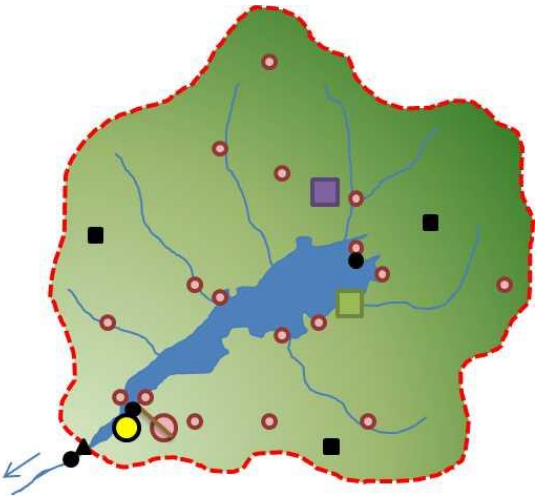
THE REPUBLIC OF UGANDA

Ministry of Water and Environment

FRAMEWORK AND GUIDELINES FOR WATER SOURCE PROTECTION

Volume 5: Guidelines for Protecting Water Sources for Hydroelectric Power Plants



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May 2013

Guidelines for Protecting Water Sources for Hydroelectric Power Plants

Introduction

The Water Sources Protection Guidelines for Hydroelectric power plants describe steps to follow to prepare a Water Source Protection Plan. The description in this Volume is derived from the overall Framework for Water Sources Protection Guidelines (Volume 1). The document emphasises those steps, actions and considerations that are particularly relevant to protecting a water source for a small to medium sized hydroelectric scheme.

The Volume is intended to be a standalone document for ease of its application by those concerned with hydroelectric power plants. However, the user may wish to refer to Volume 1 where appropriate so as to ensure that the guidelines in this Volume are correctly interpreted in context of the overall framework for protecting water sources.

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Acronyms

CBO	Community Based Organisation
CLTS	Community-Led Total Sanitation
CMO	Catchment Management Organisation
DEA	Directorate of Environmental Affairs
DIM	District Implementation Manual
DWD	Directorate of Water Development
DWO	District Water Officers
DWRM	Directorate of Water Resource Management
EIA	Environmental Impact Assessment
FSSD	Forestry Sector Support Department
iNGO	International Non Governmental Organisation
IUCN	International Union for the Conservation of Nature
JAF	Joint Assessment Framework
JSR	Joint Sector Review
MoAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MoEMD	Ministry of Energy and Mineral Development
MoFPED	Ministry of Finance, Planning and Economic Development
MoLHUD	Ministry of Lands, Housing and Urban Development
MWE	Ministry of Water & Environment
NEMA	National Environmental Management Authority
NFA	National Forest Authority
NGO	Non-Governmental Organisation
NWSC	National Water and Sewerage Corporation
OPM	Office of the Prime Minister
T/P/WS	Threat-Pathway-Water Source model
TSU	Technical Support Unit
UWA	Uganda Wildlife Authority
WMZ	Water Management Zones
WRM	Water Resources Management
WSDF	Water and Sanitation Development Facility
WSPC	Water Source Protection Committee
WSPP	Water Source Protection Plan

Glossary

Water Source	For the purpose of these guidelines, a Water Source is a geographical point, or piece of infrastructure, where water is taken from the environment and used for a specific socio-economic purpose, such as water supply, agriculture or hydroelectricity generation.
Abstraction	Taking water from the environment, generally by motorised or manual pumping from a well, borehole, lake, river or spring.
Aquifer	Any body of water-bearing rock that is sufficiently porous and permeable that water can be taken, often from natural springs or from artificially drilled or dug wells or boreholes.
Contributor	A stakeholder that contributes to the development or implementation of a Water Source Protection Plan through facilitation, information sharing, financial or in-kind contributions.
Catchment/ Watershed / River Basin	A drainage basin or area of land from which surface water drains to a single exit point (usually a point on a river or the estuary where a river enters the sea). Where there is groundwater, the movement of water is generally more complex because groundwater drainage does not always follow the same pattern as the overlying topography. In this report 'Catchment' is used by preference but some the literature refers to 'watersheds' or 'river basins', which usually have the same meaning.
Control Measure	Actions that can be taken to protect a Water Source.
Hazard	The nature of problem arising from the Threat that can harm the Water Source.
Implementer	The organisation that is the primary user of these guidelines to prepare a Water Source Protection Plan. For new schemes this will be the developer organisation, for existing schemes it is likely to be the owner of an asset (for example a Water Authority who owns a pumping station or a power company that owns an hydro-electric scheme), or a proxy (for example a Water User Committee who manages a multi-purpose reservoir although ownership lies ultimately with MWE).
Pathway	The physical route through the environment by which a Threat affects a Water Source. For example, a fuel spillage from a petrol filling station could affect a Water Source through groundwater flow or a surface watercourse.
Piped Water Supply	A water supply system where water is delivered to the end user through a pipe network. This includes both gravity flows schemes fed by spring and pressurised pumped systems from boreholes or surface water.
Point Water Source	A water supply where the user collects the water from the water source (well, borehole with handpump or spring)
Risk	The likelihood, or probability, of a Hazard having an adverse impact on a Water Source.
Threat	An activity, process, built structure or natural feature that presents a potential threat to water quality, water quantity or reliability of water in the environment which is subsequently used by a Water Source. For example, a Petrol Filling Station is a Threat because if petrol or diesel gets into public water supply it will cause health problems.
End Water Users	The people who benefit from the Water Source through supply of drinking water, water for agriculture and livelihoods, water for fisheries, or water for energy production.

Acknowledgements

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1 Water Source Protection for Hydroelectric Power Plants

What is Water Source Protection?

The water that we pump from the environment is part of a global process called the Water Cycle (Figure 1) which deposits fresh water on the land, in the form of rain, which then flows over the surface of the land or through soil and rock in the ground. The quantity and quality of the water available for our water supply systems depends on having a healthy environment in our river catchments and aquifers.

Figure 1: Water Cycle

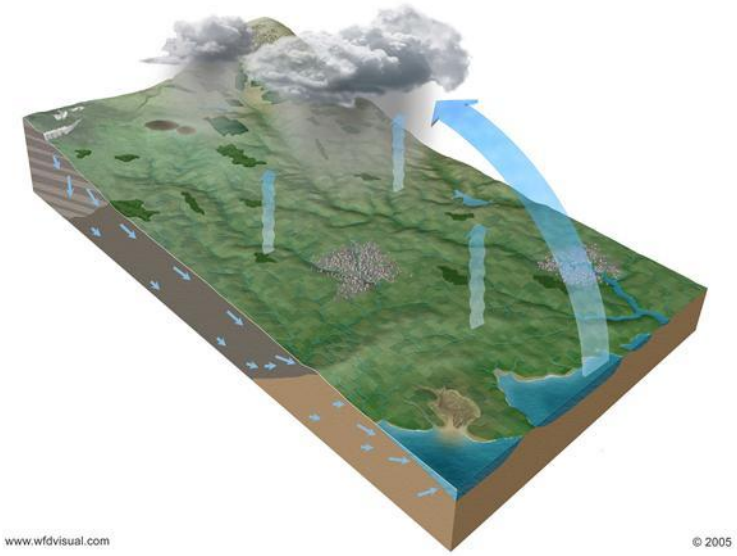
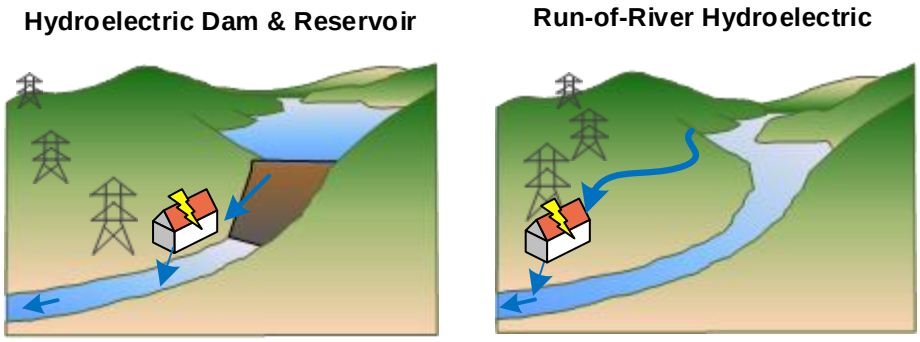


Figure 2 shows the two main types of hydroelectric powerplant found in Uganda. The first uses a dam across a valley to create a reliable pressure head to drive the turbines in the power plant just downstream of the dam. The second type is run-of-river, where flow is diverted from a river into a separate channel or pipeline and fed down-gradient to the turbine building before being released back into the main river channel.

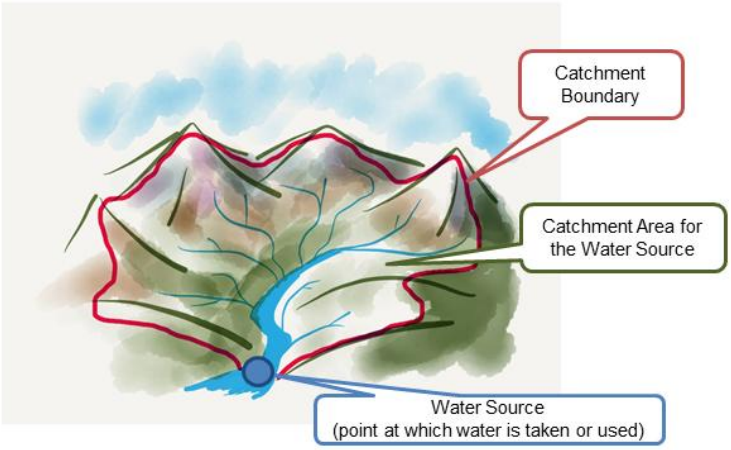
Figure 2: Common elements of Hydroelectric Power Plants



Water Source Protection is about working with others to maintain and improve the quality of the local water environment. Doing this not only maintains water quality, keeps water treatment costs down, but creates many other benefits for people and environment in the area.

A catchment is an area of land that drains to a specific point (Figure 3). For these Guidelines, a catchment is the area of land that drains water to the point on a river or in a reservoir from which a hydroelectric power station takes the water to generate electricity.

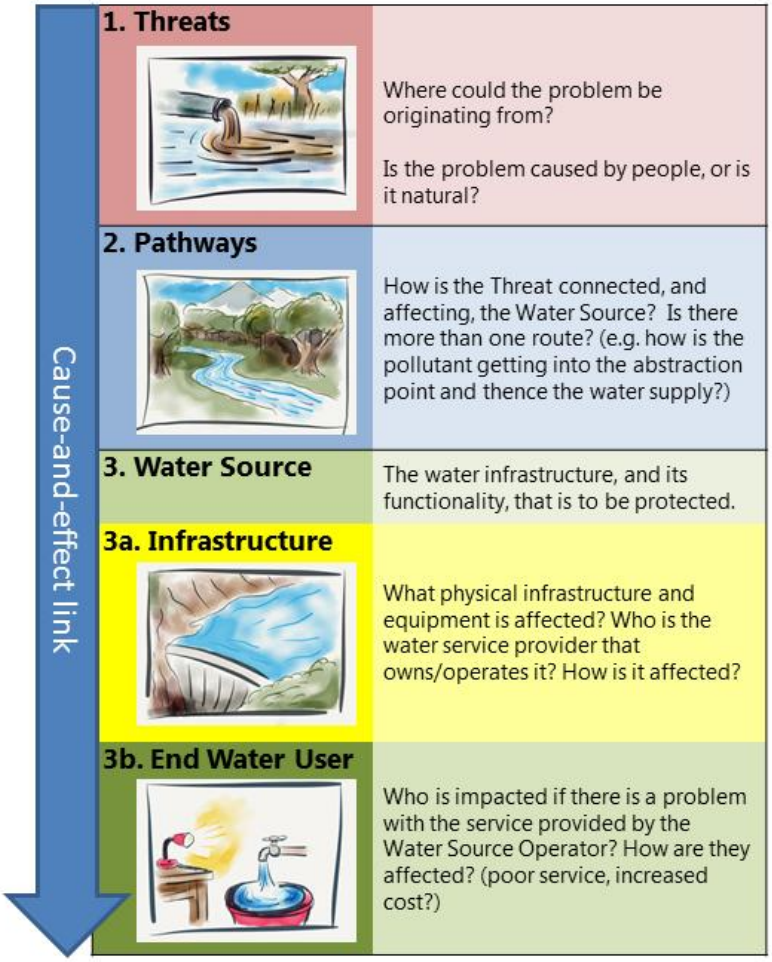
Figure 3: A catchment area (river example)



The quantity and quality of water reaching the Water Source will vary over time according to many natural and human factors. In trying to protect our Source, we must use an analytical model to establish links between cause and effect. For example, to show how a Water Source can be affected by the way farmers manage the land upstream.

To do this we use the concept of *'Threat-Pathway-Source'*. The parts of the model are summarised in Figure 4.

Figure 4: *Threat-Pathway-Water Source* model elements



What are the guidelines for?

These Water Source Protection Guidelines should help the user identify the risk to a water source and to engage the people and organisations responsible for the problem in a positive way that lead to a mutually beneficial outcome.

Quite often, the activity or practice that is causing pollution (or is disrupting natural water flows) is harmful to a wide range of stakeholders. These guidelines help the user bring those stakeholders together to identify feasible solutions and agree on a Water Source Protection Plan to achieve them.

While each plan will set its own specific aims, they should work towards the general aims and objectives set out in Table 1 below.

Table 1: Over-arching objectives for Water Source Protection

Aim	Objectives
1. Improved Water Quality	1.1. Health: Minimise the risk to human and livestock health 1.2 Equipment: Minimise risk of damage to pumps and water services equipment (e.g. through corrosion)
2. Reliable Water Quantity	2.1 Yield: Ensure adequate yield to meet water supply demand 2.2. Reliability: Minimise seasonal disruption or halt long term declines in water flows/levels
3. Better Livelihood Opportunities	3.1 Sustainable Land Management: Increase level and reliability of household income from better farming and forestry practices. 3.2 Poverty Reduction: Develop new sources of income and socio-economic security through better catchment management.

Who should use these guidelines?

The legal basis of these Guidelines can be found in many sections of the legislation in Annex A, but most specifically they are the operationalization of Section 81 of the Water Act Cap 152.

Mandates are set by laws, policies, structures and annual work plans. An organisation is either:

a) an **Implementer**: who follows these Guidelines to produce a Water Source Protection Plan

b) a **Contributor** or **Facilitators**, who supports the implementer in preparing or implementing the plan. For example, National Forestry Authority providing advice on tree planting or an NGO on contributing to agricultural outreach to farmers.

c) a **Regulator**, who has a duty to regulate or monitor processes or laws, for example the enforcement of contracts or gazetted protection zones.

Annex M provides some generic mandate sheets for common organisations, however these should be used just as starting points to get clarity and agreement on roles and responsibilities between the parties involved with Water Source Protection.

These guidelines are intended for hydroelectric plant managers and developers.

For practical purposes , the guidelines will also be useful to others who are monitoring and supporting the water source protection process, and to catchment stakeholders who are engaged with it. This document and the regulation of this process are led by the Directorate of Water Resource Management (DWRM).

Table 2: User groups for Water Source Protection Guidelines

Water Source Type	Water Infrastructure Operator	Stakeholder Engagement & Planning	Technical Design & Implementation	Monitoring & Regulation	Support, Funding, Capacity Building
Hydroelectric Power Plant	▪ Plant Operator ▪ Power Generation Company	▪ Project developers (private and public) ▪ Water User Committees/Community Based Organisations ▪ Landowners & Farming organisations ▪ Business organisations ▪ NGOs ▪ Public	▪ Ministry of Energy ▪ Consulting Engineers and Contractors ▪ NFA/FSSD ▪ DEA Wetlands Unit	▪ Electricity Regulation Authority (ERA) ▪ District Technical Officers ▪ NEMA ▪ MoEMD ▪ UWA	▪ MoFPED ▪ MoEMD ▪ Development Partners ▪ iNGOs

Why and when use these guidelines?

The primary reason for applying these guidelines is that electricity consumers continue to meet high costs and unreliable supply of power throughout the year. This is due to the fact that hydroelectric power systems are increasingly facing major operational problems or challenges in form of escalating costs for maintenance of equipment, such as turbines, due to high rate of wear and tear; and fluctuating water quantities resulting in water shortages or complete drying of water sources. Engineering solutions at the power station alone may not provide the final solution on their own, but rather, a combination of engineering and management of water sources, among others, is a better option.

To successfully apply these guidelines, the following requirements must be met:

- Preparing a Water Source Protection Plan. This could be a stand-alone plan or mitigation plan within the overall framework of the Environmental Impact Assessment (EIA).
- Submitting a Water Source Protection Plan along with an application for a Water use Permit.
- Implementing the Water Source Protection Plan and monitoring or evaluating the performance of the Water Source Protection Plan. This requires a commitment of financial resources to facilitate the implementation as well as designing and applying strategies for stakeholder participation as appropriate.

The application of these guidelines is a continuous process encompassing new and existing hydroelectricity generation schemes. The Water Sources Protection Plan and the Stakeholder engagement strategies apply indefinitely but may be modified as and when necessary.

The role of a Regulator in applying the Guidelines

Different aspects of hydroelectric schemes are regulated by the Ministry of Energy, and Mineral Development (MoEMD), MWE Directorates, De-concentrated Water Management Zone, District Local Government, and under some circumstances, the National Forestry Authority, Ugandan Wildlife Authority and NEMA. The role of regulator is to enforce the guidelines by ensuring compliance with the conditions and requirements provided in these guidelines by all stakeholders. The guidelines specifically require that:

1) Future Water Use permits (and at the anniversary of renewing existing Water Use permits) must be approved alongside a Water source Protection Plan.
2) All hydroelectricity infrastructure development must have approved Water Source Protection Plan before commencement.

A checklist for regulators is provided in Part 4 of this document that will help you track the process being undertaken by the Implementer.

The Role of Implementer

Implementers are principally the MoEMD, generally with support from Development Partners, Financial Institutions and Private Sector, and technical support from consultants. The primary role of the Implementer is to comply with the guidelines. Specifically, implementers are required to ensure:

1) Preparation of Water Source Protection Plans for all water sources.
2) Submitting the Water Sources Protection Plan alongside application for Water Permit.
3) Implementation of Water Source Protection Plan.

What is hydroelectricity supply being protected from?

The hydroelectric power plant is being protected from:

a) Unreliable water availability resulting from catchment degradation, such as soil erosion and deforestation, which reduces reliability of power generation supply, or reduces overall generation capacity.
b) Siltation, which reduces the storage capacity of the reservoir, if the scheme has one, which then reduces yield and reliability of the power generation.
c) High silt, sediment and debris load that clogs intakes and increases damage and wear on equipment.

How long will it take to produce a Water Source Protection Plan?

This will largely depend on the size and complexity of the catchment; and the depth of stakeholder engagement that you are preparing to undertake. The approach set out in these guidelines is participatory – that means many organisations and individuals work together in partnership to achieve a common goal. The greater your engagement is, the more likely you are to be able to build trust, establish long lasting working relationships and achieve long term results. However, this process has financial and time cost implications therefore it is important to set realistic time goals.

Stakeholder engagement should begin at least twelve months before implementation of any new schemes or sign off of a water source protection plan, but any longer than 1.5 - 2 years and morale and interest is likely to drop.

For new schemes, the stakeholder engagement should be done as the overall package of engagement.

What skills do I need to have in my team to implement these guidelines?

Successful use of these guidelines will take good teamwork that pulls together expertise and knowledge, both technical and local. It will be particularly important to pull in expertise from different organisations where the Implementer has limited staff resources.

- **Leadership:** the ability to take the initiate and to get people from other organisations involved, give them tasks and provide support and encouragement.
- **Stakeholder engagement:** understanding different government and non-government organisations and how to engage them in Water Source Protection in a constructive way.
- **Technical/Engineering:** understanding of how the hydroelectric system works and what costs and risks result from declining water quality/quantity coming into the works.
- **Environmental/water resources management:** understanding of hydrology, hydrogeology, ecology and human land and water management.
- **Rural livelihoods:** understanding the socio-economic fabric of the catchment area so that Threats can be diagnosed and win-win situations found.

2 Guideline Process

There are seven steps in the process, summarised in the Figure 5.

Step 1 provides for preparation on the part of the institution seeking to apply these guidelines to prepare adequately before embarking on the protection processes.

Step 2 provides for analysis of technical issues pertaining to the water source and the planned or on-going hydroelectric power generation system. The technical issues referred include assessment of catchment and water source hydrological, social and economic issues, assessment of threats to the catchment and water source as well as opportunities for protection, likely protection measures and means for measuring impacts, among others.

Step 3 provides procedures for mapping stakeholders, stakeholder sensitisation, engagement and capacity strengthening, among others.

Step 4 provides procedures for identifying and committing financial and other resources for source protection.

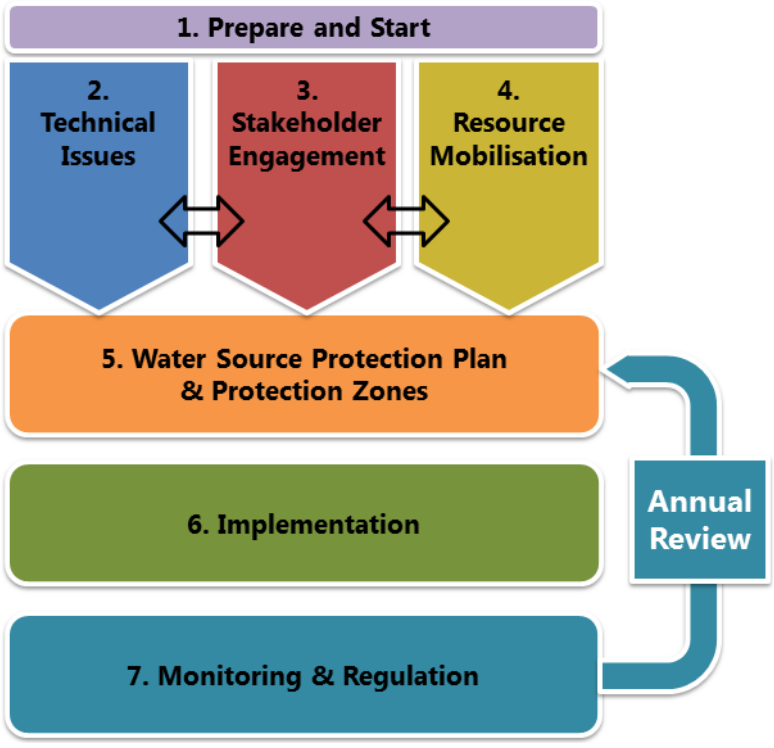
Step 5 provides procedures for developing source protection plan

Step 6 provides procedures for implementing the source protection plans

Step 7 provides procedures for monitoring implementation progress and evaluating implementation outputs.

It is recommended run steps 2, 3 and 4 in parallel, allowing exchange of information between each step until there is sufficient information and stakeholder buy-in to write and propose a Water Source Protection Plan and/or a Water Protection Zone under step 5.

Figure 5: The Guideline Steps



What skills do I need to have in my team to implement these guidelines?

Water source protection guidelines for hydroelectric power plants address new and existing generation schemes.

Under Section 2.1 (Guidelines for **new** schemes), the guidelines apply to the following cases:

a) Building or refitting a hydroelectric power plant through the public sector (e.g. MWE – Water For Production).

b) Building or refitting a hydroelectric power plant by private entity (e.g., NGO/CSO).

c) Implementing a Water Source Protection Plan as could have been approved alongside an Environmental Impact Assessment of specified reservoir.

d) Implementing a Water Source Protection Plan approved alongside the Water Use Permit.

Under Section 2.2 (Guidelines for **existing** schemes) the guidelines apply to the case of Developing and implementing a Water Source Protection Plan for existing hydroelectric power plant.

The guidelines for new and existing hydroelectricity generation systems complement each other. However, they differ in the following applications:

1. For *new* schemes, the stakeholder engagement is embedded within the wider stakeholder engagement process for developing the scheme. With *existing* schemes, stakeholder engagement may be driven by the organisation who owns or operates the power plant or a separate Water Source Protection Committee may need to be formed.

2. For *new* schemes, once initial implementation has been completed, responsibility is handed over to the operating authority to take responsibility for Water Source Protection as part of their duties. For *existing* schemes, the Implementer has much greater responsibility for implementation, monitoring and evaluation.

3. For *new* NGO/CBO/Privately owned and operated schemes that do not work within formal public sector structures, clarity should be sought from the WMZ team on what approvals are needed for the scheme (such as Water Permit) and whether a Water Source Protection Plan should be included within that process or done as a separate exercise. If the NGO or CBO or private entity does not have its own formal procedures for scheme development than it may be more appropriate to use the Guidelines for *existing* schemes, which is more standalone. An important consideration is the inclusion of water source protection monitoring and evaluation within the overall monitoring and evaluation for the scheme, as it may not be specified by the implementing organisation or the donor that is funding it.

Guidelines for NEW Hydroelectric Power Plants

STEP 1: PREPARE AND START

Action	Checklist	Where to find the information
Step 1.1 – Agree the approval process for the Water Source Protection Plan with the local Water Management Zone (WMZ) office	A) Through which process is this Water Source Protection Plan being approved? ☐ Ministry of Energy and Minerals Development Manual ☐ Water Permit ☐ Environmental Impact Assessment (EIA) ☐ DWD Water Scheme Design Manual ☐ Other:	An organisation that is implementing a reservoir project should not be the one regulating it. A standalone Water Source Protection Plan for reservoir can be approved by: ▪ Water Management Zone (WMZ) Officers ▪ District Water Officers ▪ DWRM Officers When submitted along with an Environment Impact Assessment (EIA) then the regulator is NEMA. When submitted along with a Water Use Permit then DWRM (through the WMZ team) is the regulator. If the Water Source or its catchment area, includes a Protected Forest, then the NFA will regulate aspects relating to that projected area. Likewise UWA for National Parks/Wildlife Conservation Areas and NEMA/District Environment Officer for Gazetted Wetlands. The level at which it is done will depend on the capacity of the District or WMZ to do the work in a timely manner.
Step 1.2 - Define the Problem and Objectives	A) Where does the power station get its water: ☐ River (Run-of-River generation) ☐ Lake/Reservoir (Hydroelectric dam)	
	B) What is likely to happen in the future that may threaten the functionality of this power station?	There may be well-known problems in this area that need to be considered very early on.
Step 1.3 - Check the water resources policies and other natural resources strategies for the area	A) Is a catchment plan in place? YES/NO If so, what does it say in relation to this Water Source or its surrounding area?	See ANNEX A: Relevant Ugandan Policy, Legislation and Regulations
	B) In which Water Management Zone (WMZ) is the reservoir, and what are the plans and priorities in this area?	
Step 1.4 – Contact your local WMZ team	Contact your local Water Management Zone (WMZ) team to notify them you want to undertake a Water Source Protection Plan and to get further assistance.	Each WMZ Team has the obligation to provide information about water resources and to assist those using the Water Source Protection Guidelines, to compile the outputs from Water Source Protection and to provide a link to wider Catchment Management Planning. But it is not their mandate to take the lead on applying these Guidelines. That is for the Implementer.

STEP 2: TECHNICAL ISSUES

Action	Checklist	Where to find the information
Step 2.1 - Define the catchment for the Water Source	A) Have you defined the: ☐ Surface water/topographic catchment	Seek advice from a hydrologist
	B) Is the catchment the same size or bigger than a Catchment Management Plan Area? YES/NO	
	C) If YES, then continue with the Water Source Protection Plan, or work through the Catchment Management Plan? ☐ Water Source Protection Plan ☐ Catchment Management Plan If NO, then continue with these Guidelines to produce a Water Source Protection Plan	For advice contact your local WMZ office and Catchment Management Committee. If you are going to prepare a WSPP for a source in a large catchment then begin by creating a simple sub-catchment map that shows where the water comes from that supply the water source. For catchments that extend beyond a single district it will be necessary to undertake 'hotspot' analysis (Step 2.8) to prioritise analysis and stakeholder engagement.
Step 2.2 - Collate information about the Water Source	☐ Intake capacity/water demand (peak/average flows, m^3/d)	Seek advice from an hydropower engineer
	☐ Generation capacity (peak/average, MW)	Seek advice from an hydropower engineer
	☐ Generation records (MW-hours)	Seek advice from an hydropower engineer
	☐ Number of people served	Seek advice from an hydropower engineer
	☐ Locations of people served (settlement names)	Seek advice from an agricultural engineer
	☐ Name of watercourse, reservoir or lake that water is taken from	Seek advice from a hydrologist
Step 2.3 - Collate known information about the catchment Power	☐ Land Area;	If a Catchment Management Plan has been done for your area then consult this first as much of this information is likely to have been compiled already. Otherwise, for information and data sources see ANNEX J: Further Information
	☐ Water features: streams, rivers, lakes, artificial canals/drainage channels, reservoirs, major sewers or pipelines	
	☐ Climatological, Hydrological and Environmental Monitoring Stations, and data	
	☐ Sanitation coverage data (to get an idea of likely impact from untreated sewage)	
	☐ Planned future activities	
	☐ Registered Water Permits and Waste Discharge Permits (to identity potentially competing water abstractions and potential point source pollution sources)	
Step 2.4 - Are there any other Water Sources/ Water Source Protection Plan areas within the catchment?	☐ Find out if other Water Source Protection plan existing in your area: YES/NO	Contact your local WMZ office.
Step 2.5 - Produce a water balance for the catchment	A) Effective Rainfall: ☐ Rainfall data available? YES/NO ☐ Potential evapotranspiration (PET) available? YES/NO ☐ If yes then Effective Rainfall calculated? YES/NO	See: ANNEX B: Basic Water Balance Estimation Method
	B) Indicative Resource Available: ☐ Abstraction estimates available? YES/NO	

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Action	Checklist	Where to find the information
	☐ Discharge estimates available? YES/NO ☐ Catchment Area (m^2):	
Step 2.6 - Identify Threats	☐ Location of Threats identified ☐ Size and type of Threat classified ☐ Produce a map of the where the Threats are in relation to the power station. ☐ Fill in "Hazard/Risk" column of Section B of the Water Source Protection Plan Template. ☐ Determine whether the threats are human or natural (e.g. naturally high levels of fluoride)	Refer to ANNEX C and D Also look for Water Discharge Permits, Prescribed Trades and Premises (Annex K5) and places that use Prescribed Substances (Annex K4)
Step 2.7 - Identify Pathways	☐ For each threat identify a plausible pathway (such as stream, river, lake or aquifer) by which the Threat could impact your power station. ☐ Fill in "Pathways" column of Section B of the Water Source Protection Plan Template.	This should be done by a hydrologist and/or hydrogeologist
Step 2.8 - Identify Hotspots	☐Split the catchment into smaller micro-catchments. ☐ Draw the Threats and Pathways on a map. ☐ Identify the micro-catchments where the biggest problems are happening ☐ Prioritise these 'hotspots' for follow-up stakeholder consultation and Control Measures.	This process of identifying hotspots is particularly important for surface water abstractions that are taken from a large river catchment. If there are too many Threats, or they are spread widely across the catchment then Catchment Management Planning may be more effective than Water Source Protection Planning.
Step 2.9 - Short-list catchment Control Measures	☐ Control Measures found for each Threat identified in Step 3 ☐ Part C of Water Source Protection Plan template completed.	Some control measures may help address multiple threats. Refer to ANNEX H: Generic Control Measures, to start analysis of control measures, but get further technical assistance with developing the ideas further.
Step 2.10 - Identify opportunities for improving livelihoods and reducing poverty (Win-Win situations)	Which, if any, of the short-listed control measures: ☐ Increase income – and for whom? ☐ Reduce costs or risks – and for whom? ☐ If a Control Measure costs a particular stakeholder to implement but they don't benefit directly – can the people who do benefit directly make a financial or in-kind contribution (Payment for Watershed Services)	To build stakeholder confidence in the process it is a good idea to get some positive results quickly. This is most likely to occur where there is least resistance among stakeholders. For example, training farmers in soil conservation measures and better cropping techniques can rapidly reduce soil erosion and improve farmer incomes and self-esteem. Whereas tackling a powerful vested interest will take time and patient negotiation.
Step 2.11 - Identify Options for Protection Zones	A) Are there any existing protection zones: ☐ Water Protection Zones ☐ Protected Forests ☐ Protected Wetlands ☐ Protection zones for river banks ☐ Protection zones for lake shores ☐ Hilly and Mountainous Areas	Details on the different types of protection zones can be found in the Water Act, Cap 152; National Forestry and Tree Planting Act, 2003, National Environment Act 1995, National Environment (Wetlands; River Banks and Lake Shores Management) Regulations, 2000. Available from www.mwe.go.ug and www.nemaug.org
	B) Which of the following are to be looked at further: ☐ Water Protection Zones ☐ Protected Forests ☐ Protected Wetlands ☐ Protection zones for river banks ☐ Protection zones for lake shores ☐ Hilly and Mountainous Areas	Nearby roads will present a problem because they will be a pollution risk and difficult to control. They also cannot be fenced off or easily included within a fenced off area. In such cases where physical barriers are not possible emphasis should be placed on demarcating zones where Threat activities are focusing on education,

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Action	Checklist	Where to find the information
		enforcement and improved road drainage to reduce pollution risks.
Step 2.12 - Socio-Economic Impacts	Look at indicators that might show the impact of catchment degradation and pollution on the everyday lives of people living in the area: ☐ Impact on healthcare costs (to families and health services); ☐ Loss of productive time – due to disruption or poor quality water or electricity supply; ☐ Loss of school days – due to illness among pupils or disruption to school functioning from water or electricity supply disruption; ☐ Frequency and damage costs of landslides; ☐ Design life of water infrastructure – higher maintenance and replacement costs due to problems with incoming water. ☐ Other:	This should be done by a Rural Livelihoods Economist. There may be an NGO or a consultant working in the area that can be commissioned to do this analysis.
Step 2.13 – Choose Targets, Monitoring and Indicators of Success	A) Indicators: ☐ Suitable indicators found for each objective. ☐ Responsibility for collecting data: ☐ How often will data be collected/collated? Monthly / Bi-annual / Annual	Targets and Indicators must always be **SMART**: **S**pecific, **M**easurable, **A**ttainable, **R**elevant, and **T**imely. Suggestions to start discussions are presented in ANNEX G: Ideas for Targets and Indicators
	B) Targets: identify and agree targets to be met by implementing the Water Source Protection Plan. ☐ Targets identified and agreed with WSPC for all objectives	

STEP 3: STAKEHOLDER ENGAGEMENT

Action	Checklist	Where to find the information
Step 3.1 - Identify stakeholders	Types of stakeholders: A) Within the catchment of the Water Source: ☐ Their activities may be harmful to the power station; ☐ They may be affected by the same problems that affect the power station; ☐ They may have little or no involvement or interest in land or water management; ☐ Their activities may be beneficial to the alleviating problems likely to be faced at the intake point.	
	B) Downstream of the Water Source: ☐ The behaviour or operation of the power station may affect them; ☐They may be affected by the same problems that affect the power station;	
	C) Not within the same hydrological or hydrogeological area: ☐ Government agencies and directorates; ☐ Customers and indirect water users; ☐ National and International NGOs and Development Partners;	
Step 3.2 – Identify Local Government Councils in catchment area of Water Source	When the catchment for the Water Source is defined (Step 2.) identify the local government councils that are upstream/up gradient from the water source this include: ☐ Districts (LC5) ☐ Urban Municipality/Rural Local Government (LC4) ☐ Sub-county/Division (LC3) ☐ Parishes/Wards (LC2) ☐ Villages/Cells (LC1) – in the immediate vicinity of the source only	To build support and legitimacy, it is important to engage with political leaders as well as technical officers. Record the details of the stakeholders you identify and meet in ANNEX E and tick whether they are a "facilitator/contributor " who can help directly with Water Source Protection or if they have a mandate for "monitoring and regulation."."
Step 3.3 – Sensitisation Meetings with Local Government	For each District identify and meet the following: ☐ District (LC5) Chairperson ☐ District Councillors from location ☐ District Chief Administrative Officer (CAO) ☐ District Natural Resources Management (forestry, wetlands, environment, lands) ☐ District Water Officer ☐ District Engineer ☐ District Agriculture Officer ☐ District Commercial Officer ☐ District Planner ☐ District Community Development Officer Each meeting should make the stakeholder aware of the project and ask for their insights into water and land management issues.	The WMZ should be able to help to identify and provide contact details of key District staff and political leaders. To reduce time and travel costs, Water Source Protection should be included as an agenda item in project meetings of the local government rather than done as a separate exercise. If the Guideline User works for the District Local Government then the matter can be raised as part of the normal business practice. Record the details of the stakeholders you identify and meet in ANNEX E and tick whether they are a "facilitator/contributor " who can help directly with Water Source Protection or if they have a mandate for "monitoring and regulation."
Step 3.4 – Sensitisation meetings within MWE organisations or	Meet the following local/regional offices to make them aware of the project and to start gathering issues, data and information: ☐ National Forestry Authority (NFA) ☐ Water and Sanitation Development	The WMZ should be able to help to identify and provide contact details. Every MWE team should help Guideline Users by providing access to data, reports and local knowledge.

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Action	Checklist	Where to find the information
other lead institutions	Facility, Umbrella Organisation ☐ Technical Support Unit (TSU) ☐ Uganda Wildlife Authority (if active in the area) Not all of these organisations may have an active mandate (e.g. a protected forest or National Park) in the catchment area of your Water Source, so they may not be relevant.	Record the details of the stakeholders you identify and meet in ANNEX E and tick whether they are a "facilitator/contributor " who can help directly with Water Source Protection or if they have a mandate for "monitoring and regulation."
Step 3.5 – Identify overlapping projects and sensitisation meetings with NGOs and CBOs	☐ What Non-Governmental Organisations (NGOs), Community Based Organisations (CBOs) or Faith Based Organisations (FBOs) are active in the catchment area for the Water Source?	The WMZ should be aware of major projects in each catchment. Record the details of the stakeholders you identify and meet in ANNEX E and tick whether they are a "facilitator/contributor " who can help directly with Water Source Protection or if they have a mandate for "monitoring and regulation."
Step 3.6 – Include Water Source Protection as an agenda item in project stakeholder meetings	☐ Stakeholder engagement will be part of project process for new water infrastructure. Water Source protection should be included in this process rather than creating another forum. ☐ Invite stakeholders from the wider catchment or source protection area to attend the meetings. ☐ Update stakeholders	Refer to the stakeholder engagement process relevant to your organisation or scheme type. If this manual has not yet been updated to include reference to Water Source Protection Guidelines then make sure that water source protection is included as a discussion item with stakeholders. The catchment area of the Water Source may extend into more than one District. Invite representatives from other Districts and the relevant Sub County Chief Service Assistant Secretaries, District Community Development Officers and Natural Resource Management/Environment Officers. This should be done by writing to the Chief Administrative Officer (CAO) for each District.
Step 3.7 – Establish and maintain dialogue with stakeholders	☐ Include messages and updates in water source protection in stakeholder updates about the project. ☐ Report outputs from Steps 2 (Technical Issues) and 4 (Resource Mobilisation).	
Step 3.8 - Capacity Building and Support	A) Site Visits (1 day) ☐ Organise a visit to the proposed site of the power station and to hot spots around the catchment to show the problems and how they are impacting the electricity supply system.	This may be done as part of a wider project site visit or a separate event.
	B) Water Source Protection training day for WSPC members ☐ Organise a half or one day workshop to explain the principles behind water source and catchment protection – why it is needed and how it can work, and does work elsewhere. ☐ Get speakers from different perspectives: e.g. Forestry (NFA), Wetlands (DEA), Water Resources (DWRM or the local WMZ office)	Suggested topics: 1. The water cycle – where our water comes from. 2. Why good catchment management is important 3. Simple solutions for protecting water sources 4. Examples from Uganda and worldwide of success.
Step 3.9 - Links between poor land and water management, land tenure and livelihoods	☐ Use results from stakeholder analysis and technical analysis to identify the stakeholders whose activities are likely to do most harm to the new water source.	

STEP 4: RESOURCE MOBILISATION

Action	Checklist	Where to find the information
Step 4.1 - Identify own resources available for water source protection	☐ Identify what financial resources are available in the budget for land acquisition and water source protection measures. ☐ Identify in-kind contributions within the Implementer organisation ☐ Identify what other resources, projects or skills may be available for water resource protection.	Evaluate options for acquisition or committing land targeted for protection and pursue sustainable /affordable option
Step 4.2 - Identify what other projects, and resources may be available as direct or in-kind contributions to protect the water source	☐ Are there any projects or programmes for catchment or habitat rehabilitation and protection that have overlapping, geographical areas, objectives and stakeholder groups? ☐ Are there any funding opportunities from Government, Development Partners or NGO's/CSOs for catchment protection measures? ☐ Is there willingness among stakeholders (local government, lead agencies, private sector/entity, NGOs/CSOs) to pay, or make in-kind contributions, towards water source protection measures.	The WMZ may be aware of major projects in each catchment and active international organisations. This is an iterative step that will be revisited as Stakeholder engagement progresses and technical analysis of viable catchment Control Measures go on.
Step 4.3 - Group and bi-lateral meetings to agree financial and in-kind contributions toward short-listed Control Measures	Produce outline designs and costs for each Control Measure: ☐ Capital Expenditure (CapEx) ☐ Operating Expenditure (OpEx) ☐ Capital Maintenance Expenditure (CapManEx) ☐ Support Expenditure (SupEx) ☐ Income	☐ *Capital Expenditure (CapEx)* – what is needed upfront to build or start the Control Measure ☐ *Operating Expenditure (OpEx)* – what is needed to keep the Control Measure going and working well. ☐ *Capital Maintenance Expenditure (CapManEx)* – are there any periodic big costs that are likely to occur, such as a piece of equipment reaching the end of its life needing replacement. ☐ *Support Expenditure (SupEx)* – what costs will other organisations incur by supporting, monitoring or regulating this Control Measure? (e.g. the cost of routine supervision and meetings with the District Water Officer) ☐ *Income:* what, if any, income will this control measure generate (e.g. crop sales, water tariff revenues).
Step 4.4 - Land issues and compensation	Maximise land area for Water Source Protection ☐ For groundwater and spring sources use Annex L to determine the optimum area. ☐ For surface water sources, focus on purchasing and fencing off river bank and lake shore areas.	Even where land cannot be purchased there are various legal means to influence land use, particularly in or adjacent to gazetted wetlands and river banks. Refer to The National Environment Act 1998 and The National Environment (Wetlands, Riverbanks And Lakeshores Management) Regulations, 3/2000 Refer to Step 4.4 in Volume 1 for more detail. Land issues in Uganda are complex and vary considerably from area to area. Consult the District Land Surveyor for the

Action	Checklist	Where to find the information
		District(s) where your scheme is.
Step 4.5 – Record Pledges	Enter resources pledges into PART E Financial Summary of the Water Resources Plans Template	

STEP 5: WATER SOURCE PROTECTION PLAN & PROTECTION ZONES

Action	Checklist	Where to find the information
Step 5.1 - Project Stakeholder Group Meeting to discuss and short-list Water Source Protection Control Measures	☐ Set a date and time ☐ Agree an agenda with project stakeholder group members ▪ Present short list of Control Measures ▪ Get agreement on which Control Measures to investigate further. ▪ Get agreement on what preparatory work and studies needs to be done to have enough information to agree a form plan. ☐ Find and book a venue that is accessible to as many stakeholders as possible ☐ Make sure that proper notes are taken of the meeting that capture the questions and concerns raised by stakeholders, and the decisions taken. ☐ Within one week, circulate meeting notes and thanks to the organisations who took part.	Prepare and deliver briefing about the project
Step 5.2 - Review and update Water Source Protection Objectives	A) Review aims and objectives ☐ Are the aims and objectives agreed with project stakeholder in Step 2.2 still the right ones, or do they need to be changed?	Has anything emerged from the work done so far? A WSPC will need to be held to agree any changes to the aims and objectives.
	B) Aims: ☐ 1. Improved Water Quality ☐ 2. Reliable Water Quantity ☐ 3. Better Livelihood Opportunities ☐ *4. Other:*	If the agreed aims are different from the standard ones presented, then refer to what has been agreed.
	C) Objectives: *1. Improved Water Quality* ☐ 1.1. **Health:** Minimise the risk to human health from using water from the multipurpose reservoir ☐ 1.2 **Equipment:** Minimise risk of damage to pumps, generation equipment, and pipes. *2. Reliable Water Quantity* ☐ 2.1 **Yield:** Ensure adequate yield to meet electricity supply demand ☐ 2.2. **Reliability:** Minimise seasonal disruption or halt long term declines in water flows/levels *3. Better Livelihood Opportunities* ☐ 3.1 **Sustainable Land Management**: Increase level and reliability of household income from better farming and forestry practices. ☐ 3.2 **Poverty Reduction:** Develop new sources of income and socio-economic security through better catchment management.	If the agreed objectives are different from the standard ones presented, then refer to what has been agreed. Be aware that changing the aims and objectives may have implications for the indicators and targets set in Step 2.13.

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Action	Checklist	Where to find the information
	4. Other: ☐ 4.1 Objective: ☐ 4.2 Objective:	
Step 5.3 – Consult on Protection Zone options	Based on the technical analysis in Step 2.11 and land options in Step 3.4: ☐ Decide on type and size of zone to be implemented. ☐ Work with an Authority who has the legal mandate to establish the protection zone. ☐ Define the area/boundaries of the protection zone and get it 'gazetted' ☐ Undertake sensitisation and education programmes for households and communities living in or near the protection zone. ☐ For privately owned land a separate MoU or other legal agreement may be necessary. Consult the District Local Government. ☐ Define and agree the rules and bylaws governing activities within the Protection Zone (i.e. what is forbidden and what is encouraged).	Water User Committees do not have the same legal status as a Water Authority so are not able to set up a Protection Zone under section 81 of the Water Act, Cap 152. However, there may be other protection zone options available by working with relevant regulators such as NEMA, NFA and UWA.
Step 5.4 - Agree roles and responsibilities among stakeholders	For each Control Measure short-listed in Step 6, get agreement on: ☐ Who will implement it ☐ Who will check that it is done ☐ What will be done if that Control Measure fails and who will do it.	Consider developing and agreeing on regulations/bylaws.
Step 5.5 - Agree timeline and milestones	A) For each Control Measure short-listed in Step 6, get agreement on: ☐ When will it start ☐ When will it aim to be completed ☐ Is it an on-going activity and if so what needs to be done each year?	Consider developing and agreeing on regulations/bylaws.
	B) Meeting with each relevant partner on the WSPC and agree: ☐ Who is responsible for funding each activity ☐ How much will be contributed and over what time period. ☐ Any conditions attached to those funding arrangements. ☐ Any in-kind contributions (such as labour)	Consider developing and agreeing on regulations/bylaws.
	C) Based on the information and agreements gathered, complete Part E – the Financial Plan Summary.	
Step 5.6 - Write the Water Source Protection Plan	☐ Fill in Parts A – E of the Water Source Protection Plan template ☐ Include further information, such as meeting notes, signed agreements, technical analysis etc. in Part F: Evidence Base.	Much of the information will have been filled in the previous steps but will need checking now to make sure that the overall plan is consistent and logical
Step 5.7 - Get all key stakeholders to make a public, signed commitment to delivering the Water Source Protection Plan	☐ Agree statements with partners for signing ☐ Arrange, date, time and venue. ☐ Organise a supporting entertainment programme (e.g. a local choir, school dance group or band) ☐ Invite the most senior people possible from each partner organisation represented on the WSPC to sign the agreement. ☐ Invite local and national press and issue a press release before and after the event. ☐ Organise photography and video – for	If you have got this far then you and the WSPC partners have made a substantial achievement and one that should be celebrated. A high profile launch should also help to put social pressure on the partners to meet their public commitments to improve water source protection for the benefit of the public good.

Action	Checklist	Where to find the information
	use in future publicity and put it onto the internet to raise awareness.	

STEP 6: IMPLEMENTATION

Action	Checklist	Where to find the information
Step 6.1 - Implementing Protection Measures as set out in the agreed Water Source Protection Plan	☐ Ensure all permits and permissions are in place ☐ Agree start dates for works ☐ Publicise key details (actions, dates) in the catchment area and to wider key stakeholders. ☐ Implement actions that are your responsibility. ☐ Supervise actions being undertaken by others.	
Step 6.2 - Establishing Protection Zones	☐ Arrange land acquisition and compensation, if applicable. ☐ Install physical markers and signs showing the protection zone area. If the public and/or livestock is to be excluded from zone then erect fencing and signage. ☐ Publish byelaws/binding arrangements and raise awareness. ☐ Land owners and occupiers in and around the protection zones should be educated on what is and what isn't allowed, and why.	Communicating the rules and importance of protection zones is not a one-time activity. It will require regular reinforcement of the messages. Community and Faith Based Organisations may be able to help with this.
Step 6.3 - Complete handover to Water Authority	☐ Ensure that all documentation has been handed over to the operating Water Authority as part of the handover process for the scheme.	
Step 6.4 - Final confirmation of monitoring and regulation responsibilities.	☐ Meet with officers from District Natural Resource Management/Environment, the Water Authority and other relevant local regulators to ensure that responsibilities or on-going implementation, monitoring and regulation of water source protection are a clear and agreed.	

STEP 7: MONITORING AND REGULATION

Action	Checklist	Where to find the information
Step 7.1 – Ensure that an evaluation of the Water Source Protection is included in the follow-up evaluation of the scheme	☐ Agreed indicators for water source protection are included	Refer to relevant Operations Manual for details on post-construction monitoring as part of wider scheme monitoring and evaluation.

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STEP 1: PREPARE AND START

Action	Checklist	Where to find the information
Step 1.1 - Define the Problem and Objectives	A) Where does the power station get its water: ☐ River (Run-of-River generation) ☐ Lake/Reservoir (Hydroelectric dam)	
	B) What are the main problems that have been identified with the water being taken at this power station?	There may be well-known problems in this area that need to be considered very early on.
Step 1.2 - Check the water resources policies and other natural resources strategies for the area	A) Is a catchment management plan in place? YES/NO If so, what does it say in relation to this Water Source or its surrounding area?	See ANNEX A: Relevant Ugandan Policy, Legislation and Regulations
	B) In which Water Management Zone (WMZ) is the power station, and what are the plans and priorities in this area?	
Step 1.3 – Contact your local WMZ ream	Contact your local Water Management Zone (WMZ) team to notify them you want to undertake a Water Source Protection Plan and to get further assistance.	Each WMZ Team has the obligation to provide information about water resources and to assist those using the Water Source Protection Guidelines, to compile the outputs from Water Source Protection and to provide a link to wider Catchment Management Planning. But it is not their mandate to take the lead on applying these Guidelines. That is for the Implementer.
Step 1.4 - Check activities and composition of Water Management Committees	A) Is there already an existing: Water User Committee? YES/NO District Water and Sanitation Board or Committee? YES/NO Catchment Management Committee: YES/NO Another relevant committee or organisation: YES/NO If Yes, give details……..	
	B) Are any of these existing committees willing or able to help with helping protecting the power station?	Setting up a new committee is likely to incur substantial financial and time costs so use existing structures where possible.

STEP 2: TECHNICAL ISSUES

Action	Checklist	Where to find the information
Step 2.1 - Define the catchment for the Water Source	A) Have you defined the: ☐ Surface water/topographic catchment ☐ Groundwater/aquifer catchment	For surface water abstractions, consult a hydrologist, for groundwater consult a hydrogeologist.
	B) Is the catchment the same size or bigger than a Catchment Management Plan Area? YES/NO	
	C) If YES, then decide whether to continue with the Water Source Protection Plan, or work through the Catchment Management Plan? ☐ Water Source Protection Plan ☐ Catchment Management Plan If NO, then continue with these Guidelines to produce a Water Source Protection Plan	For advice contact your local WMZ office and Catchment Management Committee. If you are going to prepare a WSPP for a source in a large catchment then begin by creating a simple sub-catchment map that shows where the water comes from that supply the water source. For catchments that extend beyond a single district it will be necessary to undertake 'hotspot' analysis (Step 2.8) to prioritise analysis and stakeholder engagement.
Step 2.2 - Collate information about the Water Source	☐ Intake capacity/water demand (peak/average flows, m^3/d)	Seek advice from an hydropower engineer
	☐ Generation capacity (peak/average, MW)	Seek advice from an hydropower engineer
	☐ Generation records (MW-hours)	Seek advice from an hydropower engineer
	☐ Number of people served	Seek advice from an hydropower engineer
	☐ Locations of people served (settlement names)	Seek advice from an agricultural engineer
	☐ Name of watercourse, reservoir or lake that water is taken from	Seek advice from a hydrologist
Step 2.3 - Collate known information about the catchment	☐ Land Area;	If a Catchment Management Plan has been done for your area then consult this first as much of this information is likely to have been compiled already. Otherwise, for information and data sources see ANNEX J: Further Information
	☐ Water features: streams, rivers, lakes, artificial canals/drainage channels, reservoirs, major sewers or pipelines;	
	☐ Climatological, Hydrological and Environmental Monitoring Stations, and data;	
	☐ Sanitation coverage data (to get an idea of likely impact from untreated sewage);	
	☐ Planned future activities;	
	☐ Registered Water Permits and Waste Discharge Permits (to identity potentially competing water abstractions and potential point source pollution sources).	
Step 2.4 - Are there any other Water Sources/ Water Source Protection Plan areas within the catchment?	☐ Find out if other Water Source Protection plan existing in your area: YES/NO	Contact your local WMZ office.
Step 2.5 - Produce a water balance for the catchment	A) Effective Rainfall: ☐ Rainfall data available? YES/NO ☐ Potential evapotranspiration (PET) available? YES/NO ☐ If yes then Effective Rainfall calculated?	See: ANNEX B: Basic Water Balance Estimation Method

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Action	Checklist	Where to find the information
	YES/NO	
	B) Indicative Resource Available: ☐ Abstraction estimates available? YES/NO ☐ Discharge estimates available? YES/NO ☐ Catchment Area (m^2): ☐ Calculate the water balance	
Step 2.6 - Identify Threats	☐ Location of Threats identified ☐ Size and type of Threat classified ☐ Produce a map of the where the Threats are in relation to the power station. ☐ Fill in "Hazard/Risk" column of Section B of the Water Source Protection Plan Template. ☐ Determine whether the threats are human or natural.	Refer to ANNEX C and D Also look for Water Discharge Permits, Prescribed Trades and Premises (Annex K5) and places that use Prescribed Substances (Annex K4)
Step 2.7 - Identify Pathways	☐ For each threat identify a plausible pathway (such as stream, river, lake or aquifer) by which the Threat could impact your power station. ☐ Fill in "Pathways" column of Section B of the Water Source Protection Plan Template.	This should be done by a hydrologist and/or hydrogeologist
Step 2.8 - Identify Hotspots	☐Split the catchment into smaller micro-catchments. ☐ Draw the Threats and Pathways on a map. ☐ Identify the micro-catchments where the biggest problems are happening ☐ Prioritise these 'hotspots' for follow-up stakeholder consultation and Control Measures.	This process of identifying hotspots is particularly important for surface water abstractions that are taken from a large river catchment. If there are too many Threats, or they are spread widely across the catchment then Catchment Management Planning may be more effective than Water Source Protection Planning.
Step 2.9 - Short-list catchment Control Measures	☐ Control Measures found for each Threat identified in Step 3 ☐ Part C of Water Source Protection Plan template completed.	Some control measures may help address multiple threats. Refer to ANNEX H: Generic Control Measures to start analysis of control measures, but get further technical assistance with developing the ideas further.
Step 2.10 - Identify opportunities for improving livelihoods and reducing poverty (Win-Win situations)	Which, if any, of the short-listed control measures: ☐ Increase income – and for whom? ☐ Reduce costs or risks – and for whom? ☐ If a Control Measure costs a particular stakeholder to implement but they don't benefit directly – can the people who do benefit directly make a financial or in-kind contribution (Payment for Watershed Services)	To build stakeholder confidence in the process it is a good idea to get some positive results quickly. This is most likely to occur where there is least resistance among stakeholders. For example, training farmers in soil conservation measures and better cropping techniques can rapidly reduce soil erosion and improve farmer incomes and self-esteem. Whereas tackling a powerful vested interest will take time and patient negotiation.
Step 2.11 - Identify Options for Protection Zones	A) Are there any existing protection zones: ☐ Water Protection Zones ☐ Protected Forests ☐ Protected Wetlands ☐ Protection zones for river banks ☐ Protection zones for lake shores ☐ Hilly and Mountainous Areas	Details on the different types of protection zones can be found in the Water Act, Cap 152; National Forestry and Tree Planting Act, 2003, National Environment Act 1995, National Environment (Wetlands; River Banks and Lake Shores Management) Regulations, 2000. Available from www.mwe.go.ug and www.nemaug.org
	B) Which of the following are to be looked at further: ☐ Water Protection Zones ☐ Protected Forests ☐ Protected Wetlands ☐ Protection zones for river banks ☐ Protection zones for lake shores	Nearby roads will present a problem because they will be a pollution risk and difficult to control. They also cannot be fenced off or easily included within a fenced off area. In such cases where physical barriers are not possible emphasis should be placed on demarcating zones where

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Action	Checklist	Where to find the information
	☐ Hilly and Mountainous Areas	Threat activities are focusing on education, enforcement and improved road drainage to reduce pollution risks.
Step 2.12 - Socio-Economic Impacts	Look at indicators that might show the impact of catchment degradation and pollution on the everyday lives of people living in the area: ☐ Impact on healthcare costs (to families and health services); ☐ Loss of productive time – due to disruption or poor quality water or electricity supply; ☐ Loss of school days – due to illness among pupils or disruption to school functioning from water or electricity supply disruption; ☐ Frequency and damage costs of landslides; ☐ Design life of water infrastructure – higher maintenance and replacement costs due to problems with incoming water. ☐ Other:	This should be done the Rural Livelihoods Economist. There may be an NGO or a consultant working in the area that can be commissioned to do this analysis.
Step 2.13 – Choose Targets, Monitoring and Indicators of Success	A) Indicators: ☐ Suitable indicators found for each objective. ☐ Responsibility for collecting data: ☐ How often will data be collected/collated? Monthly / Bi-annual / Annual	Targets and Indicators must always be **SMART**: **S**pecific, **M**easurable, **A**ttainable, **R**elevant, and **T**imely. Suggestions to start discussions are presented in ANNEX G: Ideas for Targets and Indicators
	B) Targets: identify and agree targets to be met by implementing the Water Source Protection Plan. ☐ Targets identified and agreed with WSPC for all objectives	

STEP 3: STAKEHOLDER ENGAGEMENT

Action	Checklist	Where to find the information
Step 3.1 - Identify stakeholders	Types of stakeholders: A) Within the catchment of the Water Source: ☐ Their activities may be harmful to the power station. ☐ They may be affected by the same problems that affect the power station. ☐ They may have little or no involvement or interest in land or water management.	
	B) Downstream of the Water Source: ☐ The behaviour or operation of the pumping station may affect them. ☐They may be affected by the same problems that affect the power station.	
	C) Not within the same hydrological or hydrogeological area: ☐ Government agencies and directorates. ☐ Customers and indirect water users. ☐ National and International NGOs/CSOs and Development Partners.	
Step 3.2 – Identify Local Government Councils in catchment area of Water Source	When the catchment for the Water Source is defined (Step 2.) identify the local government councils that are upstream/up gradient from the water source this include: ☐ Districts (LC5) ☐ Urban Municipality/Rural Local Government (LC4) ☐ Sub-county/Division (LC3) ☐ Parishes/Wards (LC2) ☐ Villages/Cells (LC1) – in the immediate vicinity of the source only	To build support and legitimacy, it is important to engage with political leaders as well as technical officers. Record the details of the stakeholders you identify and meet in Annex E and tick whether they are a "facilitator/contributor " who can help directly with Water Source Protection or if they have a mandate for "monitoring and regulation."
Step 3.3 – Sensitisation Meetings with Local Government	For each District identify and meet the following: ☐ District (LC5) Chairperson ☐ District Councillors from location ☐ District Chief Administrative Officer (CAO) ☐ District Natural Resources Management (forestry, wetlands, environment, lands) ☐ District Water Officer ☐ District Engineer ☐ District Agriculture Officer ☐ District Commercial Officer ☐ District Planner ☐ District Community Development Officer Each meeting should make the stakeholder aware of the project and ask for their insights into water and land management issues.	The WMZ should be able to help to identify and provide contact details of key District staff and political leaders. To reduce time and travel costs, Water Source Protection should be included as an agenda item in project meetings of the local government rather than done as a separate exercise. If the Guideline User works for the District Local Government then the matter can be raised as part of the normal business practice. Record the details of the stakeholders you identify and meet in Annex E and tick whether they are a "facilitator/contributor " who can help directly with Water Source Protection or if they have a mandate for "monitoring and regulation."
Step 3.4 – Sensitisation Meetings with MWE organisations and other lead agencies	Meet the following local/regional offices to make them aware of the project and to start gathering issues, data and information: ☐ National Forestry Authority (NFA) ☐ Water and Sanitation Development Facility, Umbrella Organisation ☐ Technical Support Unit (TSU) ☐ Uganda Wildlife Authority (if active in the	The WMZ should be able to help to identify and provide contact details. Every MWE team should help Guideline Users by providing access to data, reports and local knowledge. Record the details of the stakeholders you identify and meet in ANNEX E and tick whether they are a

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Action	Checklist	Where to find the information
	area) Not all of these organisations may have an active mandate (e.g. a protected forest or National Park) in the catchment area of your Water Source, so they may not be relevant.	"facilitator/contributor " who can help directly with Water Source Protection or if they have a mandate for "monitoring and regulation."
Step 3.5 – Identify overlapping projects and sensitisation meetings with NGOs and CBOs	☐ What Non-Governmental Organisations (NGOs), Community Based Organisations (CBOs) or Faith Based Organisations (FBOs) are active in the catchment area for the Water Source?	The WMZ should be aware of major projects in each catchment. Record the details of the stakeholders you identify and meet in Annex E and tick whether they are a "facilitator/contributor " who can help directly with Water Source Protection or if they have a mandate for "monitoring and regulation."
Step 3.6A – Include Water Source Protection as an agenda item in host water committee meetings	☐ Stakeholder engagement will be part of the project process for new water infrastructure. Water Source protection should be included in this process rather than creating another forum. ☐ Invite stakeholders from the wider catchment or source protection area to attend the meetings. ☐ Update stakeholders	Refer to the stakeholder engagement process relevant to you organisation or scheme type. If this manual has not yet been updated to include reference to Water Source Protection Guidelines then make sure that water source protection is included as an discussion item with stakeholders.
[Step 3.6B – Establish a stakeholder Water Source Protection Committee (WSPC)]	If in Step 1.4 it was found that no suitable stakeholder committee or group existed then it will be necessary to establish a Water Source Protection Committee	Setting up a WSPC should be by a mix of direct invitation (to get key stakeholders on-board) and open invitation to others who may wish to be involved, or observe (to build transparency and trust). ☐ Produce a draft constitution and Terms of Reference that sets out: ☐ Roles and responsibilities: ☐ Chair ☐ Secretary (record keeper) ☐ District and Sub-county representation ☐ Committee Members ☐ Draft aims and objectives ☐ Draft Rules of Procedure for regulating the conduct of meeting, decision making, and sharing of costs and benefits.
Step 3.7 – Organise a sensitisation meeting	A) Before the meeting: ☐ Set a date and time ☐ Agree an agenda with provisional WSCP members ☐ Find and book a venue that is accessible to as many stakeholders as possible ☐ Publicise meeting in the catchment area through civic leaders, local radio and newspapers and organisations already involved.	Suggested agenda for first meeting: 1. Opening (mayor/local civic leader) 2. An introduction to the scheme (the developer) 3. Background and goals water catchment protection (Chair WSCP) 4. Technical aspects (District Council NRM/Water Officer) 5. Financial aspects (District Council NRM/Water Officer) 6. Questions and answers 7. Vote on WSCP 8. Closing Natural Resource Management Officers for the districts involved should prepare a technical working paper for discussion at the stakeholder meeting. This is useful way of getting the local knowledge and increasing District ownership of the process.
	B) At the meeting: ☐ Hold meeting and formally establish the WSCP (if that is the option being followed, otherwise tell the meeting which committee will be taking forward this water source protection issue) ☐ Make sure that proper notes are taken of the meeting that capture the questions and concerns raised by stakeholders, and the decisions taken.	
	C) After the meeting: ☐ Within one week, circulate meeting notes and thanks to the organisations who took part. ☐ Complete the WSPC details in Section A	

Action	Checklist	Where to find the information
	of the WSPP Template.	
Step 3.8 – Establish and maintain dialogue with stakeholders	☐ Include messages and updates in water source protection in stakeholder updates about the project. ☐ Report outputs from Steps 2 (Technical Issues) and 4 (Resource Mobilisation).	
Step 3.9 - Capacity Building and Support	A) Site Visits (1 day) ☐ Organise a visit to the power station and to hot spots around the catchment to show the problems and how they are impacting the electricity generation system.	This may be done as part of a wider project site visit or a separate event.
	B) Water Source Protection training day for WSPC members ☐ Organise a half or one day workshop to explain the principles behind water source and catchment protection – why it is needed and how it can work, and does work elsewhere. ☐ Get speakers from different perspectives: e.g. Forestry (NFA), Wetlands (DEA), Water Resources (DWRM or the local WMZ office)	Suggested topics: 1. The water cycle – where our water comes from. 2. Why good catchment management is important 3. Simple /workable/affordable solutions for protecting water sources 4. Examples from Uganda and worldwide of success.
Step 3.10 - Links between poor land and water management, land tenure and livelihoods	☐ Use results from the stakeholder analysis and technical analysis to identify the stakeholders whose activities are likely to do most harm to the new water source. ☐ Complete ANNEX F	

STEP 4: RESOURCE MOBILISATION

Action	Checklist	Where to find the information
Step 4.1 - Identify own resources available for water source protection	☐ Identify what financial resources are available in the budget for land acquisition and water source protection measures. ☐ Identify in-kind contributions within the Implementer organisation ☐ Identify what other resources, projects or skills may be available for water resource protection.	Evaluate options for acquisition or committing land targeted for protection and pursue sustainable /affordable option.
Step 4.2 - Identify what other projects, and resources may be available as direct or in-kind contributions to protect the water source	☐ Are there any projects or programmes for catchment or habitat rehabilitation and protection that have overlapping, geographical areas, objectives and stakeholder groups? ☐ Are there any funding opportunities from Government, Development Partners or International NGO's for catchment protection measures? ☐ Is there willingness among local organisations and local government to pay, or make in-kind contributions, towards water source protection measures?	The WMZ should be aware of major projects in each catchment and active international organisations. This is an iterative step that will be revisited as Stakeholder engagement progresses and technical analysis of viable catchment Control Measures go on.
Step 4.3 - Group and bi-lateral meetings to agree financial and in-kind contributions toward short-listed Control Measures	Produce outline designs and costs for each Control Measure: ☐ Capital Expenditure (CapEx) ☐ Operating Expenditure (OpEx) ☐ Capital Maintenance Expenditure (CapManEx) ☐ Support Expenditure (SupEx) ☐ Income	☐ *Capital Expenditure (CapEx)* – what is needed upfront to build or start the Control Measure ☐ *Operating Expenditure (OpEx)* – what is needed to keep the Control Measure going and working well. ☐ *Capital Maintenance Expenditure (CapManEx)* – are there any periodic big

Action	Checklist	Where to find the information
		costs that are likely to occur, such as a piece of equipment reaching the end of its life needing replacement. ☐ *Support Expenditure (SupEx)* – what costs will other organisations incur by supporting, monitoring or regulating this Control Measure? (e.g. the cost of routine supervision and meetings with the District Water Officer) ☐ *Income:* what, if any, incomes will this control measure generate (e.g. crop sales, water tariff revenues).
Step 4.4 - Land issues and compensation	Maximise land area for Water Source Protection ☐ For surface water sources, focus on purchasing and fencing off river bank and lake shore areas. ☐ Consult the District Land Surveyor for the District(s) where your scheme is.	Even where land cannot be purchased there are various legal means to influence land use, particularly in or adjacent to gazetted wetlands and river banks. Refer to The National Environment Act 1998 and The National Environment (Wetlands, Riverbanks And Lakeshores Management) Regulations, 3/2000 Refer to Step 4.4 in Volume 1 for more detail. Land issues in Uganda are complex and vary considerably from area to area.
Step 4.5 – Record Pledges	Enter resources pledges into PART E Financial Summary of the Water Resources Plans Template	

STEP 5: WATER SOURCE PROTECTION PLAN & PROTECTION ZONES

Action	Checklist	Where to find the information
Step 5.1 - Project Stakeholder Group Meeting to discuss and short-list Water Source Protection Control Measures	☐ Set a date and time ☐ Agree an agenda with project stakeholder group members ▪ Present short list of Control Measures ▪ Get agreement on which Control Measures to investigate further. ▪ Get agreement on what preparatory work and studies needs to be done to have enough information to agree a form plan. ☐ Find and book a venue that is accessible to as many stakeholders as possible ☐ Make sure that proper notes are taken of the meeting that capture the questions and concerns raised by stakeholders, and the decisions taken. ☐ Within one week, circulate meeting notes and thanks to the organisations who took part.	Prepare and deliver briefing about the project
Step 5.2 - Review and update Water Source Protection Objectives	A) Review aims and objectives ☐ Are the aims and objectives agreed with project stakeholders in Step 2.2 still the right ones, or do they need to be changed?	Has anything emerged from the work done so far? A WSPC will need to be held to agree any changes to the aims and objectives.
	B) Aims: ☐ 1. Improved Water Quality ☐ 2. Reliable Water Quantity ☐ 3. Better Livelihood Opportunities	If the agreed aims are different from the standard ones presented, then refer to what has been agreed.

Guidelines for EXISTING Hydroelectric Power Plants

Action	Checklist	Where to find the information
	☐ *4. Other:*	
	C) Objectives: *1. Improved Water Quality* ☐ 1.1. **Health:** Minimise the risk to human health from using water from the multipurpose reservoir ☐ 1.2 **Equipment:** Minimise risk of damage to pumps, water treatment equipment, and pipes. *2. Reliable Water Quantity* ☐ 2.1 **Yield:** Ensure adequate yield to meet electricity supply demand ☐ 2.2. **Reliability:** Minimise seasonal disruption or halt long term declines in water flows/levels *3. Better Livelihood Opportunities* ☐ 3.1 **Sustainable Land Management**: Increase level and reliability of household income from better farming and forestry practices. ☐ 3.2 **Poverty Reduction:** Develop new sources of income and socio-economic security through better catchment management. *4. Other:* ☐ 4.1 Objective: ☐ 4.2 Objective:	If the agreed objectives are different from the standard ones presented, then refer to what has been agreed. Be aware that changing the aims and objectives may have implications for the indicators and targets set in Step 2.13.
Step 5.3 – Consult on Protection Zone options	Based on the technical analysis in Step 2.11 and land options in Step 3.4: ☐ Decide on type of zone to be implemented. ☐ Work with an Authority who has the legal mandate to establish the protection zone. ☐ Define the area/boundaries of the protection zone and get it 'gazetted' ☐ Undertake sensitisation and education programmes for households and communities living in or near the protection zone. ☐ Define and agree the rules and bylaws governing activities within the Protection Zone (i.e. what is forbidden and what is encouraged).	Water User Committees do not have the same legal status as a Water Authority so are not able to set up a Protection Zone under section 81 of the Water Act, Cap 152. However, there may be other protection zone options available by working with relevant regulators such as NEMA, NFA and UWA.
Step 5.4 - Agree roles and responsibilities among stakeholders	For each Control Measure short-listed in Step 6, get agreement on: ☐ Who will implement it ☐ Who will check that it is done ☐ What will be done if that Control Measure fails and who will do it. Record this in Parts C & D of the WSPP Template.	Consider developing and agreeing on binding mechanisms e.g., bylaws
Step 5.5 - Agree timeline and milestones	A) For each Control Measure short-listed in Step 6, get agreement on: ☐ When will it start ☐ When will it aim to be completed ☐ Is it an on-going activity and if so what needs to be done each year?	Consider developing binding and agreeing on mechanisms e.g., bylaws
	B) Meeting with each relevant partner on the WSPC and agree: ☐ Who is responsible for funding each	Consider developing binding and agreeing on mechanisms e.g., bylaws

Action	Checklist	Where to find the information
	activity ☐ How much will be contributed and over what time period. ☐ Any conditions attached to those funding arrangements. ☐ Any in-kind contributions (such as labour)	
	C) Based on the information and agreements gathered, complete Part E – the Financial Plan Summary.	
Step 5.6 - Write the Water Source Protection Plan	☐ Fill in Parts A – E of the Water Source Protection Plan template ☐ Include further information, such as meeting notes, signed agreements, technical analysis etc. in Part F: Evidence Base.	The Plan will need checking to make sure that the overall plan is consistent and logical.
Step 5.7 - Get all key stakeholders to make a public, signed commitment to delivering the Water Source Protection Plan	☐ Agree statements with partners for signing ☐ Arrange, date, time and venue. ☐ Organise a supporting entertainment programme (e.g. a local choir, school dance group or band) ☐ Invite the most senior people possible from each partner organisation represented on the WSPC to sign the agreement. ☐ Invite local and national press and issue a press release before and after the event. ☐ Organise photography and video – for use in future publicity and put it onto the internet to raise awareness.	If you have got this far then you and the WSPC partners have made a substantial achievement and one that should be celebrated. A high profile launch should also help to put social pressure on the partners to meet their public commitments to improve water source protection for the benefit of the public good.

STEP 6: IMPLEMENTATION

Action	Checklist	Where to find the information
Step 6.1 - Implementing Protection Measures as set out in the agreed Water Source Protection Plan	☐ Ensure all permits and permissions are in place ☐ Agree start dates for works ☐ Publicise key details (actions, dates) in the catchment area and to wider key stakeholders. ☐ Implement actions that are your responsibility. ☐ Supervise actions being undertaken by others.	
Step 6.2 - Establishing Protection Zones	☐ Arrange land acquisition and compensation, if necessary. ☐ Install physical markers and signs showing the protection zone area. If public the and/or livestock is to be excluded from zone then erect fencing and signage. ☐ Publish byelaws and raise awareness. ☐ Land owners and occupiers in and around the protection zones should be educated on what is and what isn't allowed, and why.	Communicating the rules and importance of protection zones is not a one-time activity. It will require regular reinforcement of the messages. Community and Faith Based Organisations may be able to help with this.
Step 6.3 - Final confirmation of monitoring and regulation responsibilities.	☐ Meet with officers from District Natural Resource Management/Environment, the Water Authority and other relevant local regulators to ensure that responsibilities or on-going implementation, monitoring and regulation of water source protection are a clear and agreed.	

STEP 7: MONITORING AND REGULATION

Action	Checklist	Notes
Step 7.1 – Undertake monitoring of agreed indicators	A) Direct monitoring ☐ Ensure that data is collected for the indicators and targets agreed in Part B of the WSPP template. B) Indirect Monitoring ☐ Where monitoring is being done by a Contributor, as defined in Part B of the WSPP template, ensure that they are performing this role and collate the information and data that they are collecting.	Good monitoring is essential to find out what is working and what is not working so that the WSPP can be updated and changed to suit the circumstances.
Step 7.2 - Compliance with regulations and bye-laws	Ensure on-going compliance with relevant regulations and bylaws. ☐ Maintain regular (at least annual) communications with WMZ team and regulators defined in Part D of the WSPP template. ☐ If there is political interference with the enforcement of the protection zones, or other legal mechanisms, then host a stakeholder meeting to determine the causes and get consensus on how to re-establish compliance and enforcement processes.	
Step 7.3 - Annual Review of progress	☐ Undertake or oversee measurements of indicators (Step 5.1) ☐ Hold quarterly or bi-annual meeting of the WSPC to review progress on implementing Control Measures, to review the data emerging from the monitoring, and to agree the way forward. ☐ Hold an annual public meeting to present progress to the wider public and stakeholders. ☐ Adjust and reissue the WSPP in accordance with events and changing stakeholder needs. ☐ Organise public celebration events when Control Measure schemes are completed or targets are reached.	On-going communication and co-ordination is critical to the success of water source protection. Producing the WSPP is the beginning of the water source protection process, not the end. Good monitoring and reporting is essential to make sure that partners stay on board and continue to make financial, and in-kind – contributions.

3 Water Source Protection Plan Template

PART A – Water Source Description Summary

PART A	WATER SOURCE DESCRIPTION
1. WATER SOURCE NAME:	
2. OPERATOR	
3. WATER SOURCE TYPE:	Piped Scheme / Multipurpose Reservoir / Hydroelectric Power Plant* / Other……
4. TAKES WATER FROM:	Watercourse (River/Stream) / Lake or Reservoir / Spring / Groundwater*
5. LOCATION: (name, grid reference)	
6. SUB-COUNTY:	
7. DISTRICT:	
8. CATCHMENT PLAN AREA:	
9. WATER MANAGEMENT ZONE (WMZ)	Victoria / Albert / Kyoga / Upper Nile*
10. WATER SOURCE PROTECTION COMMITTEE *If using a pre-existing committee then give name and details:*	
Chair:	Position: Organisation:
Secretary:	Position: Organisation:
Member:	Organisation:

*Delete as appropriate

PART B – Aims, Objectives, Targets and Monitoring Summary

PART B Aim	Objectives	Targets/Indicators	Monitoring responsibility
1. Improved Water Quality			
2. Reliable Water Quantity			
3. Better Livelihood Opportunities			

PART C – Risks and Control Measures Summary

PART C	Hazard/Risk	Control Measure (options)
1. Threat (Hazardous Activity) and release		▪
2. Pathway (Water flowing in the environment – rivers, lakes, reservoirs, groundwater, soil, surface runoff)		▪
3a. Water Source: Water Infrastructure		▪
3b. Water Source: Impact on End Water User		▪

PART D – Action Plan Summary

PART D Water Source:						
Threat	**Control Measure**	**Who does it?**	**To be completed by end of:**	**Who checks it is done?**	**Action if the control fails**	
					What to do?	**Who does it?**

PART E – Financial Plan Summary

PART E	Water Source:				
Threat: **Control Measure:** **Who does it?** **Who checks it?**					
Item	**Cost Type**	**Cost**	**Who does it?**	**Contributions** **Partner**	**Amount**

PART F – Evidence Base

Enter further information here

4 Water Source Protection – Checklist for Regulators

1) Name of Water Infrastructure/Source:	
2) Water Infrastructure Operator:	
3) Type of Water Infrastructure:	
4) Status:	☐ New Scheme ☐ Existing (upgrade planned) ☐ Existing (no upgrade planned)
5) What is the legal mechanism being used to implement Water Source Protection?	☐ Environmental Impact Assessment ☐ Water Permit ☐ Contractual Obligation ☐ Other: ….....
6) Lead Regulator:	☐ DWRM / ☐ WMZ / ☐ NEMA / ☐ District Water Officer
7) Is the reservoir equipped any water treatment?	YES / NO

8) Is a Water Source Protection Plan (WSPP) needed? YES / NO

8.1) If YES:

Agreed Timescale for completing the WSPP:
Budget for completing the WSPP:

Step	Date Started	Date Completed	Notes/Issues
1			
2			
3			
4			
5			
6			
7			Date that final WSPP was signed:
8			

8.2) If NO:

Can the Water Source be protected by implementing a radius Water Protection Zone (under s81 of the Water Act, Cap 152)	YES / NO

8.2a) If YES: Check that the following have been prepared:

Capital Costs	Operating Costs	Capital Maintenance Costs	Expenditure Direct Support (ExpDS)	Expenditure Indirect Support (ExpIDS)
Land Cost:	Daily or weekly inspections by operations or security staff	Replacing damaged signage and fencing	Supervision time/costs for District Water Officer visits	Water quality and flow/level monitoring
Compensation Cost to displaced residents and businesses:	Annual community outreach programme to local residents and water users		Facilitation, conflict resolution advice and support by WMZ.	Policy and support from MWE and MoWMD.
Fencing and signage costs:	Management of land within zone to enhance natural water filtration.		Enforcement action against encroachment in catchment area	

5 Technical Support Annexes

ANNEX A: Relevant Ugandan Policy, Legislation and Regulations

Document
Water And Sanitation Sector Sectoral Specific Schedules/ Guidelines 2009/10
Water & Waste Discharge Regulations, 1998
The Water Resources Regulations, 1998
The Uganda Water Act, Cap 152
The National Environment Impact Assessment Regulations,1998
The National Environment Hilly And Mountainous Areas Regulations
The National Environment Forestry And Tree Planting Act
The National Environment Act,1998
The National Environment (Wetlands, Riverbanks And Lakeshores Management)Regulations
The National Environment (Minimum Standards For Management Of Soil Quality) Regulations
The National Environment (Minimum Standards For Discharge Of Effluents Into Water Or Land) Regulations
National Water Policy 1999
Ministry of Water and Environment Gender Strategy 2010-2015
Lake Victoria Policy Harmonization - Draft Report

ANNEX B: Basic Water Balance Estimation Method

For new water schemes, it is important to determine whether there is enough water resource available throughout the year for the Water Source, particularly in very small catchments.

For existing infrastructure where water shortages are a problem, then a water balance model can be used to see if the problem is related to changes in rainfall in the catchment since the scheme was designed.

At its most basic, the following data are needed:

- Monthly rainfall figures (in millimetres, mm);
- Monthly potential evapotranspiration (PET) estimates (in millimetres, mm);

$$Rainfall\ (mm/month) - PET\ (mm/month) = Effective\ Rainfall\ (mm/month)$$

This can be refined further if data is available on existing abstractions and discharges in the catchment (in cubic metres per month):

$$Net\ Human\ Impact\ \left(\frac{mm}{month}\right) = 1000 \times \left(\frac{Abstraction\ \left(\frac{m^3}{month}\right) - Discharges\left(\frac{m^3}{month}\right)}{Catchment\ Area\ (m^2)}\right)$$

$$Indicative\ Resource\ \left(\frac{m^3}{month}\right) = \left(\frac{Effective\ Rainfall(mm/month) - Human\ Impact(mm/month)}{1000}\right) \times Catchment\ Area\ (m^2)$$

If the time, resources and data are available then it can be helpful to develop a computer software model of the catchment to model water balances, river flows, sediment transport, or water quality. However, this is generally a highly skilled and expensive activity to be done by a qualified hydrologist. For Point Sources (Volume 3) this will not be feasible and would be unlikely to give useful information because the magnitude of the abstraction is so small compared to the levels of uncertainty in the data and modelling. For larger schemes (for example, more than 1 Megawatt

hydroelectric generation, or 1 Mega-litre per day pumping capacity, an investment in modelling may be justified but it will vary between contexts and depend heavily on the quality of data available. If a Catchment Management Plan has been produced for the area then data may have already collated and analysed to produce some water availability information.

ANNEX C: Hazard Types

Hazard Type	Example contaminants/problems
Quality - Biological	Bacteria. Viruses. Protozoa. Helminths.
Quality - Chemical	Nitrate. Arsenic. Fluoride. Pesticides. Other heavy metals. Organic toxicants. Herbicides. Rodenticides.
Quality - Physical	Rubbish and floating debris (plastic bottles, polythene bags. Algae and plant material able to cause a blockage. Sand, silt, mud and other sediment resulting from soil erosion.
Quality - Radiological	Radioactive wastes and by-products from hospitals, industrial, research or military facilities.
Quantity – Flow	Reduced river/stream flows. Reduced borehole yield. Changes to seasonal variability of flows.
Quantity - Level	Reduced lake/reservoir levels. Reduced groundwater levels. Changes to seasonal variability of lake/reservoir/groundwater levels
Livelihood	Loss of income and nutrition resulting from soil degradation. Loss of time, income and education resulting from deforestation and longer trips to collect fuelwood. Loss of time, income and education resulting from water contamination or scarcity leading to longer trips for domestic water.

ANNEX D: Generic Threats for Hydroelectric Power Plants

Threat (1)	Hazard Types(s)	Contaminants/ Problems	Impact on Water Source (3a)	Impact on End Water User (3b)
Deforestation	Quality -Physical Quantity – Flow Quantity – Level Livelihood	Soil erosion leading to loss of catchment soil water storage – more flashing runoff characteristics. Risk of landslides	Reduced electricity yield, risk of shortages, blockages and damage to turbine equipment	Increased electricity bills. Increase chance of reduced or loss of power supply.
Poor farming practices that cause soil erosion	Quality -Physical Quantity – Flow Quantity – Level Livelihood	Soil erosion leading to loss of catchment soil water storage – more flashing runoff characteristics. Risk of landslides	Siltation of reservoir leading to reduced storage and yield. Increased chance of intake blockage and damage to equipment	Power output reduced. Increased maintenance costs.
Raw water storage	Quality - Chemical Quality - Biological	Algal blooms and toxins; stratification of the water column.	None	Increased health risk to other water users if the plant has a reservoir.
River bed sand/gravel extraction	Quality -Physical Quantity – Flow Quantity – Level	Siltation	Reduced electricity yield, risk of shortages, blockages and damage to turbine equipment	Increased electricity bills. Increase chance of reduced or loss of power supply.
Seasonal variations	Quantity – Flow Quantity – Level	changes in source water quality	Reduced electricity yield, risk of shortages	Increase chance of reduced or loss of power supply.
Solid Waste Disposal	Quality - Chemical Quality – Biological Quality – Physical	ammonium; salinity; some halogenated hydrocarbons; heavy metals; any kind of solid waste disposed in rivers (blocking intake, headrace channel, trashrack etc. of hydroelectric power plants and causing problems to turbine and further installations)	Reduced electricity yield, risk of shortages, blockages and damage to turbine equipment	Increased electricity bills. Increase chance of reduced or loss of power supply.

ANNEX E: Stakeholder Record Sheet

Name	Job Title	Organisation	Contact Details	Met?	Role (tick one)
					☐ Facilitator/Contributor ☐ Monitoring & Regulation
					☐ Facilitator/Contributor ☐ Monitoring & Regulation
					☐ Facilitator/Contributor ☐ Monitoring & Regulation
					☐ Facilitator/Contributor ☐ Monitoring & Regulation
					☐ Facilitator/Contributor ☐ Monitoring & Regulation
					☐ Facilitator/Contributor ☐ Monitoring & Regulation
					☐ Facilitator/Contributor ☐ Monitoring & Regulation
					☐ Facilitator/Contributor ☐ Monitoring & Regulation
					☐ Facilitator/Contributor ☐ Monitoring & Regulation
					☐ Facilitator/Contributor ☐ Monitoring & Regulation

ANNEX F: Livelihood Analysis Template

Question	Answer
Stakeholder Name	
Stakeholder Organisation	
Location	
Livelihood/Occupation	
Activities that are impacting the Water Source	
Awareness of their impact?	AWARE / NOT AWARE
Reasons for continuing with those harmful activities	Activity generates income Lack of awareness/training/education on alternatives Lack of resources/tools/finance to adopt better practices Lack of land tenure security Not willing to take on activities that incur additional costs Cultural/historic reasons other……

ANNEX G: Ideas for Targets and Indicators

Aim	Objective	Indicator	Possible Targets	Data Source
1. Improved Water Quality	1.2 **Equipment:** Minimise risk of damage to pumps, water treatment equipment, and pipes.	Water treatment cost	No further cost increases due to poor raw water quality after 3 years.	Water Infrastructure Operator (e.g. Uganda Electricity Generation Company)
		Equipment maintenance and repair costs	Costs kept in line with expected lifetime of equipment	Water Infrastructure Operator (e.g. UEGC) Equipment suppliers.
		Number of days with electricity generation stopped or reduced due to poor water quality or high sediment load.	Number of days per year with disruption reduced to zero within 5 years.	Water Infrastructure Operator (e.g. UEGC)
2. Reliable Water Quantity	2.1 **Yield:** Ensure adequate yield to meet electricity supply demand	Water flow data through the turbines. Electricity generation and demand data.	No rationing required.	Water Infrastructure Operator (e.g. UEGC)
	2.2 **Reliability:** Minimise seasonal disruption or halt long term declines in water flows/levels	Number of days with electricity supply stopped or rationed due to insufficient water available.	Number of days per year with disruption reduced to zero within 5 years.	Water Infrastructure Operator (e.g. UEGC)
3. Better Livelihood Opportunities	3.1 **Sustainable Land Management**: Increase level and reliability of household income from better farming	Household income from farming and forestry activities associated with good agricultural and agroforestry	Household income to increase by 15% over 3 years.	Water Infrastructure Operator should commission baseline survey and regular annual monitoring surveys.

Aim	Objective	Indicator	Possible Targets	Data Source
	and forestry practices.	practices in the catchment area.		
		Deforestation rates	Deforestation in the catchment halted within 3 years.	District Forestry Officer
		Wetland land area coverage (if present)	No change or increase within 5 years	National Bureau of Statistics
	3.2 **Poverty Reduction:** Develop new sources of income and socio-economic security through better catchment management.	Death and injury due to landslides	Reduced to zero within 5 years	District/Sub-county council
		Mean Caloric Intake (MCI) per person per day	Increase by 10% within 3 years	National Bureau of Statistics
		Number of people earning less than U$1/day	Decreased by 25% within 3 years.	National Bureau of Statistics

ANNEX H: Generic Control Measures

Control Measure	Location*	Hazard	Who Implements	Who checks?
Ability to close intakes (time of travel information) if pollution or flood event occurs, or is predicted	1,3a	Quality – Biological Quality – Chemical Quality – Physical	Threat operator/Water Infrastructure Operator	Water Infrastructure Operator
CLTS Programme to improve sanitation in catchment and reduced open defecation.	1	Quality – Biological Livelihoods	NGO / CBOs	District Health and Sanitation Officers
Capacity building of farmers on agricultural chemical use and slurry spreading	1,2	Quality – Biological Quality – Chemical Quality – Physical Livelihood	NGO	District Farming Officer
Ensure intake is set at an appropriate depth by changing depth setting ('floating intake').	3a	Quality – Physical	Water Infrastructure Operator	DWD
Eradicate *Eucalyptus* from the sensitive locations in the catchment	1	Quantity – Flow Quantity – Level	Landowners/ Occupiers	NFA
Capacity building of famers on agricultural chemical use and slurry spreading	1,2	Quality – Biological Quality – Chemical Quality – Physical Livelihood	NGO	District Farming Officer
Ensure intake is set at an appropriate depth by changing depth setting ('floating intake').	3a	Quality – Physical	Water Infrastructure Operator	DWD
Eradicate *Eucalyptus* from the catchment	1	Quantity – Flow Quantity – Level	Landowners/ Occupiers	NFA
Fire management and protection procedures. Bushfire	1	Quality – Physical	District Government	MWE (DEA?)

ANNEX H: Generic Control Measures

Control Measure	Location*	Hazard	Who Implements	Who checks?
management policy.				
Long detention times in reservoirs to allow for natural treatment.	1, 2, 3a	Quality - Biological Quality – Physical	Water Infrastructure Operator	District Officers
Perimeter catch drains around catchment security fence.	1, 2, 3a	Quality - Biological Quality – Physical	Water Infrastructure Operator	MWE
Reforestation with native species	1	Quantity – Flow Quantity – Level Quality – Biological Quality – Chemical Quality – Physical Livelihood	Landowners/ Occupiers	NFA
Regular catchment patrols	1, 2, 3a	Quality - Biological Quality – Physical	District Officers	NEMA
Regular cleaning of area close to intake.	2, 3a	Quality – Physical	Water Infrastructure Operator	DWD
Regular cleaning of screens to reduce clogging and maintain pumping rate	3a	Quality – Physical	Water Infrastructure Operator	DWD
Research programme to determine types of pathogens present in wild and domesticated animals	1,2	Quality - Biological	NGO / University	Uganda Wildlife Authority
Routine plankton monitoring for all reservoirs.	3a	Quality - Biological Chemical	Water Infrastructure Operator	NEMA
Signage and education	1, 2, 3a	Quality - Biological Quality – Physical	Water Infrastructure Operator	MWE
Stock Fencing	1,2	Quality – Biological	Farmers	District Farming Officer
Stormwater detention measures: overflow detention ponds, swales, improved soil water retention.	1,2	Quality - Biological, Quality – Physical	Farmers and Land Managers	Water Infrastructure Operator/ District Office
Sustainable Drainage Systems	1,2	Quantity – Flow Quantity – Level Quality – Biological Quality – Chemical Quality – Physical Livelihood	Landowners/ Occupiers Town Councils Water Infrastructure Operator	NEMA
Water Protection Zone (Exclude public access to land within supply catchment)	1, 2, 3a	Quality - Biological Quality – Physical	Water Infrastructure Operator	MWE

*1 = Threat, 2 = Pathway, 3a = Water Source: Structure or Activity, 3b = End Water User

ANNEX I: Directory of Control Measure Specialists (Step 7.2)

Note: the following table does not represent an exhaustive list or an endorsement of that organisation's service.

Expertise	Public Sector	NGO/others
Agricultural outreach and training	» District Agricultural Officer » School of Agricultural Sciences, Makerere University » MAAIF	» Africacare (www.africare.org) » CPAR (www.cpar.ca) » Food for the Hungry (http://www.fh.org/work/africa/uganda) » International Aid Services (http://www.ias-intl.org) » SNV (http://www.snvworld.org/en/countries/uganda) » World Vision (http://www.worldvision.org/our-work/international-work/uganda)
Community Led Total Sanitation (CLTS)	» MWE	» WaterAid in Uganda » Netwas » SNV (http://www.snvworld.org/en/countries/uganda)
Drainage systems	» Department of Civil Engineering, Makerere University » Kampala City Council Authority » Uganda National Roads Authority	
Environment regulation and enforcement	» National Environment Management Authority (NEMA)	
Forestry and Agroforestry	» NFA, FSSD » District Forestry Officer » School of Forestry, Environmental and Geographical Sciences, Makerere University » National Forestry Resources Research Institute (NAFORRI)	» CPAR (www.cpar.ca) » Uganda Agroforestry Development Network (http://www.kabissa.org/directory/ugaden)
Hydrogeology/Hydrology	» DWRM	» WE Consult » World Vision » Fontes Foundation
Participatory catchment planning and stakeholder engagement	» DWRM	» International Institution for Rural Reconstruction (IIRR) (http://iirr.org/) » Protos (http://www.protos.be/our-programs/oeganda) » WaterAid in Uganda » World Wide Fund for Nature (WWF) (www.wwf.org) » International Aid Services (http://www.ias-intl.org)
Public water supply engineering	» DWD » NWSC » School of Engineering, , Makerere University	
Wetlands, ecology and wildlife conservation	» DEA » NEMA » District Wetlands Officer	» International Union for the Conservation of Nature (IUCN) (www.**iucn**.org) » World Wide Fund for Nature (WWF) (www.wwf.org)

ANNEX J: Further Information

Annex J1: Sources of Ugandan Environment Data[1]

Institution	Data Produced
Lands and Surveys Department	Topographic Maps
National Forestry Authority	Landcover Data, Vegetation Data
Uganda Bureau of Statistics	Socio-Economic
Agriculture Planning Department	Crop Data
Kawanda Agricultural Research Institute	Soils Data
Meteorology Department	Climate Data
Department of Physical Planning	Landuse Data
Makerere University Department of Environment and Natural Resources	Biodiversity Data
Ministry of Health	Environmental Health
Directorate of Water Development	Water Quality, Quantity
Ministry of Energy And Mineral Development	Energy
Wetland Management Department	Wetlands
NEMA	National State Of Environment Reports, District State Of Environment Reports
Uganda Wildlife Authority	Protected Areas

Annex J2: International Guidance and Resources

Title	Reference	Web Link
Groundwater Protection: Guidelines for Protecting Springs	Department of Water Affairs and Forestry, Government of South Africa (2004)	http://www.dwaf.gov.za/groundwater/NORADToolkit/3.2%20Guide%20for%20protecting%20springs.pdf
Healthy wetlands, healthy people A review of wetlands and human health interactions	Horwitz, P., Finlayson, M. and Weinstein, P. 2012. Ramsar Technical Report No. 6. Secretariat of the Ramsar Convention on Wetlands, Gland, Switzerland, & The World Health Organization, Geneva, Switzerland.	http://www.ramsar.org/pdf/lib/rtr6-health.pdf
Information Products for Nile Basin Water Resources	Food and Agriculture Organisation (FAO) (2011)	http://www.fao.org/nr/water/faonile/products/index.html
Water Safety Plan Manual: Step-by-step risk management for drinking water supplies.	Bartram J. Corrales L, Davison A. Deere D, Drury D, Gordon B, Howard G, Rinehold A, Stevens M. (2009) WHO, Geneva	http://www.who.int/water_sanitation_health/publication_9789241562638/en/index.html
Protecting Groundwater For Health: Managing the Quality of Drinking-water Sources	World Health Organisation (2006)	http://www.who.int/water_sanitation_health/publications/protecting_groundwater/en/
Water Safety Plans Managing drinking-water quality from catchment to consumer	World Health Organisation (2005)	http://www.who.int/water_sanitation_health/dwq/wsp0506/en/index.html

Annex J3: Sources of Information for Uganda

Title	Reference	Web Link
Assessment of the Utilisation of Groundwater Resources Maps at National and District levels	Government of Uganda, Ministry of Water and Environment, January 2012	n/a
Groundwater potential maps	Government of Uganda, MWE, Directorate of Water Resource	n/a
Hydrochemical maps		n/a

[1] *Environmental data and statistics in Uganda,* NEMA/UBOS (undated). (http://unstats.un.org/unsd/environment/envpdf/UNSD_UNEP_ECA%20Workshop/Uganda.pdf, accessed 07/06/12)

ANNEX J: Further Information

Title	Reference	Web Link
Water Quality maps	Management	n/a
Groundwater supply		n/a
Technology options maps		n/a
Water sources location and Water supply coverage maps		n/a
Hydrogeological characteristic maps		n/a
District Environmental Policies	Districts currently available: Buteleja, Masindi, Nakasongola	http://www.nemaug.org/environment_policies.php
District State of the Environment Reports	Districts currently available: Arua, Bugiri, Busia, Butalejja, Iganga, Jinja, Kabale, Kalangala, Kamwenge, Kapchorwa, Kisoro, Kotido, Kumi, Luwero, Mayuge, Moroto, Moyo, Mpigi, Mubende, Nebbi, Palisa, Sironko, Soroti, Yumbe	http://www.nemaug.org/district_s_o_reports.php
Sector Performance Reports	MWE (Annual)	http://www.mwe.go.ug/index.php?option=com_docman&task=cat_view&gid=62&Itemid=122
Water Supply Atlas 2010	MWE (2011)	http://www.mwe.go.ug/index.php?option=com_docman&task=cat_view&gid=59&Itemid=122
Uganda: Atlas of Our Changing Environment	NEMA (2009)	http://www.grida.no/files/publications/uganda-atlas-2009.pdf
Operationalising Catchment Based WRM Report	COWI/DWRM (2011)	http://www.mwe.go.ug/index.php?option=com_docman&task=doc_download&gid=153&Itemid=122
Small Towns Water Supply Data	MWE	http://www.mwe.go.ug/index.php?option=com_docman&task=cat_view&gid=78&Itemid=122

ANNEX M: Organisational Mandates

M1: Water Management Zone (WMZ) Teams

Organisation Type:	Government. De-concentrated Water Management Zone	**Scheme of Delegation** 1. President / Parliament ↓ 2. Ministry for Water & Environment ↓ 3. Directorate of Water Resource Management ↓ 4. WMZ Team
Geographic area of responsibility	River Basin (as defined in MWE document "Operationalisation of Catchment-based Water Resources Management" September 2010)	
Mandate in relation to 'Water Source Protection Guidelines – Volume 5: Hydroelectric Power Plants' ▪ Guidance to Implementers using Water Source Guidelines ▪ Contacts and links to local stakeholders. Advice and support in setting up stakeholder meetings. ▪ Compilation and provision of information on relevant catchment management projects, studies and NGO activities. ▪ Supervision of data collection and provision of relevant data and reports to Implementers. ▪ Advice to Implementers on which catchment issues should be tackled through Catchment Management Plans rather than through Water Source Protection Plans ▪ Zonal WR database management ▪ Real-time updates transfer to centre ▪ Regional WQ laboratories ▪ Regional WR mapping, assessment and planning. ▪ Contribution to national and transboundary assessments and planning ▪ Assessment of application for abstraction and easement permits ▪ Data collection, storage and transfer to centre ▪ Zonal-level enforcement ▪ Compliance monitoring ▪ Facilitation of regional planning, including through Catchment Management Organisations in the zone. ▪ Contribute to national planning ▪ Technical Assistance and facilitation to relevant stakeholders ▪ Quality assurance and oversight ▪ Recommendations to centre on policies and legislation		
Role in relation to Water Source Protection	▪ Facilitator ▪ Regulator (Water Permits and other de-concentrated DWRM functions) ▪ Implementer	

M2: District Local Government / Sub-County Local Government

Organisation Type:	Local Government	**Scheme of Delegation**
Geographic area of responsibility	Defined local government boundaries.	1. President / Parliament ↓ 2. Ministry of Local Government ↓ 3. District (LC5) ↓ 4. Urban Municipality / Rural Local Government (LC4) ↓ 5. Sub-county/Division (LC3) ↓ 6. Parishes/Wards (LC2) ↓ 7. Villages/Cells (LC1) Some powers in relation to Environment Protection delegated to Districts from NEMA and duties in relation to agriculture from the MAAIF
Mandate in relation to 'Water Source Protection Guidelines – Volume 5: Hydroelectric Power Plants'		
Facilitation: Through committees and established relationships, Local Government can help Implementers engage with catchment stakeholders. **Contribution:** Local Government may be in a position to offer financial or in-kind contributions towards water source protection, if they can be convinced of the tangible benefits to their area of responsibility. **Regulation:** Many regulatory processes are delegated to District Local Government and below. Some have explicit links to water source protection, such as enforcing the protection of gazetted wetlands, lake shores and river banks (delegated from NEMA to District Environment Officers). Others may be less obvious, but still make an important contribution – such as the regulation of businesses, or the quality control of new road construction.		
Role in relation to Water Source Protection	▪ Contributor / Facilitator ▪ Regulator	