The Joint Water-Agriculture Ministerial Council

Sanitation Safety Planning: Framework for Piloting Sanitation Safety Plans in the Arab Region

Draft for discussion

Food and Agriculture
Organization of the
United Nations

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Disclaimer

The report on "Sanitation Safety Planning: Framework for Piloting Sanitation Safety Plans in the Arab Region" was prepared and revised by the Regional Office for the Near East and North Africa of the Food and Agriculture Organization (FAO) to support the Joint Technical Secretariat of the Joint Ministerial Council (composed of the Technical Secretariat of the Arab Water Ministerial Council and the Arab Organization for Agricultural Development) in implementing the recommendation of the High-Level Joint Water-Agriculture Technical Committee emanating from its meeting held on 18 October 2022 on the Use of Non-Conventional Water Resources in Agriculture.

Preface

"Breaking down silos and strengthening synergies between climate action, environmental protection and the SDGs are critical to accelerate transitions urgently needed for a just, inclusive and net-zero future" was a key message of the fourth global conference on strengthening synergies between Paris agreement and the 2030 agenda for sustainable development held by the UN in New York on July 16, 2023. Wastewater sector management is a cross-cutting issue particularly when directly or indirectly used for agricultural production as a reliable water source mitigating impacts of climate change. Concurrently, several SDGs are directly or indirectly linked to wastewater management due to its crucial impact on health and contribution to welfare and sustainable development through agricultural production. However, several studies have shown that low-income regions struggle to accomplish targets set by most SDGs, specifically those for SDG 6 due to financial constraints. The latest WHO and UNICEF Joint Monitoring Program (JMP) progress report showed that around 46% of world's population lacked safely managed sanitation. A main reason for such off-track is attributed to the perception that safe wastewater management requires high infrastructure investment. In fact, this perception is not necessarily correct particularly if risk management approach is used in managing wastewater and sanitation issues. Safe use of wastewater, being fully treated or otherwise, in agriculture is an issue that is receiving more attention in the Arab World during the last decades particularly in areas producing partially treated or untreated wastewater and have limited resources. Protection of public health is a main concern in such cases and calls for direct actions that take into account available resources. Accordingly, risk management plans can be of substantial benefits and would support affordable actions. This document lays the foundation for FAO's upcoming endeavor to establish improved conditions for wastewater reuse in agriculture, using the sanitation safety planning approach. This approach will be implemented in two selected pilot sites located in Jordan and Palestine. The document is structured into four main chapters, each serving a distinct purpose. The first chapter focuses on enhancing the understanding of the crucial need for coordinated actions between water and land management to safeguard public and environmental health effectively. The second chapter introduces the WHO (2006) approach for risk management, highlighting the significance of sanitation safety planning in implementing these guidelines. In the third chapter, specific attention is given to identifying the bottlenecks that must be addressed to create robust and successful sanitation safety plans (SSPs). Lastly, the fourth chapter outlines the roadmap for FAO's undertaking, slated to be completed by the end of 2023. It delineates the objectives of developing SSPs in the three pilot countries within the Arab States.

1. Introduction

1.1 Water Scarcity related challenges

The Arab region is confronted with significant challenges stemming from the scarcity of renewable water resources and the escalating rate of population growth, whether due to natural factors or otherwise. These challenges are exacerbated by the increased demand for urbanization and industrial expansions. The situation is further compounded by the delicate arid environment, which possesses limited resilience when faced with such various activities. In light of these circumstances, decision-makers bear substantial responsibilities to ensure the attainment of safe and reliable water and food supplies for the future. The scarcity of freshwater resources presents heightened risks to a community's capacity to grow and generate employment opportunities (AFED, 2014). Additionally, the prevailing political unrest in the region, coupled with economic strain, presents serious threats to sustainable development. Both water-energy-food nexus and peace-security-environment nexus are principle guiding themes to manage water scarcity. However, these priority principles should not be examined in isolation from social, economic, and institutional considerations, as the scope and impact of proposed solutions are intended to have long-lasting effects. A comprehensive approach that takes into account these interconnected factors is necessary for effective and sustainable solutions.

Climate change in the Arab region also poses a threat to water and food security by potentially reducing the availability of freshwater resources for agriculture and food production (ESCWA, 2021). Climate projections indicate changes in temperature, rainfall, and sea level, which will significantly impact both the availability and the utilization of water resources (UNDP, 2018). A climate risk index study categorized countries worldwide based on their exposure to climate change risks (Eckstein *et al.*, 2021). It revealed that Sudan ranked as the eleventh most vulnerable country in 2019. Extreme weather, rising temperatures, rainfall variability, and droughts and floods negatively impacted water availability and food security (NIPI and SIPRI, 2022). Other countries in the region were also assessed as highly vulnerable according to the climate change risk index, with Lebanon and Yemen being rated among the highest in the Arab States. Climate change impacts will not only reduce the quantity of water resources but also deteriorate water quality due to increased variability and frequency of extreme climatic events. In light of these projections, it is essential to be prepared and respond adequately to the potential adverse impacts of climate change.

In many countries of the region, a reduction in the per capita water share has been observed due to an increase in the influx of refugees across borders, creating a higher demand for water resources. Political unrest in countries like Iraq, Syria, and Yemen has directly impacted water supply and sanitation services. The overexploitation of groundwater resources throughout the Arab States has led to various issues, including a deterioration in water quality, seawater intrusion, aquifer depletion and salinization, as well as increased pumping costs. Additionally, the expansion of agriculture has further depleted non-renewable groundwater resources. The region's total blue water withdrawals for agriculture and domestic use increased by approximately 82% and reached around 153 billion cubic meters per year in 2012. Agriculture, being the largest consumer of water resources, leaves limited amounts for domestic and industrial sectors in almost all countries (Abuzeid, 2014). These challenges at the regional level necessitate urgent actions to bridge the gap between water supply and water demand.

1.2 Responses to water scarcity

1.2.1 Integrated water resources management

The primary approach to address water scarcity and climate change is through the implementation of 'integrated water resources management' (IWRM). IWRM involves various strategies, such as coordinating land and water resource management, recognizing the interconnectedness of water quantity and quality, adopting techniques to manage demand and conserve water, and learning through adaptive management experiments. One crucial and debated tactic to cope with water scarcity and increase water availability is by reallocating water resources away from agricultural sectors and towards domestic and industrial sectors. Although many countries have not officially announced sector water reallocation policies, there has been a significant emphasis on prioritizing domestic water use, leading to reallocation of water from the agricultural sector (CEDARE *et al*., 2014). Notably, countries like Iraq, Jordan, and Qatar have witnessed significant sector water reallocation. In the future, the trend is likely to involve reallocating fresh water for domestic use while utilizing non-conventional water sources, such as treated domestic and agricultural wastewaters, for agricultural purposes. The region's potential non-conventional water resources are estimated to include 1.27 billion cubic meters of treated wastewater (6%), 16.68 billion cubic meters of agricultural drainage water (79%), and 3.06 billion cubic meters of desalinated water (15%) (CEDARE, 2014). Evidently, wastewater is seen as a valuable "renewable water resource" for future agricultural expansion (Abuzeid, 2014).

1.2.2 Wastewater as a resource

The increasing importance of wastewater in integrated water resources management stems from its potential to be the only water resource that will see growth in the future. However, despite its significant role as a non-conventional water source for agricultural production, several challenges remain in its effective utilization. These challenges can be grouped into three main themes. Firstly, there are challenges related to the need for increased wastewater collection and treatment, particularly in economically feasible ways, especially in rural areas. Many Arab States have less than 50% of rural communities served with sewerage networks (Table 1), hindering the full utilization of wastewater produced (ESCWA, 2017). The high investment costs associated with conventional wastewater management systems have also limited the expansion of sanitation services in many cases. Secondly, challenges exist in creating an enabling environment for wastewater valorization in agriculture. This includes limited governmental support, the absence of a legal framework and appropriate institutional arrangements, poor financial mechanisms, inadequate skills and capacities among stakeholders involved in wastewater valorization, and a lack of socio-cultural acceptance. Thirdly, the traditional paradigm of wastewater management has focused on end-of-pipe technologies, such as conventional sewerage networks and large-scale wastewater treatment plants. This approach assumed that safe use of wastewater could be achieved by producing pathogen-free effluent, thereby minimizing risks associated with using it for irrigation and other purposes. However, this paradigm has two main drawbacks: firstly, only half of globally collected wastewater receives treatment (UN Habitat and WHO, 2021), leading to the use of raw wastewater without proper regulation; and secondly, evidence shows that effluents downstream of wastewater treatment plants can still be contaminated with pathogens, even when the effluents were correctly disinfected (Halalsheh *et al*., 2018). In summary, wastewater is gaining prominence in water resources management due to its projected increase in availability. Yet, addressing the challenges surrounding its utilization in agriculture requires improved wastewater collection and treatment, the establishment of a supportive environment, and a shift from the traditional end-of-pipe approach to more integrated and comprehensive solutions.

Table 1: Proportion of population connected to sanitation systems in selected Arab States (2013). Adopted from ESCWA (2017)

Arab State	Sewage network		On-site sanitation facilities	
	Urban (%)	Rural (%)	Urban (%)	Rural (%)
GCC				
Bahrain	87	n/a	13	n/a
Kuwait	100	n/a	0	n/a
Oman	20	n/a	80	n/a
Qatar	94	n/a	6	n/a
Saudi Arabia	54	47	n/a	n/a
Mashreq				
Egypt	87	23	13	77
Iraq	40	0	57	100
Jordan	59	n/a	41	n/a
Palestine	24	2	76	98
Maghreb				
Algeria	85	n/a	15	n/a
Libya*	56	47	44	53
Morocco	88	1	12	99
Tunisia	89	10	11	90
LDCs				
Mauritania	1	0	99	100
Yemen	36	29	64	71

* Data are for the year 2012

Despite the prevalence of the conventional paradigm in wastewater management, it is not a viable option for scattered communities and rapidly expanding peri-urban areas in the region. Moreover, using fresh water to flush excreta is not the pinnacle of scientific achievement. This practice dates back more than 150 years when little was known about water physics, chemistry, and applied microbiology. In the nineteenth century, the main concern was to minimize fatal disease outbreaks, leading to the transportation of wastewater as far away as possible from communities through existing Roman sewer networks in major European cities. Over time, this paradigm became dominant, creating a complete division between citizens-consumers and service providers. However, the financial burden associated with this approach has limited the expansion of service provision, not just at the regional level but globally as well (see Table 1). If given the chance to start anew, countries would likely not choose the method of wastewater shipping. Advancements in wastewater sciences and other factors, such as limited resources and energy costs, now encourage the adoption of alternative wastewater management schemes. One such alternative is to link sanitation management to cities' economic development (Sosa-Moy de Vitry *et al.*, 2019) by viewing waste as a resource to be utilized. This approach requires a high level of community involvement, technical feasibility, economic viability, and the establishment of appropriate legal and institutional arrangements. Moving towards this alternative could bring about more sustainable and efficient wastewater management practices.

Despite the significant benefits of the proposed alternative, its implementation faces several obstacles due to various reasons, including the lack of supportive institutional environment and enforcement measures. These challenges are particularly evident in small-scale management schemes and can be summarized as follows:

- The suggested alternative demands a high level of coordination and involvement from numerous stakeholders, making the process more complex.
- Small-scale and low-tech wastewater treatment plants or on-site systems are not as visually prominent as large-scale conventional systems, making the latter more appealing to decision-makers.
- Non-conventional sustainable sanitation alternatives would require more flexible regulations compared to conventional systems to facilitate the adoption of sustainable business models. Consequently, different institutional arrangements might be necessary to support and promote these alternatives.

One of the primary obstacles concerning wastewater management is institutional fragmentation, which undermines the design and execution of effective reuse schemes. The involvement of numerous stakeholders often leads to overlapping responsibilities and a lack of coordination. Specifically, the absence of coordination between water and agricultural authorities has frequently impeded the implementation of fit-for-purpose water quality approaches, placing unnecessary burdens on water authorities to provide high-quality water for agricultural use. Furthermore, this fragmentation has resulted in the application of overly stringent standards for treated wastewater use in agriculture, as seen in the case of Jordan. This issue becomes even more apparent in the context of small-scale wastewater treatment systems, where the need for exceptionally high-quality effluent hinders the establishment of successful business models to operate the treatment plant and the reuse site.

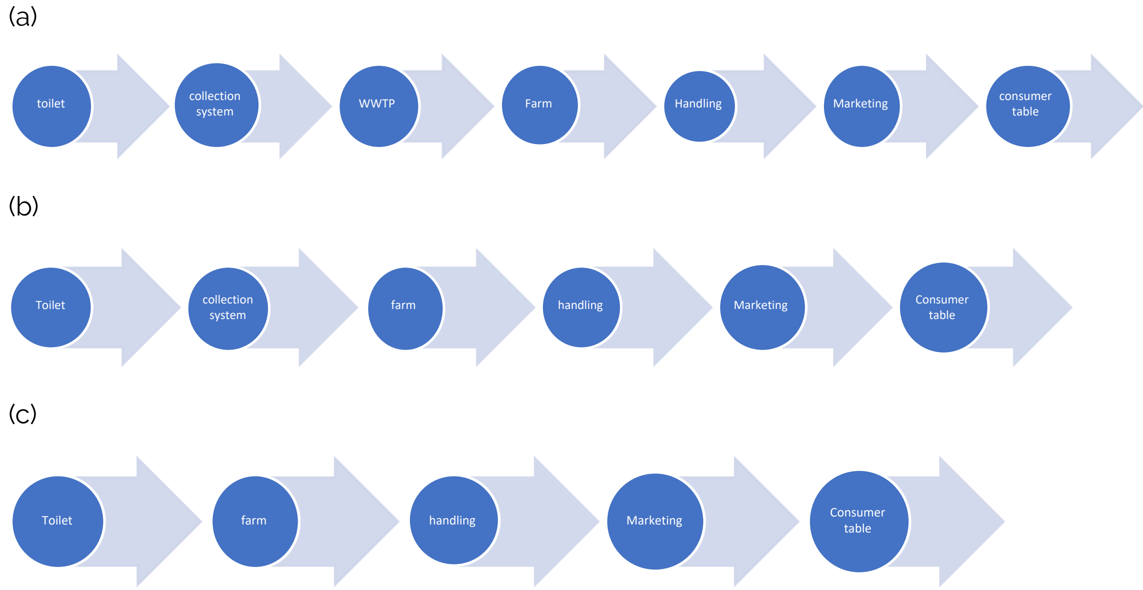
Recognizing the WHO 2006 guidelines for the safe use of wastewater in agriculture is seen as a crucial step to address both regulatory and institutional challenges associated with wastewater management. These guidelines emphasize the interconnectedness of wastewater treatment with downstream activities, considering that treated wastewater can still be at risk of contamination from various sources, such as agricultural drainage, dead animals, runoff, and others. Even after receiving secondary or tertiary treatment, non-point pollution sources may further compromise the quality of treated wastewater, leading to contamination of agricultural products. It is essential to acknowledge that controlling one agricultural input alone will not be sufficient to ensure the quality of agricultural produce. For instance, even with effluent disinfection, the use of non-composted manure in agricultural production may render the investments made to provide high-quality irrigation water upstream ineffective, as uncontrolled downstream processes can still cause contamination. Obtained results from studies have confirmed the significance of implementing the WHO 2006 guidelines by establishing a clear plan that defines the responsibilities of each body involved in adhering to the safe use requirements. Notably, Jordan is the only country that has adopted the WHO 2006 guidelines at a national scale (JS 1766/2014). Implementing these guidelines can provide a comprehensive approach to address the challenges of wastewater management and ensure safer practices in agriculture.

2. WHO 2006 guidelines and the required steps for adoption

The WHO 2006 guidelines represent a significant shift in wastewater management, advocating for the active involvement of multiple stakeholders in assessing risks and developing risk mitigation strategies not only for various agricultural inputs but also for agricultural practices. These guidelines take a holistic approach, considering both the quality of wastewater/treated wastewater and their interaction with agricultural inputs and practices throughout the entire food chain, as depicted in Figure 1a. As produce can become contaminated during handling and marketing, the proposed WHO approach emphasizes the importance of implementing controls at every step before it reaches the consumer's table. Consequently, when appropriate control measures are established and monitored, minimal treated and raw wastewater are not excluded from being safely utilized in agriculture (Figure 1b and c). While the guidelines primarily focus on preventing pathogenic contamination, it is essential to consider the impact of other farming practices on produce quality as well. For example, organochlorine pesticides, known for their carcinogenic properties, have been found to accumulate in soil and enter the food chain (Tzanetou and Karasali, 2022). Therefore, it is crucial to thoroughly consider all potential factors affecting produce quality to ensure food safety and protect public health.

In conclusion, the comprehensive approach suggested by the WHO 2006 guidelines is indeed practical, but its successful implementation requires detailed management plans that may vary between countries and even within the same country. Emphasizing coordination among different stakeholders is of particular importance during the development and execution of these plans. Moreover, the implementation plans should address concerns related to the use of wastewater, unprocessed manure in agricultural production, or any other waste stream, with a focus on managing microbial hazards. Simultaneously, they should also address additional risks associated with chemicals such as pesticides, pharmaceuticals, and personal care products, which may lead to chronic effects and non-communicable diseases. Regardless of the approach taken, the main objectives remain twofold: firstly, to safeguard the health of individuals who come into direct contact with the hazards, and secondly, to ensure the safety of produce for consumers' health. While to a lesser extent, the impact of these approaches on the environment should also be considered. In summary, implementing the WHO 2006 guidelines requires tailor-made management plans, strong stakeholder coordination, and a focus on both public health and produce safety. Addressing these aspects will pave the way for safer and more sustainable wastewater management in agriculture.

Figure 1: Control measures have to be established along the full sanitation chain whether a treatment plant is existing (a); a treatment plant is not existing (b); neither treatment plant nor collection system is existing.

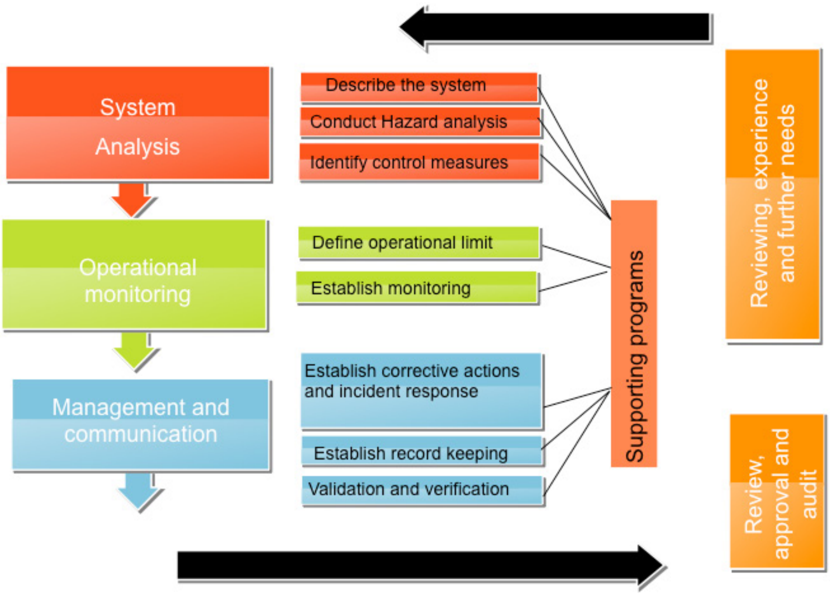


Sanitation Safety plans, known as SSPs, are designed to prioritize risks and allocate *the* limited resources towards addressing the highest-risk areas first, while also enabling gradual improvements. This approach is outlined in the developed manual known as the WHO SSP manual of *2022*. In the following sections, we will outline the steps involved in the sanitation safety planning process *in order to give* an overview of the demanded road map for adoption of the WHO 2006 guidelines.

2.1 Sanitation Safety Planning (SSP)

SSPs adopt a similar approach to the development of Water Safety Plans (WSP), as illustrated in Figure 2 (Davison *et al.*, 2005). However, SSPs are comparatively more intricate than WSPs and are best elucidated and presented through the recently developed WHO manual for *sanitation safety planning* (WHO, 2022). The manual is structured into six modules, each described below, encompassing: the preparatory phase, system description, risk assessment, development and implementation of incremental improvement plans, monitoring control measures and performance verification, and finally, the development of supporting programs. However, and before presenting the modules, it is crucial to have a common understanding for the TERM "sanitation system" as it might refer to a combination of different functional units that together allow managing and reusing or disposing different waste flows from households, institutions, agriculture or industries in order to protect people and environment. Accordingly, wastewater comprises domestic effluents, water from commercial and establishments and institutions, industrial effluents, stormwater and urban runoff, agricultural and horticultural effluents.

Figure 2: Components of SSPs, adopted from Halalsheh *et al*., (2018)



2.1.1 Module 1: Preparatory phase

2.1.1.1 Identify SSP area and lead organization

Sanitation safety plans are developed for a certain administrative area, or the service area of a sanitation utility or service provider. More information on the factors affecting the area selection for best impact of SSP on health and the environment are presented in section 3.1.1 below. In both cases, all steps of the sanitation chain are to be considered (toilet to table). According to the SSP 2022 manual, the lead organization shall be the local authority responsible for overseeing sanitation service provision. This is because SSP functions as a tool to coordinate sanitation services provision with the local authority in which sanitation service provider is best positioned to manage and coordinate these efforts effectively. However, the existing capacities and the legal mandate of the authority responsible for overseeing sanitation services do not necessarily allow for controlling selected measures along the sanitation steps. Accordingly, the authority responsible for controlling sanitation service provision might be the best authority to **coordinate** (not overseeing) between different authorities having the control over the sanitation steps particularly when water authorities are separate from agricultural authorities or rainfall runoff authorities. Alternatively, health authorities might be selected as the lead organization if they have the legal mandate to control activities over the whole sanitation chain. If this is not the case, then the lead organization will better take the role of coordinating between different authorities along the chain. Concurrently, senior representatives from the aforementioned bodies authorized to control sanitation steps shall represent the steering committee of the SSP and shall define objectives and oversee the whole process of development and implementation of the SSP along the whole sanitation chain. Steering committee might also include other important stakeholders like farmers' associations or any other relevant stakeholder. Members of the steering committee might best be decided based on stakeholders' analysis that can be simply carried out by the lead organization.

Notwithstanding the crucial role of the steering committee in the oversight of the development and implementation of the SSP, the committee shall secure the financial resources for the implementation of the SSP. Moreover, the committee shall take the lead when policy dialogue is needed to create enabling environment for the safe sanitation delivery.

2.1.1.2 Assemble the SSP team

The lead organization shall appoint the SSP team leader who will have a crucial role in communicating objectives and leading the SSP team throughout the process of development, implementation, and update of the SSP. The team leader shall have sufficient time and resources to ensure that the process is effectively implemented. The time of the team leader shall be part of the official workload rather than a voluntary additional assignment. If the lead organization does not have sufficient skilled personnel, they can still outsource the task for a national or international consultant.

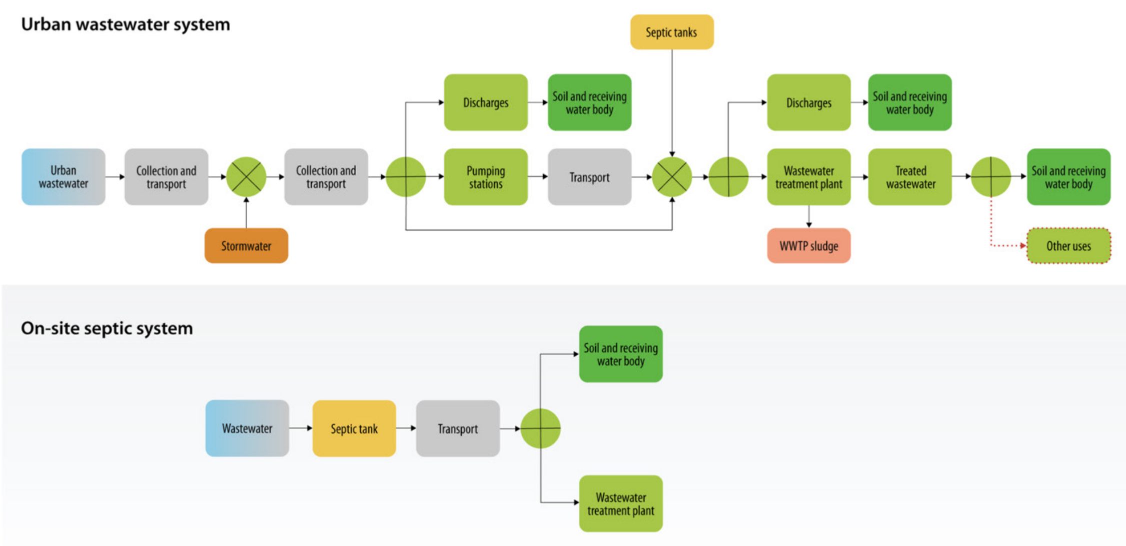
The SSP team shall also comprise members who have skills in identifying hazards and understand how risks can be controlled effectively. Members may possess a wide range of technical, managerial, social, environmental, and public health skills. It is also advisable to have representatives of key exposure groups such as sanitation workers within the team. Other ad hoc members who can support the SSP development might be consulted regarding emergency and disaster risk management like members with specific knowledge on climate and hydrology.

2.1.2 Module 2: System description

2.1.2.1 Map the system

To develop an optimal description of the entire chain within the chosen SSP area, a system mapping process is essential. This mapping can be effectively represented using a flow chart, carefully delineating the various components of the system, as demonstrated in Figure 3. If the SSP encompasses a full administrative area, a geographic map can also be beneficial for visualizing the system. During the mapping process, field visits should be conducted to gather on-site information and observations. Additionally, it is crucial to collect data on waste streams, which are integral to developing a comprehensive SSP. By combining flow chart representations and geographical maps, a thorough understanding of the sanitation system can be achieved, facilitating the development of effective and tailored SSP.

Figure 3: Example on system mapping using flow charts (SSP manual, 2022)



2.1.2.2 Characterize system flows

Available quantitative data on waste streams should be added along the sanitation chain. This includes flow rates, pollution loads, and the seasonal variability of the loads or any other expected variability. Expected pollution loads that might originate from other sources shall also be considered such as fecal contamination originating from agricultural wastes. Other potential physical and chemical contaminants shall also be included in as much quantitative matter as possible.

2.1.2.3 Identify exposure groups

As per the 2018 WHO Guidelines on sanitation and health (WHO, 2018), individuals who are most susceptible to exposure to hazards during hazardous events at various stages of the sanitation service chain are:

(U) Sanitation system users: those comprise all people using a toilet.

(L) Local community: people who work or live nearby the considered sanitation step.

(W) Sanitation workers: people responsible for maintaining, cleaning, operating any step of the sanitation service before the farm.

(WC) Wider community: the wider community who are exposed to end-use products.

(F) Farmers: people who use sanitation products (e.g., untreated, partially treated, or fully treated wastewater, biosolids, fecal sludge).

(C) Consumers: anyone who uses the products (e.g., crops, fish) that are produced using sanitation product.

Identification of exposure groups will support defining the control measures needed to minimize risks associated with hazards and hazardous events. In some cases, it might be required to have subdivisions of the exposure groups in which gender and age are identified. This will depend on the studied case and the defined risks.

2.1.2.4 Gather supporting information

Information related to quality standards, relevant laws and by-laws, planning specifications and restrictions related to urban planning, national regulations related to agricultural products, certification requirements for the produce, and specific guidelines for climate change preparedness or disaster planning. For example, if there are regulations restricting agricultural sludge application, it will require exploring alternative risk management strategies that do not involve controlled agricultural use. Not being aware of such regulations could lead to the improper selection of control measures.

Data pertaining to system management, such as early monitoring systems, documentation, epidemiological data, and the vulnerability of the study area, are crucial to know and would greatly support risk assessment and risk prioritization. Additionally, information about land-use patterns is essential, as projected developments can impact the sanitation system and the required risk assessment and risk management processes. For instance, if there are plans to establish an industrial zone upstream of the study area, it could significantly affect the developed SSP and its implementation. Accordingly, the collection of further information on waste management within that industrial zone will be vital for the SSP success during implementation phase.

During the process of compiling supporting information and conducting the system mapping exercise, it is of utmost importance to validate the description by conducting field visits. These visits ensure that the collected information is accurate and aligned with the actual conditions on the ground.

2.1.3 Module 3: Identify hazardous events, and assess existing control measures and exposure risks

2.1.3.1 Identify hazards and hazardous events

A comprehensive identification of all potential hazards and hazardous events is carried out in detail, encompassing biological, chemical, physical, and radiological agents. A hazardous event refers to the specific manner in which individuals are exposed to a hazard within the sanitation system. For example, farmers may be exposed to pathogens (the hazard) present in raw manure during the spreading process (the hazardous event) on agricultural land. Another instance is the exposure of workers and nearby communities to pathogens in raw wastewater during sewers overflow in a rainy season. Hazards identification involves a combination of desk-based research and fieldwork. Table 2 illustrates an example of a hazard identification for wastewater outlining the hazard and their associated hazardous events, causes, control approaches, and exposure groups. It should be emphasized that hazards and hazardous events should be identified at all steps along the sanitation chain. It is also advantageous to consider the exposure route to hazards among the exposure groups as it aids in better understanding of the risk and the consequent identification of the control measures that will break transmission.

Table 2: Example of hazardous events and their causes (WHO, 2022)

Hazard	Hazardous event	Cause of hazardous event affecting its frequency or severity	Control approaches of the hazardous event	Exposure group
Pathogens in WW	Dermal exposure of WW from overfall of a sewer pipe in high-rainfall event	Under-sizing of the conveyance system for rainfall event Lack of screening of overflow	Design standards to establish overflow frequency Regular maintenance of sewer system before rainy season	People living adjacent to sewer or downstream of the overflow
	Ingestion after contact with WW during repair and maintenance of sewage pump	Pumps are in poor conditions and are unsuitable for operation, resulting in frequent blockage Poor staff training or ability, or poor equipment Lack of bypass during maintenance work	Planned asset maintenance to reduce pump failure frequency Good selection of pump type and screen during design and construction phase Personal protective equipment for workers Application of SOPs Design standards for pump stations	Sewage maintenance workers

2.1.3.2 Identify and assess existing control measures

Control measures refer to actions or activities implemented to minimize hazards. For instance, at the farm level, one control measure to reduce pathogen concentration involves terminating irrigation two days before harvesting, as demonstrated by Halalsheh *et al*. (2018). To address each hazardous event, it is essential to identify the existing control measures currently in place to mitigate the risk of the event. Subsequently, it is necessary to assess how effective these existing control measures are at reducing the risk of the hazardous event. This evaluation can be challenging and may require technical studies, including reference to WHO (2006; Chapter 5 in volumes 2,3 and 4) and WHO (2018; Chapter 3), which provide log reduction values as a measure of effectiveness for various control measures. Figure 8 in the WHO (2015) documentation offers some examples of control measures. When assessing the effectiveness of a control measure, both its potential effectiveness (based on literature and technical assessments) and its actual performance in practice must be taken into account. These two measures of effectiveness may vary, and it is crucial to consider both aspects to accurately assess the control measure's impact in risk reduction. As an example, a control measure that involves the use of personal protective equipment heavily relies on the behavior of the user. It is evident that the validation of control measures should be based on the expertise and judgment of the experienced members of the SSP team. Additionally, these measures need to be regularly reassessed and reviewed over time to ensure their continued effectiveness.

2.1.3.3 Assess and prioritize the exposure risk

After conducting a hazards analysis, a comprehensive list of hazards and hazardous events will be generated. To prioritize these hazards, a risk assessment must be performed. Various approaches to risk assessment are available, including descriptive risk assessment, semi-quantitative risk assessment using a likelihood and severity matrix, and quantitative risk assessment (QMRA). While descriptive risk assessment is typically conducted by the SSP team, QMRA requires substantial data and may not be suitable for most SSP teams. In descriptive risk assessment, the SSP team classifies hazardous events as having high, medium, low, or uncertain/unknown priority based on their judgment. The definitions for each classification can be either specified by the SSP team or referred to as presented in Table 3 WHO (2022). It is recommended that for each selected classification of a hazardous event, the basis of the decision is recorded to serve as a reminder of why that particular decision was made at that time. Later on, during the revisiting of the SSP, the team may opt to conduct a semi-quantitative risk assessment. This approach allows for a more refined and structured evaluation of risks, offering valuable insights for decision-making.

Table 3: Suggested risk category descriptions for the team-based descriptive risk assessment (WHO 2015; WHO 2022)

Risk priority	Notes
High	The event could result in injuries, acute and/or chronic illness or loss of life. Actions need to be taken to minimize the risk.
Medium	The event could result in moderate health effects (e.g., fever, headache, diarrhea, small injuries) or discomfort (e.g. noise, malodors). Once the high-priority risks are controlled, actions need to be taken to minimize risk.
Low	No health effects are anticipated. No action is needed at this time. The risk should be revisited in the future as part of the review process.
Un-known	Further data is needed to categorize the risk. Some action should be taken to reduce risk while more data is gathered.

2.1.4 Module 4: Develop and implement an incremental improvement plan

2.1.4.1 Consider options to control identified risks

The SSP team should explore various options to control the prioritized hazardous events. The chosen control measures are then documented in an improvement plan. The improvement plan can include capital works (such as expanding treatment plants or fencing bio-solids land application sites), operational measures (like crop restrictions or implementing irrigation cessation before harvesting), behavioral measures (such as regular medical check-ups or the use of personal protective equipment), or a combination of these approaches. It is important to consider several factors during the identification of control measures, including the cost of the proposed measure, its acceptability, and monitorability. It is worth noting that in some cases, a combination of hazardous events can be most effectively managed by implementing a single control measure in another part of the system. TABLE 4 provides an example of control options, demonstrating how various control measures can be integrated to enhance the overall safety and effectiveness of the sanitation system.

Table 4: Control measures options to reduce exposure to helminth eggs by farmers and children (Adapted from WHO, 2015)

Hazard: Helminth eggs

Hazardous event: Exposure to partially treated wastewater in the filed by farmers or children (under 15 years) causes helminth infections.

Control measure options and considerations:

1. Wearing shoes or boots can reduce the likelihood of exposure to the hazard. However, this control measure is often not practical or commonly used by farmers or children in the field. Consequently, it cannot be relied upon as an effective solution.
2. By implementing a basic wastewater treatment approach upstream of the irrigation area, such as a properly sized detention pond to reduce the concentration of helminth eggs to less than 0.1 egg per liter, a dependable reduction in the number of helminth eggs to desired levels can be achieved.
3. Regularly providing de-worming medicines to waste handlers (*e.g.,* workers exposed to fecal sludge) can reduce the duration and intensity of infection. In settings where helminth infections are very common, de-worming medicines may also be regularly distributed at community level (e.g., in school children) for reducing prevalence rate.

2.1.4.2 Use selected options to develop an incremental improvement plan

It is essential to identify the individual or agency responsible for each proposed action or measure, along with the timeframe and estimated financial resources required. The template displayed in Table 5 can be utilized to prepare the incremental improvement plan. In some cases, the SSP team may choose to implement more cost-effective interim control measures until sufficient funds are secured to implement other measures. Moreover, the SSP team may also choose to select and implement more affordable interim control measures until sufficient funds for more expensive options are secured.

2.1.4.3 Implement the improvement plan

Depending on the control measures, many activities will depend on the commitment of authorities rather than special funds. Particularly those related to regulatory and managerial aspects, the demanded resources are usually part of the working load of the involved authorities. Behavioral control measures might require involvement of local authorities to work on awareness-raising campaigns, while technical measures might require seeking direct funds through the public budget or other external sources.

Implementation will also demand good project management skills for careful monitoring of the implemented control measures and for motivating individuals to achieve the objectives of the SSP plan.

Table 5: Template that can be used for incremental development plan (Adapted from WHO, 2022)

Step of the sanitation service chain: ___________________________ Description of the Hazardous event: ___________________________ Exposure group: ____						
Improvement options						
Option of new or modified control measure	Likely effectiveness of this control measure (high, medium, low)	Required financial resources and fund source	Lead organization	Due date for control measure implementation	Comments/ discussion	Priority for implementation

2.1.5 Module 5: Monitor control measures and verify performance

2.1.5.1 define and implement operational monitoring

Operational monitoring involves selecting specific monitoring points that can provide quick and straightforward feedback on the effectiveness of key control measures. This monitoring includes simple observations, such as on-farm practices and the turbidity of wash water at packhouses. Additionally, it may involve sampling and testing of various elements, such as irrigation water, applied organic fertilizer, and produce quality. Given that it may not be feasible to monitor all control measures, it is advisable to focus on the most critical monitoring points, prioritizing those associated with the highest risks. At this stage, various aspects need to be identified, including the monitoring method, frequency of monitoring, responsible agency or individual for monitoring, critical limits, and the action to be taken when critical limits are exceeded. It is crucial to establish limits that ensure the safe agricultural use of wastewater and the safety of agricultural practices in general. Operational limits do not necessarily refer to the concentration of hazards, but rather gauge the performance of control measures, aligning with the objective of monitoring. For example, setting a maximum allowable water storage time at the farm level can be considered an operational limit. Monitoring is essential to ensure the timely control of measures, and detailed records of all monitoring activities must be maintained. To aid in this process, a suggested template for operational monitoring is presented in Table 6.

Table 6: Template that can be used for operational monitoring (WHO, 2022)

Operational monitoring plan				
Operational monitoring plan for: (Give short description of the control measure)				
Operational limit	Operational monitoring of the control measure		Corrective action when the operational limit is exceeded	
Irrigation system	What is monitored?	Presence and condition of drip irrigation system	What action is to be taken?	
	How is it monitored?	Visual inspections		
	Where is it monitored?	Irrigation Field	Who takes the action?	
	Who monitors it?	Extension/ agricultural authorities	When is it taken?	
	When is it monitored?	After plantation!	Who needs to be informed of the action	

2.1.5.2 Verify system performance

Verification monitoring is conducted periodically to assess whether the sanitation system is functioning as intended over time. Key points along the sanitation chain are carefully selected, and a more comprehensive monitoring approach is employed, which may include parameters such as E. coli and helminth eggs, in contrast to the simpler operational monitoring. For verification monitoring, specific parameters to be monitored, monitoring frequency, monitoring methods, responsible agency or individual for monitoring, critical limits, and actions to be taken when the limits are exceeded must be specified. This monitoring can be carried out either by the SSP team or by an external authority, and typically involves fewer monitoring points compared to operational monitoring. Additionally, verification monitoring primarily focuses on system end points, such as the microbial quality of agricultural produce, the health status of exposed groups, and the quality of effluent water.

2.1.5.3 Audit the system

Audits play a crucial role in ensuring that SSPs continue to have a positive impact on health outcomes by examining the quality and effectiveness of their implementation. These audits can be conducted by internal teams, regulatory authorities, or independent auditors. Their primary aim is to verify that the SSP was well-designed, correctly executed, and is effective in its intended objectives. The frequency of auditing should align with the level of confidence required by the regulatory authority, and it serves as a mean to maintain ongoing compliance and improve performance. By conducting audits, organizations can identify areas of improvement and address any potential gaps in the SSP's implementation, thereby ensuring its continued success in promoting public health and safety.

2.1.6 Module 6: Develop supporting programs and review plans

2.1.6.1 Identify and implement supporting programs

Supporting programs encompass a wide range of activities that contribute to process control and the overall effectiveness of the SSP. These programs include the development of standard operating procedures (management procedures), implementation of hygienic practices, community awareness campaigns, training initiatives, and research efforts. Additionally, supporting programs may involve creating a comprehensive understanding of the organization's compliance obligations. While supporting programs are not directly considered a part of the SSP, their significance cannot be overstated. They play a critical role in upholding the operational environment and ensuring proper control measures. By implementing these supporting programs, organizations can foster a culture of safety, enhance awareness, and reinforce best practices, thereby bolstering the success and impact of the SSP in safeguarding public health.

Management procedures consist of detailed instructions on how to operate the system effectively. These instructions encompass not only regular operations but also maintenance and inspection procedures for various system elements. Both normal and emergency operation scenarios should be covered in these instructions. For instance, in the context of a wastewater treatment plant, management procedures may entail an operation and maintenance schedule, a schedule and procedure for monitoring wastewater quality and adhering to statutory requirements, as well as procedures for all treatment aspects, such as screening, aeration, sedimentation, sludge thickening, sludge drying beds, and so on. These comprehensive procedures are vital in ensuring the smooth and efficient functioning of the system and help maintain its integrity and compliance with necessary regulations.

2.1.6.2 Periodically review and update the SSP outputs

The SSP should undergo systematic reviews at regular intervals. These reviews must encompass an assessment of the improvements that have been implemented, any observed changes in operating conditions, and any new evidence related to health risks associated with the sanitary system. Additionally, it is essential to conduct reviews of the SSP after emergency situations or major improvements or changes to the system. By conducting these comprehensive and periodic reviews, organizations can ensure that the SSP remains up-to-date, effective, and responsive to any emerging challenges or advancements in the field of sanitation and public health.

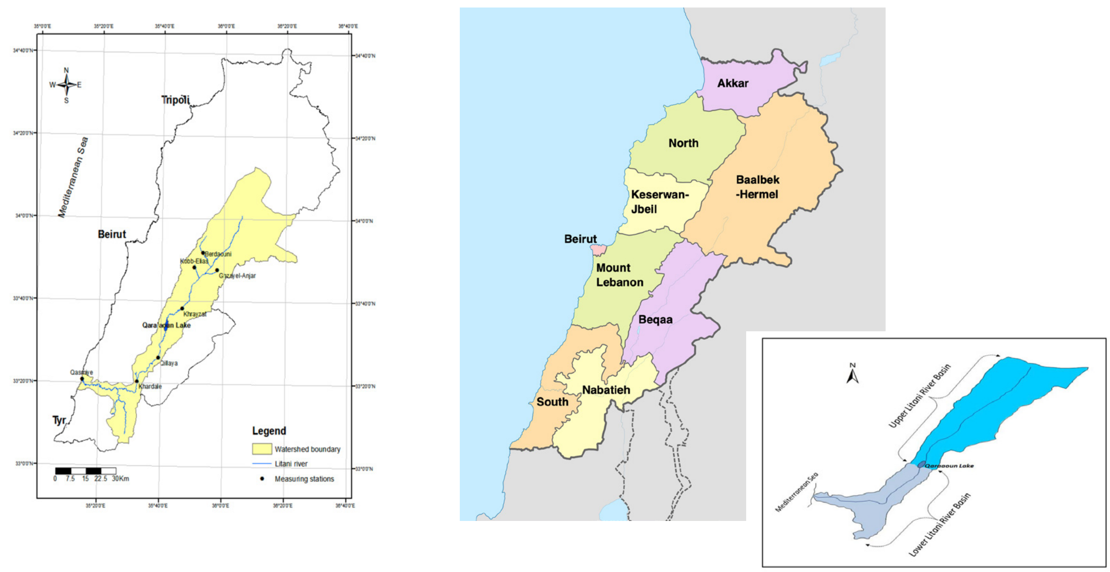
3. Bottlenecks for a successful development and implementation of a pilot SSP

3.1 Selection Criteria and defining the boarders of the study area

3.1.1 Administrative area versus catchment/sub-catchment area

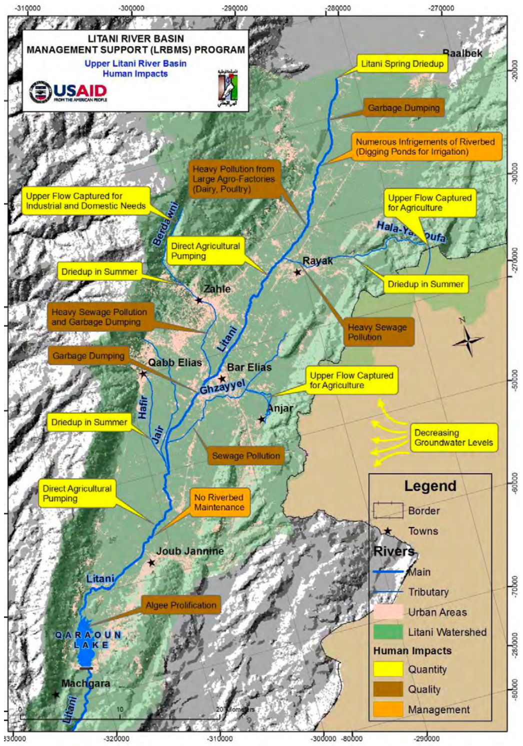
Implementation of SSP in an entire administrative area by local authorities is a goal (SSP manual, 2022). Nonetheless, relying solely on administrative boundaries may not be the most optimal approach for defining the study area. The inclusion of catchment or sub-catchment areas could significantly influence the value of any developed SSP (Spatial Strategic Plan). To illustrate this point further, let's consider an example from Lebanon. The Litani River basin spans approximately 2180 km², constituting a quarter of Lebanon's total land area. Moreover, it traverses four distinct governorates, also known as administrative areas (Nassif *et al*., 2015), namely: Bekaa, Nabatiye, Mount Lebanon and South Lebanon as shown in Figure (4). The Litani river originates from the middle parts of Bekaa plain forming the upper Litani Basin, which discharges primarily in the Qaraoun Lake, then it continues southward as lower Litani Basin where it is meandered near Al-Khardali region and then extends westward to the Qasmiye where it finally outlets into the sea.

Figure 4: (a) Catchment area of Litani River basin (Nassif *et al*., 2015); (b) Administrative areas in Lebanon (Wikipedia, accessed 25th of July 2023); (c) sub-catchments of the Litani River basin distributed as Upper Litani River Basin and Lower Litani River Basin (Hayder *et al*., 2014)



The water of Qaroun Lake, utilized for irrigation projects in South Bekaa and South Lebanon within the Lower Litani River Basin, is facing pollution primarily caused by human activities in the Upper Litani River Basin, as depicted in Figure (5). These activities involve the discharge of untreated sewage, industrial effluents, agricultural runoff, and improper waste disposal (USAID, 2014). If any sanitation safety planning is being considered for an administrative area in the Lower Litani River Basin, it must prioritize health protection while also addressing the issue of pollution originating from upstream sources. Neglecting the pollution problem upstream could potentially render the proposed plan ineffective, given the current environmental conditions.

Figure 5: Pollution sources in the Upper Litani River Basin (USAID, 2014)

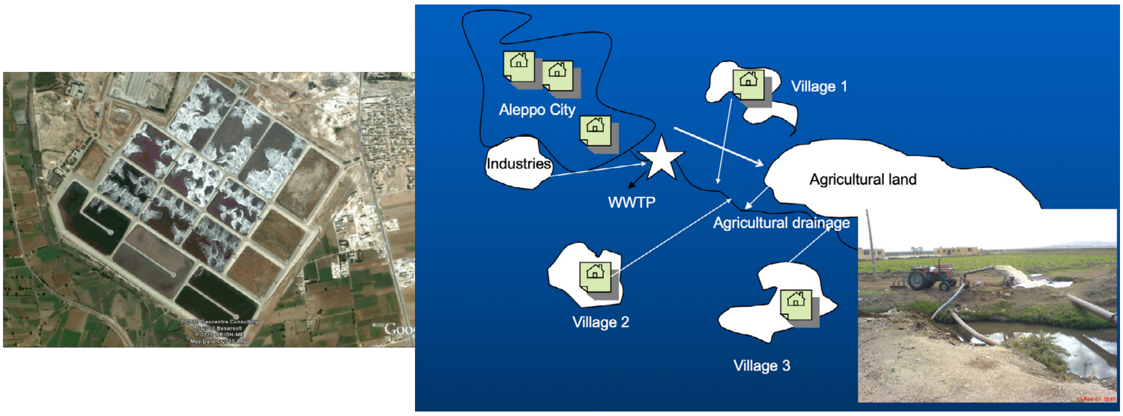


In this particular scenario, a more sensible choice for the development of the SSP (Sanitation Safety Planning) would be to focus on the upper basin. However, if the SSP team and the lead organization concluded that a smaller area should be selected, it is advised that they consider the upper sub-catchment area within the Upper Litani River Basin. This would result in a sound plan that will show obvious positive impact upon implementation.

3.1.2 Availability of quantitative data

The availability of quantitative data regarding hazards within the chosen study area is a crucial factor in the development of a proper SSP. Such data plays a key role in prioritizing risks and determining the necessary control measures and the demanded resources for their implementation. To illustrate, Figure (6) depicts the wastewater treatment plant in Aleppo, which previously served both municipal and industrial zones. The treated effluent was discharged into a canal connected to the Queiq River near the plant's outlet (Hagstrom, 2020). Before the Syrian conflict, the treatment plant effectively treated wastewater, producing effluent suitable for agricultural use. However, downstream villages discharged untreated wastewater directly into the canal, and agricultural drainage also added to the pollution load in the river. Since 2013, and due to the conflict and its aftermath, the Aleppo wastewater treatment plant ceased functioning due to energy shortages and extensive war-related damage to the infrastructure. Consequently, the river now carries a high pathogenic load and contains elevated levels of heavy metals. Given this critical situation, urgent actions are required to mitigate health and environmental risks associated with using very poor-quality irrigation water. With severely limited available resources, careful consideration is necessary to prioritize investments aimed at improving the river's water quality.

Figure 6: Schematic presentation of Aleppo wastewater treatment plant and downstream



Risk prioritization requires the quantification of hazards originating from various sources. Therefore, it is crucial to determine or approximate the pollution load (including pathogenic hazards and heavy metals) from Village 1, Village 2, Village 3, non-point agricultural sources, and Aleppo WWTP. This information is essential for planning immediate actions, taking into account the available resources. It is important to clarify that considering these specific sources does not imply ignoring others. Instead, the focus is on identifying actions that can be taken to achieve the most significant impact given the available resources. Without estimating or knowing the pollution load, prioritizing actions, and anticipating their potential outcomes will prove to be highly challenging.

3.2 Willingness of authorities to cooperate and coordinate

As mentioned previously, the successful implementation of the SSP relies heavily on effective coordination between relevant authorities. This coordination necessitates the willingness of different authorities to collaborate and fulfill their responsibilities based on their legal mandate. Furthermore, it requires strong managerial capacities to ensure successful implementation, monitoring, and control across the entire sanitation chain. However, these capacities may not be uniform among all authorities and may need to be developed in certain cases. Capacity building also calls for the willingness of authorities to allocate resources for enhancing their capabilities. As a result, the steering committee of the SSP should consist of decision-makers from the relevant authorities to facilitate resource allocation for both the development and implementation of the SSP. Without this commitment, the risk of failure in implementing the SSP becomes considerably high. By ensuring a collaborative and resourceful approach, authorities can create an enabling environment that fosters the effective execution of the SSP and contributes to its overall success.

In certain situations, challenges may arise due to high turnover within the same authority and the absence of a clear communication plan. To address this, outsourcing the implementation, monitoring, and verification of control measures can be considered as a strategy to ensure a sustainable and consistent approach. By engaging external experts or agencies, the SSP can benefit from specialized knowledge, continuity, and more effective communication, leading to a smoother and more successful implementation of the control measures.

Notwithstanding the earlier discussions, decision-makers in various authorities should be cognizant of the personal benefits they can attain by adopting the sanitation safety planning approach. Embracing this approach can significantly bolster their credibility and standing in the eyes of the public, especially during the increasing occurrences of emergency situations driven by climate change. By proactively implementing sanitation safety planning, decision-makers demonstrate their commitment to public health and safety, showcasing their readiness to address potential challenges and ensuring a more resilient and sustainable response to environmental crises. Adoption of the approach by decision makers will definitely be reflected in the lower management actions, and consequently, secure a successful implementation and monitoring of the SSP.

3.3 Consideration of all steps along the sanitation chain

While it may sound straightforward, addressing all aspects of the sanitation chain is indeed a challenging endeavor that demands a coordinated team with strong motivation and exceptional managerial skills. Therefore, the selection of the team should carefully consider the multidisciplinary nature of the task, as previously discussed. The consultant has observed that some water utilities in the Arab World may encounter confusion regarding the scope of an SSP. In some instances, there is a misconception that the development of an SSP should solely focus on the WWTP itself, resembling standard operational procedures rather than serving as a comprehensive planning tool aimed at enhancing health and environmental conditions within a specific affected catchment or sub-catchment area. It is essential to clarify the purpose and broader scope of the SSP to ensure its successful implementation and impact in improving sanitation and public health outcomes.

3.4 User friendly presentation of the SSP

An essential aspect that the SSP team must take into account is the effective presentation of the final SSP product to ensure its accessibility and user-friendliness for all stakeholders. Employing proper arrangements to showcase the information can significantly enhance its impact and understanding. One effective approach is to utilize GIS tools, which enable the team to map out all pollution sources, assess their quantities, illustrate land use patterns, and incorporate the necessary control measures at each specific location. Additionally, using GIS allows for continuous monitoring and evaluation of the system over extended periods, providing valuable insights for ongoing improvements and decision-making. This comprehensive and visually engaging presentation ensures that stakeholders can easily comprehend the SSP's content and contribute effectively to its successful implementation.

4. Road map for piloting sanitation safety planning in the Arab States

4.1 Formation of SSP teams for selected countries

Four countries, namely Jordan, Palestine, Libya, and Tunisia have expressed their interest in the development and implementation of SSPs. To facilitate this process, focal points representing water, agricultural, and environmental authorities have been designated by Jordan and Palestine, and accordingly, they were selected for further developments. These authorities' representatives will take the lead in forming the full SSP teams within their respective countries. The focal points will be responsible for the following main tasks:

- Conducting a comprehensive stakeholder analysis to identify relevant authorities and other stakeholders who have the potential to contribute to the SSP steering committees and SSP teams.
- Conducting a detailed analysis of the existing regulations in each country that pertain to various sanitation activities along the sanitation chain.
- Propose potential pilot sites to be discussed during a face-to-face workshop to be held in Cairo in October, 2023

Working in collaboration with the focal points, the consultant, with the support of the FAO and relevant committees of LAS, will finalize the composition of the SSP steering committees and SSP teams. Additionally, the FAO will provide the expertise of a GIS specialist to assist in visualizing the SSP for the selected pilot areas. By leveraging the combined efforts of the focal points, consultant, FAO, and GIS specialist, the successful development and implementation of SSPs in the three countries can be effectively achieved.

Moreover, an online meeting early September 2023 with focal points will be utilized to introduce selection criteria for potential pilot sites. This will facilitate discussions during the face-to-face workshop to come up with the final decision regarding the selected pilot site in each country. Additionally, the meeting will be utilized to discuss stakeholders' analysis conducted at each country and the potential SSP steering committees and teams' members.

4.2 Training workshop and field visit to Egypt

A training workshop will be conducted in Cairo in October 2023 in order to level the knowledge of all focal points and equip them with the necessary motivations required to take the lead in their countries throughout the SSP development process. The workshop will expand over two days in which the first day will be reserved to strengthen the knowledge of participants regarding the rationale of the SSP and the required enabling environment, while the second day will be oriented for a field visit to Beni Suef governorate. Tentative topics to be covered are:

First day

1. Introduction to SSP

- This would include rationale behind the necessity of SSP applications:

A. Example rationale

  i. project results showing the importance of considering pollution loads along the sanitation chain. Misleading decisions might be taken when considering only one input.

  ii. Enabling environment (regulatory frame, socioeconomic factors, technological factors)

  iii. Introduction to SSP manual

Some reported challenges for the safe wastewater management will be discussed in group work. This might include the lack of social acceptance to direct reuse for irrigating food crops resulting in application of un-necessary constraints in regulations and very high level of treatment required with no value added.

Additional main bottle neck would be the identification of lead institution since all aspects related to food safety downstream of wastewater treatment plants are outside direct control of water authorities. Accordingly, risks of chemicals in most cases are overlooked particularly when it comes to crops sold in the local markets.

Additional point that can be discussed within the first day is the pilot site selection. Participants will be communicated one month before the workshop in order to prepare potential pilot sites in their respective countries.

Second day

The main idea of the field visit is to position wastewater in the whole scheme of water sources in the governorate. Around 85% of the populated area in Beni Suef is agricultural land (Melegy *et al.*, 2014). The water balance in the governorate is shown in Figure 7, which outlines wastewater (treated and untreated) use in the governorate. Apparently, drainage water has a minor contribution to agricultural water. However, it is noticed that pollution of the Nile's River, drains and canals in the governorate had increased particularly those related to heavy metals contamination (Moselhy *et al.*, 2016). Sources of contamination include municipal, industrial, and agricultural wastewaters (Melegy *et al.*, 2014). Domestic sewage water in the governorate is estimated at 163,000 m^3/d (Melegy *et al.*, 2014). According to HCWW, 43% of the population are connected to the sewerage network and the ratio is expected to increase to 50% in the future. According to the data presented during the field visit, it seems that all collected wastewater is being treated.

Fifteen wastewater treatment plants exist in the governorate (it is believed that pumping stations were counted). During the field visit, delegates were exposed to the experience of the HCWW in two wastewater treatment plants; namely, Tezmant and Bayad El-Arab WWTPs. Tezmant WWTP was commissioned in 2006 with a design capacity of 50,000 m^3/d. The plant was expanded to receive a total of 62,500 m^3/d in 2010. It applies activated sludge system as shown in Figure 8. The plant was also upgraded from secondary treatment system into tertiary treatment system in 2018. It serves a population of 420,332 inhabiting Bani Suef city and additional 11 villages. Effluent of the treatment plant discharges at Demoshiya drain, which connects to Ehnasya drain before it ends up discharging at the Nile River. Accordingly, effluent of the treatment plant is being indirectly used for agricultural irrigation (Figure 9).

Figure 7: Mani water balance components in Beni Suef governorate (Hleeika *et al.*, 2021)

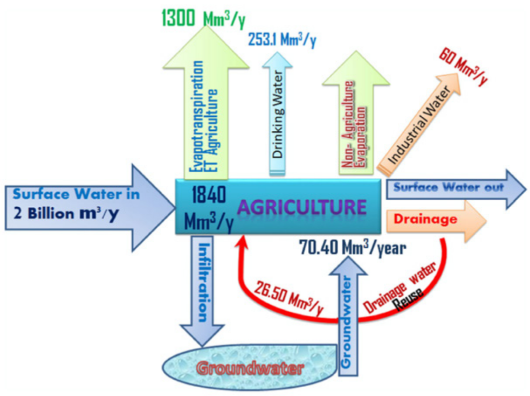
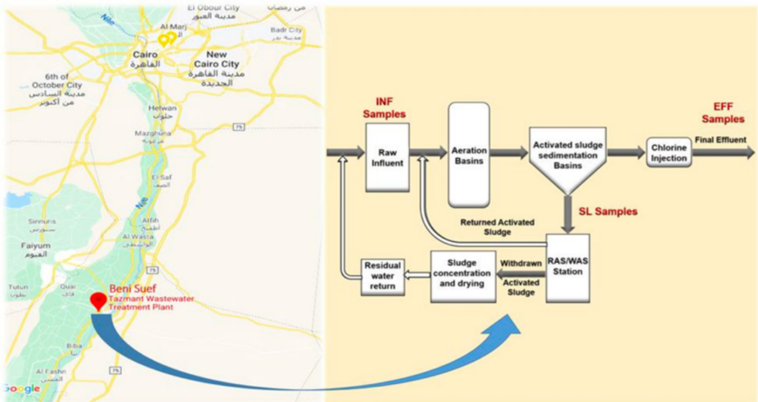


Figure 8: Tezmant wastewater treatment plant (adopted from Ali *et al.*, 2021)



Bayad El-Arab wastewater treatment plant has a design capacity of 21,000 m³/d and was commissioned in 2011. The plant currently receives 17,000 m³/d and consists of stabilization ponds, which are located to the south of the industrial zone of Bayad El-Arab east of Nile River). The main purpose of the project was to solve industrial and domestic wastewater challenges in Bayad El-Arab and provide an integrated management of the wastewater by investing in direct agricultural reuse project. The main motivation for the direct reuse project was the absence of safe discharge of treated effluent and the resultant risk of ponding at the nearby village and electricity towers as shown in Figure 10.

Figure 9: Effluent discharge of Tezmant WWTP (HCWW-Bani Suef, 2021)

Figure 10. Ponding of treated effluent before implementing the reuse project (HCWW, 2021)

In order to deal with such challenge, the HCWW decided an urgent solution that reduced the risk of water ponding next to electricity towers. This solution targeted 4000 m^3/d by pumping to filtration unit having a design capacity of 18,144 m^3/d and using the filtered water for irrigating a specifically established farm with drip irrigation system and cultivation of 110,000 seedlings of different plants including jojoba, ornamental palms, conocarpus trees, and bougainvillea trees. The urgent solution also included the construction of a storage tank with a capacity of 2500 m^3. The permanent solution followed the urgent solution and consisted of two stages in which the first stage targeted 8000 m^3/d, while the second stage targeted 9000 m^3/d. The permanent solution comprises pumping water to additional filtration system before using it to irrigate an established farm equipped with drip irrigation. The farm was cultivated with 450,000 seedlings of the same crops used in the urgent solution farm. This stage was also accompanied with construction of storage tanks with a total capacity of 42,000 m^3.

4.3 Step-by-step SSP development

With reference to section 2.1, the consultant together with the SSP teams will work hand in hand to develop the SSPs for each pilot site. Firstly, the consultant together with the GIS expert will delineate the selected sites. Secondly, the consultant will prepare a time schedule for each team

to go through every single step starting with system description and ending up with the incremental improvement plan. The consultant will be flexible to arrange online meetings whenever needed. Moreover, when necessary, joint on-line meetings will be conducted in order to share experiences gained by each country and foster discussions. By the end of SSPs teams' work, the plans will be introduced to the steering committees for comments and further approval.

In a later stage, the developed SSPs will be implemented and monitored. This will take place on the year 2024, and improvements on health and environmental conditions shall be reported for the next evaluation of the implemented SSP. A good documentation system will be necessary and the evaluation of key non-governmental organization might be considered to ensure accountable work.

5. Time plan for the development of SSPs for pilot countries

Activity	weeks																		
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19
Report revision																			
Online-meeting with focal points																			
Stakeholder analysis																			
Existing regulations																			
Formation of steering committees and SSP team																			
Selection of pilot area																			
Pilot areas delineation																			
First face to face workshop																			
System description																			
Identify hazards and hazardous events																			
Locating information on the map																			
Risk assessment																			
Existing control measures																			
Define potential control measures																			
Develop the incremental improvement plan																			
Final workshop																			
Plans approval																			

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