in 2005 to serve this need.

FIGURE 6.1 Map of Tala Bay, Jordan showing location of WWTP.
SOURCE: Google Earth.

Reuse case description at a glance

The Tala Bay WWTP started operations in 2005 serving the Tala Bay Resort. Initially, it had a capacity of 300 m^3/day, which increased to 1,000 m^3/day when Aquatreat Water and Wastewater Engineering Company constructed a new Tala Bay WWTP (WAJ 2020). The plant is located on the offshore side of the resort, where the water is pumped through lifting stations to the main trunk line, which has a diameter of 250 mm and is 8 km long. There are four lifting stations inside the resort compound and another four lifting stations outside the compound (Figure 6.2).

The plant uses a modified activated sludge treatment system and collected wastewater goes through three stages of treatment: primary (grit removal and sedimentation tanks), secondary (biological activated sludge and nitrogen removal) and tertiary (polishing ponds followed by chlorination disinfection) (Figure 6.3). The sludge is then dried and transported for disposal.

Recycled water from the Tala Bay WWTP is then returned to the resort where it is stored in an on-site tank with a capacity of 8,000 m^3. The water is pumped from the storage tank to be reused in different ways around the resort, for example, to the sprinkler systems to irrigate the green areas in the resort or to the drip network to irrigate the trees. Some of the recycled water is pumped to nearby hotels such as the Mövenpick Resort and Spa. Currently, 500–1,000 m^3/day of the recycled water is used for irrigation, with the rate varying depending on occupancy in the hotels and resorts.

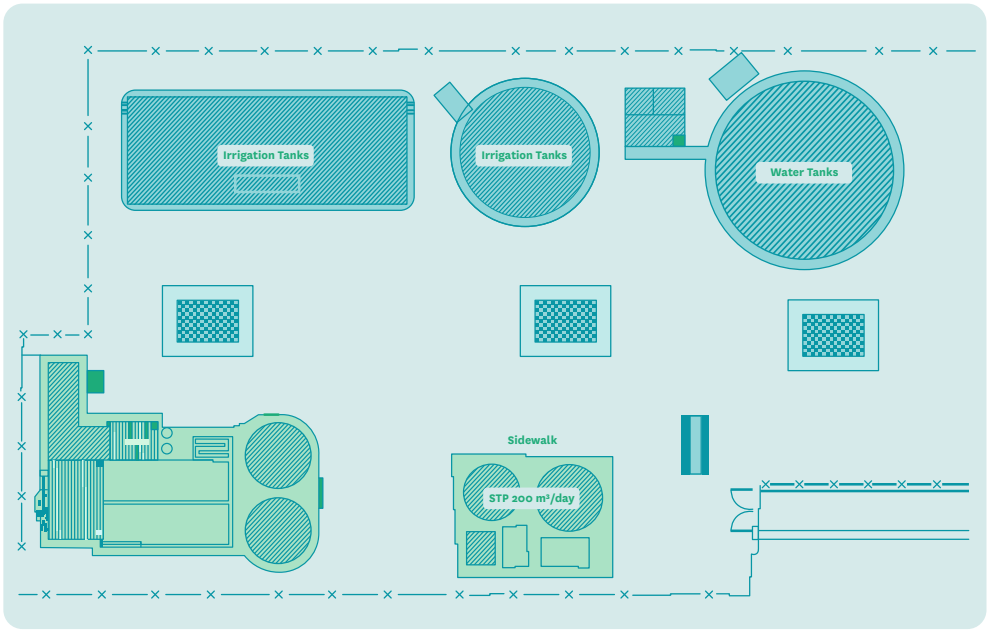

FIGURE 6.2 Tala Bay WWTP: Site map.
SOURCE: Jordan Projects for Tourism Development (JPTD).

One of the main challenges facing the use of recycled water for irrigating the landscaped areas is increased levels of salinity in the water, which is affecting the drip irrigation system. This increase is mainly due to hotel water uses including laundry and restaurants (JPTD 2022).

National institutional and policy environment

Jordan's National Water Strategy promotes decentralized wastewater treatment plants for industry and tourism and is very clear on the need to recycle water for various reuse purposes. The Tala Bay WWTP was constructed with both wastewater treatment and water reuse in mind, thereby contributing to the national strategy (WAJ 2020).

Tala Bay WWTP is privately owned by JPTD (ADC 2022). This means that responsibility for its operations and maintenance (O&M) as well as water reuse within the hotel area lies solely with JPTD and not the Aqaba Water Company, which is responsible for water and sanitation services in the Aqaba Governorate and water reuse from wastewater treatment plants that serve Aqaba city. As the recycled water from the Tala Bay WWTP is mostly used to irrigate the landscaped areas in the resort area with some transferred to nearby private hotels like the Mövenpick Resort and Spa, it does not come under the Aqaba Water Company's overview. However, JPTD is required to follow ASEZA's environmental regulations on wastewater treatment and reuse that have been adopted by the Ministry of Environment, as well as the national water quality standards for landscaping, which have also been adopted by the Ministry of Water and Irrigation (ASEZA 2001; ADC 2022; AWC 2022).

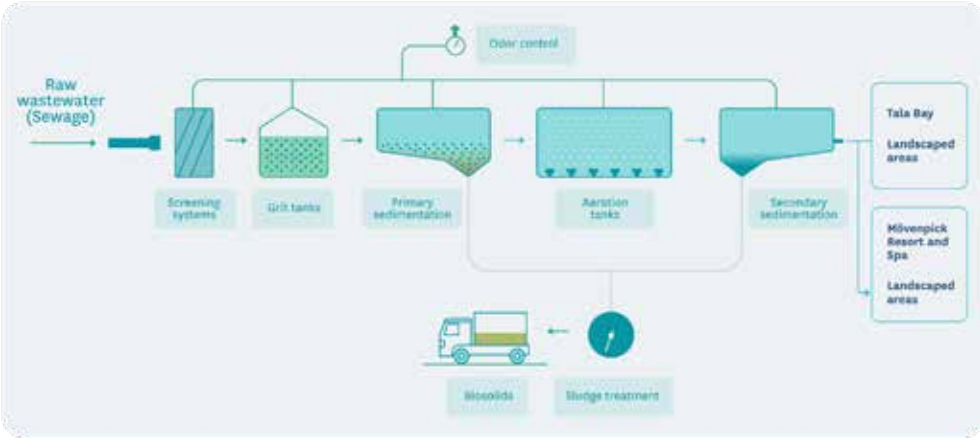

FIGURE 6.3 Tala Bay WWTP: Schematic diagram of treatment and reuse system.

Stakeholders involved and management model

ASEZA is responsible for managing the development of Aqaba including through the development of master plans and investment opportunities and is one of the key stakeholders involved with the management of the Tala Bay WWTP (ASEZA 2001). The plant was constructed by JPTD as a private investor as part of the development of the Tala Bay Resort. Approval for its construction was obtained from ASEZA, which implies fulfillment of its environmental regulations.

The Ministry of Environment and Health plays a minor role confined to the specific case of contamination to the surrounding land or sea caused by Tala Bay WWTP. Bin Hayyan Laboratories, a private laboratory, is responsible for testing effluent samples to ensure they meet the defined parameters set by ASEZA (ADC 2022).

Other stakeholders include commercial entities which provide chemicals, tools and equipment for Tala Bay WWTP's O&M.

Funding and financial outlook and cost recovery

Tala Bay WWTP is owned by JPTD, a private company that covers the costs of its construction, operations and maintenance.

Operation and maintenance costs in the company's annual budget (such as staff salaries, electricity, fuel, spare parts and chemicals) are around USD 350,000 (JOD 200,000)/year. The percentage of cost recovery ranges from 10% to 20% and is generated from the sale of water. As part of its business operations, JPTD sells part of its recycled water to nearby hotels, mainly the Mövenpick Resort and Spa, for use in landscaped areas. The price of sold water ranges between USD 0.7 and USD 1.4 /m^3 (JOD 0.5 and JOD 0.9) (ADC 2022). Higher prices are charged for industrial and commercial purposes and lower prices are charged for irrigation (Table 6.1).

Socioeconomic, health and environmental benefits and impacts

The water reuse project brings significant economic savings for the Tala Bay Hotels and Resorts complex. Fresh water is expensive for commercial and industrial entities, costing an average of USD 2.5-4/m^3 with a saving of between USD 400/day and USD 2,500/day through the use of recycled water to irrigate their trees and green landscaped areas. Excess water is also sold to other nearby hotels, mainly the nearby Mövenpick Resort and Spa, providing a further source of income.

In addition, water reuse is improving the environment by expanding the green areas around the hotels and the Tala Bay WWTP continues to function properly with no pollution problems reported, benefiting both human and environmental health.

The Tala Bay WWTP has a design capacity of just 1,000 m^3/day, which means that its socio-economic impact is quite small. It has four staff members who are usually local residents of Aqaba.

Gender equality

A study led by the Women Studies Unit of the Ministry of Water and Irrigation in Jordan (USAID 2018; UN Women and REACH 2018) assessed the status of more than 1,200 women working in the water supply and sanitation sector across the country. It revealed that only 11% of employees in the water sector are women and recommended that improved facilities such as nurseries and additional training could help increase this number, particularly in operations where the percentage is much less. There is also a perception of the water sector as being a

TABLE 6.1 Tala Bay WWTP: Funding and financial outlook and cost recovery.

	Wastewater collection and transport	Wastewater treatment	Transport of recycled water	Additional wastewater treatment for reuse	Distribution of reclaimed water to end-users
Construction and equipment services (description and dimensions)	10 km of sewers and eight lifting stations	Activated sludge system	Water pumped 8 to 10 km to the Tala Bay Resort and nearby hotels	None	All reuse is used for irrigation of trees and green areas in the Tala Bay Resort and nearby hotels
Stakeholder that delivers the service	JPTD	JPTD	JPTD	None	JPTD
CAPEX (in USD)	JPTD provided all funds for plant construction				
CAPEX recovery and percentage of subsidy					
O&M services (description)	Jet system, Closed-circuit television (CCTV), manhole covers, replacement of damaged or corroded sewers	Replacement of damaged parts, removal of grit, oil screenings and sludge	Fixing leakage	None	PTD
Stakeholder that delivers the service	JPTD	JPTD	JPTD		JPTD
OPEX (in USD/year)	USD 494,350 (JOD 350,000)				
OPEX recovery and percentage of subsidy	10–20% JPTD covers all remaining costs. There is no subsidy			None	

SOURCE: Jordan Projects for Tourism Development (JPTD). *NOTES*: Capital Expenditure (CAPEX), Jordan Projects for Tourism Development (JPTD), Operations and Maintenance (O&M), Operating expenditure (OPEX).

masculine area of work, particularly when it comes to the long hours and physical fieldwork and some cultural barriers. For example, women are not encouraged to travel alone, which could be required. Yet currently there are no women working in the operation and maintenance of Tala Bay WWTP or any work related to it.

Resilience to COVID-19

In 2020, the working hours and movements of staff and farmers were restricted due to the COVID-19 pandemic, including a period of full lock down from February to April. During that period, only key staff members were allowed to work. This was followed by a period when staff capacity was reduced to 50%. However, the Tala Bay WWTP was able to remain functioning and farmers continued to work and irrigate their farms as usual but with less labor.

Scalability and replicability potential

Private investments in the tourism and industry sector in Jordan need to include the construction of wastewater treatment plants to service their projects as part of their investment plans. Inside cities, development projects can usually connect to existing sewerage networks so that wastewater collection and treatment are covered in water bills. For areas that do not have a sewerage network like Aqaba city's southern beach, the hotels have to construct their own treatment plant.

The construction of a wastewater treatment plant for a stand-alone project, in this case, Tala Bay Resorts, is not based on a financial and economic analysis but is rather considered as any other facility belonging to a hotel and resort complex. The complex needs to be able to collect and dispose of its sewage, which means that any associated costs need to be considered as part of the project cost. However, the reuse of the recycled water produced by the plant represents an added value as it saves the cost of purchasing fresh water for landscaping, which costs USD 2.5–4/m^3 for hotels in Aqaba. In this context, the Tala Bay WWTP provides a good model that could be replicated and scaled in other hotels and resorts.

SWOT analysis

The strengths, weaknesses, opportunities and threats (SWOT) analysis of the Tala Bay WWTP plant and water reuse project is given in Table 6.2. The main outcomes of the project analysis include savings in the use of fresh water and a reduction in water costs and environmental impacts.

Key factors for achieving success along the project life cycle and lessons learned

During the design, construction and operation of the project, key factors for achieving success include the following:

- A functioning hotel and resort with green spaces that attracts many visitors.
- Using recycled water for landscaping saves the use of fresh water.
- The availability of a new source of water that can be used for landscaping purposes by the project and other nearby buildings or hotels.
- Investment projects like big hotels and resorts can be constructed in areas without wastewater collection systems already in place.

Lessons learned include:

- Local community acceptance of investment projects requires potential work opportunities for the local communities.
- Coordination with various governmental organizations was essential for the success of this project.

TABLE 6.2 Tala Bay WWTP and water reuse: SWOT analysis.

	HELPFUL TO ACHIEVING THE OBJECTIVES	**HARMFUL** TO ACHIEVING THE OBJECTIVES

INTERNAL ORIGIN ATTRIBUTES OF THE ENTERPRISE	**STRENGTHS**
	■ Significant savings in the cost and use of fresh water
	■ Partial operations and maintenance cost recovery through sales of recycled water to other hotels
	■ Visible environmental benefits:
	  ■ Increasing green areas
	  ■ Improving public health
		WEAKNESSES
		■ An increase in oil percentage in wastewater affects plant efficiency
		■ Although local expertise in running the plant is available, there is limited expertise in advanced process techniques

EXTERNAL FACTORS ATTRIBUTES OF THE ENVIRONMENT	**OPPORTUNITIES** ■ A new source of water for landscaping purposes in the hotel vicinity and other nearby hotels ■ Reduced demand for municipal water for landscaping uses	**THREATS** ■ In case of plant failure, the untreated water will be discharged to the sea ■ Odor problem if the plant's treatment efficiency drops

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Methods and resources

Data about the Tala Bay WWTP and its water reuse were requested directly from the plant manager who was sent a template to complete. The plant manager returned it after three weeks with the requested information.

The consultant reviewed the data and compiled it as needed into the project template. Where data were missing, the consultant made an informed judgment based on personal experience and by comparing information from other similar plants.

Another source of information was the Jordan Projects for Tourism Development website (https://talabay.net/), which provides information about the history of the construction of Tala Bay Hotels and Resorts and the Water Authority of Jordan's Annual Report 2020.