CREW CENTRE OF EXPERTISE FOR WATERS

"Integrated Water Resource Management in Southern Malawi" – Enhancement report for project expansion

CREW CENTRE OF EXPERTISE FOR WATERS

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EXECUTIVE SUMMARY

ABREVIATONS

ADCs Area Development Committees
AU Abertay University
CP Critical Path
CJF Climate Justice Fund
CSO Community support officer
CREW Centre of Expertise for Waters
CONGOMA The Council for Non-Governmental Organisations in Malawi
DEC District Executive Committee
DF Delivery Framework
DFID Department for International Development
DWO District Water Officer
HSA Health surveillance assistant
HEI Higher Education Institution
IFD Information Flow Diagram
IWRM Integrated Water Resource Management
MAIWD Ministry of Agriculture, Irrigation and Water Development
MoF Ministry of Finance
NWRA The National Water and River Authority
NGO Non-governmental organisation
PSIP Public Sector Investment Programme
SDG Sustainable Development Goal
SWAp Sector Wide Approach to Planning
SG Scottish Government
UNIMA University of Malawi
UoS University of Strathclyde
WASAMA Water Services Association of Malawi
WASH Water, Sanitation and Hygiene
WESNET Water and Environmental Sanitation Network
WMA Water Monitoring Assistant

Executive Summary

Project Scope

Abertay University was commissioned by the Scottish Government through Hydro Nation International to explore ways to enhance the impact of Scottish Government support to the Government of Malawi in the achievement of Sustainable Development Goal 6 (SDG6). The project involved:

- A review of the changing demand on water supplies, the impact of abstraction and the resilience and sustainability of ground water in Malawi
- Engagement with key stakeholders in water development in Malawi to map and understand the complex interaction of key water stakeholders
- The development a roadmap for scaling up Scottish Government support to meet the SDG6
- The establishment of enhancement indicators to support planning and monitoring of a future roll-out of Scottish Government SDG activities across Malawi.

Methodology

The project was undertaken in Malawi and in Scotland using visits, meetings and interviews to identify stakeholder roles and interactions and key barriers and enablers to the achievement of SDG6. This included 30 semi-structured interviews with Malawi and Scottish based stakeholders in 2017 and 2018. In addition, academic and grey literature were reviewed to support the findings on SDG6 and to provide an overview of knowledge on sustainable water resources in Malawi. Three visits were undertaken to Malawi, in January and November 2017, and in October 2018 for meetings and interviews with key stakeholders. These included relevant Malawi Government Ministries, Region and District officers, Donors and NGOs, Water Quality laboratories, Water Boards, Malawi universities and training providers, village heads and other key Water, Sanitation and Hygiene (WASH) stakeholders. Meetings and interviews were also held with Scottish organisations who have worked in or have knowledge of Malawi.

Information Flow Diagrams were produced from each interview and combined to provide a composite Stakeholder Map. The map was developed and refined over the three visits to Malawi. An initial map was produced following visit in January 2017 and reviewed prior to the November 2017 visit to identify any potential gaps or areas of uncertainty. Similarly, October 2018 interviewees were selected to allow the completion and verification of the final Stakeholder Map.

An initial Critical Path was developed based on findings of the January 2017 visit to Malawi. The initial draft critical path was presented at a project meeting in July 2017 to stakeholders involved in the CJF2 project from University of Strathclyde, the Scottish Government and CREW and feedback was received on the relevance of the content. Discussion of the Critical Path also informed the selection of appropriate Malawi stakeholders for the November 2017 and October 2018 visit. NVIVO software was used to carry out theme analysis of the stakeholder interviews during these visits and this identified thirteen key themes. The phrases were then grouped into either "Issues" or "Solutions" and similar responses pooled into common groupings. Thirteen themes were identified then grouped into 5 key challenges that would require to be addressed by the critical path and the lists of issues and solutions were reviewed to identify a set of high-level needs and potential Scottish Government areas of intervention for each of the key challenges.

Project Deliverables

The review of knowledge of sustainable water resources in Malawi showed that there is a general reduction in available water resources resulting in significant lowering of surface and groundwater levels. Large-scale deforestation alongside reduced frequency of precipitation and higher ambient temperatures, and increased water demand associated with high population growth rate are believed to be some of the factors affecting the water levels. Hence, a holistic assessment of water supply and demand, i.e., integrated water resources management implementation, is needed to address medium to long-term water availability challenges.

The Stakeholder Map provides a representation of the water sector in Malawi showing stakeholders in relation to their contribution to key areas of governance and policy development, regulation, policy implementation and service provision. The representation shows the diverse range of actors resulting in a complex interaction amongst stakeholders. It highlights the complexity of the planning and co-ordination processes and a need for enhanced coordination of activities in the sector. It was found that the nature of these processes limits the effectiveness of the planning process, which in turn restricts the effective operation of the water sector and the implementation of water development projects.

The Critical Path will assist Scottish Government to identify and develop suitable interventions actions to support the water sector in Malawi. It identifies 5 key challenges for Malawi, namely; coordination and governance, water resource management, infrastructure, capacity building and monitoring and surveillance. The following key interventions have identified from the Critical Path to help address these challenges.

- Scottish Government (Role as a donor) - Support coordination efforts at Donor and NGO groups (Donor Group/Sector Working Group/WESNET).
- Scottish Government – Raising the profile of water and improving the governance and regulatory framework (Government – Government interaction).
- Scottish Government - Support local training provision and capacity building
- Scottish Water International - Support asset assessment and management plans
- Scottish Environment Protection Agency (SEPA) - Catchment management and water resources management support.

Enhancement Indicators have been established to aid planning and monitoring of future Scottish Government support activities in Malawi. Planned support activities can be designed using a delivery framework, the identified deliverables mapped to relevant indicators and a qualitative assessment made of the extent of their contributions of the activities to the indicators. An appropriate sub-set of indicators can then be developed into metrics for ongoing monitoring.

Overall, this study has provided tools and templates for assessing and developing effective interventions to address SDG6 needs in sub-Saharan African countries.

1.0 Introduction and Project Context

Abertay University was initially commissioned by the Scottish Government (SG), through the Centre of Expertise for Waters (CREW), to undertake an independent evaluation of the "Integrated Water Resource Management - Southern Malawi" Climate Justice Fund (CJF) project. Following the initial visit and subsequent reporting in April 2017, the University was given a wider remit by the Scottish Government through Hydro Nation International to explore ways to enhance the impact of Scottish Government support to the Government of Malawi in the achievement of Sustainable Development Goal 6. The CREW and Hydro Nation International projects were carried out in parallel up to the completion of CREW element in April 2018.

The Hydro Nation project work involved:

- A review of the changing demand on water supplies, the impact of abstraction and the resilience and sustainability of ground water in Malawi
- Engagement with key stakeholders in water development in Malawi to map and understand the complex interaction of key water stakeholders
- The development a road map for scaling up Scottish Government support to meet the Sustainable Development Goal 6 (SDG6) and the provision of an enhancement indicator set for planning and monitoring future roll-out activities across Malawi.

The Hydro Nation Project Deliverables are to provide:

- An initial review of knowledge of sustainable water resources in Malawi
- A stakeholder map identifying areas for enhancement & governance support requirements
- A critical path to scaling up to meet the 2030 Sustainable Development Goals (SDGs) and recommendations on opportunities for enhanced impact
- Enhancement Framework indicators.

2.0 Data Collection and Analysis

2.1 Data collection

The project was undertaken in Malawi and Scotland using visits, meetings and interviews to identify stakeholder roles and interactions, and key barriers and enablers to the achievement of SDG6. The methodology encompassed data gathering and information triangulation techniques based on over 30 interviews with Malawi and Scottish based stakeholders in 2017 and 2018. In addition, academic and grey literature were reviewed to support the findings on SDG6 and to provide an initial overview of knowledge on sustainable water resources in Malawi.

Three visits were undertaken to Malawi, in January 2017, November 2017 and October 2018 for meetings and interviews with key stakeholders. These included relevant Malawi Government Ministries, Region and District officers, Donors and NGOs, Water Quality laboratories, Water Boards, Malawi universities and training providers, villages and other key Water, Sanitation and Hygiene (WASH) stakeholders.

Meetings and interviews were also held with Scottish organisations who have worked in or have knowledge of Malawi. Data collection activities involved:

- Discussions with Scottish Government officials
- Discussions with University of Strathclyde (UoS) CJF team including an initial workshop at UoS, Oct. 2016.
- Surveillance and observations collected during January 2017 visit to Malawi
- Discussions with key stakeholders in Malawi in January 2017
- Synthesis of interviews carried out November 2017
- Triangulation of initial findings from interviews and discussions with key stakeholders in Malawi in October 2018
- Interviews with relevant Scotland based stakeholders in 2018.

2.2 Data Analysis

2.2.1 Stakeholder Interaction

The nature and level of stakeholder interactions were determined through the series of interviews. At the beginning of each interview, interviewees were asked to briefly explain their role in relation to SDG6, to identify their key contacts and to explain their interactions. This allowed an Information Flow Diagram (IFD) to be produced for each interview and these were combined to provide a composite Stakeholder Map.

The map was developed and refined over the three visits to Malawi. An initial map was produced following the CREW Project surveillance visit in January 2017 and was included in the July 2017 Hydro Nation International Project Interim Report. Examples of IFDs and Stakeholder Maps are included in Appendix B. These reflected the focus at that time of the CJF2 project in the southern districts and showed the interaction with the Ministry of Agriculture, Irrigation and Water Development at District Level and emerging interaction with high-level officials in the Malawi Government Ministries. The CREW report recommended improved coordination of efforts between District and Ministry level, development of links with the academic community in Malawi, a need for wider engagement with other NGOs and funders in the Southern districts and with a World Bank funded Shire River Basin Management project.

This initial Stakeholder Map was reviewed prior to the November 2017 visit to select appropriate Malawi stakeholders through the identification of potential gaps or areas of uncertainty. Similarly, October 2018 interviews were selected to allow the completion and verification of the final Stakeholder Map. This process is described in more detail in Appendix B.

2.2.2 Development of the Critical Path

An initial Critical Path was developed from the findings of the January 2017 surveillance visit to Malawi and was included in the July 2017 Hydro Nation International Project Interim Report. This is included in Appendix C. The draft critical path was presented at a project meeting in July 2017 to stakeholders involved in the CJF2 project from UoS, Scottish Government and CREW. Feedback was sought from these stakeholders on the relevance of the content. Discussion of the critical path at the July 2017 meeting highlighted some key needs for achieving SDG6 in Malawi:

- Increased culture change regarding integrated water resources management (IWRM)
- Understanding the value of water
- Localised definition of IWRM based on local issues and priorities
- Engagement of local water boards may assist
- Scottish Water role in progressing objectives
- Future changing demographic
- How to ensure reliable data is used to make decisions
- The need to consider the link between energy and water consumption

Discussion of the Critical Path also informed the selection of appropriate Malawi stakeholders for the November 2017 visit and NVIVO software was used to carry out theme analysis of the 2017 visit stakeholder interviews. The analysis assigned key themes to issues raised by the twelve interviewees and this identified a need to seek additional evidence on planning systems, coordination, governance and capacity needs. The October 2018 visit again included semi-structured interviews with stakeholders to address these information gaps and to provide verification of initial findings, guided by the following questions:

1. What is your role in relation to water supply and sanitation in Malawi?

2. Have you heard of SDG6? If so,
   - what is its current status in Malawi, and what is the role of your organisation in ensuring that the goals are met?
   - what other organisations (including national and international donor agencies) does you organisation work with directly or indirectly in relation to meeting SDG6 goals in Malawi.

3. What in your opinion is the Malawian strategy/approach to achieving SDG6?
   - Who is involved?
   - What kinds of action?
   - What's missing?

4. What challenges do you see in relation to achieving SDG6 by 2030?
   (Follow up – each identified challenge by seeking more evidence "what makes you say that")

5. What do you think are some practical actions/interventions to address some of these challenges?

6. Identify the key intervention points that donor agencies currently assist in relation to helping meet the SDG6 goals. What, in your view, are some of the:
   - challenges faced by these agencies
   - ways to overcome the identified challenges
   (Follow up - assess the quality of assistance the interviewee feels that some of the agencies are currently providing).

Each Interview concluded with a summary of matters arising from discussions of the above and a review of suggestion of ways forward.

The Final Critical Path is presented in Section 4 and the process of development is described in more detail in Appendix C.

3.0 Stakeholder Interaction

The overall Stakeholder Map is shown in Figure 1. The map shows the complexity of the water sector in Malawi. The map groups stakeholders in relation to their contribution to key areas of governance and policy development, regulation, policy implementation and service provision. Figure 2 focusses on the water sector implementation. The maps capture the key stakeholder groups and present illustrative example of organisations, such as Funders and NGOs.

Policy development and its implementation through central planning and regulation are the responsibility of relevant Government Ministries. Provision of water services in Rural areas is the responsibility of the District Water Offices supported by their District Executives, and Water Boards are responsible for Urban and Peri-urban areas in keeping with the Malawi Government decentralisation policies. There are now examples of larger communities self-managed "mini water- boards" with central water sources and reticulation systems. The map also shows that water supply development is funded from multiple sources, including significant support from Donors (external non-governmental sources), through projects that are undertaken by non-governmental organisations. The diverse range of actors results in a complex interaction amongst stakeholders and therefore a number of bodies have emerged to promote collaboration in the sector.

The following sections of the report outlines the key stakeholder grouping and their interactions.

3.1 Central Government

The most relevant Ministry is the Ministry of Agriculture, Irrigation and Water Development (MAIWD). This operates at three levels:

(i) at the Headquarters in Capital Hill and Tikwere House in Lilongwe, providing "Leadership and Oversight" and dealing with policy and planning

(ii) at Regional Level (Northern, Central and Southern) providing "Management and Oversight" and with a greater focus on Implementation and Operation and providing specialist skills and support to

(iii) District Level staff in 22 District offices who focus in "Operational and Implementation".

In addition, there are necessary close links between water, sanitation and health which involve Ministries such as Health and Education including WASH programmes with Donor agencies. Operational and development plans were established by MAIWD and these are passed to the Ministry of Finance who set water operational and development budgets at district level. These budgets are devolved to District Executives that are not controlled by MAIWD.

The impact of catchment management practices on water quality and quantity involves other Ministries in the sector. These include the Ministry Natural Resources and Environment, and Departments such as Forestry. The National Water and River Authority (NWRA) was created by the Malawian Government in 2013 (but has only been operational from November 2018) and has the potential to coordinate areas such as the regulation and protection of water catchments and coordinating the preparation, implementation and amendment of a National Water Action Plan.

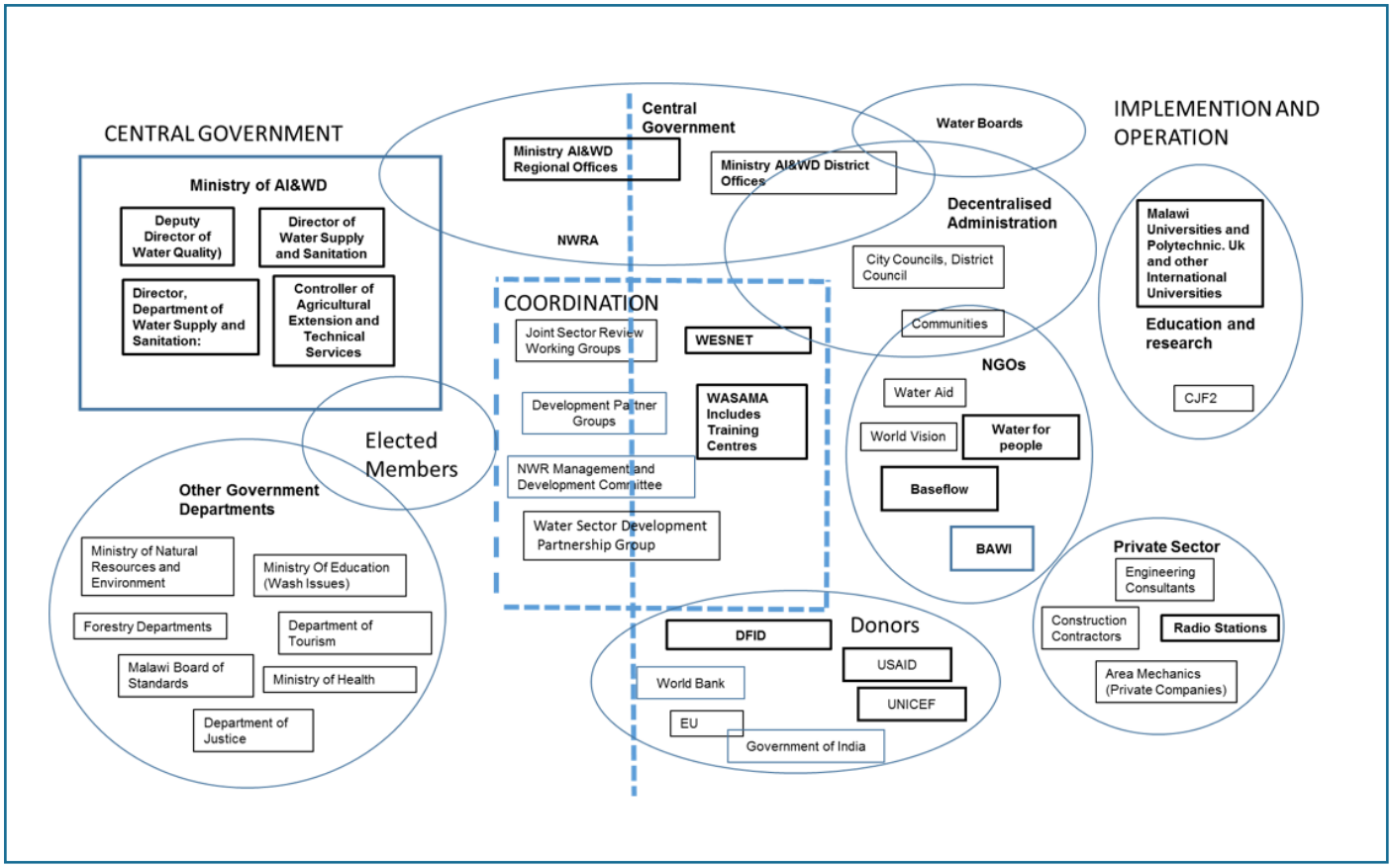

Figure 1: Water Sector Stakeholder Map

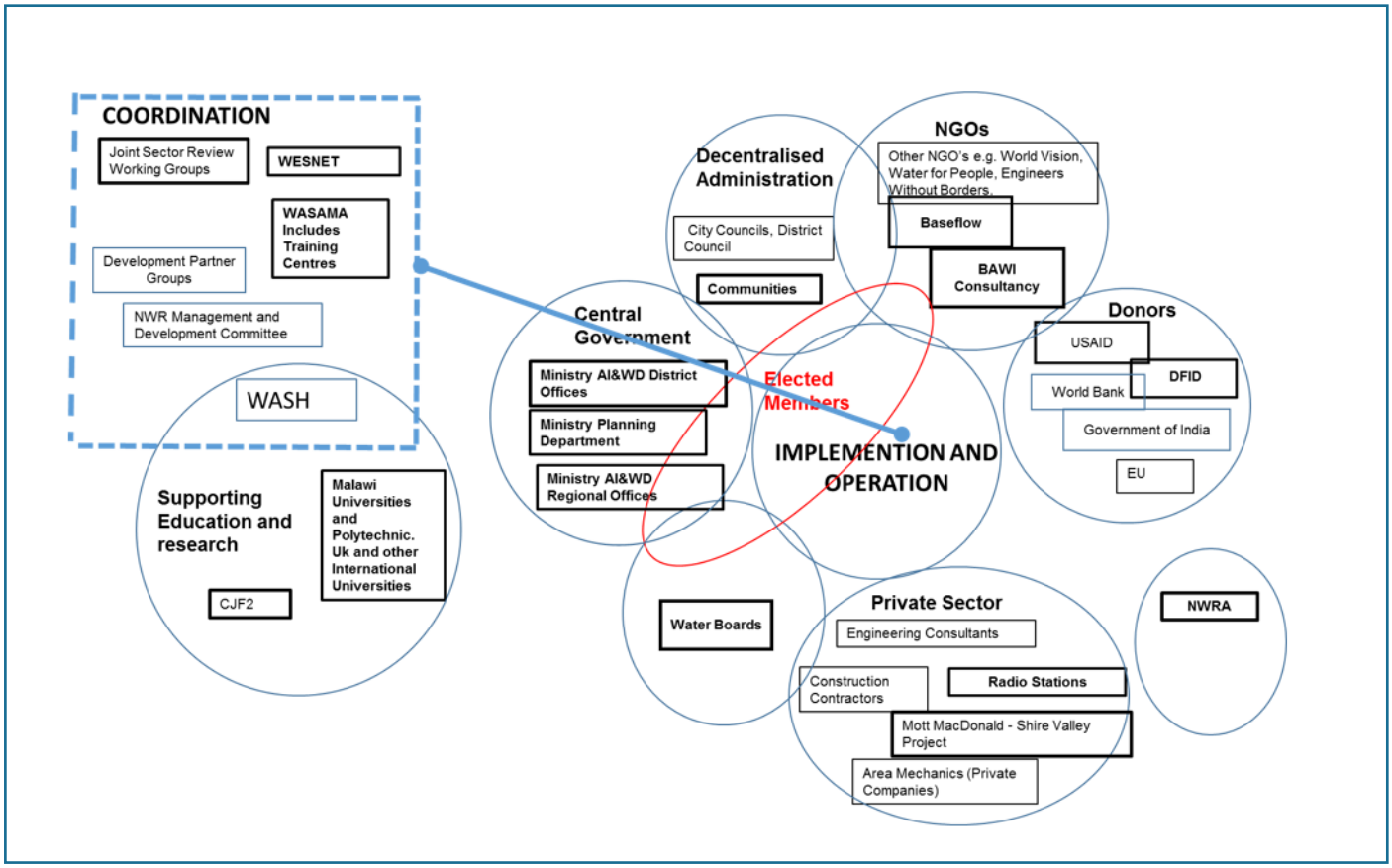

Figure 2: Water Sector Key Implementation and Operation Stakeholders Map

3.2 Implementation and Operation

3.2.1 Ministry of Agriculture, Irrigation and Water Development Regional and District Offices

The Ministry Headquarters structure is replicated at Regional and District levels.

The three Regional Offices form the link between Headquarters and Districts and provide expert support to district level. The staff include specialist such as hydrogeologists whose duties include the provision of advice on groundwater supply issues and groundwater monitoring and civil engineers whose duties include monitoring large capital projects, mainly in urban areas. The Regional Offices also collate data collected by the District Offices and filter the data before passing relevant data to Headquarters departments, including the Planning Department.
The District Offices are responsible for operation and implementation. They are staffed by District Water Officers, with varying degrees of educational attainment and water related expertise, supported by Water Monitoring Officers. They work with, and are funded through, the District Executives that are led by District Commissioners. Responsibilities include:

- Working with communities to support the operation of their water systems
- Forming, training, and monitoring committees
- Monitor borehole status and undertake major repairs
- Liaison with NGOs on the planning and implementation of externally funded water development projects
- Data collection at District Level, passed to Regional level for onward transmission for monitoring and planning National level
- Advocacy for water issues on District Executives.

District and Regional Officials noted that they are understaffed with high levels of unfilled vacancies due to budget constraints and that recurrent budgets were insufficient. Examples include activities being severely constrained when the fuel budget (e.g. for travelling to borehole locations) was spent and inadequate monitoring of borehole levels due to failure of automatic monitoring equipment and lack of staff for manual recording.

3.2.2 NGOs and Donors

There are many NGOs in Malawi. There is no formal regulation of NGO activities and practices and MAIWD has little control over their activities. The Council for Non-Governmental Organisations in Malawi (CONGOMA) lists a membership of over 500 national and international NGOs, some of which are active in the water sector. CONGOMA is designated as NGO coordinating body in Malawi as stipulated in Section 24 and 25 of the Non-governmental Act of 2001. There is a desire that NGOs should register with the NGO Board and some have done so but the issue of mandatory registration of all NGOs is yet to be resolved.

NGOs are key players in water development, implementing Donor funded projects across Malawi. It has been estimated that there are over 100 NGOs active in the water sector alone. Some are members of CONGOMA and/or the Water and Environmental Sanitation Network (WESNET). WESNET aims to enhance "coordination, transparency, accountability, advocacy and knowledge sharing for provision of high quality standards and sustainable water and environmental sanitation services in Malawi[1]", WESNET has the following objectives:

- To act as the collective mouthpiece of NGOs operating in the Water and Environmental Sanitation sector
- To build a positive and collaborative relationship between WES NGOs family and other stakeholders (Government, Donors etc.) and to promote partnerships among them
- To provide a research-backed common platform for advocacy in the WASH sector
- To act as an independent advisor to the government on standard services, accountability and financing in the WASH sector
- To promote adherence to high standards in provision of services in the water and sanitation sector in line with existing government policies
- To promote water and sanitation of the poor and underprivileged through civic education and other suitable means.

The number of full members and engaged NGOs is not clear but it would seem to range between 20 (current website) and 80 organisations (press and news release). Not all NGOs who interact with WESNET contribute to its costs through payment of membership fees which constrains its effectiveness. The NGOs active in the sectors can be categorised as those who:

- Engage with and fully support WESNET and apply the agreed high standards of operation
- Engage with WESNET and who are selective in the application of agreed high standards of operation
- Have limited engagement with WESNET and therefore are likely to have varied degrees of application of the WESNET standards of operation.

NGO reporting of activities to inform water development plans is not integrated. NGOs were not involved in broader sector reporting until recent years but the annual Sector Performance Report (SPR) has included a chapter on NGOs. WESNET "has been mandated by government to complement government by reporting on NGO activities. However, this mandate is not yet strong enough to allow WESNET to collect and coordinate comprehensive information –at the moment reporting is voluntary, and of more than 100 NGOs active in the sector only 32 provided information for the 2016 report[2]".

Donors are a key source of NGO funding for water development, supporting large and small development projects, particularly at District level. They include National Governments and their Aid Agencies and charities of varying sizes. Whilst all these bodies have a common interest in enhancing water development in Malawi, their mechanisms for selection of supported project, their local partners and their methods of operation are guided by the Donors mission, values, and strategies which may not be fully aligned with Malawi's needs at District and National levels. This presents a barrier to both NGO coordination and to strategic planning. Considering the former, despite the efforts discussed above to regulate NGOs and coordinate their activities, there is a high a degree of competition amongst NGOs to secure Donor funds. In addition, they must be responsive to Donor aims and objectives to ensure future funding. Consequently, project auditing and monitoring systems focus on the donors' objectives which result in the use of a range of assessment metrics which is not helpful for coordinated planning.

[1]www.wesnetwork.org
[2]Strengthening SWA engagement at country level: Malawi case study, March 2017, Clare Battle and James Mambulu. Research conducted by WaterAid, under the leadership of the Government of Malawi and on behalf of the Sanitation and Water for All (SWA) partnership.

Not all donors currently share reports with the MAIWD about programmes that they are implementing. There is currently no well-developed formal system of reporting and coalescing data to provide a full picture of all the activities in the sector. There are mechanisms in place, as discussed in section 3.2, (particularly the Joint Sector Review and Sector Performance Report) but these are not fully functional. Donors have acknowledged that they give more emphasis to their internal reporting systems than those of the Government of Malawi due to the lack of established institutionalised systems for monitoring and reporting at the sector level.

There is a desire expressed amongst Donors to coordinate their funding of the sector, including the establishment of a joint "Basket" fund. In contrast to other sectors such as Health and Education, there is little evidence of this in the water sector. Government officials believe that this is due to the individual donor's focus on their own missions and strategies whilst the Donors believe that it is hampered by a lack of leadership from Government, partially due frequent changes in key Senior Staff at the relevant Ministries.

3.2.3 Water Boards

There are five water boards, Northern, Central, Lilongwe, Blantyre and Southern, reconstituted by an Act of Parliament, the 'Water Works Act' No. 17 of 1995. They are responsible for the provision of water supply services including for example in the case of Lilongwe, to "manage the source of raw water, abstract and treat water in full compliance with regulatory bodies such as World Health Organization (WHO) and Malawi Bureau of Standards (MBS); and provide adequate and reliable water supply to the residents of the City of Lilongwe that meets customer needs.[3]" They serve designated urban and peri-urban areas and are intended to be self-financing, raising revenue from domestic, institutional, industrial and commercial customers. They describe themselves on the websites in a number of ways including "Parastatal Organisation", "Statutory Corporation", "Public commercial-statutory corporation" and "wholly owned by the Government of Malawi". They operate in a similar way to Scottish Water but without the benefit of independent financial regulation. Hence, they are constrained in their financial planning by government and short-term focussed political influence in setting fees and tariffs. In addition, their status as corporations prohibits support from many donors for water development funding. Key challenges include rapid population growth from migration from rural to urban and peri-urban region, which leads to pressure on existing water sources, inadequate distribution systems comprising limited networks that include pipes that are too small for the increased flow rates that are now required, and pipe failure in system that lack ring mains. In addition, aging infrastructure has high leakage rates and there are incidents of cholera in Lilongwe from cross contamination from aging sewer systems. Investment in infrastructure is severely constrained by tariff levels that are set by the Government on a socio/political basis and non-payment of or late payment of water bills by public sector clients.

3.2.4 Private Sector

Private sector support is available in both rural and urban areas. Examples of these in the former include drilling companies, hydrogeology specialists, contracted by NGOs and the Government. There is evidence of variation in quality management in these organisations and variable levels of supervision. The lack of compliance to good practice by the contacting organisations has contributed to high levels (up to 30% non-functionality) in rural borehole systems. Borehole maintenance is the responsibility of the village water committees and there are examples of small pump maintenance businesses being established to service this need. There are some examples of donor supported projects in this area. In urban areas, ministry officials stated that there were adequate skills available in civil engineering consultants and contractors for major development projects, but the main barrier to implementation was funding shortages. There are examples of the engagement by the Government of financial consultants to help unlock funding for major projects.

3.2.5 Education and Research

There are a many research projects that are funded by donors and undertaken by universities and research organisations. There are relevant and appropriate expertise in the faculties in the Malawian academic institutions e.g. University Malawi (Polytechnic) and University of Mzuzu. Whilst there are some examples of direct research funding to these bodies and some involvement in international research projects, this could be enhanced to support the generation of local capacity. In addition, recently developed MSc Programmes led by the research staff at University of Mzuzu can develop the skill set of District Water Officers to enable them to be more influential on District Executives.

Many donors support activities including education and training aspects, again delivered by local businesses and associations, NGOs and external universities. An example of this at a professional education and training level is the Water Services Association of Malawi (WASAMA) whose objectives include:

- to promote, encourage and find ways to facilitate the countrywide exchange of information and knowledge amongst bodies concerned with water supply and water in the areas of education, research, water and wastewater management, water treatment
- to organize International Congresses, Specialized and National Conferences, Symposia, Workshop and similar events, and to produce, contribute to and advertise in scientific and technical publications
- to make submissions to legislative bodies and/or regulatory authorities on any existing laws and proposed laws that may affect the Association or its members and customers
- to finance training, education, consulting and other related support activities aimed at developing the human resources and organizational capacity in Malawi for water supply services
- to create and operate irrigation and water management training colleges in Malawi.

There is scope to more fully engage the expertise and facilities of local providers to build capacity.

3.3 Planning and Coordination

The complexity of the stakeholder interaction impacts on water sector planning and budgeting. The planning and budgeting process is illustrated in Figure 3.

District Water Officers have a key role in the planning and implementation process. They provide data for the planning

[3]www.lwb.mw

and budgeting activities and are then responsible for the implementation activities with the budget provided. They are also involved in the district administrations. Malawi's Decentralisation policy assigns districts the responsibility for management, maintenance and oversight of water services. Figure 4 illustrates and explains the operation of District level Administrations under decentralisation, based on a study of three districts by O'Neil et al (2014) that included Rumphi, a district that was selected for inclusion in the Abertay October 2018 visit. District Water Officers also interact in the planning and execution of water development projects with NGOs and Donors. Many of these projects are organised at District level with limited direct consultation with the MAIWD central planning process.

Data from Districts is collated and filtered at Ministry Regional Office level before being passed to Ministry Headquarters for final filtering and collation by Heads of Department before transmission to the Planning Department. Data is also retained and used at District, Region and Headquarters levels for operational and development planning.

The Planning Department considers this data and outputs of the Sector Wide Planning Working Group and Technical Working Groups. Malawi's has been developing a Sector Wide Approach to Planning (SWAp) since 2008. The water sector had the intention of establishing SWAp governance structures under the overall coordination of the Planning Department within the Ministry of Water Development and Irrigation. Mechanisms were put place including the Technical Working Group, which report to the Sector Working Group (SWG). The SWG is comprised of government, donors, and NGOs and produce an annual Joint Sector Review Group. The Planning Department provides key data and support in data interpretation. In theory, the Sector Working Group should hold Quarterly meetings but our research revealed a need for a secretariat. Initially SWAp was funded by the World Bank which provided a budget that included meeting venues, travel costs, etc. but this has not been available since 2015. The Planning Department now tries to provide this but meetings are infrequent. On occasions the Technical Working Group meetings often only have Ministry staff in attendance. The SWAp has not resulted in the production of joint plans and a joint (basket) fund for the water sector but these do exist in other sectors such as Health and Education.

At a National level, projects and programmes submitted by MAIWD to the Ministry of Finance (MoF) are appraised by the Public Sector Investment Unit in the MoF'S Planning Division, to check that they are aligned with Development Goals and sectoral policies. Projects have been assessed for alignment with Millennium Development Goals but Sustainable Development Goal indicators are now being developed. SDG6 indicator development is led by the MAIWD Planning Department but there was no evidence on additional funds being made available for this. Approved projects are included in Public Sector Investment Programme (PSIP) document. However, not all projects in PSIP will necessarily be funded, depending on the availability of resources.

At District level, District Executive Committees (DECs) meet quarterly, with each sector presenting what they are doing and challenges faced, based on inputs and plans from Area Development Committees (ADCs). Projects are then presented at Council level for endorsement.

Wahba, Byrns & Smith (2017) provide a detailed insight into the operation budgeting processes at District level and note the very low levels of available funding. They note that Decentralisation policy assigns districts the responsibility for management, maintenance and oversight of water services. However, there is no budget line dedicated to operation and maintenance activities. They note that the limited budget must first be used to "cover office costs such as utilities (electricity and water, telephone), repair and maintenance of vehicles, office supplies, computer costs, fuel and allowances." allowances". They conclude that the "need to put greater emphasis on preventative maintenance is particularly relevant when considered in light of estimates that a USD 193 million investment is needed in rural water supply to reach 98% coverage in Malawi by 2025."

Overall, the planning and co-ordination processes are complex which limits the effectiveness of the budgeting process. This in turn restricts the operation of the water sector and the implementation of water development projects. District Officers have a key role in both data collation for planning and in the coordination of local water development projects but are underfunded and lacking in staff, skills development, facilities and equipment. Their function is made more difficult by their dual reporting mechanism, to MAIWD Regional Offices and to District Executives where the water sector is underrepresented. The challenges at District level restricts the quality of data that reaches the MAIWD Planning Department who are further constrained by limited input from Donors and NGOs. Their coordination is not well developed which constrains central planning and leads to much of the direct water sector interface being between Donors, NGOs and District Executives where the prioritisation of donor funded projects at District level can be influenced by local politicians. Final budgets are set by the Ministry of Finance and there is a strong perception in the water sector that water has a low political priority nationally compared to sectors such as health and education. This impacts on the adequacy of budgets allocated by the Government to the District Executives for the water sector and on the prioritisation of major water development projects for consideration by major Donors and funders such as the World Bank and the African Development Bank.

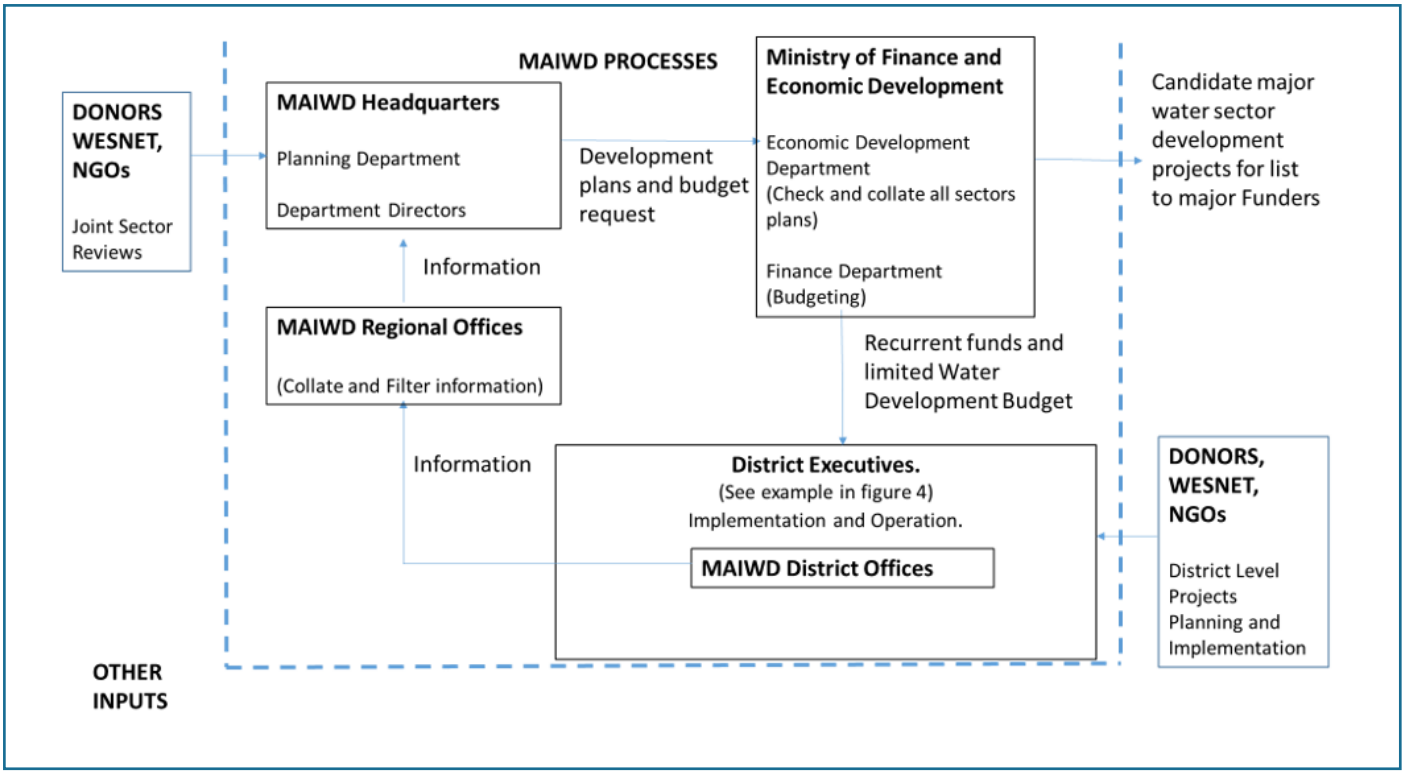

Figure 3. Planning and Budgeting Process (Dashed line indicates the Ministry structure)

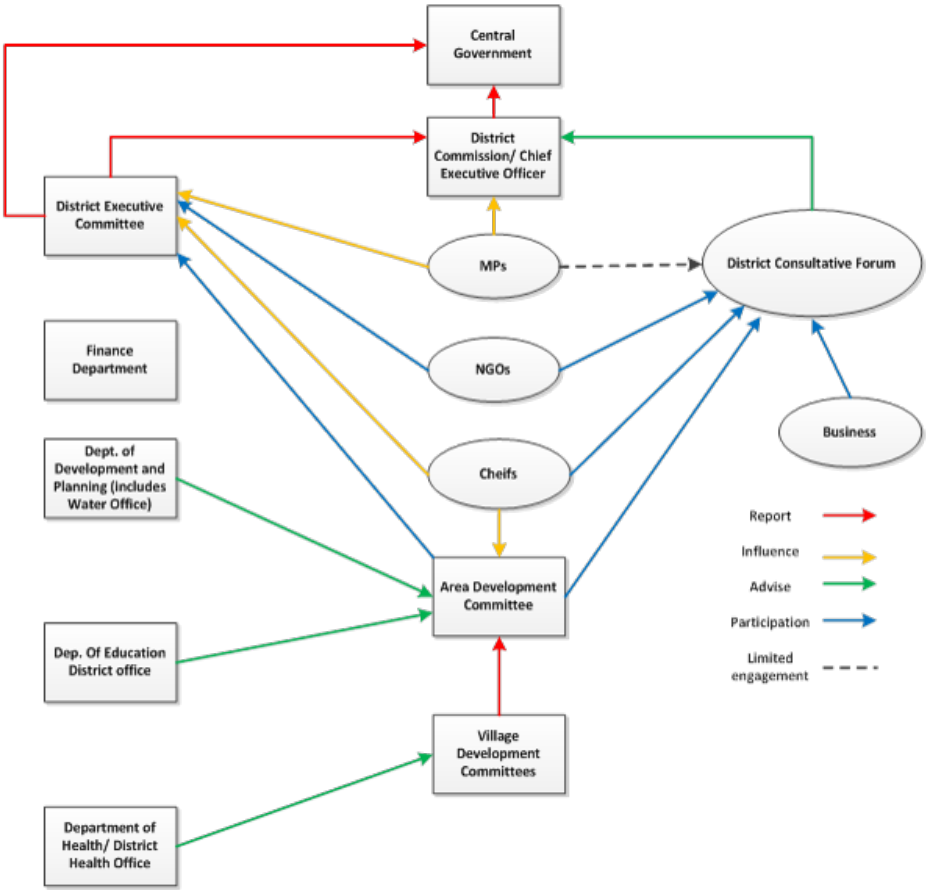

Figure Notes:
The DC and the heads of departments/sector offices are the permanent members of the District Executive Committee (DEC), responsible for the administration of the district. Members of the DEC form specialist committees, co-opting other district officials (e.g. DC Internal Procurement Committee, Budget Committee). The DC convenes regular DEC meetings. The DC may invite non-DEC members to meetings (e.g. the District Water Development Officer (DWDO) for water matters, NGOs, Area Development Committee or ADC Chairs). The DC convenes ad hoc District Consultative Forum meetings to inform and consult with the local elite. Participation is by invitation only but the meetings can be large (e.g. 50 in Rumphi for some meetings).

Figure 4: Basic local government structures and relationships in practice (Adapted From O'Neil et al, 2014)

4.0 Critical Path and Key Indicators

4.1 Critical Path

The purpose of the critical path is to identify a set of high-level activities that are required in Malawi to work towards achieving SDG6 by 2030 to facilitate discussion on the alignment of future Scottish Government activities.

An initial draft critical path (CP), together with an associated draft set of indicators, was presented to stakeholders involved in the CJF project with representatives from UoS, Scottish Government and CREW at a project meeting in July 2017. Feedback was received and the CP was further developed following the November 2017 and 2018 visits by the Abertay team. In total thirty interviews were undertaken during the visits and the data analysed using NVIVO. This identified thirteen key themes and the coded phrases were then grouped into either "Issues" or "Solutions" and similar responses pooled into common groupings related to Water Quality and Quantity, and Temporal and Spatial aspects as summarised in Table 1. This assisted in identifying where key issues or solutions would fit within the overall critical path (e.g. relevance to Water Quality or Water Quantity, and the temporal (short, medium and long term) or spatial (international, national -ministry, district, community) context.

The thirteen themes were then grouped into 5 key challenges that would require to be addressed by the critical path and the lists of issues and solutions in Table 1 were reviewed to identify a set of high-level needs and potential Scottish Government areas of intervention for each of the key challenges. The Critical Path is presented in Table 2.

Table 1. Key Issues and Solutions emerging from interviews

	Issues	Solutions
Water Quality	• Poor water quality associated with poor sanitation, lack of education of good sanitation practice and increased use of non-protected sources, particularly in hard to reach areas. • Poor drilling practice is prevalent, and initial quality testing of boreholes is lacking. There is also lack of consideration of potential water quality at planning stage. • Monitoring of water quality is limited (drinking water and environmental water quality) with limited borehole monitoring after commissioning. • Access to historic monitoring data (where it exists) is limited due to difficulty in retrieving data. Also lack of knowledge or protocols used to apply data to planning or enforcement. • Limited coordination across groups and functions; imbalance of effort towards water quantity, but less for sanitation and quality. • Although general pollution is not considered as a key issue, plastic-related pollution is increasing. • Overall lack of data on water quality and data is not being centralised. • Use of water from Lake Malawi is leading to health issues. Cost of treating the water is too high. •General perception that water resources are drying up, associated with deforestation, •agriculture, overuse, leakage and siltation (less useable resource). •Rural and hard to reach populations are suffering the most.	•Improve surface water management, source protection and awareness of good, water quality monitoring and environmental limits. Investment in schools and water boards. •Improve skills associated with water treatment, and monitoring including accessibility of water quality data, and training on use of data for decision making. •Engage private sector and borehole drillers to improve drilling practice, water quality testing, engagement with planning departments and NGOs to improve overall practice surrounding installation of boreholes. •Use risk based approaches (based on data) to focus on areas of greatest need. This may include more training of planning departments to apply data to planning. •Integrate sanitation into water schemes and include community, Ministry of Health and improve coordination across functions. •Increase government (i.e. public sector) involvement in water management. •There should be benchmarks and local training on gathering data in urban and rural locations. Improve understanding about where decisions are made and improve resources for processing data (e.g. repositories). More skills-based training in terms of data collection at district level and better data management procedures could ensure that data is accessible at all levels. •An implementation plan for the NWRA is needed (awareness raising, water regulation). •IWRM solutions should include improved catchment management with considerations of quality and multi-purpose resource management (piped systems, dams, for energy, storage and run-off control, infrastructural improvements, aquifer recharge methods, reforestation, education, behaviour change, deep drilling capacity).

	Issues	Solutions
Water Quality	•Poor understanding of hydrogeological systems (aquifers) and effects of recharge methods. •Monitoring of borehole levels is limited, and issues about reliability and value of data including staff to process this data, update it, and make it accessible. •With population increasing (also impacted by migration) this is creating more pressure in urban locations. •Boreholes are often vandalised, non-functioning, damaged or not maintained. •Water conservation is often overlooked (overuse, leakage, awareness of NWRA). •Difficult to provide water for some areas around Lake Malawi. •Dam capacity is an issue as some dams cannot hold enough water even with high rainfall. •Declining water level of Lake Malawi has impact on the reliability of HEP and economic development •Transnational water demand- conflict.	•Immediate needs of many rural communities should be considered with increased access to new water points/ communal boreholes. •Improve knowledge of the resource and aquifer recharge and water balance including improved access to data and monitoring. •Also focus attention on urban locations in addition to rural ones. Need for more investment in new systems which can handle the growth in population.
	Issues	**Solutions**
International (e.g. Donor level)	•There is limited oversight or control on NGO activities who operate at different levels of government or none. There is no independent regulator. •Donors direct NGOs and influence type of data collected and data collection activities instead of Government or stakeholders; interventions can undermine sustainability where there is lack of strategic approach and consideration of local best practice. •There are multiple mapping activities. Governments do not have access to NGO data however NGOs want government data. •There is reduced flexibility in how donor funds can be distributed after cashgate damaged donor confidence. This may result in policy and activities aligned to donor benefits (e.g. headlines), more project based than strategic •NGOs compete for human resources (poach staff) but do not contribute to capacity building or legacy milestones. The donor In/Out model is not sustainable. Duplication of activities is common. Much of this is due to donors seeking leadership roles in attainment of SDG6, but results in duplication of effort. •Donors more likely to focus on rural areas and boreholes and not give money to Water Boards. •NGOs often use different systems for information management, which all have different licenses. Donors bring software but it quickly becomes outdated.	•Regional offices can help keep track of NGOs, and enhance accountability; having a fixed first point of contact (e.g. Ministry) could advise NGOs on locations and needs to maximise benefits. Set up a regulator (in process, e.g. NWRA). •NGOs should improve engagement with local stakeholders, consult local experts before starting work and improving harmonisation of data. There should also be dissemination of both the immediate goal and the legacy. Donor ideas should be influenced by community needs. •Mapping can inform where to work, assist understanding and evidence-based decision making but support is needed for government to articulate their programme and approach •A methodology for greater data usability is needed •Community ownership scheme for sustainable borehole operation. Better education/training, coordination, communication and understanding of activities is required. Government financial support and an independent programme under the planning department would provide opportunity to oversee all donor projects and goals. Donors should also come together regularly under WESNET. There needs to be more joint planning. One overarching SDG taskforce would be useful. • Need to change the perception of Water Boards (they are often not considered as businesses and thus not suitable recipients of funding). More networking across levels would enhance channels of communication.

	Issues	Solutions
National (e.g. Ministry level)	•There is lack of government leadership in water; no strategic policy and programme. The government is not considered to be taking water and sanitation issues seriously. Water, in comparison with other sectors, appears to be slower. There is a greater focus on food and agriculture. •There is a lack of engagement and coordination of activities across NGOs, within and across Ministry departments and with stakeholders, and limited oversite of activities. •There is a lack of Ministry human resource (data management, IT support, licencing), with poaching of staff by NGOs •There is lack of data management systems, poor national statistics and reliable data to inform political decisions. There are also potential rifts between universities and politicians with regards data availability. •There is a lack of understanding/interpretation of water quality and quantity data and mechanisms for cascading and translating data for decision makers. This leads to failure of data-based projects. •There is a lack of funding for monitoring and maintenance, capacity issues across the board; people want paid to attend training •Water board level – issues related to leakage of treated water •Decision making – Ministry level not always compatible with functional level (local), decision makers may not know what data is needed or how to interpret. Many strategies and documents on shelves, but little changes after projects implemented. •Even with developed business cases for water boards, there is not enough money to fund them. Money often goes to rural areas, not urban ones. With population increasing (also impacted by migration) this is creating more pressure in urban locations. •There is a need to tackle non revenue water (including government and non-government bodies). •Setting of tariffs is both inconsistent and political.	•Government should lead policy on programmes not be led by NGOs and Donors. e.g. Catchment authority and catchment managers may allow for a more holistic approach; Increase sustainability win an implementation plan and greater awareness and enforcement of Water Resources Act. Government to government links might help influence this. •Ministry planning could be first point of contact for Aid proposals, to advise on programme and best location to max benefit (evidence based interventions advised by good data). District or Regional offices could coordinate NGO activities. Need for NGOs to share more, work together; wider coordination and collaboration. •Need to build IT capacity for data management; investing in digitisation of information and site for hosting key information that is made widely accessible. Human resource needs to be developed and means to retain skilled staff developed. •A national data approach/system should be determined, sustained and funded by government, Increase sustainability with Government at heart of information collection; greater harmonisation of data. More networking between universities and politicians could be facilitated. •Resilience can be linked to decisions based on data not politics but methodology for usability and adoption is needed •Need for awareness raising for WRA (ministry, NGOs) on legal and management issues, community will take lead from Government •Process for reflection - documenting what does or does not work (Assessment and evaluation) •Need to mobilise domestic finance •Also focus some attention on urban locations in addition to rural ones. Should be more investment in new systems which can handle the growth in population. •Need to improve and increase accountability. Independent regulator could facilitate this. •Creation of an overarching body that sets tariffs. Government could step aside to allow this regime to change which could encourage more investment. Power generation at water dams could reduce water charges (although dams often not holding enough water now)

	Issues	Solutions
Community	•Can end up with multiple activities in a village with no coordination •Some NGOs are not interested in local best practice, not consulting local experts; Do not embed community ownership in borehole (therefore not maintaining or conserving water) • Lack of follow up of borehole function post-installation by NGOs (e.g. NGO drilled holes they drill them then don't maintain or take care); Lack of local supervision of drilling, enforcement of guidelines, bad drillers; how is data updated at local level once grant support is gone. •Non-functioning water points, poor quality •Piping pumped water is too expensive •Water table dropping/lack of water •Need more boreholes/water points •Reliance on charcoal as main income source (deforestation) •Deforestation due to cutting down trees to make money •Monitoring issues (equipment, transport, no DWO, WMA presence) •Often no financial legacy or maintenance/operational plan to projects. •There is sometimes resistance from traditional leaders to ideas that are generated from village members in the village development committees. •Maintenance issues (hard to reach, expensive spare parts, scarce, lack of funds for maintenance, lack of training, lack of maintenance plan) •Although some communities have been empowered through education to voice their needs and concerns, others are not in the same position •Local issues – vandalism, theft •Grassroots aspects are key failure points. Community based management is not working, difficulties in local water point committees management. Water Point Committees lack capacity/knowledge to manage; lack of behaviour change, training, learning, cheating , corruption political interference	•Use of Ministry data to allocate villages; planning departments identify areas for most beneficial impact •WESNET Sector performance report on NGO activities at village level. Local knowledge and experiences should be valued. •Contractors and NGOs should be accompanied by ministry staff (relates back to lack of resources for this to happen). More supervision and accountability is required. NGOs and donors should factor supervision in to the costs. Village based solutions (permaculture, borehole banking, tree planting), communal boreholes and community ownership, Incorporate training and behaviour change measures with installations. Community must be engaged and contribute and sensitised (reduce vandalism). •Villages working together on watershed level projects; stakeholder collaborations for IWRM. Could ask trained persons to monitor small networks of water points (spend more time on intense training for few, than surface training for many); management by local volunteer groups – must be the most competent people (pre-existing interest or skills in engineering or accountancy – schools could be involved) •Outreach by radio can enhance educational aspects •Need to control deforestation. •Training should focus on ground level staff (e.g. area mechanics, extension staff with basic hydrogeology training to improve oversite of drillers/NGOs) •Engagement of local extension workers, community based officers •Intervention fund to encourage and reward best catchment management practices through small loans (Shire Valley) •Community empowerment. Community voices incorporated in to design and ensuring there is a legacy (e.g. rice development – from growing to market). Village water boards often have the skills and knowledge, but not the funding. •Ensure that traditional leaders are not also taking the lead in the village water committee (cultural sensitivities to this in relation to decision-making). How can deeply engrained culture and behaviours be changed? •Government should offer alternative sources of income together with better regulation (e.g. bee keeping). More coordination – catchment management, forestry.
		Alternative energy sources, e.g. solar panels. More community sensitisation to increase vegetation and the development of forest to aid recharge. Promotion of seedlings planted within well area. •Provide communities with the opportunities to manage spare parts (e.g. a shop for spare parts) or other levels of control. •Improve literacy and awareness of water-related issues.

Table 2 Critical path

Key Challenges	Needs	Scottish Government Supported Intervention
Coordination and Governance - Improve strategic approach to water	-Leadership from Ministry on the production of more coordinated Water Development plans based on country needs including an alignment of NGO/Donor interest. -Address the continuity of "projects"; Code of conduct for NGOs working in the country (Drilling practice, end of project support, maintenance and operation considerations) -Develop catchment management approach, enhanced environmental management; communities working together on watershed-level approaches (engage community in strategy development) -Ministry capacity building in planning, budgeting and regulation of the water sector. -Improve coordination of stakeholders activities; improve understanding of what is going on across the country -Improve oversite of NGO activities) -Improve evidence-based decision making	Scottish Government (Role as a donor) - support coordination efforts at Donor and NGO groups (Donor Group/Sector Working Group/ WESNET). Scottish Government – Raising the profile of water and resourcing requirements (government - government) SEPA - NWRA Catchment management support
Water Resource Management -Increase investment in water provision	-Increase priority for Government investment in water provision -Responsible investment by the government with formal financial reporting and accountability -Advice on sourcing new water supply, new or rehabilitated treatment and distribution systems -Invest in building capacity amongst ground-level staff (DWOs, WMAs, extension workers) both in terms of number of staff and their skills base. -Address key issues at community level (CBM failure points related to capacity for financial management, technical operation and maintenance (O&M,) -Support for the introduction of independent financial regulation of Water Boards to allow tariffs to be set that enable investment in Urban infrastructure -Funding of new or improved water points in Rural areas	Scottish Government – Raising the profile of water sector and resourcing requirements (government - government) Scottish Water International -support asset assessment and management plans Scottish Government - Support local training provision and capacity building. Engage local providers e.g. Mzuzu university, WASAMA
Water Resource Management -Address root causes of source protection quality and quantity	-Address deforestation caused by lack of alternative economic opportunities for communities (jobs) and energy needs -Improve community action /sense of ownership of water supply (to protect from pollution, and improve use) -Improve monitoring and enforcement structures by investing in district level staff capacity and resources (IT, vehicles, monitoring equipment) -Improve understanding of aquifers and water recharge issues (reforestation, recharge methods) -Research is needed in aspects of IWRM such as Rainwater harvesting, storage and use at household and community levels, establishment (nationwide) of wetlands to encourage groundwater recharge, and possibly use for irrigation	Scottish Government – Raising the profile of water and resourcing requirements (government - government) SEPA - NWRA Catchment management support

Key Challenges	Needs	Scottish Government Supported Intervention
Infrastructure -Improve infrastructure and performance of water supplies	-Masterplan for water supply investment to include refurbishment of distribution systems, dams with multiple uses (energy and water supply) -Development of asset management plans -Increase the priority of major water sector schemes within the portfolio of projects for large donor funding. -Encourage water conservation (education, behaviour change) -Reduce leakage across aging water board assets -Improve rural borehole functionality	Scottish Water International -support asset assessment and management plans
Capacity Building- Improve human resource across key water functions	-Investing in training at strategic (policy, regulation and decision making) and operational (IT, Monitoring, Enforcement) levels -Develop Mechanisms to recruit, train and retain skilled staff at operational level. -Incentivise new recruits and have a career structure in place to retain key staff.	Scottish Government - Support local training provision and capacity building. Engage local providers e.g. Mzuzu university, WASAMA
Improve monitoring and surveillance	-Increase numbers of WMAs and DWOs -Increase IT capability (hardware, software and human capability) -Improve data accessibility, reliability and harmonise data collection approaches. -Align data with the Malawi SDG indicators -Collate and review water quality data to identify poor quality water sources, and gaps in data -Improve data sharing between sectors.	Improve Monitoring and Surveillance - NWRA Catchment management support through SEPA Scottish Government - Support local capacity building. Engage local providers e.g. Mzuzu university, WASAMA

4.2 Enhancement Indicator set

The purpose of the indicator set is to aid planning and monitoring of future Scottish Government support activities in Malawi, therefore the enhancement indicators have been aligned to the UN SDG6 indicators. Planned support activities can be designed using a delivery framework and the identified deliverables should be mapped to relevant indictors and a qualitative assessment made of the extent of their contributions to the indicators.

The appropriate sub-set of indicators can then be developed into metrics for monitoring.

The indicator set in Table 3 has been developed in the context of the key challenges set out in the Critical Path; Coordination and Governance (cross cutting), Improve monitoring and surveillance (cross cutting), Water Resource Management, Infrastructure and Capacity Building. The link to related SDG6 target and indicators are also shown in Table 3.

Table 3 Enhancement Indicators

Key Challenges	Enhancement Indicators	Related SDG6 Target	SDG6 indicator
Water Resource Management	Investment in water provision Functionality of water systems Water quality monitoring	6.1. By 2030, achieve universal and equitable access to safe and affordable drinking water for all	Indicator 6.1.1: Proportion of population using safely managed drinking water services
Water Resource Management	Risk to water source WASH coordination and engagement	6.2. By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	Indicator 6.2.1: Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water
Water Resource Management	Improved monitoring and enforcement structures	6.3. By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated waste water and substantially increasing recycling and safe reuse globally	Indicator 6.3.1: Proportion of wastewater safely treated Indicator 6.3.2: Proportion of bodies of water with good ambient water quality
Infrastructure	Asset management plan development Understanding of surface water availability and aquifer water recharge Use of database to manage local assets	6.4. By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	Indicator 6.4.1: Change in water-use efficiency over time Indicator 6.4.2: Level of water stress: freshwater withdrawal as a proportion of available freshwater resource
Water Resource Management	IWRM Good practice demonstrated	6.5. By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	Indicator 6.5.2: Proportion of transboundary basin area with an operational arrangement for water cooperation Indicator 6.5.1: Degree of integrated water resources management implementation (0- 100)
Water Resource Management	Catchment management approaches Improve community action and sense of ownership	6.6. By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	Indicator 6.6.1: Change in the extent of water-related ecosystems over time
Infrastructure	Implementation plan for WRA Data for investment strategy Accessibility of data for decision making	6.a. By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programs, including water harvesting, desalination, water efficiency, waste water treatment, recycling and reuse technologies	Indicator 6.a.1: Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan
Capacity Building	Local community ownership & knowledge Invest in building capacity of staff	6.b. Support and strengthen the participation of local communities in improving water and sanitation management	Indicator 6.b.1: Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management

5 Conclusions and Recommendations

The aim of the Hydro Nation Project was to provide Scottish Government with additional supporting information to aid their understanding of water resources, stakeholder interactions and to identify key challenges for Malawi in achieving SDG 6 and to help identify areas where the Scottish Government could provide further support.

The Hydro Nation Project deliverables are to provide:

a. An initial review of knowledge of sustainable water resources in Malawi
b. A stakeholder map identifying areas for enhancement & governance support requirements.
c. A critical path to scaling up to meet the 2030 sustainable development goals and recommendations on opportunities f or enhanced impact
d. Enhancement Framework indicators.

The review of knowledge of sustainable water resources in Malawi showed that there is a general reduction in available water resources resulting in significant lowering of surface and groundwater levels. Large-scale deforestation alongside reduced frequency of precipitation and higher ambient temperatures, and increased water demand associated with high population growth rate are believed to be some of the factors affecting the water levels. Hence, a holistic assessment of water supply and demand, i.e., integrated water resources management implementation, is needed to address medium to long-term water availability challenges.

The stakeholder map provides a representation of the water sector in Malawi showing stakeholders in relation to their contribution to key areas of governance and policy development, regulation, policy implementation and service provision. The representation shows the diverse range of actors resulting in a complex interaction amongst stakeholders. It highlights the complexity of the planning and co-ordination processes and a need for enhance coordination of activities in the sector. It was found that the nature of these processes limits the effectiveness of the planning process which in turn restricts the effective operation of the water sector and the implementation of water development projects.

The critical path is based around 5 key challenges for Malawi, namely; coordination and governance, water resource management, infrastructure, capacity Building and monitoring and surveillance. It is recommended that the critical path should now be used to help Scottish organisations to identify and develop suitable interventions actions to support the water sector in Malawi. It is noted that some of the suggested interventions, such as training at district level, data collection and visualisation, the involvement of SEPA in the development of the NWRA and dialogue between Scottish Water International and Water Boards have already been initiated by the Scottish Government, but most are still in their infancy.

In summary proposed key interventions to enhance impact are as follows:

- Scottish Government (Role as a donor) - support coordination efforts at Donor and NGO groups (Donor Group/Sector Working Group/WESNET). There is a role for Scottish Government as a donor in supporting the donor group. This is important as the current coordination of Donors coordination is weak and getting weaker. There seems to be limited progress on common basket funding (which seems to be more successfully carried out in non-water sectors in Malawi).

- Scottish Government – Raising the profile of water and improving the governance and regulatory framework (Government – Government interaction). There is a role for Scottish Government in raising the profile of water within the Malawi Government. Malawi Government funding for operation costs and water development projects is inadequate as are available levels of Water Board investment in Urban areas. This support needs to take account of the current high level senior staff turnover in the relevant Ministries and that some investment decisions at district and national levels seem to be heavily influenced by partisan politics. There is also a need for independent regulation of Water Boards (as there is in the Energy sector), to give the boards the opportunity raise sufficient revenue for the enhancement of water systems and the renovation or aging infrastructure in the rapidly growing cities and peri-urban settlements, subject to charges being set at affordable levels. In rural areas, intervention by Donors and NGOs must be undertaken in closer partnership with government at national and district levels to ensure legacy through the establishment of effective post project community management schemes. Appropriate operation and maintenance systems must be put in place with sustainable funding sourced to address population growth and increasing access to water resources. There are examples of emerging innovation that could be supported. For example, the Malawi Government and some donors are piloting projects on the practicality of clustering rural communities to enable water distribution through piped systems from a centralised high yield borehole rather than the current multiple borehole system preferred by individual donor.

- Scottish Government - Support local training provision and capacity building. In addition to a shortage of staff at district level there is a need for training and skills development, knowledge retention and transfer amongst staff in areas such as water systems operation and development and Integrated Water Resource Management. There is need to increase direct involvement of local universities and training institutes in capacity building e.g. Mzuzu University and WASAMA. Capacity building activities need to be delivered through local public sector training and educational establishments and not through private sector or other NGOs. By so doing, knowledge can be retained by entities that are not likely to disappear when donor support comes to an end. Moreover, this will ensure that knowledge is transferred to, and retained within, local universities and training institutes.

- Scottish Water International -support asset assessment and management plans. Water Boards have aging and failing infrastructure, leakage, cross contamination from failing sewers, insufficient capacity (resulting from growing population due to migration to urban areas means pipes to growing suburbs are too small) and no ring mains. There are very limited prospects for Water Board investment in infrastructure because of poor revenue recovery due to government influence on tariffs and non-payment or late payment of water bills by Government agencies. There is also evidence that whilst feasibility studies for major projects have been completed and submitted to major funders, these studies may have not have adequately addressed the social and environmental aspects, hence, some support could be given in this area.

- SEPA - Catchment management and water resources management support. Deforestation and land use changes seem to affect urban water supply through, for example, siltation of dams and degradation of water quality and the consequent increase in treatment costs. They can also affect rural water supply through falling ground water recharge

rates that influence level and quality. Deforestation is inevitable due no alternative rural energy sources. Support is needed for the development of the NWRA, and in supporting research involving local partner Universities in aspects of IWRM such as rainwater harvesting, storage and use at household and community levels, establishment (nationwide) of wetlands to encourage groundwater recharge with possible co-use for novel, water efficient irrigation systems. Hydrological studies are also required e.g. the collection and analysis of hydrological data, groundwater levels and trends, the impact and role of forestry.

The enhancement indicators were based on the main cross cutting challenges set out in the critical path and set against SDG6. The purpose of the indicator set is to aid planning and monitoring of future Scottish Government support activities in Malawi. Planned support activities can be designed using a delivery framework and the identified deliverables should be mapped to relevant indicators and a qualitative assessment made of the extent of their contributions to the indicators. The appropriate sub-set of indicators can then be developed into metrics for monitoring.

APPENDICIES

APPENDIX A: Review of knowledge of Sustainable Water Resources in Malawi

APPENDIX B: Initial and Intermediate versions of the Stakeholder map

APPENDIX C: Development of the Critical Path

APPENDIX A: Review of knowledge of Sustainable Water Resources in Malawi

Review the changing demand on water supplies, the impact of abstraction, the resilience and sustainability of ground water in Malawi

Rachel Helliwell, Sheila Gibbs and Joseph Akunna

Key Points

- Prior to the drought in 1991/92 there was no formal monitoring of groundwater level or quality, as a consequence there no baseline to assess change.
- Literature exists on past changes in rainfall, evapotranspiration, temperature and the findings are broadly consistent.
- Climate variability and change are already affecting Malawi. Over the last two decades there has been a greater incidence of drought and intense rainfall events.
- Statistically significant increases in rainfall were identified from long term 1896-1990s, since then there has been no identifiable trend.
- Future projections of climate are inconsistent. That is largely due to the date of study (scientific progress in this area is rapid), climate model and downscaling method used, available data to drive the models.
- Some studies indicate that total annual rainfall will increase in the future; others conclude that it will remain unchanged.
- There is agreement in the literature that temperature will increase in the future, precipitation patterns will become more erratic, and extreme weather event will increase in frequency and intensity.
- The search for literature will continue into the future predictions of drought in terms of occurrence, frequency and length of drought periods.
- Government reports confidently state opportunities to expand irrigation (2 or 3 fold) based on current water resources but to date we have found no literature to quantify that resource in Malawi.
- The level of Lake Malawi has been used as an indicator of wet and dry years. Past trends (reflected in the literature) are broadly consistent. Some authors link lake level purely to rainfall; but to date, few studies have considered the wider controls on the changing level of lake, such as regulation/ transboundary demand etc. Future predictions of lake levels are inconsistent; this is largely a result of the contrasting projected rainfall projections and assumptions made in the models.
- More work is required to:
    - o Quantify the various demands on the water resource in Malawi. Rapid population growth will increase water demand especially in the urban areas (surface/ groundwater).
    - o Quantify past and future demand by industry and agriculture (irrigation) on ground water supplies
- To enhance resilience of water resources, large scale afforestation is necessary to 'slow flows' and promote infiltration and more effective groundwater recharge. There is a need to source relevant literature that demonstrates the effect of deforestation on groundwater and the potential of sustainable future forest management on the groundwater resource. An international assessment is underway based on studies from countries with similar challenges with regard to deforestation and water resources.

1. THE PROBLEM

While a broad overview of the effect of climate change and drought on groundwater resources is relatively easy to obtain (most officials in Government Departments paint the same picture), fleshing this picture out in terms of quantitative data is rather more difficult[3].

There are several reasons for this:

- No comprehensive groundwater monitoring system giving reliable information on the status of rural water supplies existed prior to the drought of 1992. Emergency assessments were carried out during the drought, but donor funding for nationwide monitoring ended with the return of the rains;
- No overall evaluation of the impacts of the 1992 drought on groundwater supplies appears to have been made. This is in stark contrast to the amount of effort which has gone into evaluating the impact of the drought in terms of food security;
- Government Departments, with limited financial, technical and manpower resources, did not have the capacity to tackle the water supply problem in rural areas by itself. For this reason, the donor response often side-stepped the 'Water Department' with the result that comprehensive and coordinated data collection and analysis was made more difficult; and
- Donor support financed a massive capital programme of well drilling and rehabilitation but did not finance any continuous groundwater monitoring programme.

2. CLIMATE

Malawi's present climate is characterized by a warm wet season from November to April (during which 95 per cent of the country's annual precipitation falls), a cool dry winter from May to August, and a hot and dry season from September to October. It currently experiences considerable fluctuations in year to year rainfall variability, resulting in difficulties in pinpointing long-term historical trends[8]. However, based on recent community-level interviews with smallholder farmers, there is evidence to suggest that the climate in Malawi is changing. For example, there has been a marked change in the growing season and the crops grown over the past several decades. In recent years, repeated floods and droughts have compromised the country's food and water security, including impacts on health and energy supply[8].

In another study, observed and simulated changes in the

water balance component over Malawi, during 1971-2000 were compared but still didn't detect a statistically significant trend in rainfall. General findings were as follows: (1) An area of high rainfall, evapotranspiration and runoff areas located in the south east and north east highlands and decreasing westwards. Temperature and evapotranspiration were highest in the lower Shire River valley and along Lake Malawi; (2) Statistically significant positive trends in mean annual temperature and evapotranspiration and declines in annual rainfall, evapotranspiration and runoff, though their trends were not statistically significant. The decline in rainfall coupled with temperature increase suggests that Malawi became more water-limited during 1971-2000[11].

Longer term assessments[2, 4] beginning in 1896, have detected very clear and statistically significant increase in rainfall, however studies of recent trends over past decades have not identified a statistically significant trend.

Anticipating the future impacts of climate change in Malawi is difficult as climate models have not been adequately downscaled for the country and consequently projections vary from one study to another[1, 7, 12, 19, 20]. In addition, Malawi is influenced by two regional climate zones—southern and eastern Africa—further compounding climate projections. In the future, climate change is expected to impact negatively on water resources in southern Africa through rising temperatures, associated increases in evaporation losses and changes in rainfall, together with increases in the frequency and magnitude of extremes events.

Nonetheless, evidence from regional climate models, as shown in Figure 1, suggest that Malawi will not experience extreme changes in annual levels of precipitation; rather it will experience changes in rainfall patterns, including further shifts in seasons, decreases in rainfall during dry seasons and increases during the wet season. Regional climate models predict that temperatures will increase by 1.1 to 3°C by the 2060s and by 1.5 to 5°C by the 2090s.

A separate study identified that climate change in Malawi is projected to increase median temperature by 3-4°C and precipitation is predicted to changes by 0-5% (contrary to predictions depicted in Figure 1) by the end of the 21st century. However, large levels of uncertainty exist with temporal and spatial variability of rainfall events[1].

Whilst many studies agree that extremes in rainfall intensity and severity of droughts will increase, there is considerable disagreement about the frequency of events and drought and the longer term trends in rainfall. Some studies found that in the future reductions in rainfall, reductions in surface runoff are likely to impact negatively on groundwater recharge and consequently contribute to drying of boreholes across the country[10].

3. DROUGHTS AND GROUNDWATER

In the last 36 years, Malawi has experienced eight major droughts, affecting over 24 million people[17]. The drought of 1991-92 was the most severe and is well documented. However, lower than average rainfall and drought conditions persisted into the 1992-93 and 1993-94 wet season. The normally perennial North Rukuru, Lilongwe and Bua Rivers dried up not only in 1992, but in 1995 also - a hitherto unheard of phenomenon. This has meant that water resource problems have continued to occur long beyond the end of the food crisis. As far as groundwater resources in particular are concerned, it is recognised that there may be a considerable time lag between periods of low rainfall and effects on groundwater levels, and that several (not necessarily consecutive) periods of low rainfall may conspire to create a situation of groundwater drought. This makes it important to have a continuous groundwater monitoring and assessment programme, with monitoring of groundwater supply status to include periods outside drought episodes defined only by surface water and food security indicators. The focus of the BGS report on the events of 1991-92 rather than, say, 1991-1995, is therefore recognised as a weakness, but reflects the fact that drought monitoring efforts are concentrated in periods defined by indicators other than groundwater status (REF 15). Currently, the country is experiencing the after effects of two consecutive disasters—devastating floods from 2014-2015 and dry spells between 2015-2016—leading to agricultural drought[17].

So far, few studies have been identified on the long-term forecast of drought conditions.

4. LAKE LEVELS

The level of Lake Malawi has varied widely since the late 1800s, and has risen dramatically in the period 1976-1980. The causes of the change in level have been investigated using a water balance. Results indicate that the recorded changes in rainfall were sufficient to have caused the observed changes in lake level, and that man-made changes in runoff and outflow have been comparatively unimportant. The model study showed that an increase in average rainfall equal to that recorded between 1915 and 1937, and between 1940 and 1979, is sufficient to have caused the recorded rise in average lake level over those periods. The period 1937-1940 could not be modelled because the outflow rating was changing rapidly[2, 4].

Whilst increasing lake levels have resulted from increasing rainfall in the past, sensitivity analysis of the Water Balance Model of Lake Malawi to climate change have shown that water level will "continue to drop following a decrease in the rainfall season and an increase in evaporation rates from the lake"[5] The predicted future drop in water level of the lake calls for alternative proposals for both hydropower and irrigation development as the current system relies too much on the lake[5].

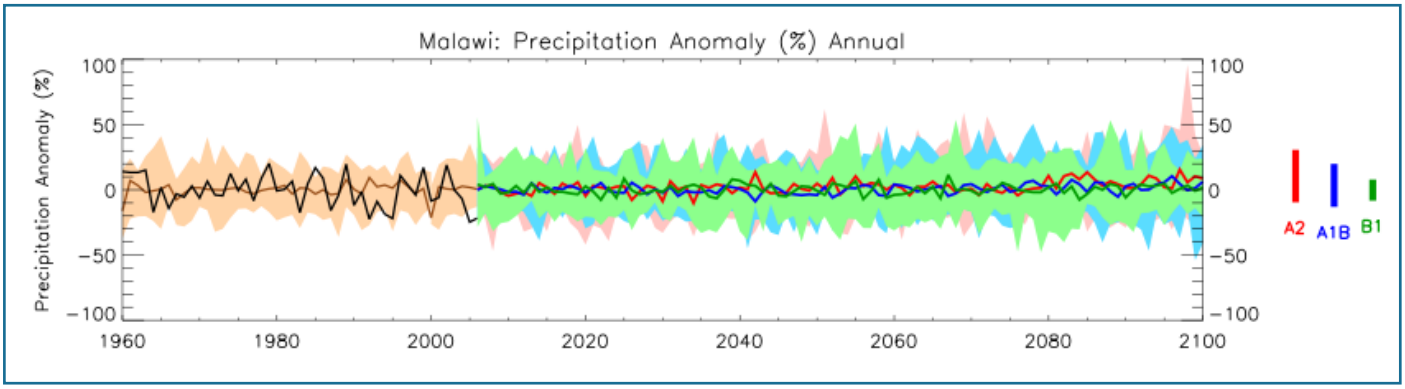

Figure 1. Trends in monthly precipitation for the recent past and projected future. All values are percentage anomalies, relative to the 1970-1999 mean climate8

GROUNDWATER RECHARGE

In the highlands where orographic rain is significant, recharging waters penetrate scree slopes around the syenite inselbergs. On the weathered basement, the presence of low permeability clays in the weathered superficial saprolite may act as a semi-confining layer. Nevertheless, recharge is likely to occur through it regionally by slow direct infiltration.

Groundwater recharge estimates vary from 5- 100 mm/year for the weathered basement aquifers and from 3-80 mm/year for the alluvial aquifers. To put these recharge estimates into perspective, groundwater abstraction in 1991 from wells and boreholes with handpumps, expressed over the whole catchment, is estimated to be less than 1 mm/year on average, and 2-3 mm/year in densely populated areas[3].

Changes in water level have important water supply implications, particularly where the aquifers are thin and when drawdowns are large. Water level falls due to low annual recharge can result in the loss of a large proportion of transmissivity. This was observed in escarpment boreholes at Ntcheu in 1983, where the aquifer only has limited fracture storage. Receding water levels resulted from below average recharge in the two preceding wet seasons. Wells with short water columns, for instance shallow wells and partially penetrating boreholes are particularly vulnerable to the effects of falling water levels.

Important lessons can be learnt about areas at risk of drying during drought periods from the 1991-92 drought. These are summarised[5] from the "November 1992 Drought Assessment Report" MIWD and the 1992: Status of Water Resources and Supplies. Prepared by Water Task Force, 1992.

In describing the impact of the drought, a distinction is again made between boreholes and shallow wells. The report states that relatively few (perhaps 5% of the 8200 catalogued) boreholes had dried up by November 1992. Dry boreholes were mainly concentrated in hilly and mountainous areas such as Livulezi Valley, where aquifers are of limited thickness and storage capacity. The report presents water level data from some monitored boreholes which indicate a significant decline in water levels between the period of maximum rise and maximum decline (March-November), if not a total drying up. Most of these boreholes are located on basement and fractured escarpment aquifers; no data from the alluvial aquifer was available, and no historical data is available. In contrast, the report states that most shallow wells (perhaps 70%) were dry by November 1992, especially in catchments where major rivers (for example Bua, South Rukuru, Phalombe, Mwanza) had dried up. These districts included: Chitipa, Rumphi, and Mzimba in the north; Casing, Dowa, Mchinji, Lilongwe and some parts of Salima, Dedza and Ntcheu in the Central Region; and almost all districts in the south.

In areas where shallow wells were the principal source of potable supply, impacts were particularly severe. Examples quoted in the report include Salima, where all 17 wells dug by the 'Water Department' dried up by September, and Nkhotakota, where 114 out of 169 shallow wells were dry by November.' The report goes on to state that " the drying up of traditional water sources in the north appeared to have seriously affected some parts of Mzimba, Rumphi, Chitipa, Karonga and isolated areas in Nkhata Bay."

POPULATION

In Malawi projected water supplies are affected by increases in temperature and local variability of precipitation. This is compounded by rapid population growth which, as shown in Figure 2, leads to increased water demand especially in the urban areas thereby putting pressure on water supplies[13, 15]. Malawi is growing rapidly with a 3% annual growth rate. By 2050, the population is expected to hit 45 million, which is almost triple the 2010 population. Currently 92 per cent of Malawians rely on water sources which are dependent on rainfall recharge and are highly impacted by projected droughts and floods.

DEFORESTATION

More than 97% of Malawian households use charcoal or firewood for cooking and heating, making Malawi one of the most biomass energy- dependent countries in the world. In Malawi's rapidly-growing urban centres, biomass energy remains the primary cooking and heating fuel for 88% of the population, and charcoal is now the primary source of fuel for the majority (54%) of urban households[14]. Charcoal and firewood is the only source of fuel in rural communities. This demand, coupled with rapid population growth, has and will, place increasing pressures on the forest resource of Malawi. Malawi's 3.6% rate of annual deforestation is among the worst in the world. There is a need to source relevant literature that demonstrates the effect of deforestation on groundwater and the potential of sustainable future forest management on the groundwater resource.

Figure 2. Malawi actual Population growth trend[18]

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APPENDIX B: Initial and Intermediate versions of the Stakeholder map

Interviews were undertaken in Malawi in January 2017 with the University of Strathclyde (UoS) project team and a representative of their Malawi Local Partner (Water for People) to understand the CJF2 project delivery structure and its stakeholder network in Malawi. The interviews were used to develop Information Flow Diagrams (IFD) for the key project team members. Figure 1 shows an example of the IFD from an interview.

Not surprisingly, the diagram reflected the focus at that time of the CJF2 project, showing strong interaction with the Ministry of Agriculture, Irrigation and Water Development at District Level and emerging interaction with high level officials in the Malawi Government Ministry's. The diagrams demonstrated opportunities to enhance the robustness of the delivery and opportunities to scale up the project to other districts. The solid lines between all the Strathclyde team and WFP, and District Executive Committees illustrate the close working on the ground between these three groups. The diagrams also reflected the following CREW Project initial audit findings, namely;

- A need for greater engagement with high level officials in the ministries and with the academic community in Malawi and for improved coordination of efforts between District and Ministry level. The CJF2 project was seen to provide a forum for these groups to come together.
- A need for wider engagement with other NGOs and funders in the Southern districts and with Shire Basin River Basin Management" project in order to improve coordination of activities and approaches.

The Abertay team visited Strathclyde University in June 2017 to review the IFD and the CJF2 activities and plans. Changes to the scope of the project and to the local delivery partnership were identified. Therefore, following the meeting a wider range of stakeholders were identified for interviews and meetings in the November 2017 Malawi visit to provide a fuller understanding of both the expanded CJF2 project and the wider stakeholder interaction in the Water Sector in Malawi. Meetings and Interviews including a Ministry staff in Lilongwe, Ministry Laboratories, other NGO's and Donors, representatives of the Shire Valley project, Universities in Malawi and the emerging National Water Resources Authority NWRA. Semi-structured interviews were undertaken guided by the following questions:

- What is your role in relation to the water in Malawi?
- Who do you work with within you water related role (Key contacts and Major players)?
- What do you think are the main issues and barriers to achieving clean water for all in in Malawi? What can be done? What Indicators can be used?
- Any other Issues?

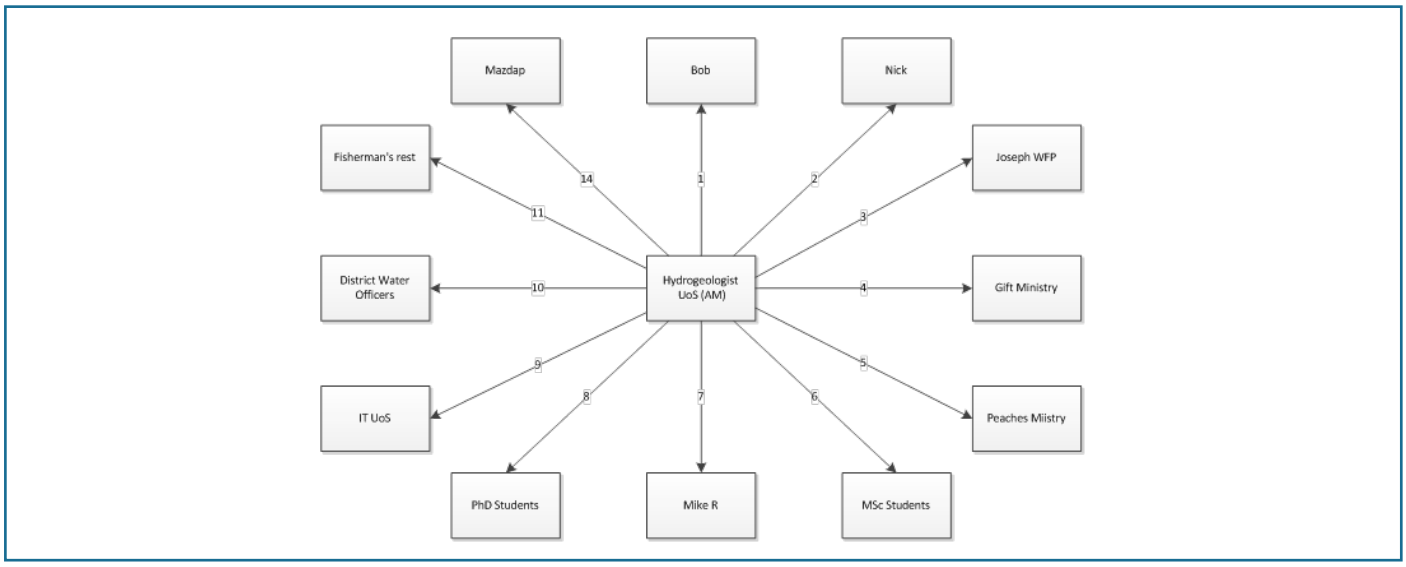

Figure 1. Example of an IFD from An Interview

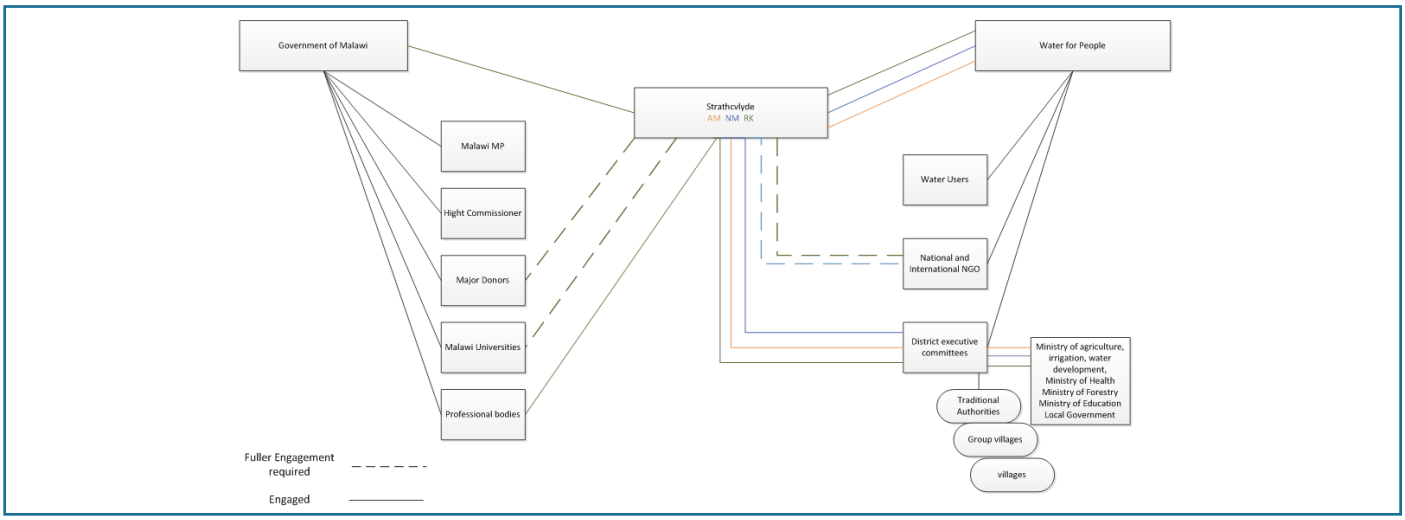

Figure 2: Composite Information Flow Diagram for the CJF2 project in January 2017.

IFD's were again prepared for each interview and combined to create an Initial Composite Stakeholder Map as shown in Figure 3. The Map shows the complexity of the water sector in Malawi, both in terms of the number of active stakeholders and their interactions. Whilst this is useful, the Map does not demonstrate the role of the stakeholders in the sector in terms of their contribution to key areas such as governance and policy development, regulation, policy implementation and service provision. In addition, the Map is now focussed around the activities of the Ministry of Agriculture, Irrigation and Water Development, reflecting the types of interviews that had been undertaken during the November 2017 visit. Therefore, further revision of the map was required to increase its effectiveness and to ensure that it was representative of the full scope of water sector activities.

Further analysis was undertaken of the interview data to assess the key contribution of each of the stakeholders to the water sector and this enabled the production of the Initial Stakeholder Map a shown in Figure 4. Two key subsectors emerged, these being Central Government (Policy Development) and Implementation and Operation, the latter being a complex network of stakeholders, including government regional and district offices, district commissioners and district executives, NGO's supported by donors, Water Boards and private sector organisations. Interaction was facilitated by non-governmental coordination bodies.

The interviews that were undertaken up to and including the January and November 2017 visits are highlighted in bold font in Figure 4. This shows that the current set of interviews provided an understanding of the general stakeholder interaction in the sector and of Central Government activities but that there were potential gaps in knowledge on the Implementation and Operation subsector and on the co-ordination activities. This was confirmed in the NVIVO analysis of the November interviews which also identified a need to develop a fuller understanding of the contribution of stakeholders to the planning process in the sector. This informed the planning of the October 2018 visit where interviews were focussed on collecting additional evidence on planning systems, coordination, governance and capacity needs. Figure 4 shows a revised version of the Map that was produced following the October 2018 visit. Interviews are shown in Bold font and this demonstrates the coverage of the sector. This version forms the basis of the Final Stakeholder Map.

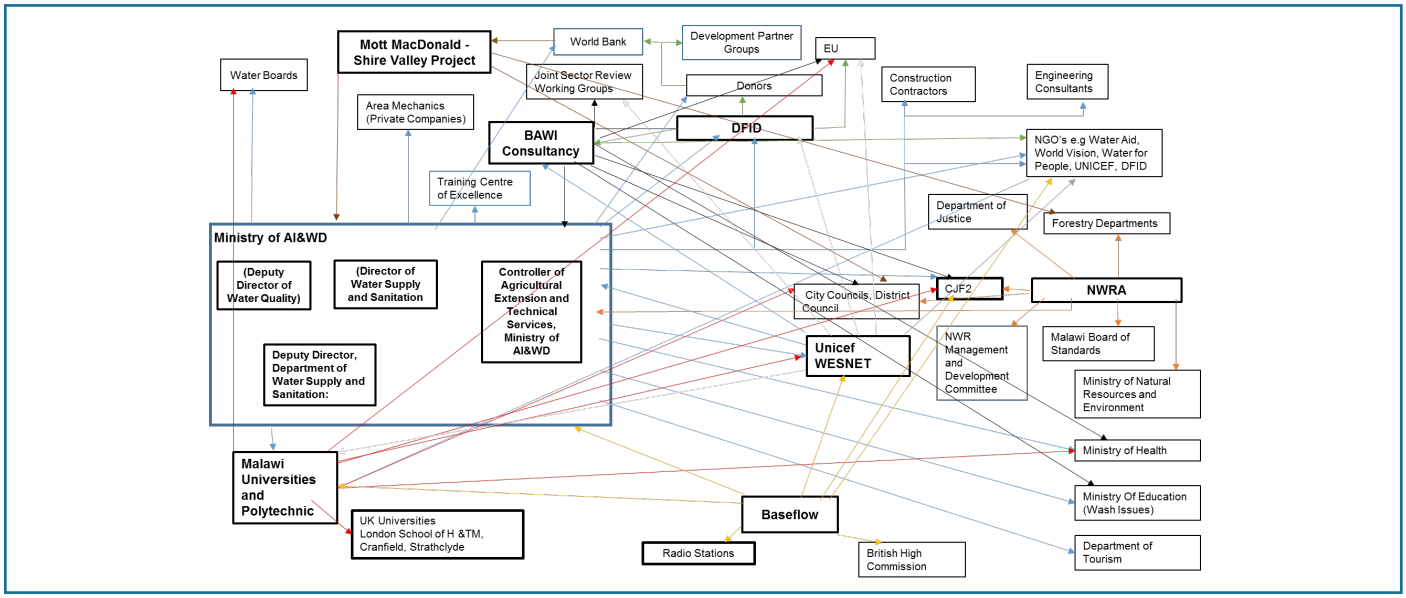

Figure 3: Initial Composite Stakeholder Map after November 2017 visit

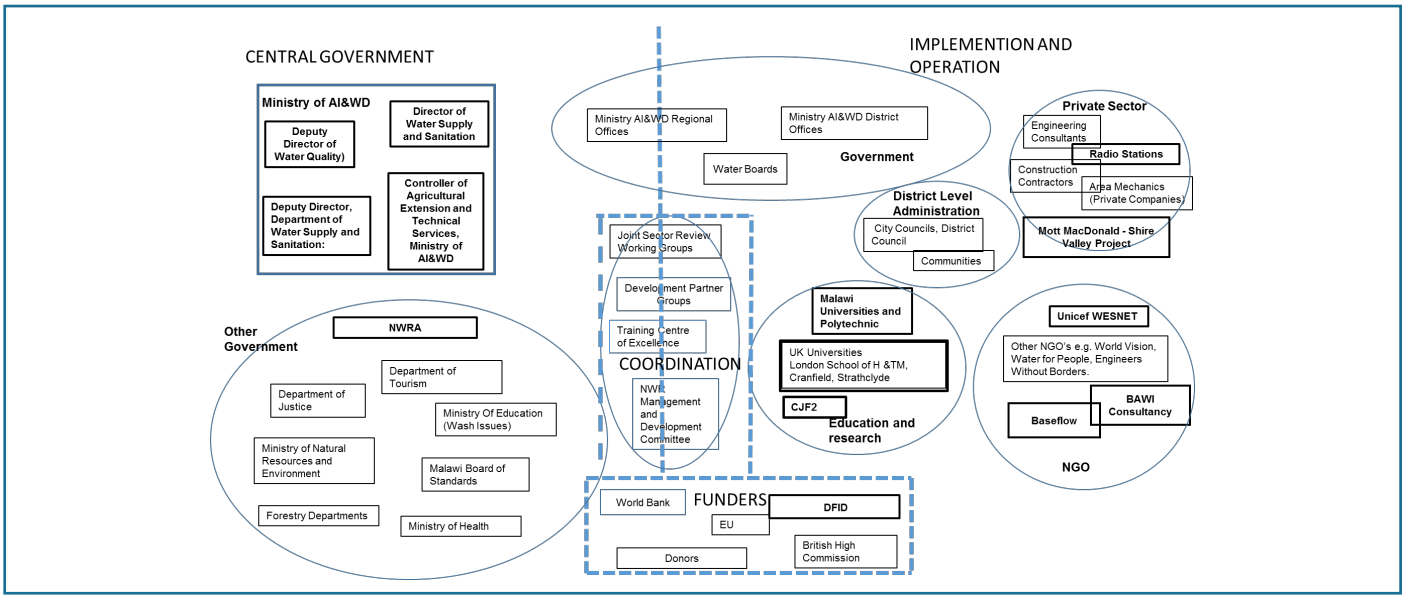

Figure 4: Initial Stakeholder Map after November 2017 Visit

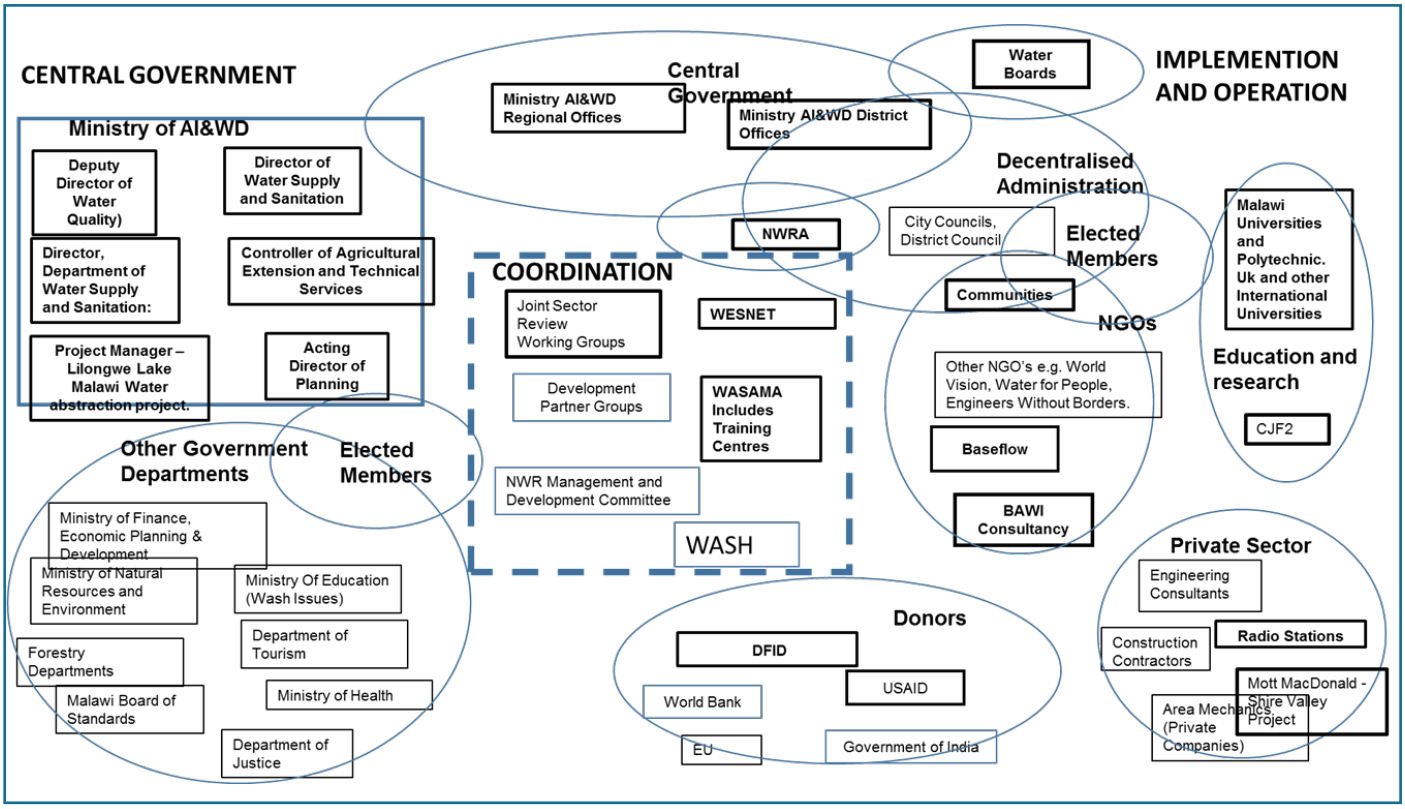

Figure 5: Stakeholder Map after October 2018 Visit

APPENDIX C: Development of the Critical Path

Introduction

The purpose of the critical path is to independently identify the key sequence of IWRM activities likely to be required to work towards achieving SDG 6 in Malawi by 2030 and facilitate discussion on the alignment of future CJF activities with the wider Malawi IWRM programme to assist in achieving SDG 6 in Malawi by 2030.

A first draft critical path was developed from a variety of information sources:

- Discussion with Scottish Government
- Discussions with University of Strathclyde (UoS) CJF team (including an initial workshop at UoS, Oct. 2016)
- Surveillance and observations collected during January 2017 visit to Malawi
- Discussions with key stakeholders in Malawi in January 2017
- Synthesis of interviews November 17
- Triangulation of initial findings from interviews Discussions with key stakeholders in Malawi in Oct October 18
- Interviews with relevant Scotland based stakeholders in 2018.

The initial draft critical path (CP) is presented in Section 5 of this appendix along with a set of draft indicators. This draft was presented to stakeholders involved in the CJF project from UoS, Scottish Government and CREW at a project meeting in July 2017. Feedback was sought from these stakeholders as to the relevance of the content and logical flow of steps. Discussion of the critical path at the July 2017 meeting highlighted some key needs for achieving SDG6 in Malawi:

- o Increased culture change regarding IWRM
- o Understanding the value of water
- o Localised definition of IWRM based on local issues and priorities
- o Engagement of local water boards (WASAMA) may assist
- o Scottish Water Internationals role in progressing objectives
- o Future changing demographic
- o Once data is obtained, how long is it valid, what is it good for? How to ensure data is used to make decisions (can we be confident that it will be?)

Emerging Themes

In November 2017, a second visit to Malawi was carried out by the Abertay team. This visit included extensive interviews with key stakeholders involved in Malawi's water sector and visits to villages, laboratories, ministry offices, civic society organisations and donor offices. These visits included semi-formal interviews with stakeholders and provided additional evidence to inform the critical path, particularly on understanding governance and capacity needs, which were identified as key issues in developing the first draft of the critical path. NVIVO software was used to carry out theme analysis of the stakeholder interviews. Table 1 shows the top ten themes that were mentioned by the most interviewees and also mentioned multiple times.

The purpose of the October 2018 Malawi visit was to confirm the findings of the previous visits, to identify any other existing or emerging themes and to explore the current status of SDG6 and the challenges and barriers its achievement. Interviewees were selected based on the analysis of the November 2017 stakeholder mapping to ensure a wider coverage of stakeholders than that of previous visits. NVIVO software was again used to carry out theme analysis. The key initial themes were verified, and 6 new themes emerged from the analysis due to the wider stakeholder involvement as shown in Table 3. The theme narratives in the next section present the composite findings from all visits grouped by 2018 theme headings.

	Nov 2017	
	Number of Sources	Number of Coding References
Capacity building	12	52
Coordination of activities	12	41
Catchment management and integrated approach	12	36
Capacity for monitoring	11	35
Water Quality and Quantity	12	32
Training	11	31
Data quality	12	28
Ground water	11	25
Activity driven by NGO objective	11	24
Mapping	11	23

Table 1: Top themes from interview coding exercise (Nov 2017 interviews).

	October 2018	
	Number of Sources	Number of Coding References
Capacity building	12	60
Coordination of activities	13	36
Politics and politicians	11	31
Decentralisation	12	29
Water Quality and Quantity	11	28
Influence of donors	11	23
Training	10	19
Environmental degradation	9	18
SDG development	7	18
Activity driven by NGO	10	16
Community empowerment	5	15
Data quality and management	8	13
Water Boards	7	13

Table 2: Top themes from interview coding exercise (October18 interviews).

Post 2018 themes	Post 2017 interview themes
Capacity building **Community empowerment**	**Capacity building**
Coordination of activities	**Coordination of activities**
Environmental degradation	**Catchment management and integrated approach**
Water Quality and Quantity	**Water Quality and Quantity** **Ground water**
Training	**Training**
Activity driven by NGO	**Activity driven by NGO objective**
Data quality and management	**Mapping** **Capacity for monitoring** **Data quality**
Decentralisation	
Politics and politicians	
The influence of Donors	
SDG development	
Water Boards	

Table 3 Post 2017 and 2018 visit theme narratives

Theme Narratives

Capacity Building

The theme of capacity building includes interviewee engagement with insufficient or outdated equipment, provision for training and access to training locations, resources including financial, transport, and staffing. In addition, references to knowledge have also been included in relation to sharing of knowledge across actors. Although these themes were uncovered and are engaged with separately below, they are interrelated and thus must be dealt with together.

Training was highlighted by several respondents in relation to capacity at the local, district and national levels to not only provide opportunities to train individuals but to also ensure that knowledge gained from training is shared across different spaces. A number of respondents suggested that local training would be both more accessible and efficient as not only would it allow a greater number of Malawians to benefit but there is greater likelihood that the knowledge will be shared with others and thus retained given the high staff turnover in Government departments. Specific training needs were identified around mapping and data management (for example, computer literacy) which would require both significant financial investment and a recognition that the development of such skills is also an investment of time. This need for investment is also expressed in relation to career development for district water officers who often find themselves in positions with limited progression or further opportunities. Currently there are vacancies across government and district levels but there is a lack of succession planning within a number of districts which prevents the movement of people in to those positions.

Relatedly, knowledge sharing was highlighted across different levels as a barrier to coordinated activity. Knowledge is not always disseminated through the relevant channels and between stakeholders. Barriers to sharing information occurs vertically with regards to information originating from communities, and being transmitted to districts, and then to government and donors. It also occurs horizontally between different districts, between government departments, and between donors. With knowledge production and retention being cited as core concerns, questions were raised around forms of knowledge, and what knowledge is privileged, particularly with regards to valuing the knowledge held by local communities and those working directly with them, such as district water officers. While there is a wealth of knowledge at these levels, this is not always taken in to consideration by those with the power to make decisions. Alongside this, lessons learned from existing and past projects funded by donors are not always retained, transferred, or embedded within the development of future projects. To address this, more importance should be given to long-term knowledge retention and legacy of donor contribution. With disruptions to the flow of knowledge, there are opportunities for better coordination between stakeholders at international, national and local levels who are working on WASH.

While better coordination is desirable, in order to share knowledge and resources, adequate budgets are required. Interviewees suggested that donor activities are aligned with government funding cycles to allow a budget for the project legacy. Budgets therefore need to reflect the need for future maintenance and long-term sustainability of projects at both government and district level. Basket funding was identified as a possible solution to ensuring there is a continuous source of money available. A proposal in relation to this is currently being considered. There should be a transition period that covers that from when the project terminates to the government taking control of the activity. Although decentralisation is now well established in Malawi, resources continue to be limited. At district level, funding limits their ability to fully engage – on a regular basis – with local communities due to the high cost of vehicles and fuel. This also limits the ability to supervise drilling, an issue raised during interviews. In urban areas, water boards identified challenges around investment and non-payment of water bills by the government. This non-payment of water – alongside fixed water rates – negatively impacts the availability of funds to invest in future developments.

Issues emerged of accountability and regulation. In particular, the government's role in setting water tariffs was raised as problematic given that they are also a primary consumer. An independent financial regulator is required in order to allow the water boards to review charging structures.

Community empowerment

As the legacy of projects is an issue, there is a need for greater community involvement in not only their development but also ways to ensure they are sustainable in the long term. This would require mobilisation of communities and a more bottom up approach, for which there are good examples to follow, e.g. REPO Africa. Community empowerment is important.

In terms of a bottom up approach, village development committees play a key role in empowerment, and often involve 4 people from the village, with minority groups such as women, young people and people with disabilities being included. While this system works well and ideas are fed back to district level, informing wider development plans, it was highlighted that there has sometimes been resistance to these plans. Traditional leaders 'have power over everything within the traditional area' and although they are important 'they should not impose on others'. It was suggested that traditional leaders should not also be the leaders of village development committees for this reason.

One aspect of community empowerment is the model of 'community savings', whereby money is contributed by the community each month, which gathers interest over time, and can be used to cover the rising costs of spare parts. Gathering interest offers an incentive, as well as ensuring that money is available should boreholes need to be repaired.

Other issues concerning deforestation and land degradation were cited as the result of little opportunities for villages to make money. While young people in villages are being educated about water and degradation through 'village nature clubs', communities also rely on cutting down trees to sell. To address this, interviewees stressed that there needs to be a focus on issues of natural resources and poverty, and alternatives available, such as making honey. The government is beginning to realise that there is an environmental issue here that needs to be addressed. Although there are no state laws regarding cutting and burning of trees, community penalties are usually more of a deterrent. Dealing with issues with community justice approaches should be encouraged and supported. In addition, there should be more community sensitisation to environmental challenges alongside offering alternative sources of income.

Overall, communities should be involved in the development of ideas as well as be trained to manage not only funds but to ensure the long-term sustainability and legacy of projects. As it is recognised that some people rely on trees as a source of income, education on environmental issues alone will not combat the problem. The government needs to support and empower communities to source alternative income.

Coordination of activities

Issues surrounding coordination of activities were highlighted in relation to ministries, political will and resources, and donor involvement.

In terms of developing and funding projects in Malawi, while donors often know what projects they would prefer to fund there must be a balance between the already identified priorities across different areas and the financial resources available outside of donor funding, for example to ensure the legacy of projects. For SDG6, in particular, the involvement and vision of donors needs to be more long term with an awareness and understanding of project design from community level, to district, to government and donor, and the project itself should not only align more with government objectives but there is currently little communication regarding the handover and sustainability of projects.

Additionally, projects that emerge from communities or non-governmental organisations must also fit with district plans, which are largely formed by feedback and requests from the Village Development Committees which form their own Village Action Plans. Firstly, ideas are brought to the attention of the Director of Planning and Development and the District Coordinating team. These ideas and plans must then be approved by the District Executive Committee and must also fit with the needs of the district and villages. If the project does not align with the District Development Plan then the proposal will not be realised. If granted, there is often little supervision of work being carried out by NGOs. Although investments from the government are measured and tested in terms of efficiency, this assessment does not take place for donor NGO activity. The concern is that NGOs therefore proceed with the activities that most easily meet their objectives, and then leave. In order to ensure that donor, government, district and community interests are incorporated, there needs to be greater communication across different levels and greater levels of regulation, supervision and measurement of efficiency.

Understanding what the key areas for action are around SDG is challenging; there are no clear definitions or indicators (although a draft to clarify these is being produced by WASAMA). This means that there is little ability to measure progress overall, and with the decentralisation of government and the fragmentation of ministries, there is little monitoring of NGOs taking place which has resulted in duplicated efforts. In other cases, there is an over concentration of effort in one location and little support in another. NGOs should therefore work more closely with districts. Interviews identified the constraints that donors are often under in terms of their own financial administration procedures and donor organisation objectives that, when combined with a competitive environment to be the 'leader' in relation to SDG, there are many projects that cross-over and may work more effectively or efficiently if they were not separate. To address this, some interviewees suggested setting up a basket fund for both ideas and funding although, for the reasons above, not all donors are keen. Basket fund models already exist in other areas such as health, and whilst the government is interested in establishing this, donors require more convincing.

Interviewees suggested that greater communication between the planning department and government, with support from WASAMA, would deal with some of these issues. The government is keen on support from WASAMA to deal with issues of NGO supervision. While there is a level of coordination through WESNET, where donors come together, most initiatives taking place are led by 'individual champions' and WESNET do always meet regularly (although do have a WhatsApp group where they are in more regular contact). They do continue to be useful for ensuring the government has an overview of NGO activity and for ensuring some level of communication. WESNET could be supported more and act as a champion of good practice to encourage NGOs to apply appropriate standards and policies. Not all NGOs are currently members of WESNET and it is suggested that this is due to the competitive funding environment whereby they are driven to focus more on donor objectives than on ministry plans.

Lastly, there is disconnect between ministries who work separately in relation to water, agriculture and health, yet there is a clear connection between each of these areas. Funds and political will and attention are distributed unequally, with greater focus on agriculture and sanitation, yet sanitation and water should not be separate. The sector is only able to respond to water issues due to donors. It was suggested that training for district commissioners in water and sanitation is desirable.

Environmental Degradation

Availability of water and environmental degradation is a big problem with competition for water from the tobacco industry and reliance of 93% population on firewood. Wide recognition of destruction of the environment, no vegetation, water runs straight off leading to lack of ground water recharge and problems of siltation. There have been big changes to the landscape over the years. The land is getting drier. Mountains are more "open" now (less trees, more exposed). This greatly affects the gravity schemes were siltation reduces storage capacity and groundwater recharge concerns. "It's going one step further but one step back because of environmental degradation. The government has started to realise that there is an environmental issue.

There was a wide recognition that the water table is dropping and so there is a pressing need to control the cutting of trees. Communities require sensitisation to increase planting of vegetation, development of forest to aid recharge of aquifers. There are coverage problems in rural areas, no research has been done but ground water levels may be falling, requiring drilling deeper to hit first water. However, it was noted that this may also be due to technical shortcomings in drilling practice. Poor standards of some companies.

In terms of this control, there is hope of passing by-laws. Activated through village actions plans- traditional committee buy in vital. Water Users association is a strong mechanism together with the strength of the chief in villages is important. There are no stiff penalties for cutting or burning trees (often done to draw out mice to eat or sell). Laws are meant to be there but no one is punished. Stiff penalties are the solution. Penalties include paying a goat or a chicken to the chief. Community penalties like this are what people fear as opposed to state law and punishment like prisons. They are for more serious crimes. "When you have community law it can avoid people going to prison because it is dealt with at community level".

There should be more connection with the forestry commission because there is little done in terms of vegetation coverage. Many issues interconnected - soil fertility, soil erosion, adaptation to climate change, declining yields, limited technology to investigate these. Need more support from partners. There needs to be a focus on issues of natural resources and poverty. As people cut down trees to make money, the government should offer alternative ways to make money, for example bee keeping and harvesting honey. This would deter people and stop the destruction of the environment. Dependence on trees must be reduced.

There is no independent regulator in Malawi. The responsibility for Forestry is under natural resources, another government department, so catchment management not a MAIWD function. A wider catchment management role was identified for an independent regulator, although pollution is not considered a big issue as it is regarded to be currently at safe levels a future remit for pollution control was considered also relevant.

Water Quantity and Quality

There are increasing pressures on water supply with an increase in population of 3% per annum made worse in urban areas due

to migration from rural areas for jobs. Water boards will have to match that level of increased investment to supply to the growing urban and peri urban areas. Lack of investment to maintain existing network leads to occurrence of cross contamination from failure of aging sewer lines. Note most infrastructure dates back to the 1970's, including water distribution systems.

Coverage (potential access) was not considered a problem in terms of complying with SDG6, with 80% of the Malawi pop having access to water points or boreholes. The reliability of the water supply was identified as a key issue with only 30% functioning or operating. Other issues mentioned include aging infrastructure in urban areas with no significant investment. A major issue is lack of investment due to an existing scarcity of finance made worse by population growth. Therefore, failing to build new extra capacity and to renovate aging infrastructure, particularly in urban areas is particularly pressing. The feeling from the respondents was that Malawi will go backwards unless it invests and invests heavily.

There was a need to focus on capability rather than on infrastructure. Extension workers are often funded via donor funded projects, but government does not always honour agreements to continue funding once projects are complete. Need to consolidate initiatives avoid fake approval and NGOs' reluctant for joint funding pool. Suggested there was a focus on long term sustainability and future maintenance. Budgets need to reflect this and understand limited spend by government at district level. Look to health projects for good examples.

Under a decentralised model the budget is set for water using a bottom up approach. One the budget is passed the water devolvement monies fed to district led by district commissioners. Whenever funding is released this will go to project in the prioritised district. Due to the influence district commissioners have on investment it was considered important to train district commissioners in water and sanitation. One Issue to note is that all final decisions are taken by politicians. With this apparent split between technical planning and political implementation how do they know where to prioritize spend. Extension planning area.

Technical and performance issues around existing boreholes was identified as a common problem. On key issues identified was the quality of the drilling. Although officers may be aware of responsibilities, the district officers don't have the capacity to supervise. Standards are provided by the government but not followed by the private contractors. Single point boreholes prone to pollution, pit latrines are encroaching. Some springs and dams in higher areas, catchment protection measures are required in these areas to protect sources. Many options can involve less pumping e.g. more dams for Blantyre and therefore not need higher charges in the long run.

Training

The role of universities in both the development of technology and training of staff is important, but respondents highlighted the increased value of having people train 'in country' in order to ensure staff retention and improve capacity. With regards to training, the focus is on human capacity and although there are sufficient numbers of graduate level engineers and accounts, for example, there is not enough skills development training for district level technicians, such as plumbers, plant fitters and plant operators. Training centres for school leavers have closed, such as the government work school in Zomba, and there is now only on the job training available. For those in higher positions preparing to retire, there is concern with regards to the level of qualifications available and accessible for those that will take their place. There is little promotion within the sector, unlike in others such as health and agriculture. With the government push for more people to go to school and be educated to professional positions, the job of an assistant is less attractive. This results in the water sector being slow in terms of human capacity.

While the training conducted in Scotland has been useful, with only 3 out of the 28 districts not attending, stress is placed on the need for local training. Local universities should be better utilised for this as well as training centres such was the MAWI Mongoshie Training Centre and the Malawi Water Institute training centre. In country or being sent overseas, training costs are high.

Currently, although some university academics are members of WASAMA, universities are working in isolation. There is a desire for more collaboration and not competition with regards to knowledge production, and universities like Mzuzu University were highlighted as potential spaces not only for people to acquire qualifications, but to also encourage and promote people coming together to discuss ideas and innovations. WASAMA is considered as a space for accessing and disseminating information as not only do they engage with water related professionals in Malawi but they also oversee the coordination of training whilst working closely with Ministry departments of planning, water and sanitation services.

Specific and increased training is required in order to ensure capacity in a number of areas, such as data gathering, data management, handling equipment, using computers and updating databases, as well as ensuring staff are kept up to date with software changes and availability. Financial constraints make this difficult, and any change here is likely to take a number of years. Respondents also pointed out that more community resources need to be developed in order to provide operational training as well as promote community management of funds.

Overall, there is a need for more investment in training at a local level to encourage people in to the water sector at all levels. More coordinated opportunities for the dissemination of knowledge across and between governments, districts, communities, donors and universities is required. Much of this is limited by financial constraints.

Activity driven by NGO

NGOs are the main project delivery mechanism. This is as a result of the shift from donor to government support, to donor support via NGO. Governments need NGOs to link in with the planning department. However, activities tend to be driven by the NGO and the lack of engagement of some NGOs is thought to be due to competition between NGOs and the need for them to focus on the Donors objective which may not always match the Ministry's plans.

Respondents identified that NGOs should work closely with districts. There are expert knowledge at district and government levels. NGO should go to the district and notify them of proposed projects. Respondents noted that NGOs know the weakness in Government monitoring and control when planning their own operations. Role of Government is week in the process of standards enforcement and different standards are adopted by different NGO's

There is a desire from respondents for more coordination of NGO activities but the key barrier is some NGO's do not want to reveal sources of funding for "commercial" competition reasons. . There is also a challenge around sustaining NGO funded projects. Districts and communities develop a relationship with NGOs. Many projects have an exit strategy for withdrawing NGO funds and sustaining the project legacy with government funded posts. The districts and regions go through the process of handover but being able to sustain through government resource is difficult.

Data quality and management

Appropriate data is essential for decision making, finance and planning at national level. Data in an available form can solve issues in terms of water supply because this provides evidence and it can avoid too much influence from politics. Data management is key. High level data at Ministry level such as planning and detailed data on water and sanitation at district level is key. Data filters are required for the various levels. We need to understand certain things for national planning but much more data is needed for cases at District level. Also need more capacity in data management at the various levels – training, equipment, computers and connectivity, staff resources. Interviewees stated concerns about the capacity to update database. Even with resource for training it was though it would take 4 years to develop data management capacity in the ministry.

The Government is not keen on collecting data and information that they cannot maintain, e.g needing on-line upload, continually needing updated (this is by district council) – questions the capability have they got for doing this in future. It was felt that simplicity and capacity for update are key. It was noted that a CJF2 agreement was made with central government not with local officers. Concerns were aired that other Donors had pausing data collection whilst CJF2 was ongoing. Such decisions are very risky for the Donors as the data collated by CJF2 might not be fit for purpose. One concern is that data is being collected for the CJF2 research teams' interest and not for government of Malawi needs. It was also noted that current data collection is difficult for government staff as they don't have the necessary skilled staff at the district level. To overcome this they borrow staff to help with data collection from health teams but this adds to an already high workload.

Interviewees identified some concerns with regard CJF data collection, noting uncertainty of how to update and replicate data collection exercises. Past problems with lack of compatibility of data. Lessons have been learned from the initial data collection work but respondents had concerns on maintenance of Smart phone data and M&E data coordination.

Interviewees were concerned about the pace of data collection as part of the CJF2 project. Interviewees thought that the current CJF2 work was a pilot with a chance to pause and check. Some data is clearly useful but CJF have missed and continue to miss SDG6 data both in terms of type and quality of data. One question raised was how will potential data gaps be addressed in the future relating to mapping, functionality of borehole and functionality of community management? Interviewees assumed that they were doing a pilot study opposed to the intention to map the whole country. Respondents identified that it would be good to get a Malawi statistician involved. It was identified that good bits of CJF2 using districts to collect the data but questioned who pays extension worker once the first pass of data is collected. Interviewees noted that promises are being made that Scottish Government will be around for a long time but can these workers be kept on across the country. It is noted that data on coverage and functionality will be good for the planning department.

The Planning Department currently uses only key indicators on access and functionality. Data is collected at district and regional level and passed upward to government departments. This high-level data also informs the Joint sector review. Planning hold a database of high-level indicators with other data held by departments at the level at which it is needed. Interviewees explained the emergence of the Sector Wide Planning approach SWAP in 2007. This involved the recognition that all sectors should be involved in the planning. Quarterly meetings advised by technical working groups produce the Joint Sector Review Report each year. The Planning dept. role is to input key data and support in data interpretation.

The challenge of data sharing and data flow was identified from district and regional level. Two people at the ministry collate and manage the data. The data rarely it comes back to the region to enhance the evidence at the regional and district level. Challenges around analysis and storage were identified by the interviews, with many not having access to database or database version may be out of date. NGOs all use different systems with different licences. Many offices reported no network, no computers or licensees. Donors come with software but quickly outdate and not supported by government. There is an IT team in Lilongwe but little practical support provided for Regions.

Decentralisation

Decentralisation in Malawi has resulted in challenges with regards to funding – particularly distribution across ministries. One respondent suggested that for decentralisation to work, there needs to be a significant cultural change. District Water Officers and communities used to be able to ask for money and receive it, but now there are other actors involved in developing water services. In addition, while there have always appeared to be challenges with regards to data production and management, these are compounded by decentralisation where data will need to be filtered across different actors. This lack of data impacts on the construction of budgets and management of funds. With a rising population there is a need for greater investment, but proposals for investments need to be accompanied by data that supports that need. Data that is being gathered, for example in terms of mapping by Water for People, helps to identify gaps and helps with planning, but it also needs to be centralised and shared.

Overall, whilst donors and NGOs must work with government, districts and community levels, this is further complicated by decentralisation, lack of resources and tight budgets. It was suggested that the changes in ministry functions have not been good for water with only 1% of the budget being allocated to water.

Politics and politicians

Interviews highlighted aspects of political will and decision making as having an influence on development and success of water projects in Malawi. In addition, with decentralisation there are often districts prioritised over others, issues around payment for water, and engagements with donors.

Interviews highlighted a bottom up approach to setting budgets, which when passed, result in monies being distributed to districts, but they also pointed out that all final decisions are made by politicians and this can result in conflicts between both planning and politics – particularly when donors also know what their own priorities are. A balance needs to be struck between competing interests. For this reason, it is recommended to incorporate local staff within District to develop new ideas and ensure that there is greater focus on long term sustainability and future maintenance of projects that works with government and district budgets. District Water Officers could also play a larger role given that they tend to know many of the problems at a local level.

There were also some concerns around the prioritisation of loans and grants because, as highlighted earlier, there are often areas that are prioritised over and above water, and the fear is that the money will be spent on those, with communities seeing little benefit from it. Engaging with district staff from the initial development of ideas to the distribution of money might also address this, particularly as there is no independent regulator. More face to face contact and networking between local universities and politicians may offer more opportunities for advice and support, but there currently appears to be a rift between them.

Overall there is a culture of mistrust in the government that emerged in terms of the distribution of funding because, as a number of interviewees highlighted, the government does not appear to be taking water as seriously as it does, for example, agriculture. Budgets reflect this as well as name changes for the ministries, which mirror changes in political priorities; politicians prefer 'visible work' like infrastructure. This combines with the non-payment of water charges, which is leaving water boards short of money. Yet, the government are the often the owners of boards as well as the regulators and providers, so have overarching control.

Influence of donors

As donors often approach issues with specific projects in mind, they hold some influence over activities in the country. It is suggested that projects are often overambitious with insufficient budgets and time for completion; a result of the competitive environment between donors and NGOs. Donors also have other influences for example over politics and payrolls.

Often competing ideas, which are similar in nature, resulting in duplicated projects. Donors initialising project are encouraged to access expert knowledge at both district and government levels which would benefit the viability of projects. Water boards for example have a wealth of both knowledge and skills but what they lack is funding, yet they are also considered to be commercial, profit-making enterprises and thus are not considered to a suitable spend of donor money. Boards themselves should invest, but as highlighted, funds are limited. There have been occasions when donors have asked for ideas for smaller projects, as USAID did, as opposed to investment in larger projects. Interviewees at district level highlighted the value and importance of knowledge held in local villages and districts.

Donor coordination appears to be poor. There is a Water Sector Development Partnership Group to coordinate and provide an overview of funds that are entering the system as well as create a forum for sharing ideas and creating awareness of donor activities, but this does not meet frequently and lacks a funded secretariat and a budget for associated costs.

Donors often seek projects with more tangible and visible outcomes. Interviewees expressed concern that donors need to be encouraged back into the water sector because major donors are moving in to other sectors – a reflection of government priorities. There are some projects ready but there is no one to fund them. This is where the concept of basket funding would be more beneficial. Combined with an SDG taskforce, this could minimise the influence of donors on projects and ensure that there is a combined effort and approach to planning. However, donors are unenthusiastic about join funding.

Overall, problems surrounding NGO competition and donor objectives need to be resolved in order to ensure there is true joint planning. There are lots of experiences and resources going in to the sector, but it is unclear whether these are being used efficiently.

SDG Development

Awareness of SDG were explored with the respondents. The vision of water for all is not new and has long been an ambition in Malawi. Inherently all levels have been working towards it where language at district is focussed on WASH.

Measurement of SDG is at an early stage with SDG6 Indicators to be advised by the ministry. Localised SDG6 indicators have been discussed with WASH partners. The alignment of a set of WASH indicators with SDG6 were considered by partners. The need to ensure that district level staff understand issues was identified.

Respondents felt that SDG indicators were more complex than Millennium Development Goals and there is a need to simplify data, look critically at the results, synthesise at district level then propose plans and a roadmap involving all partners.
Respondents felt that currently there were no clear definition of indicators and there is a need to modify indicators to reflect local conditions in Malawi. The Team critically reviewing WASH indicators e.g. Water criteria Scale: Safely Managed or Basic. Safely managed is defined as a tap in house, basic as a shared water point or borehole. Because of the rural situation these will be combined. Respondents considered SDG indicators will easily be met urban areas and the challenge will be in rural areas. Could disaggregate the data in Urban but not rural areas. There is a target of a 100% for combined categories.

Respondents identified planning needs to result in move upward on the indicator scale. There is a Government Team working SDG indicators but they are not sure of timescale for their expected completion but now contextualising indicators. Water resources team focusing on water resources and water quality sub-indicators. The team had problems understanding the UN template, all key players are being consulted e.g. NG0's Civil Society etc. They are considering the indicator % of the population with access to water. Considering the distance options, within 800m or 500m is too much – round trip too high. Target could be one source (pump kiosk) for each 250, but they may be clustered and not well distributed across a district. Some parts of a district may have many water points, some few and therefore some may have long journey distances to get access to water.

A complicating factor is a number of SDG taskforces are currently underway based around particular funding streams. Respondents identified that the government say yes to everyone who comes with funding and wants to set up an initiative. This leads to multiple initiatives about the same thing under the guise of MOA. This leads to power struggles and multiple actors. Respondents suggested that the SDG task force should have more influence.

Water boards

Water boards based mostly in urban and peri urban settings operate as business entities and are self-sustaining. Water boards have the capability to supply, but the schemes have to make business sense. They supply to cities and will consider larger settlements on a case by case basis. It is not economically feasible to operate water treatment plants. In other rural areas and communities do not have the capital to invest and maintain in borehole/distributed pipe work system
Respondents identified the challenge that water boards have with much of the infrastructure is colonial and aging with anticipated high leakage. A major issue is lack of Investment due to an existing scarcity of finance due to limited income from fixed tariffs. Finance is required to build additional capacity and to renovate aging infrastructure, particularly in urban areas.

Critical Path development

The initial Critical Path (July 2017) reflected the focus of the CJF2 project and was centred around water point mapping to facilitate discussion on the alignment of CJF activities with the wider Malawi IWRM programme. The Malawi Ministry of Agriculture, Irrigation and Water Development (Department of Irrigation and Water Development) project proposal for the Third National Water Development Project (January 2017) provided a useful context for the development and verification of the critical path and proposed indicator set. The Plan includes components relating to (i) Water Resources and Catchment Management, (ii) Water Supply and Sanitation, Irrigation Rehabilitation and Development, and (iii) Project Coordination and Monitoring Evaluation. The

report concludes on implementation arrangements highlighting the need for (i) partnership arrangements, (ii) institutional and implementation arrangements and (iii) monitoring and evaluation of outcomes. This sets out components of the critical path framework; water quality, water quantity and governance across spatial (international, national/ministry, district, community) context as presented in Fig 1.

The results of the 2017 interviews were compared to the original critical path as shown in the final section of the appendix "Initial 2017 output for reference" to check for agreement or gaps in the Critical Path. The review found that many of the key resource requirements and dependencies listed in the critical path had also been picked up in the analysis of the interview data, with some gaps and areas where more defined actions were needed. Additional gaps in the Critical Path were noted with regards to coordination of water resource management and monitoring, as well as regulation, oversight and enforcement. This review highlighted a need to establish a greater understanding of the level of operation (spatial consideration of local, district, national) that may be important to identifying the resource requirements and key dependencies in the CP, and also the temporal consideration of short, medium and longer-term needs. It was also observed that a distinction between issues relating to water quality and water quantity may assist in developing the CP further. The issues identified for further examination guided the selection of interviewees in the 2018 Malawi visit.

A second theme analysis exercise was undertaken across interviews and observational records from both the Malawi 2017 & 2018 visits. This information was analysed to assist in identifying where key issues or solutions would fit within the overall critical path (e.g. relevance to Water Quality or Water Quantity, and the temporal (short, medium and long term) or spatial (international, national/ministry, district, community) context. The phrases were then grouped into either "Issues" or "Solutions" and similar responses pooled into common the key words appearing in relation to Water Quality and Quantity, and Temporal and Spatial levels. These are presented in Section 4 in the main body of the report.

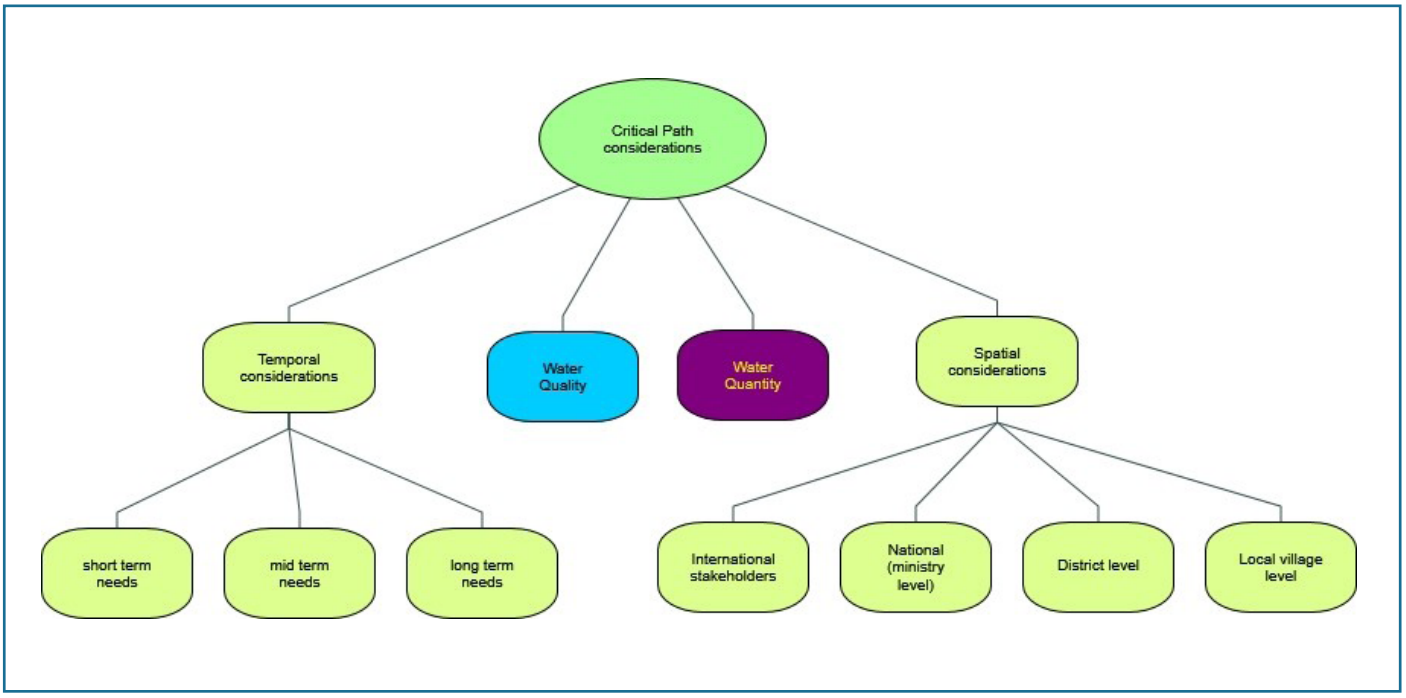

Figure 1 Critical Path Framework

Initial 2017 output for reference

Initial Critical Path

The initial Critical Path (July 2017) reflected the focus at that time of the CJF2 project and centred around water point mapping to facilitate discussion on the alignment of CJF activities with the wider Malawi IWRM programme. . The 2017 critical path has been reviewed based on the 2017 and 2018 interviews. The items highlighted in grey during the review agree with interview data analysis. Observations during the review are included as a column.

Activity	Resource requirement	Dependencies	Milestones and time scales	Observations
1. Water point mapping and data management.	Supporting framework •Database format* •Assigned Ministry number •Coordination of NGOs *(A new national data set and data collection approach needs to be established. Potential for adaption of the BASEFlow methodology needs to be assessed, current BASEFlow data set needs to be reviewed) Trained human resource (point mapping and assessment)	•Ministry strategic support •Coordination of donors (NGOs)	Chikwawa mapped 2018 7 Additional districts mapped 2018 Rest of Malawi mapped 2025	Ministry is a weak link when it comes to data management From interviews, the data management aspects appear to be more important than mapping Need new IT capacity (human resource and infrastructure)
	Physical resource •Phones/GPS •Aps and software development. •Transport	•Ministry or donor financial support		
	Trained human resource (water point mapping and assessment)	•Ministry or donor financial support		
	Data Collection must be coordinated with mapping activities on sanitation and solid waste management, irrigation needs/responses and flood management.			
2. Water point access and improvement	Human resource – Government officials district officials, NGO's Funders, •Prioritisation of sites, •Coordination of funding and implementation organisations. •Engagement of communities. Understanding short and long-term hydrology and impacts of abstraction and water harvesting.	•Availability of a robust data set, including water quality and quantity data, now and in future •Engagement and cooperation of all stakeholders at national and district level. •Agreement and involvement of community		Who should be responsible for coordination, management and monitoring?

a. Water point access where not previously exists	Funding and skilled human resource for drilling of new boreholes, pumps, construction of surface water collection and distribution systems, creation of new taps and kiosks,	•Coordination of donors (NGOs) and Ministry officials •Increased training and skills development for drillers and other technicians •Improved tender and contracts process	100% access in Chikwawa DATE? 100% access in 7 Additional districts mapped DATE? 100% access across Malawi. 2030	This did not come up that much in the first analysis of interviews – but when coding to "water quality" in the second analysis, the need for increased access (short term goal) became more apparent Regulation, policing and oversight in general may be more appropriate than specific regarding tender/contracts as this applies to drilling only
b. Water point improvement where failure has been recorded	Funding for improvement and skilled human resource for repair and improvement work Funding and skills development including sanitation education	•Coordination of donors (NGOs) and Ministry officials •Increased number of trained/skilled persons •Increased community education on sanitation issues •Sustainable funding through e.g. borehole banking and other urban initiatives	% of-functioning boreholes	Appears to be a disconnect between Ministry and End-users (coordination of activities should take account of user needs too); related to lack of monitoring
		Plan needs to be coordinated with improvements to work on sanitation and solid waste management, irrigation needs/ responses and flood management.		
3. Water point utilisation				
a. Secure and reliable supply	•Funding and skills for planned maintenance •Understanding short and long-term hydrology •Transfer of skills to local water point committees/ BUA (training and education •Resources for maintenance (various models e.g. Borehole banks)	•National and International Research •Sustainable funding through e.g. borehole banking and other urban initiatives •Expanded regional capacity for knowledge transfer •Community engagement and buy-in	100%? in Chikwawa DATE? 100% access in 7 Additional districts mapped DATE? 100% access across Malawi Date?	
b. Safe supply	Funding and skills and facilities for water quality sampling	•Planned sampling, laboratory capacity, central database. •Increased community education on sanitation issues	1 District 2020 10 District 2025 All Malawi 2030	

c. Water point improvement enhanced utilisation	Funding and skilled human resource for enhancement	•Coordination of donors (NGOs) and Ministry officials •Increased community education	% coverage of enhanced water use 100% by 2030	
	Utilisation needs to be coordinated with work on sanitation and solid waste management, irrigation needs/responses and flood management.			
4. Water point monitoring	Trained human resource (monitoring and assessment)	•Ministry or donor financial support	100% coverage of monitoring (first time) % coverage of annual/ monthly monitoring % failures recorded (level of quality achieved)	Need leadership and coordination
	Physical resources for routine inspection • Water meters • Transport • Laboratory facilities	•Ministry or donor financial support		
	Supporting framework •Water quality standards established •Framework for enforcing standards	•Ministry processes/ standards established and enforced		Who should deal with the data?
5. Sustainability of water for everyone for ever (IWRM)	1. Resources for continued education and awareness	•Ministry or donor financial support	Post 2030.	
	2. Resources for continued monitoring, inspection			
	3. Resources for long term maintenance and renewal of water points	•Community adoption of assets		Difficult to say if this is the best way
	4. Improvement plans for enhancement of water points over time	•District/Ministry strategic plans		

Initial list of proposed Enhancement Indicators

Headline indicator	Primary Indicator	Indicator	Proposed Evidence Source
Quality	Data collection	1. Functionality of water points	Ministry/District documents
		2. Prevention and maintenance	Ministry/District documents
	Technical best practice	3. Tendering and contract process	Ministry tender/contract
		4. Drilling Quality	Records of contract sign off
		5. Training	Ministry tender/contract
		6. Supervision	District procedures
Resilience	Scalability	7. Data collection methodology is resilient and transferable	Ministry/District documents
	Sustainability	8. Economic stability	District/Ministry/User groups
		9. Good practice IWRM demonstrated	Record of number of groups, and number of districts engaged in stakeholder events
		10. Risk to water source	Ministry Risk Register, District Risk Register, Local Risk Register
		11. Local community ownership & knowledge	Water User Associations processes
	Accessibility of data for decision making	12. Use of database to manage local assets	Ministry data, Project training records, District level training records
		13. Access to available data	Ministry data
		14. Data for investment strategy	Evidence of data used in planning measures at district level
	Data management & ownership	15. Security of data	Who owns the data, At what level is data managed
		16. Data timeliness	Ministry documentation
		17. Harmonisation of Data	Ministry level database

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