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**Annex 5: Water Sector Fact Sheet – Water Safety Plans**

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| **Sector** | Water |
| **Category** | Promotion of adaptive management strategies to water safety |
| **Adaptation needs** | Increased resilience to water quality degradation<br>Adapt to long-term climate change and slow-onset hazards |
| **Technology Name** | Water Safety Plans (WSPs) |
| **How this technology contributes to adaptation** | WSPs contribute to climate change adaptation at the catchment level primarily through increased resilience to water quality degradation. The WSP approach allows for water suppliers to be flexible and responsive to changing input parameters. This means that the monitoring, management and feedback components of a successful WSP naturally absorb the acute impacts of climate change. The WSP approach can also be modified to adapt to long-term climate change and slow-onset hazards by recognizing how the water supply system may be affected by specific climate change effects, by factoring these effects into the risk assessment, and by identifying appropriate control measures.<br>The burden of disease attributable to poor water, sanitation and hygiene has been estimated to be over 200 times higher in developing than in developed regions (Prüss et al., 2002). Waterborne illnesses diminish economic productivity and confine people to poverty. Since WSPs are developed to meet health-based targets that are specific to the disease burden of a particular region, the approach can significantly reduce the risk of exposure to health hazards that contribute the most to disease in developing countries (Davison et al., 2005). Therefore, WSPs can make a significant contribution to economic development by reducing the burden of waterborne illness in resource-limited settings. |
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<td>Background/Notes, Short description of the technology option sourced from ClimateTechWiki, Seminars, etc</td>
<td>The World Health Organization (WHO, 2008) Guidelines for Drinking Water Quality (GDWQ) is the basis for current water quality standards in many countries around the world. In the GDWQ, Water Safety Plans (WSPs) are described collectively as a systematic and integrated approach to water supply management based on assessment and control of various factors that pose a threat to the safety of drinking water. WSPs enable identification of threats to water safety during any and all steps in the catchment, transport, treatment and distribution of drinking water. This approach is fundamentally different from those traditionally adopted by water suppliers, which rely on treatment and end-product testing to ensure water safety. When implemented successfully, the WSP approach can ensure that water quality is maintained in almost any context.
A framework for preventative management and delivery of safe drinking water is illustrated in figure 1. As shown in the figure, a WSP consists of three separate activities: system assessment, monitoring and management.


Figure 1: Framework for safe drinking water (source: WHO, 2008)
System assessment: During this phase of a WSP, potential hazards to water quality and health are identified at key steps or locations, normally referred to as Critical Control Points (CCPs), within specified boundaries of a water supply chain. Typical health hazards might be source catchment contamination, poorly maintained service reservoirs, leaking valve boxes or unhygienic standpipe collection systems (Godfrey and Howard, 2004). Associated risks of negative health outcomes due to these hazards are also quantified at this time.

Monitoring: Once health risks have been defined, they are used to develop a prioritized and system-specific plan for monitoring and controlling hazards at each CCP during the monitoring phase of a WSP. Such a plan will define operational parameters and associated sampling and reporting methods. Critical limits or targets for these parameters should be defined at this time. It is likely that a combination of observational and traditional water quality monitoring methods will be implemented by members of the community as well as by trained personnel</td>
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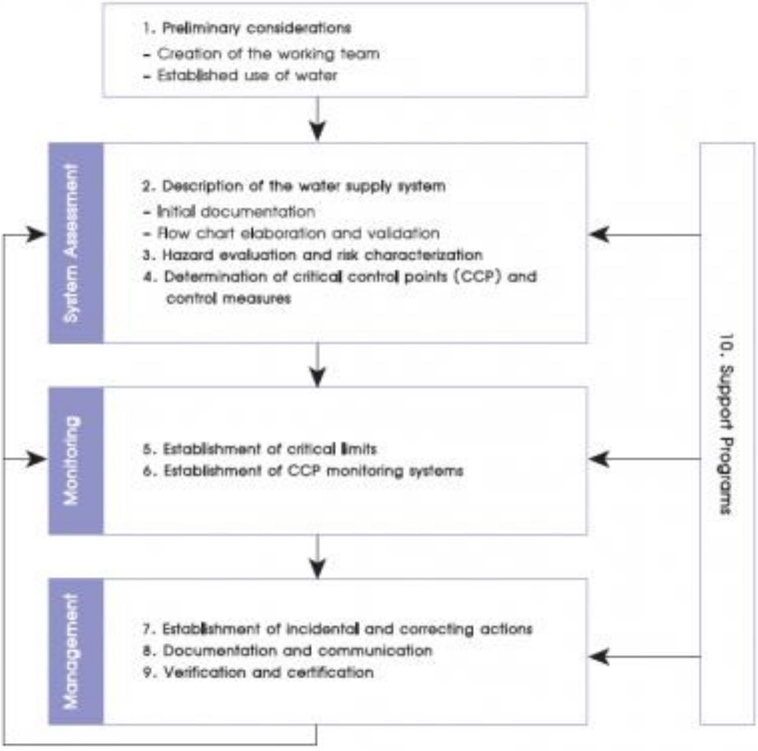
| | *Management*: The actions necessary to correct any issue identified during monitoring are established in the management phase of a WSP. Such measures may include alleviation of source water contamination through controlling activities in the watershed, optimization of physical or chemical treatment processes, and prevention of recontamination during distribution, storage and handling (Water Safety Plans, 2010). By controlling hazards at the water supply system's CCPs, any issue that occurs in the catchment or distribution network can be detected and corrected before water of poor quality is delivered to the consumer. This proactive method of monitoring reduces the amount of sampling that needs to be conducted in the distribution system. In addition, processes are established for documentation, record keeping, validation and verification during the management phase.<br>The WHO has published a foundational document that describes the process water suppliers must follow in order to ensure that a WSP is planned and implemented properly (Davison et al., 2005). These steps are illustrated in Figure 2 and have been summarized as follows (Godfrey and Howard, 2004). In order to develop a WSP, a water supplier must:<br>• Assemble a team that understands the water supply system and its capability to meet the water quality targets<br>• Identify where contamination could arise within the water supply, and how it could be controlled<br>• Validate the methods employed to control hazards<br>• Establish both a monitoring system to check that safe water is consistently supplied and agree to corrective actions in the case of deviation outside acceptable limits<br>• Periodically verify that the WSP is being implemented correctly and is achieving the performance required to meet the water safety targets<br><br><br>Figure 2: Steps in the development of a WSP (adapted from Davison et al., 2005) |
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Implementation assumptions, How the technology will be implemented and diffused across the subsector?	The WSP design team must have a sound understanding of the catchment area, treatment facilities, and distribution networks that make up a water supply system. These components must be mapped and characterized in order for the system's capability to meet water quality targets to be fully understood and for control measures to be developed. This may require in-depth assessment of the water supply chain, as some information may be unknown prior to development of the WSP. It is also important that WSP designers and stakeholders understand how water quality affects health in order for appropriate limits on specific water quality parameters to be set. This requires basic knowledge of sampling and monitoring techniques as described in the GDWQ. Furthermore, the members of the design team must have a working knowledge of the corrective actions that should be taken when water quality deviates outside acceptable limits. The WSP design team must understand how the implementation of a WSP will affect pre-existing water sector arrangements in order to facilitate cooperation among all stakeholders. This may require a review of the current organizational and institutional structure in order to establish which entities have a vested interest in or responsibility for water safety. The institutional and organizational requirements of a WSP are related primarily to personnel needs. The first step in planning a WSP is to set-up a steering group that is composed of members from varied professional backgrounds. This interdisciplinary team will be responsible for gathering the background information required to plan a WSP and for developing its components. The steering group should include engineers, water quality managers, academics, planners, surveyors, sociologists and health scientists (Godfrey and Howard, 2004). In addition to the steering group, it should be made clear which entities or individuals are responsible for carrying-out operational monitoring, for documenting and reporting monitoring results, for taking corrective action when necessary, for performing operational audits, and for certifying and validating the risk assessment plan. In order for the implementation of a WSP to be successful, it is also important that all stakeholders buy into the process. While representation of all stakeholder entities on the steering group will help to encourage cooperation, some cases may require additional effort from WSP designers to foster an environment of acceptance and trust. Strategies for

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| **Costs** | The implementation of a WSP will potentially require water suppliers to increase sampling frequency and number of locations where process indicators (such as turbidity, chlorine, residuals, pH, etc.) are monitored. However, the amount of required microbiological tests will also decrease significantly. In fact, it is likely that the cost of providing and distributing safe water from a risk-based approach will actually be less than from a traditional end-product monitoring approach (Davison et al., 2005). This is especially true in developing countries, where consumables required for coliform and other microbiological testing are expensive and where a high percentage of monitoring funds are spent on field test kits or maintaining expensive certified laboratories. Even in cases where the equipment required for on-line monitoring must be purchased, the recurrent cost savings of using process indicators for monitoring instead of microbiological indicators is almost certain to outweigh the initial capital investment.<br>The WSP approach can also result in long-term decreased institutional costs. In general, the planning process identifies opportunities for low-cost improvements on operations and management practices. However, WSPs also improve the efficiency of communication and collaboration between water providers, consumers, regulatory authorities and the commercial, environmental and health sectors. This creates an enabling environment where financial support can be leveraged and where capital improvement needs can be prioritized and sustained (PAHO et al., 2010) |
| **Country social development priorities** | • Growth and Sustainable Development Strategy for Belize, 2015 (Draft).<br>One of the conditions to achieving the goal of the Growth and sustainable Development Strategy is to coordinate the efforts of various ministries to invest in adequate infrastructure, including water, in order to expand the production of goods and services. Infrastructure development planning will consider sector development needs as well as community participation. One of the long-term goals is to ensure universal access to potable water. |
| **Country economic development priorities – economic benefits** | • Integrated Water Resources Management Policy 2015.<br>WSPs can make a significant contribution to economic development by reducing the burden of waterborne illness in resource-limited settings.<br>Climactic events that are expected to affect the availability of national water resources have created the need for improved management of our water resources. Measures have to be applied now to build resilience against scarcity and degradation of the resources. . |
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| **Country environmental development priorities --environmental benefits** | • National Adaptation Strategy to Address Climate Change in the Water Sector 2009<br>• National Integrated Water Resources Management Policy -2008<br>• The National Integrated Water Resources Act-2010<br>1. Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment;<br>2. Access to safe drinking water is a fundamental right of all Belizeans;<br>3. Water basins and their linkages to the marine environment are the basic functional units for achieving Integrated Water Resources Management (IWRM);<br>4. Integrated Water Resources Management (IWRM) is paramount to the socio-economic development of Belize;<br>5. Water resources are vested in the state and require stewardship;<br>6. Users and polluters should pay. |
| **Social benefits** | The WSP approach can ensure that water quality is maintained in almost any context and as a result contribute to the livelihood of the users. |
| **Other considerations and priorities(such as market potential)** | This should address issues regulating the use of ground and surface waters across all sectors of Belize, inclusive of commercial and industrial use. |
| **Capital costs (per facility)** | With the endorsement of the Policy, and legislation of the Act, the next steps include development and promulgation of regulations, educational programmes to encourage buy-in to the policy and regulations, and subsequent enforcement. Enforcement will require additional human resources, training, and equipment. These activities will incur costs estimated at US$1,250,000 (Source: Public Utilities Commission) |
| **Operational and Maintenance costs (per facility)** | Low or minimal. Except for replacement of equipment.<br>US $82,500 and US $550,000 (Source: Public Utilities Commission) |
| **Daily supply capacity per facility** | Daily supply of water is secured for all users through monitoring and management. |
| **Up scaling potential** | Low. Water safety plans are generally applied at the national level. |
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