Knowledge Broker Support Program

Volume 2 – Knowledge Broker Tools – Water risk module

The Knowledge Broker Support Program (KBSP) was funded by the Australian Department of Foreign Affairs and Trade, through the Australia Pacific Climate Partnership.

CSIRO Australia's National Science Agency

Citation

Cosijn, M., Meharg, S. Grigg, N., Busilacchi, S., Barbour, E., Nadelko, A., Skewes, T., Hayes, D., Dutra, L.X.C., van Putten, I., Taboada, M.B., Laka, J., Konia, R., Souter, R., Anisi, A., Teava, B., Petsakibo, E., and Butler, J.R.A., 2023, Knowledge Broker Support Program Volume 2 – Knowledge Broker Tools, CSIRO, Canberra, 92 pp.

Cover photo: Knowledge broker in action. Photo by Tom Greenwood, 2017. Photo below by Seona Meharg.

Water risk

This module is structured around three key messages for knowledge brokers:

- **A systems approach to managing water helps us understand both the natural system and how people interact with it. Working collaboratively to build trust and shared understanding supports collective actions for managing water systems.**
- **Quantitative information, such as data and models, is both powerful and has limitations when managing water systems.**
- **Understanding existing and future water risks helps inform better actions now.**

This module includes:

Why water?

Understanding water systems is essential to our very existence. Managing water requires a balance between living with natural forces and taking action to reduce our risk to hazards such as cyclones, storm surge, landslides, or a lack of adequate, accessible, and safe water.

It also typically involves trade-offs with conflicting objectives. Knowledge brokers are needed to support the understanding of water systems and help stakeholders negotiate for a better outcome.

Ensuring the resilience of water systems is needed now to better withstand the impact of future risks such as climate change. The pressure for development continues with issues such as logging, population growth, and infrastructure development, all of which impact our water systems.

Like climate adaptation, water issues are examples of 'wicked problems' because there are so many uncertainties and no single solution. By understanding and communicating uncertainty well, you can find ways to make wise decisions despite large uncertainties.

Water systems

Water systems are about both the natural environment and people.

We often only think of water in terms of how we directly interact with it – such as getting it from a tap, needing it for agriculture, or being impacted by a flood. However, to understand how water reaches or affects us, we need to understand where it comes from and how it reaches us.

Given that water systems are being managed for people, it's important to understand how people interact with water. The problem may not be physical, such as too much or too little rain, but a social, political, or economic one that dictates how water is managed. We need to understand what drivers impact water availability, such as logging, population pressure, climate change and infrastructure.

https://www.waterforwomenfund.org/en/news/resources/PLANPNG_WFW341_SurfaceWater-A1-poster.pdf

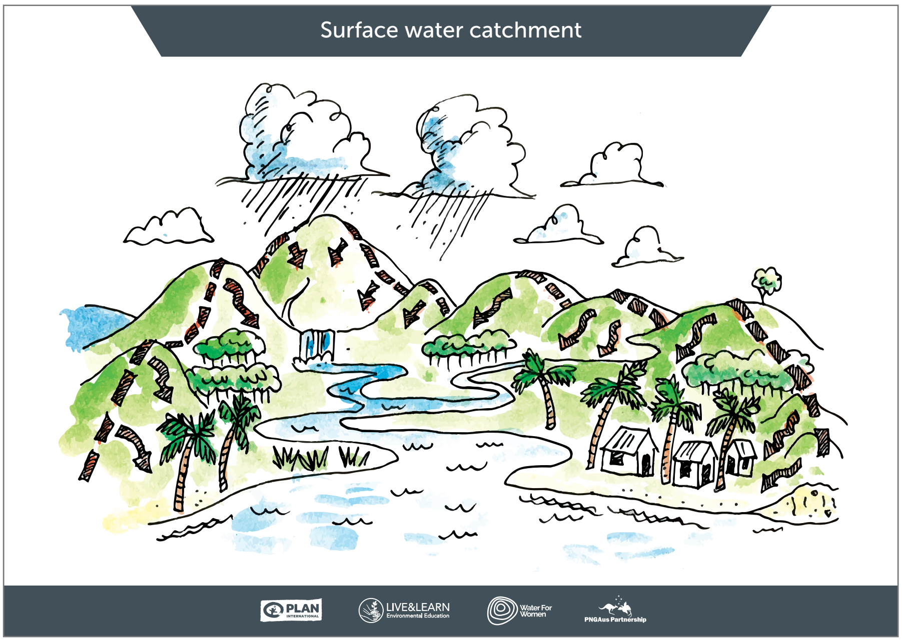

Figure 13 Surface water catchment. Source: Water for Women

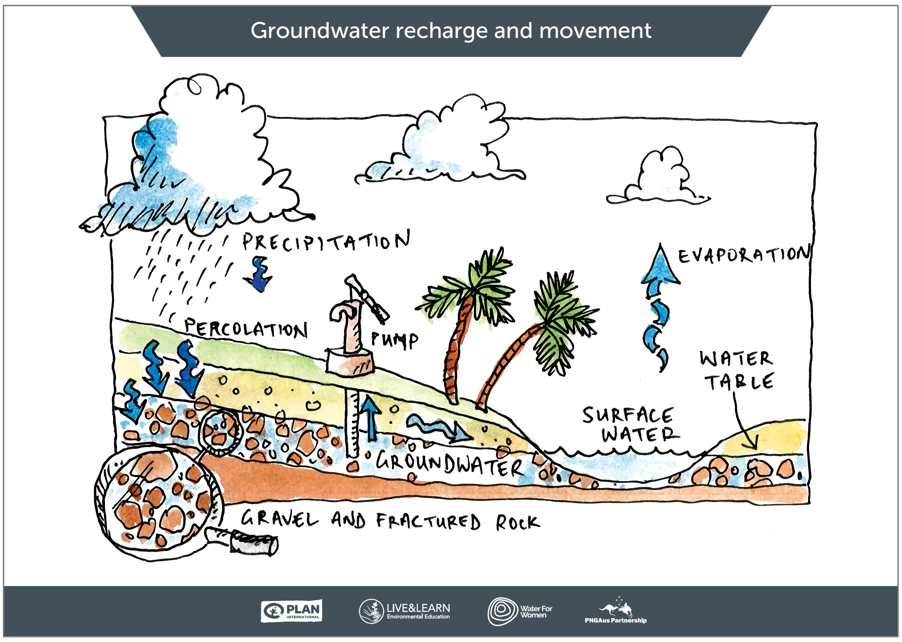

Figure 14 Ground water recharge and movement. Source: Water for Women

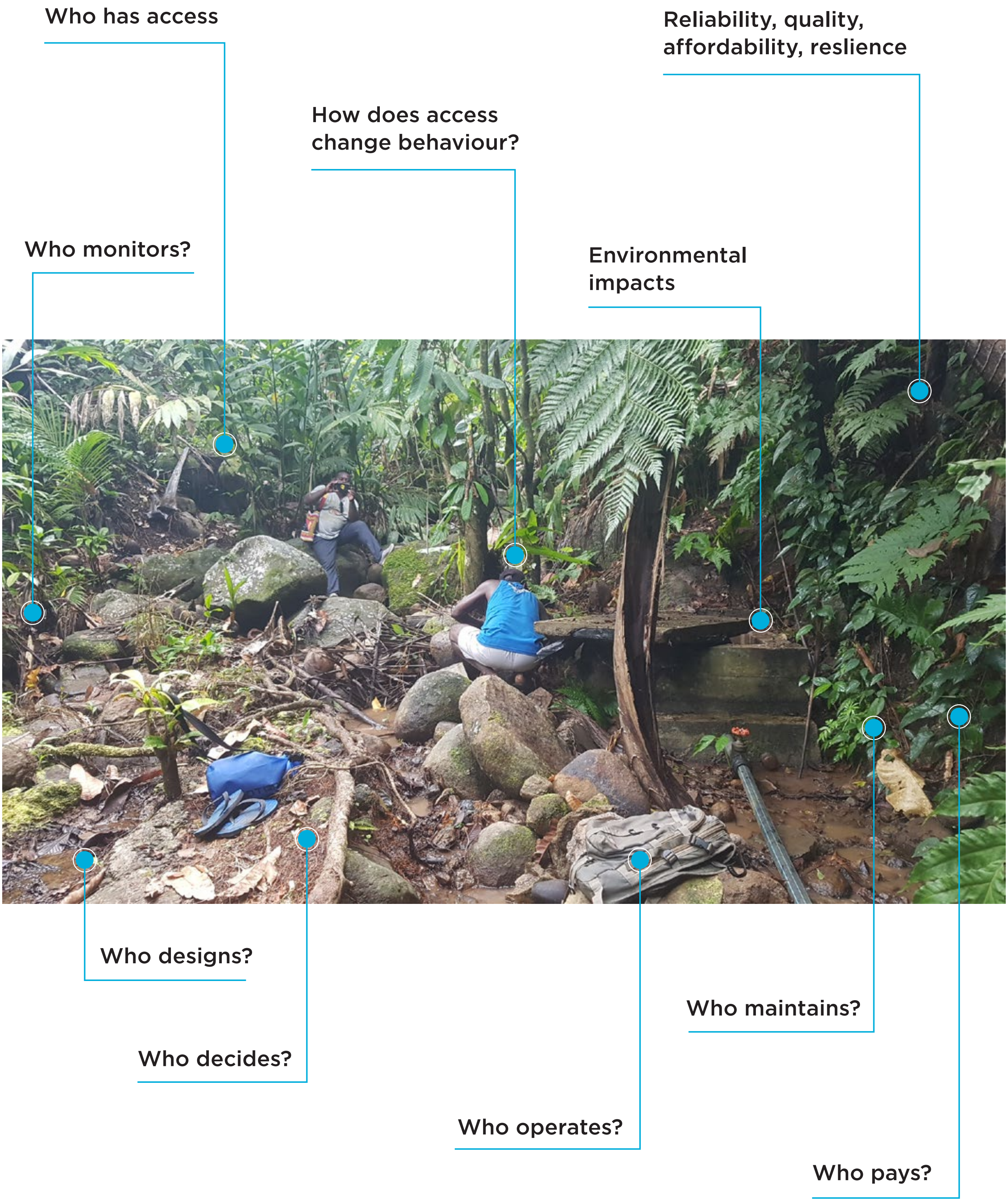

Figure 15 Aspects to consider in Water Management (CSIRO)
Photo by Brendon Teava, Live and Learn, Solomon Islands

Water systems in the Solomon Islands

In the Solomon Islands, water is often collected in protected or unprotected storages.

An example of a protected storage is a "spring box" – an enclosed storage tank that collects shallow groundwater. Water then flows through a pipeline to tap-stands.

Not everyone has equal access to the tap stand. Some women live further away, making access harder. Pressure can be lower at the end of the system due to design and leakage. A growing population can also put pressure on the system.

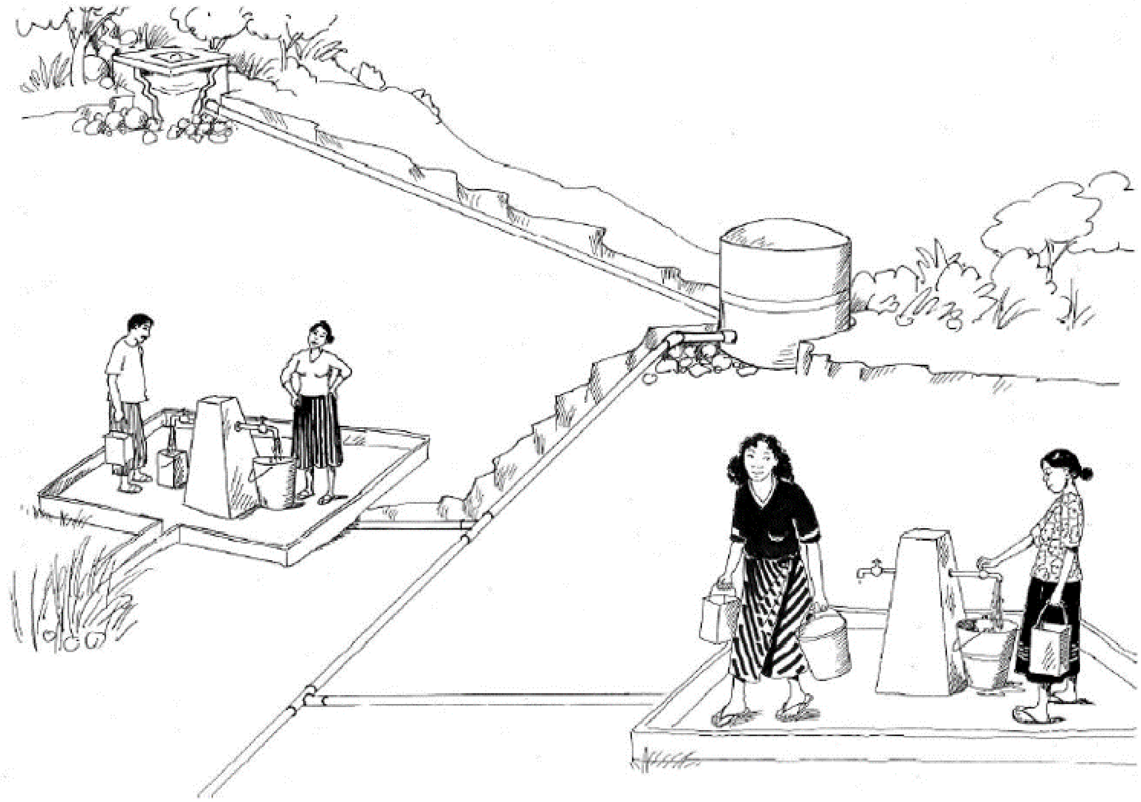

Figure 16 Protected water storage – spring box. Adapted from: The Solomon Islands Rural WASH Community Engagement Guidelines. Caretaker's Manual. Rural WASH Programme, Environmental Health Division, Ministry of Health & Medical Services. August 2020.

QUESTION – In a water system you are familiar with, is the main challenge one of natural resources (e.g. too much or too little rainfall) or a human one?

What is a water balance?

A water balance calculates the amount of water available in different parts of the water system, and compares this with the amount of water used by people and the environment.

Not all precipitation (rainfall) reaches the village. Rainfall may become surface runoff, groundwater, or leave the system as evapotranspiration.

A water balance can be quantitative, where we estimate the amount of water, or it can be qualitative – where we focus on how water moves through the system. This section explores a water balance tool that can help you understand different parts of the physical components of the water system.

As knowledge brokers, this tool will help you to:

1. **Understand how the water system works and is connected.**
2. **Identify the main issues and sources of uncertainty.**

A water balance helps to manage water now and plan for the future.

Understanding different amounts of water in the system can help you work with communities so they can understand what the key challenges are.

The challenge for knowledge brokers is how to take this type of information and translate it in a way that supports decision making in communities.

In this example, only a proportion of the total rainfall over the catchment ends up as surface runoff, flowing down the slopes and through the forest. It may end up in creeks, rivers, and the sea. Some rainfall will also infiltrate the soil and may end up in shallow or deep underground storages (aquifers).

While we will not use quantitative estimates in this course, we can use similar demonstrations using buckets or rainwater tanks to illustrate to community members how the amount of water changes through the system.

Working with communities. Photo: Enif Petsakibo, Live and Learn Solomon Islands

Estimating water balance requires the following steps

STEP 1: Understand the catchment

STEP 2: Estimate water availability

STEP 3: Estimate water use

STEP 4: Risk and future change

Once you have undertaken a water balance assessment to better understand the existing system and potential future risks, you can also use a Water Risk Action Plan such as that used in the Community-based Water Security Improvement Planning Project (*Gud wata plan blong iumi*) to help identify how to remove, mitigate, or reduce vulnerability to these risks.

This module also covers how to undertake a Water Risk Action Plan.

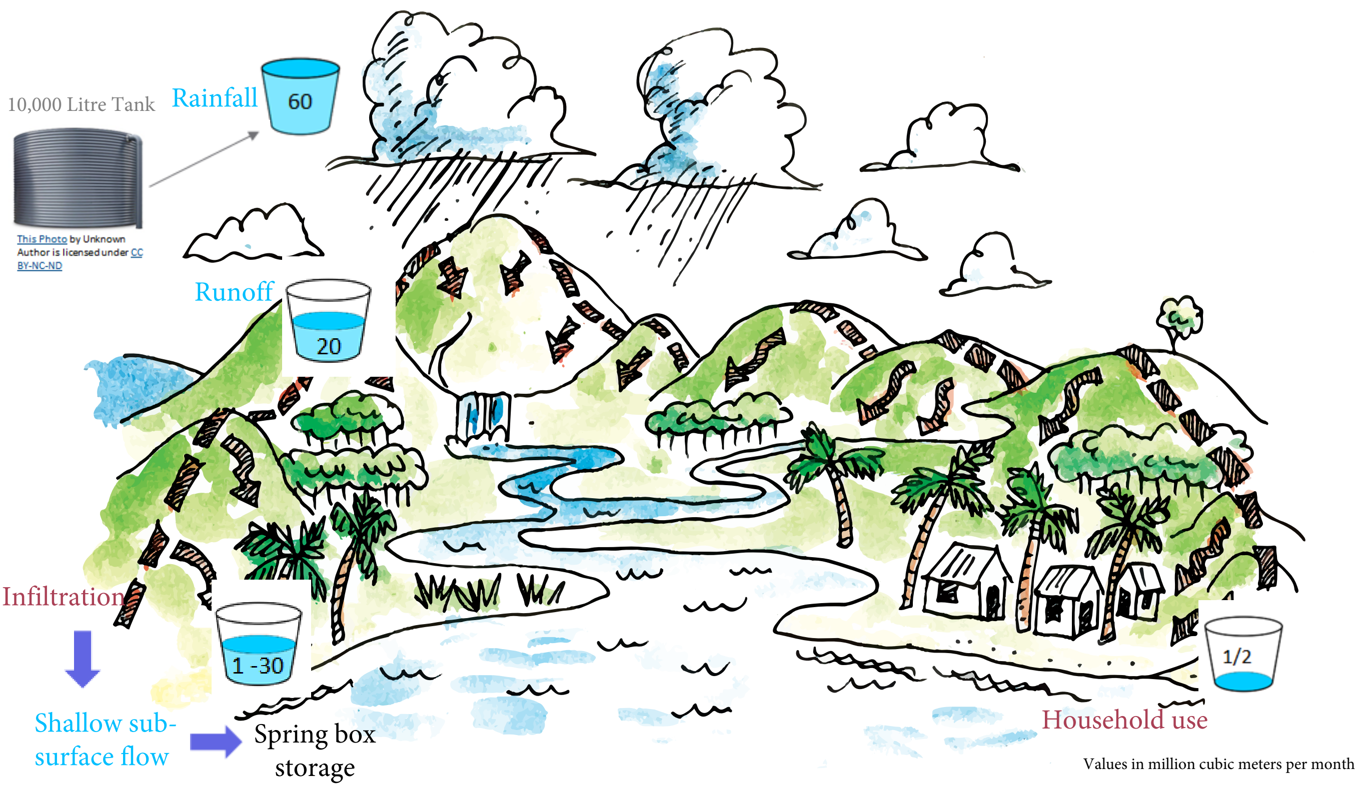

Figure 17 Estimating the amount of water. Source: Water for Women, Live and Learn Environmental Education and Plan International. Artwork adapted by Manuela Taboada, Queensland University of Technology

STEP 1 – Understanding the catchment

Anything that happens in the catchment can affect the water quantity and quality, such as land clearing for logging.

It is helpful to know the catchment area (so we know the total amount of water) to understand what happens to rainfall once it falls on the catchment; this includes the slope and land cover as:

- There is generally higher surface runoff when the slope is steeper and with less vegetation.
- A less steep slope with more vegetation and forest typically means more infiltration.

More surface runoff with less vegetation can result in erosion or washing away of the topsoil and chemicals from the land, which can pollute water sources, such as unprotected rivers and wells, and increase the risk of flooding.

Figure 18 Understanding the catchment area. Credit: Anthony Nadelko, CSIRO

STEP 2 – Estimating surface water availability

To understand surface water availability, you need to know two key pieces of information:

- rainfall
- loss across the catchment.

When looking at rainfall, we want to think about how much there is and how variable it is. We can ask questions such as:

- How often does it rain?
- How often does it flood?
- How often is it really dry with no rain or not enough rain?
- How does it change during the year?
- How does it change between years?

Loss across catchment

Once you have the amount of water falling over the catchment, you can estimate how much of this is either 'lost' from the catchment, infiltrates into the ground, or ends up as surface runoff.

Rain falls from the sky where it may fall onto trees, grass, bare soil, or paved surfaces. Only a proportion of this rain reaches the ground to flow over the surface or soak into the ground and become groundwater. Trees may intercept this rain and stop it from reaching the ground. Plants may also use this water to grow, or it may evaporate back to the sky.

This can be discussed in the context of the catchment – as you saw earlier, more water becomes surface runoff if the catchment has a steep slope, and has bare, clay soil, compared with a catchment that has a gentle slope, lots of vegetation, and/or more sandy soil.

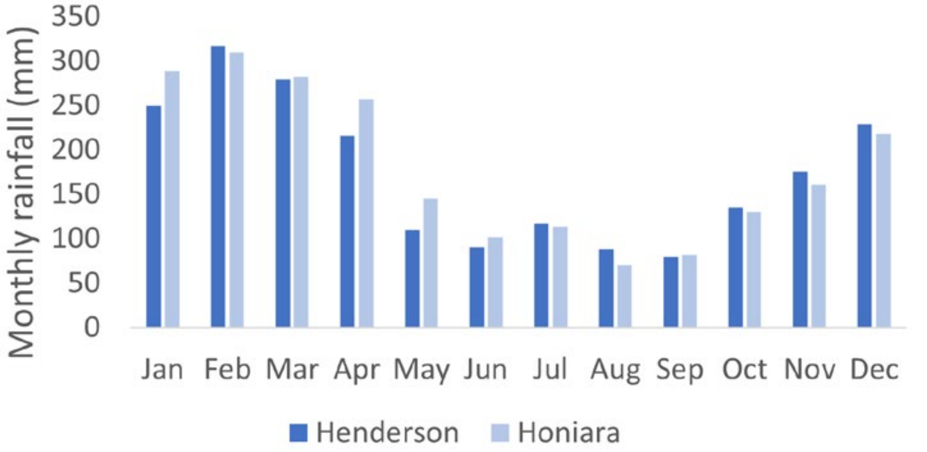

Figure 19 Examples of observed monthly rainfall data showing less rain in the middle of the year

STEP 3 – Estimating water use

This module does not look at methods to estimate water use but it is based on number of people within the catchment using the water, how much they use at a household level and what activities exist in the catchment that use water (e.g. crop irrigation, industrial activities etc). You may need a specialist to assist you.

STEP 4 – Risk and Future Change

Determining water risk

After examining how water moves through a catchment to understand water availability, we can then look at water risk. Exploring risk helps understand what potential hazards exist, the likelihood of them occurring, and the potential impact if they did occur. These hazards could be due to natural events like floods or human, such as a leaking pipe.

Risk assessments help identify and manage these risks. They can be existing risks, such as an unprotected drinking water source, or future risks, such as a changing climate or land clearing.

Actual risks can be different from perceived risks. This matters because the impacts of a hazard like a cyclone are greatly influenced by the nature of the hazard and the social, political, and economic decisions that shape our exposure and vulnerability to it.

In the context of climate change, the Intergovernmental Panel on Climate Change (IPCC) defines "risk" as "the potential for adverse consequences where something of value is at stake & where the occurrence and degree of an outcome is uncertain." Adverse consequences can arise directly from climate hazards themselves and from responses to that hazard.

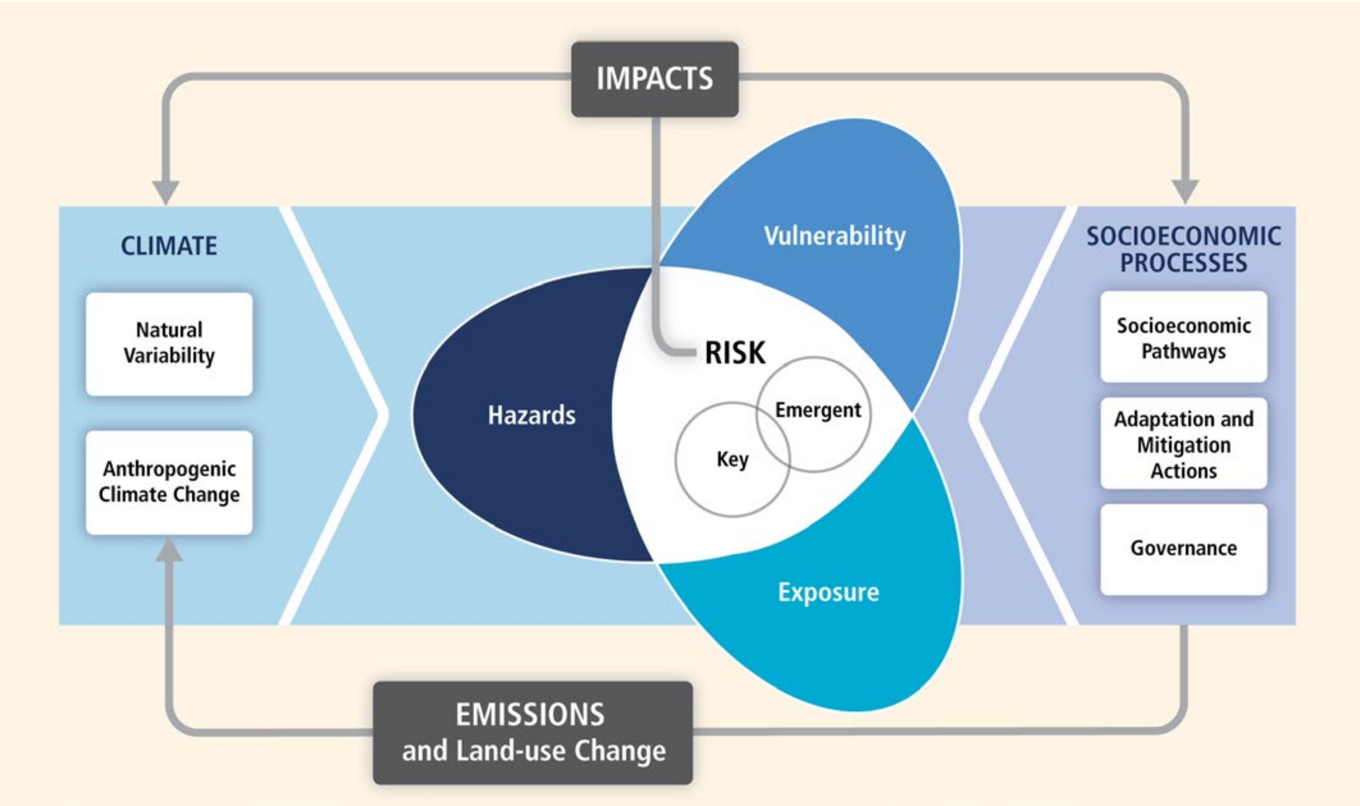

Figure 20 Risk the potential for adverse consequences where something of value is at stake and the occurrence and degree of an outcome is uncertain. Figure 19-1 from **Oppenheimer, M., M. Campos, R. Warren, J. Birkmann, G. Luber, B.C. O'Neill, and K. Takahashi, 2014: Emergent risks and key vulnerabilities. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1039-1099.**

Sea wall Image credit: Seona Meharg

SEA WALL EXAMPLE

For example, a policy to build sea walls in anticipation of sea level rise could have adverse consequences and cascading impacts because sea walls are expensive and have other impacts on the local environment. Adverse consequences can be on lives, livelihoods, health and well-being, ecosystems, economic, social and cultural assets, services (including ecosystem services), and infrastructure.

For example, sea walls may cause waterlogging behind the wall as they trap rainfall leading to health hazard of standing water including malaria and water borne diseases. They can also cause erosion in surrounding areas or be inadequately maintained, leading to structural failure.

To navigate these risks, it is important to explore not only the existing risks but to identify potential risks that may occur in the future as a result of the intervention.

We don’t know exactly what the future will look like, but we can ask

- What changes might happen?
- Where, when, and how might we be exposed to hazards (such as flooding)?
- What makes us more vulnerable if we are exposed? (E.g. children, elderly people, people with a disability cannot evacuate as quickly.
- What changes would we like to have happen?
- What can we do now to implement desirable changes and manage changes that we don’t want?
- Who would need to implement these? What do we have control over, and what don’t we control?

Many factors are driving and influencing change in water systems, and the interactions between them will ultimately determine the accessibility, affordability, reliability and quality of water for people.

The image below shows how some of these interactions may play out in the system.

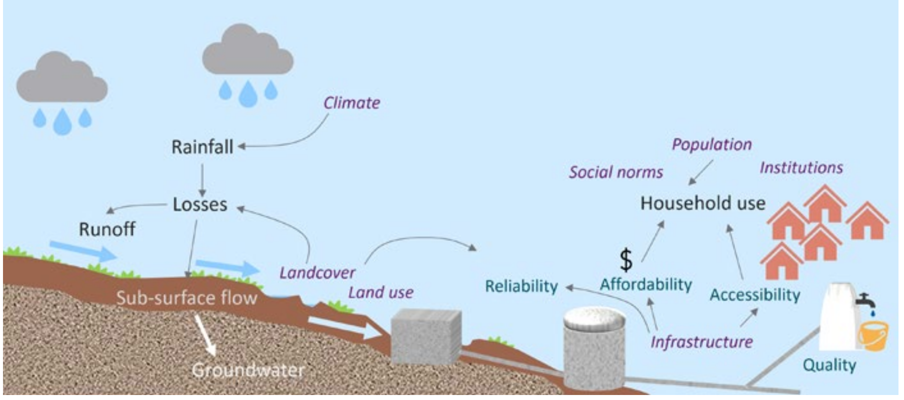

Figure 21 Risks and drivers

Climate change and water systems

Discussing the water balance with a community can help build shared awareness of future water availability and use issues.

To explore future water availability, we can draw on available information on future climate projections (see the module on Climate Information).

Using this information, discussions can be held with the community to explore different possible futures, and what “low regrets” actions they could take now that would be helpful in any future. You can use the Community Adaptation Pathways tool to help facilitate this by asking questions identifying community adaptive capacity strengths and weaknesses. You can then build on the strengths to create low-regrets strategies that benefit the community in any future.

These questions could include:

- How might livelihoods be impacted by future changes in your catchment, water supply, and waste systems?
- When have there been floods, droughts or other extreme climate events in the past? What impacts have these had on your water systems? What has helped people cope and recover from these impacts?
- If it is wetter in the future and flooding increased, what are the likely impacts to existing and planned infrastructure? Should any new infrastructure be built in places with lower flood risk?
- If more land was cleared, what would the impact be for runoff when it does rain heavily?
- What adaptive capacity strengths can support future planning?

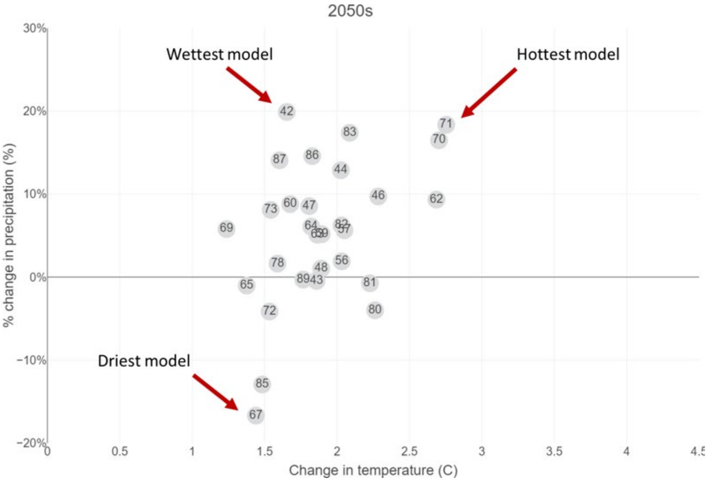

Figure 22 Guadalcanal 2050 projections

Developing future scenarios

If there is the opportunity to work with specialists, a quantitative water balance model can also help to explore how the system may change in the future due to changes such as climate, as well as due to many other types of changes such as land use or logging.

Once you know more about how different parts of the water system are impacted, you can start exploring which risks are due to the natural water system – such as too much or too little rain – and which risks relate to how the water system is managed. For example, what could it mean for decisions being made in the Water and Sanitation Health (WASH) sector?

The **Water Risk Action Plan** tool developed by the International Water Centre, Plan International, and Live and Learn can also assist in identifying risks and strategies for managing these.

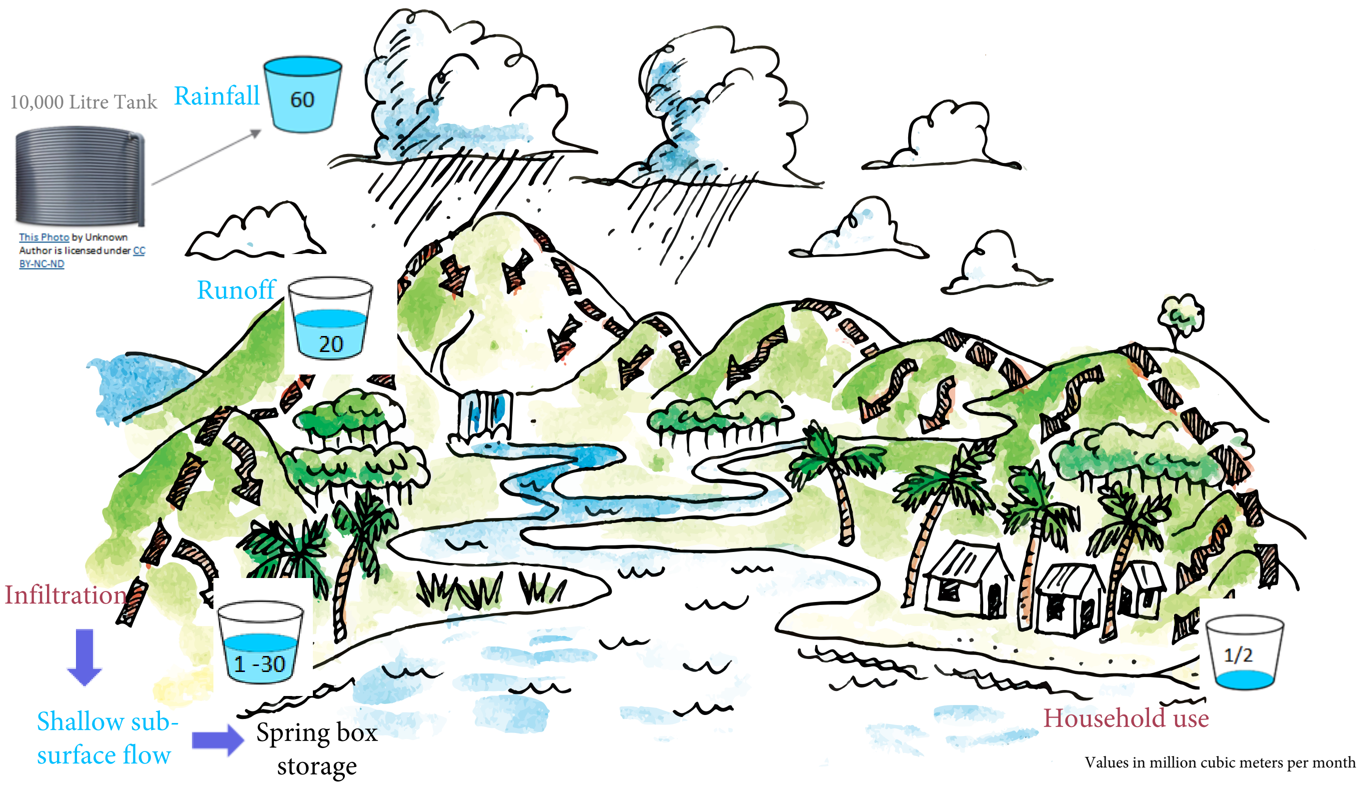

Figure 23 Water balance model. Source: Live and Learn Environmental Education and Plan International.
Artwork adapted by Manuela Taboada, Queensland University of Technology

TOOL: Developing a water risk action plan

An Action Plan can be used with communities to identify what actions need to be undertaken, by whom, and when to address identified existing and future hazards.

Live & Learn Environmental Education and Plan International have been trailing and implementing an Action Plan developed in collaboration with the International Water Centre (Griffith University) through the Water for Women Community-based Water Security Improvement Planning project in the Solomon Islands. The process has been implemented for existing hazards and will soon be trialled for future hazards.

Key steps in the water risk and management approach by the Water for Women Project are:

STEP 1 – Identify risks and hazards to community water systems.

STEP 2 – Identify control and mitigation measures for risks and hazards.

STEP 3 – Develop an Action Plan.

STEP 1 – Identify risks and hazards to community water systems

Assessing the risks to a water system can enable village resources to be prioritised to address hazards that have the biggest impacts.

In Solomon Islands villages, representatives from each zone within the community facilitated conversations within their own household settings. Conversations identified the main drinking water sources and access points, and any water-related issues experienced by people.

In assessing the risk in water systems, the team assessed the severity, likelihood, exposure and vulnerability to a range of risks.

Working with zones – male, female, youth and older representatives from zones encourage all water experiences to be recognised and addressed. (Cret: Regina Souter, IWC)

Explanation of severity, likelihood and exposure level

1. **Severity** is how serious (bad) the effects of this hazard are (e.g. could they cause death or are they less severe). Levels of severity are categorised as high, medium or low.
2. **Likelihood** and exposure of how likely a hazard is to happen and how many people be affected. Levels of likelihood are categorised as high, medium or low.

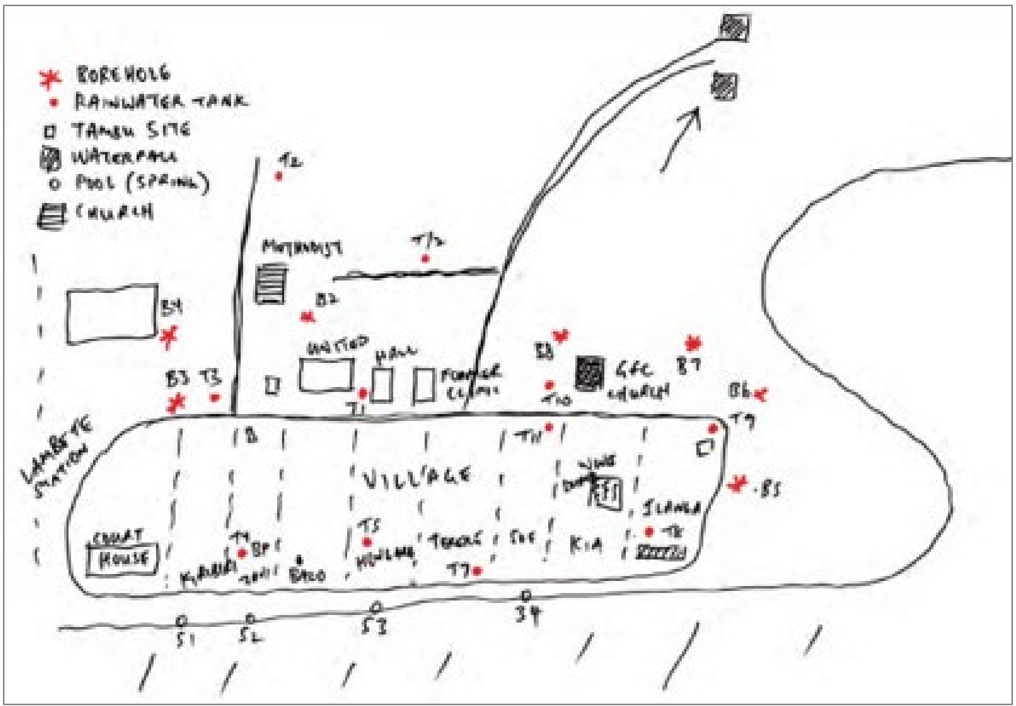

Figure 24 Example of a village map drawn by village members, showing main village landmarks (roads, churches, etc), main water sources and zones. (Image from: Regina Souter, IWC)

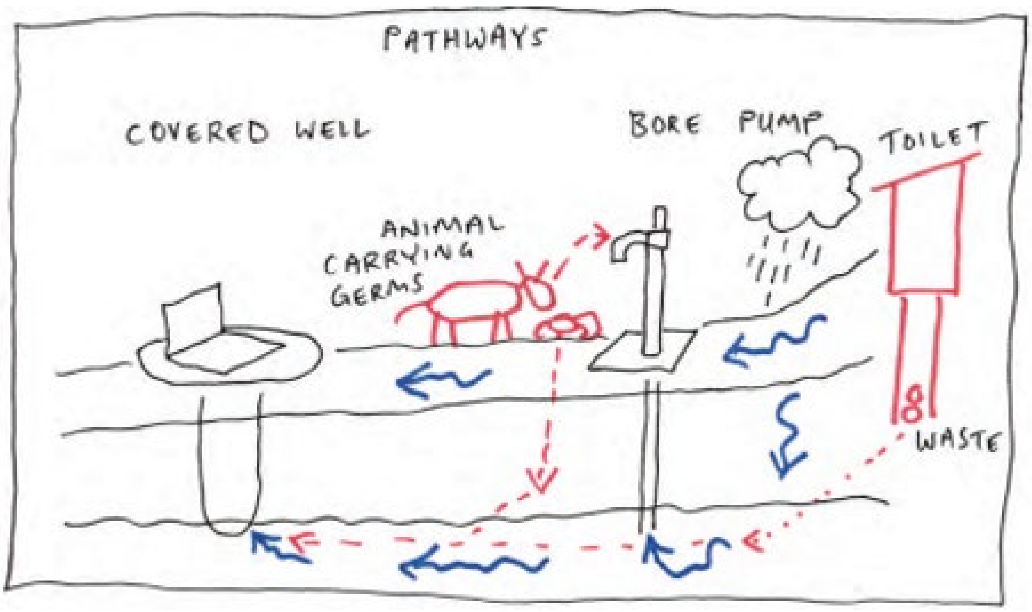

Figure 25 Water pathways – how water moves through the environment. (Image from: Regina Souter, IWC)

LIKELIHOOD AND EXPOSURE	SEVERITY		
	Low	**Medium**	**High**
High	Medium	High	Urgent
Medium	Low	Medium	High
Low	Low	Low	Medium

Figure 26 Risk assessments often consider the likelihood and exposure of the risk, along with the severity

STEP 2 – Identify control and mitigation measures

Following hazard identification, the next process of the water risks session is focused on what control and mitigation strategies could be applied.

A key question asked is ***'what can be done to remove the hazard, or reduce exposure and vulnerability to the hazard'?***

This provides an opportunity for the zonal representatives and their households to deliberate and discusses ways to remove hazards or to reduce exposure and vulnerability to hazards that cannot be removed.

An unprotected water source in one of the communities in the Solomon Islands. Unprotected water catchments have a high likelihood of contamination by people, animals, or vegetation debris. Image credit: Water for Women, Solomon Islands

An enclosed storage tank with a pipe that transports water to the village. Water is collected in a spring box and then piped into a storage tank. These types of structures are typical in most of the project communities. Image credit: Water for Women, Solomon Islands

A ferro-cement water storage used by the local communities. Project officers along with zone representatives, conduct physical checks on community water sources and storage. All information feeds into the risk and hazard identification process and feedback from zone representatives to households. Image credit: Water for Women, Solomon Islands

STEP 3 – Develop an action plan

The culmination of this activity is a facilitated process for the community to develop their own Action Plan. Through the risks and hazards identification process, zone representatives facilitate detailed conversations within their own zones.

A combined meeting is held with all four zonal representatives. Each zone representative shares their own zones risks and issues with the broader group. This information is then put into a table in the Action Plan, where the details are clearly specified.

Care is taken to make sure that clear language or imagery is used in the action plan so that it is accessible to all, regardless of literacy level.

Through this process, the community can discuss controls and how to implement them.

The action plan consists of three parts:

- **Part 1: Create a table** to capture the following (based on the results from the community meeting).
- **Part 2: Get SMART** (Specific, Measurable, Achievable, Realistic and Timely) goals.
- **Part 3: Create a table** expected change to capture how change to water management will happen.

After these components are outlined, the project leaders will share back with the community, contact authorities and/or define roles for implementation.

Why community members may not bring up issues?

Most times, water hazards and problems are known and acknowledged by the communities themselves. However, they are not brought up through their various meeting channels for a number of reasons, including:

- They don't feel empowered;
- There may not have been an open invitation for other gender groups and age groups to participate (e.g. women and girls or youths).
- Concerns about raising contentious issues such as logging or open defecation may exist.

This communication challenges make it very difficult for communities to collectively sit and deliberate on how to solve their community problems, such as water risks and how to go about it.

Community based water security improvement planning process allows a space for this open dialogue to occur.

Part 1: Create a table

Create a table to capture the following:

- What action is needed to mitigate and manage the risks and hazards (i.e. what we will do?)
- Who will do it (i.e. who will lead this action?)
- Timeframes (i.e. when to start and expected time to complete?)
- Resources (i.e. what money, skills are required to achieve / solve this issue?)

ACTION	WHO IS RESPONSIBLE	WHEN? START – COMPLETE	RESOURCE NEEDED

Part 2: SMART Goals

Participants are then encouraged to outline SMART goals. SMART stands for Specific, Measurable, Achievable, Realistic and Timely.

It is important to acknowledge that not everything will work according to plan.

Everyone has to remain flexible and adaptable as the agreed plan changes.

GOALS	ACTION	WHO IS RESPONSIBLE	WHEN? START – COMPLETE	RESOURCE NEEDED

Part 3: Expected change

An expected change component is incorporated into the plan to make it clear how changes will happen.

GOALS	EXPECTED CHANGE	ACTION	WHO IS RESPONS-IBLE	WHEN? START – COMPLETE	RESOURCE NEEDED

References and additional materials

If you would like to watch a YouTube video on this module, please see https://www.youtube.com/playlist?list=PLa3eWR75XNLzLG6Pq_raFTTsnexGzDiZm

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Acknowledgements

Emily Barbour (CSIRO): research scientist in hydrology. Emily works on a diverse range of water issues focusing on collaboratively generating knowledge and tools to support decision making for complex environmental challenges.

Nicky Grigg (CSIRO): research scientist who works in interdisciplinary teams on a diverse range of projects concerned with global change and social-ecological systems.

Angellah Anisi (Plan International): Project Manager for the Water for Women program in the Solomon Islands.

Brendon Teava and Enif Petsakibo (Live and Learn): Project Officers for the Live and Learn WASH Project for Water for Women Solomon Islands.

The team would also like to acknowledge contributions from the following people, who helped inform the material included here:

- **Anthony Nadelko (CSIRO)**
- **Donna Hayes (CSIRO)**
- **Tom Rankin (Plan International)**
- **Regina Souter (IWC)**
- **James Butler (CSIRO)**
- **Michelle Abel (Live and Learn)**
- **Mark Love (IWC).**


3. EGS-COWBe importance
What is the importance of each EGS to the 4 CoWBe
Income
Health
Food security
Social cohesion

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