# Utility Platform

For strengthening partnerships
of municipal utilities worldwide

## Outcome Report 1 –
## Water Operator Partnership

Jordan Water Company “Miyahuna”,
German Operators HAMBURG
WASSER and hanseWasser Bremen

## IMPRINT

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**Image on front cover:**
Investigation and Optimisation of water treatment processes at Ras El-Ein WTP | 03/2023 |
Photo: HAMBURG WASSER

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On behalf of Federal Ministry for Economic Cooperation and Development

In cooperation with German Water Partnership

VKU VERBAND KOMMUNALER UNTERNEHMEN e.V.

**About "Utility Platform for Strengthening Partnerships of Municipal Utilities Worldwide"**

**Context**
In many German partner countries, municipal utilities providing public goods and services such as water and waste disposal are in poor economic shape. As a result, their service provision is only unreliable or does not reach the entire population. Due to the war, utilities in Ukraine are finding it particularly difficult to maintain operations, restore destroyed technology and bring new plants up to European Union standards. In the face of climate change, growing cities and digitalisation, utility companies in Germany and its partner countries are facing similar challenges in order to continue providing their services.

**Objective**
Municipal utilities in cooperating countries have better access to up-to-date, tried-and-tested knowledge and the technical and institutional expertise of German municipal utilities.

**Approach**
The Utility Platform promotes and supports 28 partnerships between German municipal utilities and operators in Zambia, Tanzania, South Africa, Jordan, Moldova, Ukraine and Albania in the water and waste sector. The platform promotes close exchange on corporate management and on operating and maintaining plants. Technical advice, mutual visits, job shadowings, virtual meetings and the procurement of technology, particularly for Ukraine, form the core of the cooperation between the companies.

The project has also established a logistics hub that dispatches donations and procurements from German utility companies to their Ukrainian counterparts. Appeals for donations by the Association of Local Utilities (VKU) make it possible to deliver needed technical equipment to Ukraine. In addition to the donations, the logistics partner Go Local also transports the goods that are procured for Ukrainian utilities as part of the 16 solidarity operator partnerships.

**About the author: Maria Pascual-Sanz**

Maria Pascual-Sanz is a development professional with over 20 years of experience in the fields of water services and urban sustainability. The last 16 years of her career have been dedicated to Water Operators' Partnerships (WOPs), through diverse roles in several organisations. From direct implementation of WOPs as part of VEI (The Netherlands), to research and lecturing as part of Rotterdam School of Management and UNESCO-IHE (in Delft), to global WOPs programme design, coordination and implementation as part of UN-HABITAT GWOPA. She is currently an independent consultant based in Barcelona engaged in organisational support on areas such as monitoring, evaluation and learning; research, knowledge management and product development; partnership facilitation; strategic planning; WOP programme design and resources mobilisation and advocacy.

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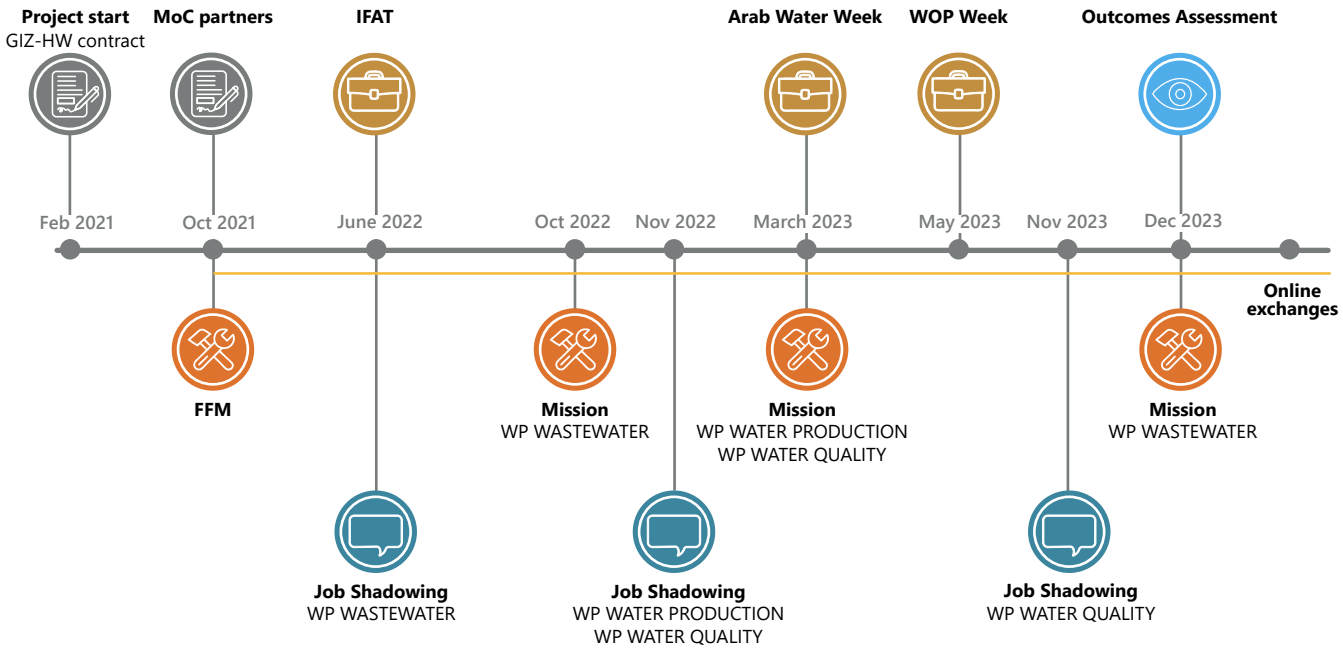
## ACRONYMS

| | |
|---|---|
| COD | Chemical Oxygen Demand |
| DWA | Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall. e.V. |
| FFM | Fact Finding Mission |
| FOG | Fats, Oils and Grease |
| IFAT | International Trade Fair for Water, Sewage, Waste and Raw Materials Management |
| KfW | Kreditanstalt für Wiederaufbau of Germany |
| KPI | Key Performance Indicator |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH |
| GWOPA | Global Water Operators' Partnerships Alliance |
| HW | Hamburg Wasser |
| hWB | hanseWasser Bremen |
| MoC | Memorandum of Commitment |
| ORP | Oxidation-Reduction Potential |
| SDGs | Sustainable Development Goals |
| SOPs | Standard Operating Procedures |
| WOP | Water Operators' Partnership |
| WP | Working package |
| WTP | Water treatment plant |
| WWTP | Wastewater treatment plant |

# EXECUTIVE SUMMARY

The Water Operator Partnership (WOP) between Miyahuna Water Company from Jordan, Hamburg Wasser (HW) and hanseWasser Bremen (hWB) from Germany is one of eight international WOPs that are part of the pilot phase of the 'Utility Platform for strengthening partnerships of municipal utilities worldwide', funded by the Federal Ministry for Economic Cooperation and Development of Germany. The contract between HW as lead partner and GIZ was signed in February 2021. In October 2021 the Memorandum of Commitment (MoC) with Miyahuna was signed. The project termination date was initially set to be May 2023, but two extensions took place until June 2024. The main Working Packages (WP) addressed by partners were: 1) Water Production, 2) Wastewater, and 3) Water Quality. The WP were developed in coordination with the GIZ water portfolio Jordan to use synergies with other projects of Miyahuna and GIZ Jordan.

The project timeline shows a total of 4 Missions to Jordan, 3 Job shadowing visits (2 Hamburg, 1 Bremen), 2 Networking meetings and 1 conference joint participation (Arab Water Week) had taken place by December 2023.



### WOP Outcomes (Chapter 3)

The WOP resulted in capacity outcomes at individual, operational and strategic level at Miyahuna. The table below includes a visual summary of the main outcomes achieved throughout the WOP for each of the work packages. Details on the achieved Capacity outcomes can be found in Chapter 3 "Progress towards results by work area" under 3.1, 3.2, 3.3 and 3.4.

| Organisational level | | Capacity outcome | Work Package 1: Water Production | Work Package 2: Water Quality and KPI | Work Package 3: Wastewater |
|---|---|---|---|---|---|
| INDIVIDUAL |  | Enhanced knowledge and skills | 10 people, see p. 17 | 30 people, see p. 20 | 5 people, see p. 22 |
| |  | Increased motivation | see p. 17 | see p. 20 | see p. 22 |
| |  | Applied new knowledge and skills | 5 people, see p. 17 | 30 people, see p. 20 | More than 5 people, see p. 22 |
| OPERATIONAL |  | Improved data and information | see p. 17 | see p. 20 | see p. 22 |
| |  | Better systems | see p. 18 | see p. 20 | see p. 22 |
| |  | Improved organisational structure | | | |
| |  | Better equipment/ infrastructure | see p. 18 | | see p. 22 |
| |  | Improved management practices | | | |
| |  | Improved working routines | see p. 18 | see p. 20 | |
| STRATEGIC |  | Improved vision, mission, strategy | | see p. 20 | |
| |  | Additional resources | savings of 30,000€ monthly, see p. 18 | | |
| |  | Improved external relations | | see p. 20 | |
| |  | More supportive organisational culture | | | |
| |  | Better leadership | | | |
| OTHER |  | Any other Outcomes | see p. 23 | | |

## Key Outcomes Achieved

- **Enhanced knowledge and skills (WP 2):** 30 staff benefited from knowledge gains on topics such as selenium removal, odour removal, Water Quality and KPI selection.

- **Increased motivation (WP 3):** The gained internal visibility through the energy analysis work and the presentation of this work in the Arab Water Week were reported to be sources of enhanced motivation of staff.

- **Applied new knowledge and skills (WP 1)**: At least 5 staff are applying new measurement methods for ORP (Oxidation-Reduction Potential).

- **Better systems (WP 3):** The energy analysis methodology according to DWA-A 216 has been fully embedded for Madaba and rolling it out to other plants is foreseen. A plan for energy reduction has been developed.

- **Improved vision, mission, strategy (WP 2):** The development strategy for the Miyahuna central laboratories is ongoing with the support of HW.

- **Improved external relations (WP 2):** The topic of selenium removal triggered rich discussions with a wide pool of stakeholders i. e. Hamburg University of Technology.

- **Additional resources (WP 1):** Optimising water treatment processes led to significant savings in chemical consumption. €30,000 ($33,000) per month materialised from changing the dosing point for polymer. Besides, it was estimated that there are potential savings when switching from cationic to anionic polymer.

- **Enhanced capacity and motivation of the German partners (Other outcomes):** The German partners reported to have gained very rich knowledge and motivation to learn more and provide better peer-to-peer support.

## Partnership strength (Chapter 4)

When asked for the quality of their collaboration, partners agreed that the partnership had matured. It has reached a point at which they enjoy smooth and effective collaboration. The partnership design was positively valued by partners, particularly the flexibility built-in, since it allowed partners to jointly identify and adapt priorities along the way. In terms of clarity of roles and responsibilities it took time for the Miyahuna partners to fully understand the role of the supporting partners as opposed to delegating tasks to consultants. In-person interactions during the missions were reported as crucial for the Miyahuna colleagues to understand the peer support nature of this project. Partners targeted having in-person interactions at least twice a year through missions, job shadowings or networking events in Germany and at least one online meeting per month.
Work processes seem to be quite smooth, both during in-person exchange and online exchanges. For each work package plans are jointly made, reviewed and updated during online meetings. Public procurement processes were evaluated to be too long, which delayed targeted operational improvements related to the equipment to be procured. Partners reported to have achieved a state of great trust, transparency and openness that helps them to work efficiently. Partners claimed that a longer WOP duration is necessary to consolidate the positive operational changes led by partners through the WOP.

# 1. INTRODUCTION

The Federal Ministry for Economic Cooperation and Development of Germany has set up the 'Utility Platform for strengthening partnerships of municipal utilities worldwide', as a pilot project running from 2019 until 2024. Another project phase will be starting in July 2024, running until June 2027. The initiative supports partnerships between municipal utilities in Germany and its partner countries to support the implementation of the Sustainable Development Goals (SDGs) and the New Urban Agenda. The partnerships of the pilot project follow principles of peer-support with the aim to build capacity on a not-for-profit basis to enable better service delivery. These principles were derived from the Global Water Operators' Partnerships Alliance (GWOPA), which was founded in 2009.

This WOP project is one of nine international WOPs, three solid waste operator partnerships and 16 solidarity operator partnerships with Ukraine supported under the pilot project until June 2024. This report summarises the design and implementation of the project and identifies the main outcomes derived from the partnership in each work package. It should be noted that the WOPs described in this paper have only been in place since 2021 and are still in their early stages.

The current report describes key project characteristics, progress made, outcomes in each of the working packages and evolution of the partnership strength. Multiple methods were used to collect the relevant data. These are:

- documentary review, including project proposal and annual reports, budgets, mission reports and operational plans,
- semi-structured interviews with key informants from the projects mainly coordinators,
- Online surveys directed to both partners requesting their perception about outcomes achieved, and
- online dedicated focus group discussions (workshops) per work package with participants from all partners engaged in each work package.

The methodology applied to assess the capacity outcomes (Chapter 3) and partnership strength (Chapter 4) was inspired in the WOP-tailored methodology design by GWOPA and embedded in the web-based Partnership Management Platform PMP.

The PMP methodology for capacity outcome assessment is an adapted version of the 'Performance and Change Model' by Burke and Litwin (1992).

**Capacity is unpacked into individual, operational and strategic capacity outcomes:**

| Organisational level | | Capacity outcome | Description |
|---|---|---|---|
| INDIVIDUAL |  | **Enhanced knowledge and skills** | Availability of human resources and the extent to which they have the required skills and knowledge to accomplish the work they have been assigned to. |
| |  | **Increased motivation** | Proactive tendencies to move towards goals, take needed action and persist until satisfaction is attained. |
| |  | **Applied new knowledge and skills** | Active use of the newly acquired knowledge and skills in daily practices. |
| OPERATIONAL |  | **Improved data and information** | Updated information on the conditions of any part of the water utility system, be it related to physical infrastructure (e. g. pipes), management processes, (e. g. customer database) or otherwise. |
| |  | **Better systems** | Standardised policies, procedures, management and operational information systems and mechanisms that facilitate work. |
| |  | **Improved organisational structure** | Arrangement of functions and people into specific areas and levels of responsibility, decision making authority, communication and relationships to assure effective implementation of the organisation's mission and strategy. |
| |  | **Better equipment/ infrastructure** | Tools and equipment necessary for utility operations and basic infrastructure for the business processes (e. g. water production and distribution). |
| |  | **Improved management practices** | Practices that managers use to mobilise the human and material resources at their disposal and advance the strategy, including managerial behaviour, work etiquette, professionalism, planning, communication and control. |
| |  | **Improved working routines** | The way the tasks are executed daily in consolidated routines. |
| STRATEGIC |  | **Improved vision, mission, strategy** | The vision outlines the company's goal for the future and the values that define it. A mission states how the company will achieve its vision. Strategies are the ways in which the mission and vision will be reached. |
| |  | **Additional resources** | Additional (financial) resources via new acquisition or operational costs savings. |
| |  | **Improved external relations** | Improved communications with external stakeholders and customers. This includes stakeholder relations that the operator has forged and how such networks support the achievement of its strategy. |
| |  | **More supportive organisational culture** | Collection of rules, values and principles that are enduring and guide organisational behaviour. |
| |  | **Better leadership** | Managerial staff providing overall organisational direction and serving as behavioural role models for all employees. |
| OTHER |  | **Any other Outcomes** | |

The Partnership Strength of the project is analysed in Chapter 4 by looking into several aspects such as partnership design, clarity of roles and responsibilities, meeting processes and representation, working processes, resources, trust, transparency and teamwork and flexibility/adaptability of the project. The partnership's strength methodology follows 'Partnership Health Check' tool categories developed by Prescott and Stibbe (2017).

*On-site discussions and investigations of the South Amman WWTP | 12/2023*

*Photo: hanseWasser*

# 2. THE WATER OPERATOR PARTNERSHIP (WOP)

This report refers to Miyahuna as the Jordanian partner and HAMBURG WASSER (HW) and hanseWasser (hWB) as German partners.

HAMBURG WASSER is the German lead partner of this WOP and undertakes the overall technical, administrative, and financial coordination of the project. Each Work package (WP) has a focal point on the German side and a focal point at the Jordanian partner. Each focal point from the German partner reports to HW. As lead coordinating partner HW schedules regular meetings with partners. Every 2-3 weeks a meeting takes place with hanseWasser, and once every three months with all the partners of the project, including GIZ Germany and GIZ Jordan. More details on how the project implementation coordination takes place are included in the section below 4. *Partnership Strength*.

## 2.1 WOP Partners

**The Jordan Water Company LLC, MIYAHUNA**, established in 2007, provides water supply and sanitation services to the governorates of Amman, Zarqa, Madaba and Balqa. MIYAHUNA operates water distribution and wastewater collection networks as well as water and wastewater treatment plants (WTP). The served area is 14,522 km$^2$ in the four governorates. The company has a number of drinking water treatment plants. The most important of them are the Zai WTP, the Zara Maeen desalination plant, and a number of pumping stations and wells related to the Disi aquifer. MIYAHUNA operates the wastewater collection network and several wastewater plants in the four governorates. The plants treat about 11% of the collected wastewater of Amman, the other quantities are treated by another company (Al Samra WWTP Company).

**HAMBURG WASSER** (HW) is the largest public water supply and wastewater utility of the North of Germany. The company provides water and sanitation services to more than two million people in the metropolitan region of Hamburg, Germany. There are two separate legal entities in the company – Hamburg Waterworks (Hamburger Wasserwerke GmbH) and Hamburg Public Sewage Company (Hamburger Stadtentwässerung AöR). Both were merged in 2006 under one roof with a common aim, structure, and procedures, as well as identical management for the first three hierarchical levels. HAMBURG WASSER operates 16 waterworks and produces around 120 million m3 of drinking water from groundwater every year (HW Geschäftsbericht 2022).

**hanseWasser Bremen Ltd.** (hWB) is a wastewater company that is partly owned by Bremen municipality. Since 1999 the company has run two sewage treatment plants, the sewer system of Bremen and treats wastewater from the city of Bremen and some surrounding municipalities. Cleaning quality standards and the automation level of the sewage treatment plants and pumping stations are on a very high technical level. There is a close exchange of experience with the allied companies. Preventing bad decisions and optimized technical solutions on the one hand, and the development of good experiences within the company group on the other hand, lead to a solid financial and technical reliability with a long-term perspective.

## 2.2 Timeline of the partnership

The idea of a WOP between HW and Miyahuna was a suggestion by GIZ to HW. The contract between HW as lead partner and GIZ was signed in February 2021 and it was not until October 2021 that the MoC with Miyahuna was signed. These delays were due to unanticipated administrative and legal complexities in the setting up of the programme. So far, 26 months of project implementation have taken place if counted from the MoC signature from Miyahuna. The project termination date was initially defined for May 2023 and two extensions have taken place until June 2024.

By Dec 2023 the total resource envelope for the WOP was € 460,864.

The overall project goal was to establish a sound long-lasting cooperation in partnership between Miyahuna, HAMBURG WASSER and hanseWasser in terms of trust and relation. The main working packages addressed are:

**Work Package 1: Water Production, supported by HAMBURG WASSER. The main objective is:**

- Improved processes in drinking water production

**Work Package 2: Water Quality and KPI, supported by HAMBURG WASSER. The main objective is:**

- improved water quality management through the improvement of the effectiveness of monitoring programs and the existing key performance indicators for quality issues and development of benchmarking for some indicators, and
- improved lab management processes and standards as well as analytical methods.

**Work Package 3: Wastewater, supported by hanseWasser. The main objectives are:**

- Improved operation and maintenance of wastewater and
- sludge treatment with a focus on energy efficiency.

Up to December 2023 the project had been implemented for 26 months counting from the date in which Miyahuna signed the MoC with HW. A total of 4 Missions, 3 Job shadowing visits (2 Hamburg, 1 Bremen), 2 Networking meetings and 1 conference joint participation (Arab Water Week) had taken place. The timeline below specifies when they happened and which WPs they were mostly addressing.

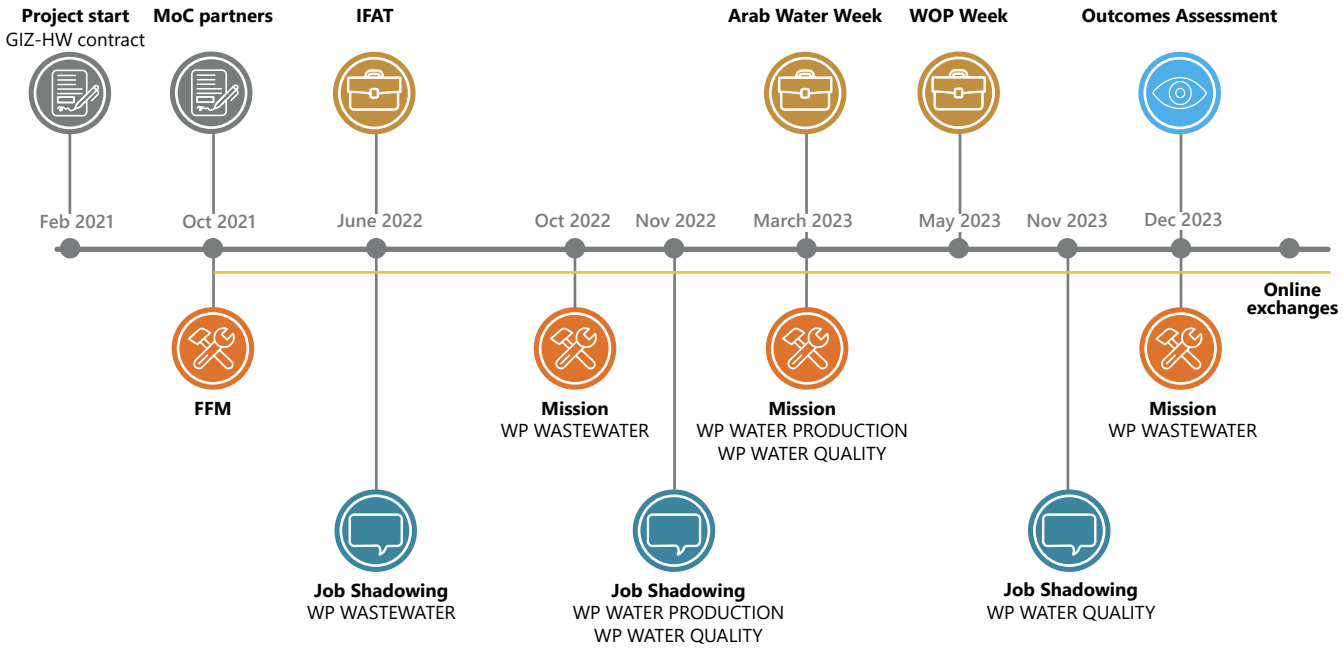



*Figure 1 WOP Timeline*

More details on the duration of each event are included in this list:

- Contract between GIZ and HW – February 2021
- Memorandum of Commitment (MoC) signature in October 2021
- Fact Finding Mission (FFM) – October 16 to 22, 2021
- Networking Event Utility Platform and IFAT – May 30 to June 3, 2022
- Job Shadowing in Bremen on Wastewater and Sludge – June 26 to July 3, 2022
- Wastewater and Sludge Mission – October 8 to 16, 2022
- Job Shadowing KPI, Water Quality and Water Production – – November 21 to 25, 2022
- Mission Arab Water Week, Water Production & Water Quality - March 5 to 14, 2023
- GWOPA WOPs Congress and Utility Platform Networking Event – May 22 to 27, 2023
- Job Shadowing Lab Twinning Indirect Discharger – November 19 to 25, 2023
- Mission to Amman on Wastewater (hanseWasser) – December 9 to 16, 2023
- Initially anticipated end date of the project (as per MoC) was May 31, 2023
- Extension of Utility Platform pilot project and the WOP until June 2024

# 3. PROGRESS TOWARDS RESULTS BY WORK AREA

The three work packages are being looked at regarding the implementation of activities and the Outcomes achieved.

## 3.1 Work Package 1: Water Production

### Implementation of activities

The primary focus was to identify opportunities for savings in chemical, operating, and energy costs that could be achieved at various stages of the water treatment process. This led to a decision to systematically and incrementally evaluate the treatment process on-site. For surface water treatment at MIYAHUNA the process steps encompass raw water intake, coagulation/flocculation, sedimentation, filtration, and disinfection (including post-chlorination), as depicted in Figure 2. At MIYAHUNA in Jordan, 93 % of the produced water comes from surface water sources, which makes chemical costs the second largest operating expense after energy consumption (Bochmann et al., Forthcoming).

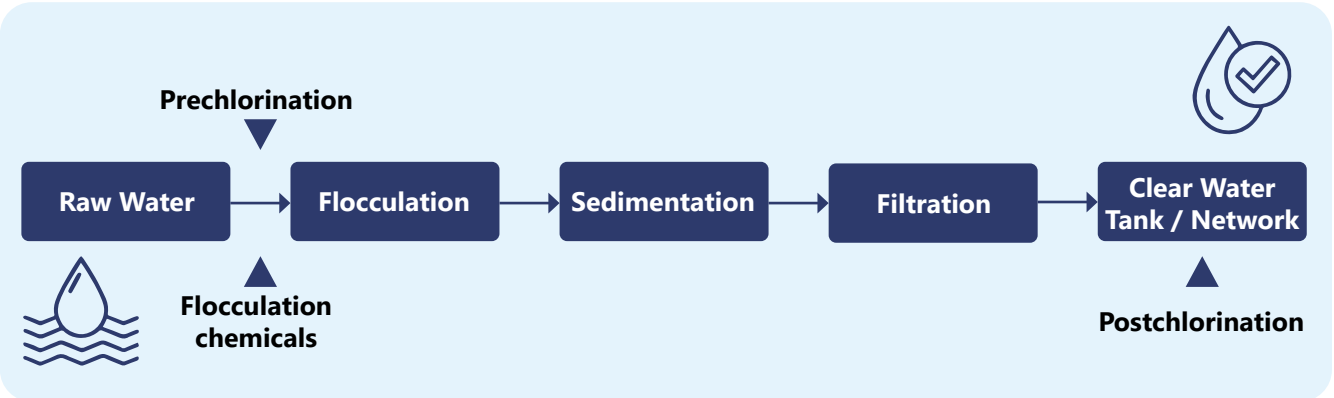



*Figure 2 Water Production Treatment process (Copyright: HAMBURG WASSER)*

### Flocculation

The primary focus was on the flocculation process in water treatment, which incurred higher costs due to the required treatment chemicals (coagulant, flocculant). Collaborative jar tests demonstrated that MIYAHUNA could benefit from the adjustment of dosing time, concentration, choice of chemicals, and energy input. Modification of the flocculant dosing point was proposed at the Zai waterworks. The dosing point was changed. Now the coagulant could be dosed in the middle of the pipe in order to achieve better mixing and prevent corrosion on the inner wall of the pipe. Given the plant's configuration, it was feasible to temporarily modify the process by dosing the polymer after the coagulant and to adjust the energy input. Consequently, larger, and better sediment flocs were observed, requiring fewer chemicals for optimal performance (Bochmann et al., Forthcoming).

The savings from relocating the dosing point for the cationic flocculant were estimated to be around €30,000 ($33,000) per month (Bochmann et al., Forthcoming). Based on experiments carried out together during the third mission, it was determined that the savings potential by switching from cationic to anionic polymer could be up to approx. 630,000€/year. However, the polymer dosing stations at the Zai waterworks are no longer usable and new ones (not financed by WOP) must be purchased. The tender documents were prepared and discussed together in online meetings after the mission. The procurement process is in progress.

### Filtration

Due to the high flocculation and sedimentation performance, which leads to very low turbidity at the filter inlet, there is no need for a high anthracite layer. On the other hand, the sand layer is comparatively small. The optimization strategy that is to be pilot tested on a filter is to increase the sand layer with the same reduction in anthracite. If this modification works well for both filtration and filter backwashing, increasing the sand layer to 50 cm should be discussed as a further step. This height is often used in filters that provide improved haze removal and have the potential to also improve nematode removal.

*Site visit and exchange at Zai WTP (Filtration) | 11/2022*

*Photo: HAMBURG WASSER*

- The proposed change of sand layer took place in 2 of the 12 filters. These measures have already given results in terms of reduced turbidity and lower presence of nematodes.
- Discussions over the suitability of Granular Activated Carbon (GAC) and Powdered Activated Carbon (PAC) have taken place and have led to the commissioning of a study funded by a different donor.

### Disinfection

To improve the performance of chlorine dioxide and reduce chlorite formation, combined dosing of chlorine and chlorine dioxide can be a promising option. It is widely used in water treatment practice, especially for water with high organic matter content. During this (2024) winter period, experience can be gained with combined dosing in conjunction with redox measurement.

- A new method for redox measurement using electrodes was introduced and successfully implemented to exactly adjust disinfectant dose to demand for improved nematode removal. Ongoing monitoring of key parameters is taking place.

### Other activities

- Discussion about Ras El-Ain WTP – where system components regularly become slimy in the summer months. Sulphur or methane bacteria were discussed as the cause. A pre-aeration system could help to promote the growth of bacteria outside the water treatment systems.
- Establishing contact with the donor KfW to finance an activated carbon filter stage at the Zai waterworks (meeting at IFAT 2022)
- Joint preparation of tender documents for dosing stations to optimise polymer usage
- Joint presentation of the project results to date at the 6th Arab Water Week in 2023 as part of a separate session
- Joint publication submitted to the special WOP issue of IWA Journal of Water, Sanitation and Hygiene.

## Outcomes achieved

### Individual level

- **Enhanced knowledge and skills:** At least 10 staff members have gained knowledge on relevant water treatment processes. Some examples are jar test experiments, results assessment, background knowledge on flocculation, filtration process.

- **Increased motivation:** Staff from the Water Production department agree that the activities implemented through the WOP are enhancing motivation. More specifically, the quick results shown by the optimization of the flocculation process and the joint presentation about these achievements conducted in the Arab Water Week were reported to be great motivation boosters.

- **Applied new knowledge and skills:** At least 5 staff members are applying new knowledge gained. Some examples are new measurement methods implemented for ORP (Oxidation-Reduction Potential) at Deir Alla intake, data quality analysis and monitoring and independent evaluations on chemical use.

### Operational level

- **Improved data and information:** More complete and updated information has been achieved through WOP activities. I. e. Enhanced Data Collection and Analysis via Key Performance Indicators (KPIs) for continuous monitoring of various parameters, including water quality, chemical dosages, and costs; Detailed information about the water treatment processes, including the stages of flocculation, sedimentation, filtration, and disinfection, was gathered and analyzed; improved documentation and reporting practices, which led to more organized and complete information about the water production systems.

- **Better systems:** Improved methods for monitoring water quality, Standard Operating Procedures (SOPs) for the refilling of filters, plans were created for new dosing points, data sheets and reports were created for tests and visits of other water treatment plants.
- **Better equipment/infrastructure:** The dosing point for polymer was changed leading to better quality results.
- **Improved working routines:** The following working routines were improved:
  – continuous monitoring of water quality, chemical dosages, and costs;
  – optimised chemical dosing and improved filtration techniques;
  – conducting laboratory tests, such as jar tests for treatment chemicals enabling a more systematic approach to testing experimentation and optimization in general.

**Strategic level level**

- **Additional resources:** The availability of resources for the participating water operators has improved, primarily through actual savings and optimization of existing resources:
  – Savings in Operational Costs: Optimising water treatment processes led to significant savings in chemical consumption. €30,000 ($33,000) per month savings materialised from changing the dosing point for polymer. Besides, it was estimated that the savings potential of switching from cationic to anionic polymer could be up to approx. 630,000 €/year (not yet materialised).
  – Efficiency in Resource Utilization: By improving operational efficiency through techniques like optimizing filter backwash processes, the WOPs have helped in more efficient use of existing resources, such as water and energy.

*Job Shadowing and exchange on water meters and best practices | 11/2022*

*Photo: HAMBURG WASSER*

## 3.2 Work Package 2: Water Quality and KPI

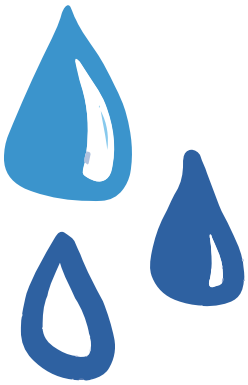
### Implementation of activities

The main activities implemented under this WP are hereby described.

**Establishment and consolidation of Laboratory Twinning**

- In November 2022 there was a visit to Germany to discuss and evaluate the material available about standards and risk management (job shadowing). As part of this visit no needs for new equipment were identified but there was a great awareness raised on the potential of new methodologies, standards etc. to be created and applied in the lab at Miyahuna.
- Identification of suitable KPIs for the Laboratory Performance Monitoring and benchmarks for each selected KPI.
- 5 Online workshops discussing different aspects such as Quality Management Systems, Water Quality Complaint Management, Heavy Metals analysis-ICP, indirect discharges, others. Each workshop counted with the participation of around 8 to 10 people.
- New methodologies have been shared and developed I.e., developing methodology for heavy metal analysis and microbiological methods and standards.
- Support of the development strategy for the Miyahuna central laboratories.

Partners shared that approximately 30 people benefit from newly acquired knowledge through the lab twinning exchanges.



Other areas of work are:

- A major challenge for the Jordanian partner is increasing selenium concentrations in groundwater of the Swaqa wellfield. Analysing the specific species is proving difficult. The analytic standard method for selenium specification was shared with Miyahuna. A standard chemical is needed to implement the method in Miyahuna lab. HW is now elaborating how to send the chemicals from Germany to Jordan as they are not available in Jordan so far. Precipitation tests in the Miyahuna drinking water laboratory were unsuccessful. Studies by the Federal Environment Agency showed that selenium removal using precipitants (addition of iron) is only possible if selenite is present. As part of the cooperation with HW and Hamburg University of Technology, it was also determined that certain conditions are required for felling. The investigations are still ongoing. Miyahuna conducted on-site anaerobic testing following the third mission. The results were again not positive but were discussed intensively online. A new test material (granular iron hydroxide) was then sent to Amman for further investigations. First tests using the new material in test columns directly at a contaminated well showed complete removal of selenium. Thanks to Miyahuna's initiative, an online meeting with a number of stakeholders (WAJ, CDM Smith, BGR, GIZ..), who have already been involved in the topic of high selenium concentrations in the well field, took place and a joint discussion on all the information available took place.
- Partners have discussed the problem of sulphur bacteria blocking technical installations.
- Odour problem in the raw water of the wells in Hashmeyeh, in which raw water has a gasoline-like smell. Miyahuna has built a test facility to treat this raw water, for which new operating recommendations could be made.

## Outcomes achieved

### Individual level

- **Enhanced knowledge and skills:** 30 staff benefited from knowledge gains on topics such as selenium removal, odour removal, Water Quality, KPI selection and identification of a suitable benchmark values, the problem of sulphur bacteria blocking technical installations, or the topic of indirect discharges or water quality complaint management.
- **Increased motivation:** Staff at Miyahuna reported that they are eager to engage in the activities with HW given that there is a lot of learning taking place. New topics keep emerging and Miyahuna stated that they would like to further intensify the exchanges between laboratories.
- **Applied new knowledge and skills:** The laboratory coordinator from Miyahuna shared that all the knowledge exchanges are very practical and problem oriented. Staff from Miyahuna applies all the knowledge gained in their day-to-day operations.

### Operational level

- **Improved data and information:** The ongoing investigations (i.e. selenium removal, sulphur bacteria, others) are resulting in a more comprehensive picture of some critical problems for Miyahuna.
- **Better systems:** Good progress has been achieved in the development of a Water Quality KPI Monitoring System. New lab methods have been developed by Miyahuna based on the shared materials and continuous exchanges by HW I.e. methodology for heavy metal analysis, microbiological methods and Fats, Oil and Grease (FOG) standards.
- **Improved working routines:** The new systems acquired (I.e. heavy metal analysis, microbiological methods and FOG standards, Water Quality Monitoring System) are leading to new working routines being established.

### Strategic level

- **Improved vision, mission, strategy:** The development strategy for the Miyahuna central laboratories is ongoing with the support of HW.
- **Improved external relations:** The topic of selenium removal triggered rich discussions with a wide pool of stakeholders i. e. Hamburg University of Technology including a donor that could potentially fund a specific investigation on Selenium Removal.

*Site visit and exchange on Hamburg's central WWTP | 11/2022*

*Photo: HAMBURG WASSER*

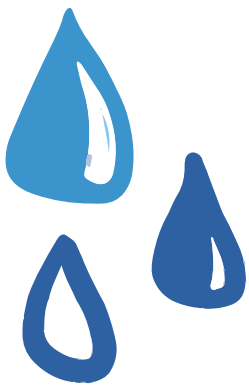
## 3.3 Work Package 3: Wastewater

### Implementation of activities

The main objective of this WP was to improve operation and maintenance of wastewater and sludge treatment with a focus on energy efficiency. The following aspects have been addressed in this WP so far.

#### Energy analysis WWTP Madaba

The initial analysis showed that the Madaba sewage treatment plant is very comparable to the Bremen-Farge and Bremen-Seehausen sewage treatment plants. An energy analysis according to DWA-A 216 for the KA Madaba was proposed. Partners worked together to understand the methodology proposed, collect the necessary data and roll it out internally to conduct the energy analysis in the Madaba WWTP. The WWTP Madaba energy analysis was completed in 2023 and it is currently being shared internally at Miyahuna. Measures were identified in the short, medium and long term for energy consumption reduction. A first energy analysis improvement measure is already being implemented. In addition, the underlying systematics and applicability in other plants were presented together with Miyahuna's colleagues. The knowledge and skills to conduct the analysis and design short, medium and long-term measures was developed and Miyahuna is autonomous to roll it out to other plants. Miyahuna staff expressed how valuable this is for them. Not only does he have the knowledge, but he is now training other colleagues so that they can conduct the work in the other plants. They also shared how valuable it is to have a contact person from hanseWasser to reach online whenever necessary to support them in the process.



This work was also part of the presentations of the project at Arab Water Week, at the 5th GWOPA WOP Congress in May 2023 (2 sessions) and at a Community of Practice Webinar for German and International WOPs of the Utility Platform on May 9, 2023. The work on the energy analysis of WWTP in Madaba is helping Miyahuna colleagues to increase visibility of their work in the company and in the sector.

During the most recent mission in December 2023 partners had an intensive technical exchange on ways to reduce energy consumption on Miyahuna WWTPs. Also, the first energy optimization point of the energy analysis, a change of two pumps, were realised at WWTP Madaba in December 2023.

#### Sludge management WWTP South-Amman

The analysis of the sewage treatment plants showed that the sludge drainage system installed on site is not operational. This task is tackled jointly by the operators. The aim is to have a feasibility study to improve sludge management. Discussions on different possible methods have taken place between partners since June 2022 at IFAT. A job shadowing took place in June 2022 in Bremen, where all drainage processes were examined together. This intensive discussion created a good foundation for the feasibility study. During the first mission, partners got a deeper insight into all processes of the plant on-site. Solutions for the drying beds were discussed and a proposal for renovation was developed to increase the dry-mass-result. Discussing the using of polymer to dewater the sludge from the aeration tanks came to the result that it would not be successful in all cases. Because of the big amount of grit in the sludge it seemed to have a low water delivery capability. Therefore, it is important to look in laboratory-experiments, to see if it could work with special polymers.

In 2023 the feasibility study on WWTP South-Amman sludge dewatering was largely completed. Furthermore, potential synergies with other United States Agency for International Development USAID programmes on the anaerobic stabilisation of the sludge in South Amman WWTP are being explored. During the second wastewater mission that took place in Dec 2023, partners looked into optimisation points for sludge dewatering at the treatment plant and continued with the preliminary tests for the use of a new sludge dewatering unit. The colleagues from hanseWasser shared, that the location provides the opportunity for a test. With a mechanical thickening system, the sludge discharge could be reliably controlled to a specific target value.

### Limitation of the inert (non-biodegradable) COD (Chemical Oxygen Demand) WWTP Madaba

During the initial diagnosis it was noted that the WWTP Madaba is subject to strong fluctuations in the COD parameter due to industrial production processes. Partners agreed to try to identify the load fluctuations more precisely to find their origin and design reduction or avoidance strategies. During a networking meeting in Stuttgart in May 2022, it emerged that the topic of limiting the inert COD in Madaba is significantly more extensive than envisaged in the Action Plan. During the second mission in December 2023 partners established a test stand for analysing the COD elimination rate of the wastewater treatment plant in Madaba. The test procedure is very robust and can also be used in future by wastewater treatment plant operators to analyse the COD degradability of wastewater samples.

Moreover, as part of the mission in December 2023 partners visited the Na'our wastewater treatment plant in the Wadi Al-Seer region. The plant is currently undergoing acceptance testing by Miyahuna and is designed for a daily inflow of 17,000 m3. Support to this will also be provided as part of the WOP with a new colleague working in that plant joining in Knowledge Transfer activities.

## Outcomes achieved

### Individual level

- **Enhanced knowledge and skills:** At least 5 staff have gained new knowledge on areas such as methodology for energy analysis according to DWA-A 216, sludge management alternatives, chemical oxygen demand COD parameter due to industrial production processes.
- **Increased motivation:** Staff motivation has been reported to increase. The gained internal visibility through the energy analysis work and the presentation of this work in the Arab Water Week were reported to be sources of enhanced motivation.
- **Applied new knowledge and skills:** Partners worked together to understand the methodology proposed for the energy analysis according to the DWA-A 216, to collect the necessary data and to roll it out internally to conduct the energy analysis in the Madaba WWTP. Miyahuna's colleagues are now not only able to use the methodology, but are also capacitated to train other members of Miyahuna to develop those skills.

### Operational level

- **Improved data and information:** Thanks to the conducted energy analysis in Madaba there is very rich information on the plant operations and consumption. The analysis of the sewage treatment in South Amman WWTP showed that the sludge drainage system installed on site is not operational and a feasibility study was conducted to explore better options for sludge management.
- **Better systems:** The energy analysis methodology according to DWA-A 216 has been fully embedded for Madaba and rolling it out to other plants is foreseen. A plan for energy reduction has been developed for Madaba and it incorporates short, medium and long-term activities.
- **Better equipment/infrastructure:** Partners established a test stand for analysing the chemical oxygen demand COD elimination rate of the in Madaba WWTP.

## 3.4 Other activities and outcomes achieved

### Outcomes reported by partners

- **Enhanced capacity and motivation of the German partners:** The German partners reported to have gained very rich knowledge and motivation to learn more and provide better peer-to-peer support.
- **Resources:** Beyond the enhanced capacity at individual, operational and strategic level of the water operators, the improvements and efficiencies gained through the WOPs may position Miyahuna in a more favourable position for future resource acquisition, such as funding for further improvements or investments in technology. I.e. Potential funding from other donor to conduct a study about the selenium problem in the groundwater.
- **Strategic aspects such as enhanced visibility and external relations** Partners reported that the engagement in the WOP and the specific efforts on external communication activities have helped them to interact with other active WOP actors and extend their network, to create visibility of the type of activities in a WOP and to raise interest to collaborate in WOPs. Annex 1 includes some links to some communication activities in the project.

*Job Shadowing and exchange in terms of sludge dewatering and treatment at Seehausen WWTP, Bremen | 06/2022*

*Photo: hanseWasser*

*Photo: hanseWasser*

*Job Shadowing and exchange Camera investigation of the sewage network, Bremen | 06/2022*

# 4. PARTNERSHIP STRENGTH AND LESSONS LEARNED

This section documents the WOP participants' perceptions on the evolution and overall partnership strength based on an assessment of a number of partnership aspects. Participants of all Working Packages (WPs) were consulted. All partners agreed that the partnership has matured over the last 26 months reaching a very efficient collaboration work. This has taken time to get to know each other, to better understand the nature of this kind of project. Some quotes from Miyahuna are included to illustrate the perception of the Jordanian partner on the partnership strength.

**Quotes**

***We are family now, it is difficult to improve the relationship. We have a very strong programme and we are eager to keep learning and improving on many more aspects relevant for Miyahuna.*** *(Miyahuna)*

***We now have a great collaboration. It took us time to reach this point and we would very much like to extend this project.*** *(Miyahuna)*

***We value greatly that the WOP is not only about Knowledge Transfer but ran ongoing peer support that goes from a shared identification of needs, to provision of peer support and supervise the implementation of improvement measures.*** *(Miyahuna)*

***Top management is convinced, that this WOP is a very fruitful partnership and is even now asking if HW can also support with other key areas for Miyahuna like Non-Revenue Water (NRW)*** *(Miyahuna)*

Various aspects informing the level of partnership strength are now described more in detail.

### Partnership design

The partnership design was considered overall good by project partners with the exception of the short duration of the projects and the heavy administration and financial processes required. Partners praised the flexibility built-in to the project design, given that it allowed partners to jointly identify priorities along the way, which avoided having to rush into defining expected results when there was only a superficial understanding of the situation on the ground. An example of flexibility is incorporated in the section Adaptation and Flexibility below. On the other hand, a point was also raised on the value of jointly agreeing on activities and expected tangible results on an annual basis, once partners have had the chance to get to know the situation on the ground. A good balance between the built-in flexibility in the possibility to adapt and additional activities or shift intended ones coupled with adequate activity and results planning and monitoring jointly conducted by all partners is encouraged.

### Roles and responsibilities

Roles and responsibilities were not clear from the beginning. Sufficient time for in-person interactions during the missions were reported as crucial for the Miyahuna colleagues to understand the peer support nature of this project.

### Meeting processes and representation

Generally, for every WP in the project partners targeted having in-person interactions at least twice a year through missions, job shadowing or networking events in Germany and at least one online meeting per month. Working groups were formed to address each of the working packages integrating all relevant partners. The composition of the teams from the international partner often involves pairing individuals with different experience allowing them to mutually learn from one another's distinct perspectives. The German partner hanseWasser also tries to improve gender inclusion in their teams. When it comes to the Jordanian partner, the aim is usually to involve staff at operational and management level. This approach is considered useful in ensuring commitment and knowledge transfer.

*Fact-Finding-Mission at WWTP Madaba | 10/2022*

*Photo: hanseWasser*

### Work processes

Work processes seem to be quite smooth in general, both during in-person exchange and online exchanges. For each WP plans are made and jointly reviewed and updated during the online meetings. Each working group has agreed on their preferred ways of online communication (including MS Teams, E-Mails and instant messaging). The only remark concerning work processes refers to the public procurement processes that tend to be quite long. This means that the operational improvements that are dependent on equipment procurement tend to delay more than initially anticipated. It is important to take this into consideration when planning activities and expected results and to manage expectations from partners.

### Trust, transparency and teamwork

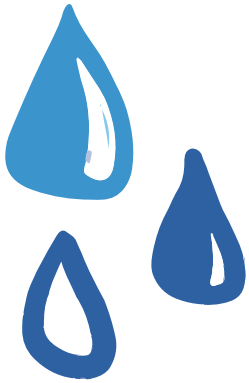
Partners reported to have achieved a state of great trust, transparency and openness that helps them to work efficiently as partners. Such trust and good teamwork were not there at the beginning of the project. It took a few months for partners to start a smooth collaboration with strong engagement from Miyahuna. Some factors that contributed to such delay were COVID-19, which did not allow for in-person exchanges, a change of management (CEO) when the project was finally formalised, a severe water crisis in Jordan during summer 2021, and a previous poor peer-to-peer experience of Miyahuna with a different water operator. The first Fact Finding Mission that took place in October 2021 was a turning point in the collaboration. Together with the continuous online communication and the quick wins achieved in the Water Production WP, the mission in October 2021 consolidated a trustful and open working relationship.

The FFM on-site was critical for the international partners to gain a detailed understanding of the technical installations and processes, to share thoughts and ideas and to get a sense of the intentions of the peers. Partners argued that engaging together in experiments and on-the-job exchanges was extremely useful to get to know each other and identify individuals for each WP that were eager to learn and to improve. This was instrumental to identify key counterparts at Miyahuna with whom to maintain continuous exchange online for following up on optimisation measures and implementing an action plan by agreeing on ways of communication and data transfer. ¨The trust cultivated through collaborative work. I.e. testing and identification of quick results in the production plants laid a robust foundation for ongoing cooperation¨ (Bochmann et al., Forthcoming). A factor that helped with the initial introductions between staff was an existing relationship between some staff at MIYAHUNA and an expert from HW from 25 years ago. A peer from HW shared that by the end of the FFM, His Excellency the CEO was truly committed and engaged directly in the meetings. He instructed further that the cooperation would be prioritised¨ (HW staff Dec 2023).

The achievement of quick wins early on during the project was also critical in developing trust and engagement in project activities, at operational and top management levels by Miyahuna. The example of the outstanding cost savings achieved in such a short time in the WP Water Production clearly illustrates this point. An employee from MIYAHUNA shared, “we were blown away by the results. It was a great job and we gained additional experience” (Bochmann et al., Forthcoming).

Partners shared how there is currently a great transparency in terms of information exchange for each of the WPs with regard to coordination and technical information. However, HW suggested the need to improve the transparency of funding available towards the Jordanian partner. This would help to best manage expectations and jointly agree on what to prioritise each year.

The networking meetings organised (I. e. Stuttgart, Bonn, Berlin) and joint participation in Water Events (e. g. Arab Water Week) to present the project were also reported to create trust, extend the network and develop a motivating and engaging shared sense of belonging at a programme level.



### Resources

Partners claimed that a larger duration which would entail larger budget commitments is very necessary to really consolidate the positive operational changes led by partners through the WOP.

In general, Miyahuna reiterated the positive value of the in-person support during the missions and claimed, that they would really benefit from additional inputs from the German partners. The WP Water Quality also expressed that they would like to have more interaction online as well with their peers from the Water Quality department in HW. HW shared staff are really motivated and would very much like to engage, but there are limited resources, and they have to also attend their work back in Germany.

### Adaptation and flexibility

All partners agree on the value of the great flexibility built-in to the projects to adapt to emerging needs. An example of such flexibility is how, even though a WP dedicated to NRW reduction was initially included in the project, it was later removed as there were other organisations supporting Miyahuna on this same topic or the new subjects that are being proposed to the WP Water Production, which were not initially proposed. I.e. selenium removal, odour problem investigation.

*Intensive brainstorming on drinking water lab processes | 10/2021*

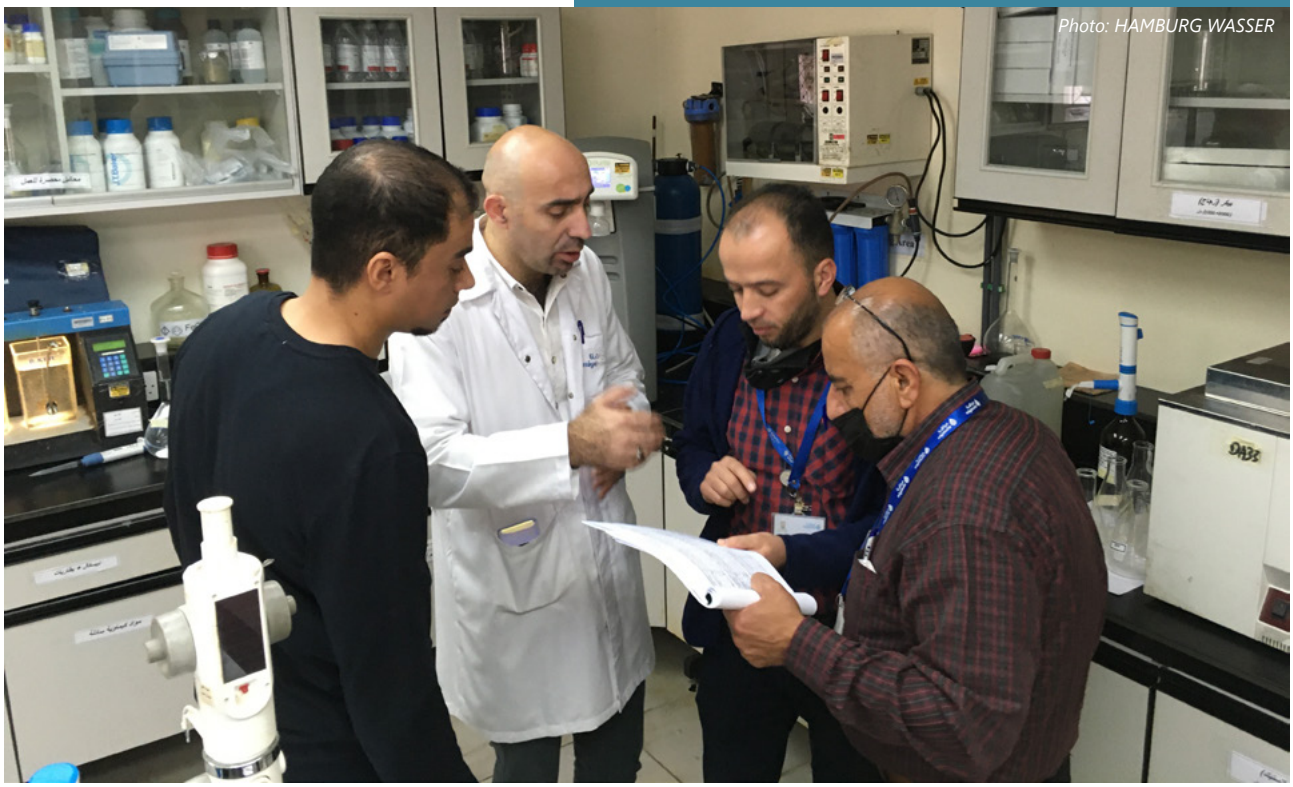


*Photo: HAMBURG WASSER*

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# ANNEXES

Annex 1 Links to external communications initiatives

**HAMBURG WASSER LinkedIn:**
LinkedIn Channel HAMBURG WASSER International

**hanseWasser LinkedIn:**
LinkedIn Channel hanseWasser Bremen

**Work Package 1: Water Production**
The partner MIYAHUNA in Jordan treats 93 % surface water, which makes chemical costs the second largest operating expense after energy consumption. Good first results could be achieved in optimizing the water treatment processes in the biggest WTP Zai close to Amman.

See some impressions of the first results in the videos here:
- LinkedIn Video on the optimisation of the flocculation at Zai WTP
- LinkedIn Video on the optimisation of disinfection at the intake at Deir Alla

**Work Package 2: Water Quality and KPI**
A paper about some results was submitted to the IWA special journal on WOPs and is currently under review.

See some impressions of the first results in the videos here:
- LinkedIn Video on the lab twinning in Jordan
- LinkedIn Video on the lab twinning in Hamburg
- LinkedIn Video on the impressions of the session at 6th Arab Water Week
- LinkedIn Video on the 6th Arab Water Week in Amman, Jordan
- LinkedIn Video of Lydia Bochmann about the WOP

**Work Package 3: Wastewater**

In this work package, the focus is on 2 WWTP Madaba and South Amman, in particular: energy analysis, sludge dewatering, limitation of the inert (no longer biodegradable) and knowledge transfer on the subject of construction and operation of digestion plants.

Some insights here:

- LinkedIn Article of Jörg Oppermann on the WWTP
- LinkedIn Video on energy analysis activities

# Utility Platform

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of municipal utilities worldwide

Thank you to all employees from Miyahuna, HAMBURG WASSER and hanseWasser who contributed to this publication via interviews, photos, editing etc.!

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