



SURFACE WATER MONITORING REPORT

Campaign November 2020

Rwanda Water Resources Board

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1. Introduction

Water flow measurement campaign is done within the seasons repartition along the year; it is planned to have 3 water flow measurements every year, the first in November to December for collecting peak flows for short rain season, the second April to May for collecting the peak flows for long rain season and third in August to September for collecting peak flows for long dry season (i.e. collecting low flows for the whole year). The main information gathered during these campaigns is the status of hydrological stations and the amount of water flowing in the rivers. It is done for the purpose of quantifying the changes of the natural surface water system as a result of implementation of development measures and assessing the performance of the control measures used to limit their impacts. The collected information is critical for informed decision making, business leaders and public officials within a given hydrological system. It is therefore a prerequisite that information has to be up to date and accurate. The whole process from data collection to water management is briefly described in the figure below.

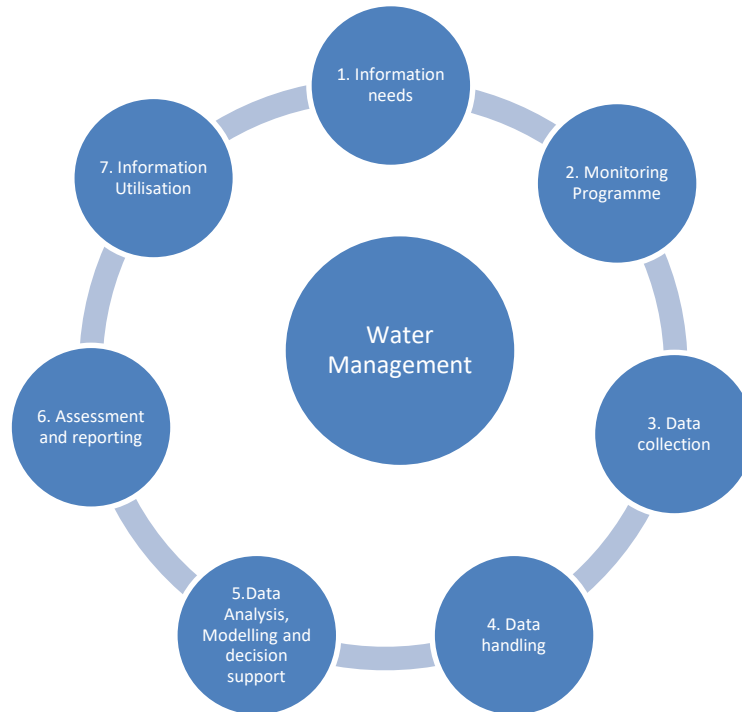


Figure 1: *Water monitoring cycle*

In this last campaign of November to December 2020, flow measurement was done on 20 hydrological stations around the country. All data collected during this last campaign and observations made are discussed in this report.

1.1. Purpose of the report

This report presents the activities done as the Surface Water monitoring. It provides the outcomes of the hydrological measurements done during the campaign and recommendations for further improvements.

1.2. Surface water monitoring activities

The summary of surface water monitoring activities (year 2020-2021) is presented in the following table:

Table 1: Activities planned vs achievement in 2020-2021

Activities	Targets	achievements	Comments
Discharge data collection	3campaigns	1 campaigns	The station of Mbirurume is washed away, Rusumo-Rugezi needs a staff gauge.
Improvement of hydrological network	Installation of 8 stations	Preparation of installation still under progress	Need for more identification is needed to have a complete hydrological network. For example in Karongi and Nyaruguru
Production of weekly and Monthly bulletin and Annual Water Status	Weekly, monthly, quarterly bulletins are targeted	Weekly bulletins have been produced since July 2020. For monthly the plot is being edited for better visualization.	There is a need to change the format of graph structure

1.3. Methodology

1.3.1. Water level

The water level also known as stage is measured and recorded in Rwanda using the following instruments:

- Staff gauge: Essential at all sites as a back-up and to calibrate instruments. It can be used together with any other water level recording instrument in order to avoid any loss of important data, it is read manually. It is installed at all gauging stations of RWB.
- Float operated shaft encoders: is a simple method of measuring water level. It is placed in a stilling well connected to the river by an inlet pipe and the data it records are saved on its data logger and are downloaded to the computer for further use. It can be used together with a staff gauge,
- Pressure sensors,
- Radar.

1.3.2. River flow

River flow also known as discharge is the volume of water passing a measuring point or gauging station in a river in a given tie. It is measured in volume unit per unit of tie. Several types of device are available for measuring a river discharge. RWB uses the following instruments:

- Mechanical current meters: used in shallow rivers (OTT and SEBA types).
- Acoustic Doppler Current Profilers: used in medium to wide rivers (River Ray, OTT and Sontek types).
- Dilution gauging method: convenient for turbulent flows. This is done using kitchen salt and a dilution meter (Easy flow type).
- Radar point velocity-meters (RQ30 and RLS types).

1.3.3. Stations Selection Criteria for data collection

The criteria for selection of stations is as follows:

- Every catchment has to be monitored seasonally thus, at least one hydro-station in every catchment has to be reached.
- Hydro stations on rivers comes on the first line in monitoring. i.e. if stations on rivers and on the lakes are located within the same catchment; the priority is given to hydro stations on the river
- From Western to Eastern; Northern to Southern; hydro-stations representing each side have to be reached to have an overview on river behaviour of each part of the country.

1.3.4. Hydrological data

Here below are the data collected during this last campaign November 2020; discharges and corresponding water levels.

Table 2: Data collected during the campaign November 2020.

No	Stations	Water level (m)	Discharge(m ³ /sec)	methods	Dates
1	Kinoni- Base		4.63	ADCP	20/10/- 13/11/2020
2	Nemba-Nyabugogo	1.78	16.1	ADCP	
3	Mbirurume		14.5	ADCP	
4	Nyakinama	1.32	17.2	ADCP	
5	Ruliba-Nyabarongo	2.79	213	ADCP	
6	Ururumanza		0.47	Current Meter	
7	Nyundo-Sebeya	0.86	2.7	Current Meter	
8	Rukarara	0.45	7.22	ADCP	
9	Bihongora	0.6	0.657	Current Meter	
10	Ngaru-Nyabarongo	1.9	121.978	ADCP	
11	Yanze	0.8	1.2	Current Meter	
12	Butare-Ngozi	1.43	50.3	ADCP	
13	Nyabisindu	1.61	4.7	ADCP	
14	Nyagahanga-Warufu		1.15	Current Meter	
15	Kabuga-Muvumba		8.6	ADCP	

16	Kamanyola	1.978	156	ADCP	
17	Ruhwa	1.678	13.5	ADCP	
18	Rubyiro		4.41	ADCP	
19	Karambo	0.528	0.215	Current Meter	
20	Pfunda	0.199	0.33	Current Meter	

1.3.5. Other findings

In this campaign, some observations were made during the campaign and the outcome should be considered during the next phases of rehabilitation as described below:

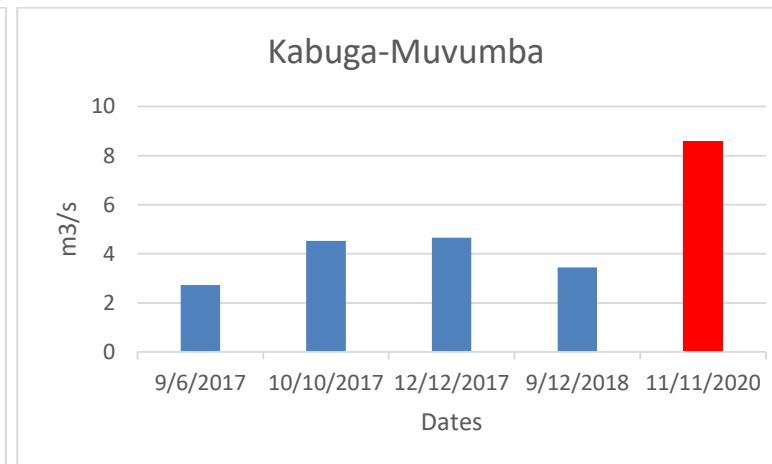
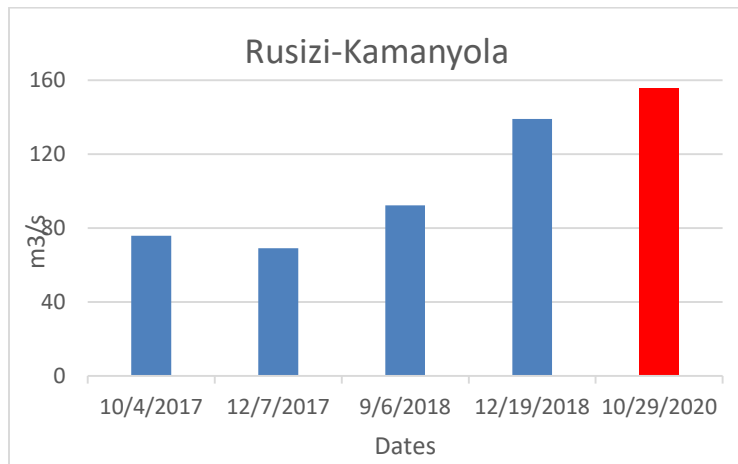
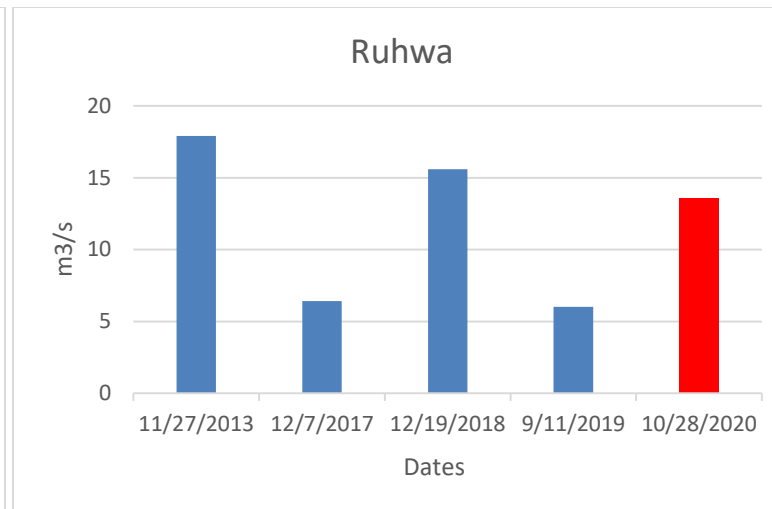
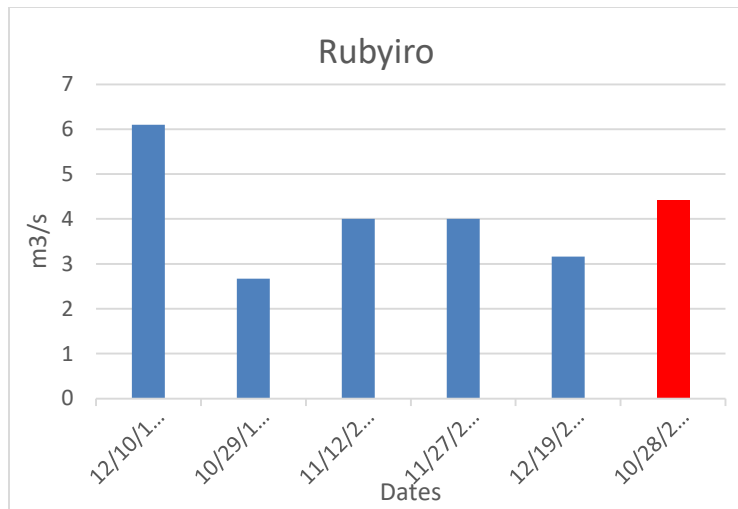
Table 3: Observation made during the campaign.

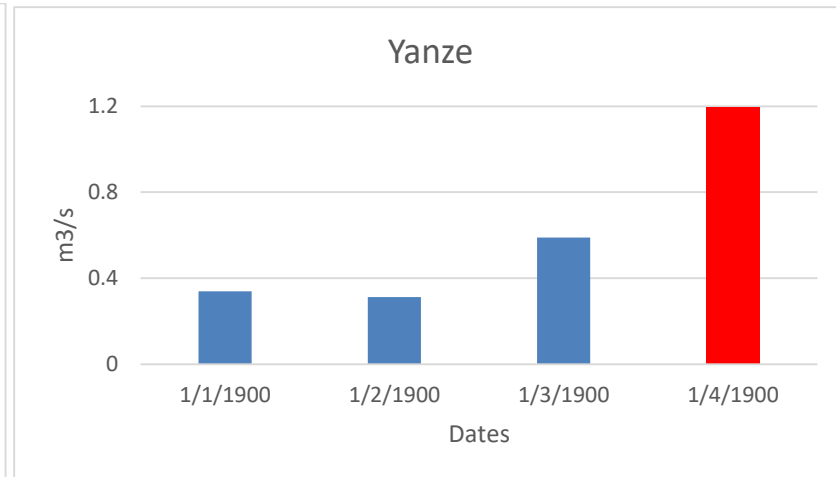
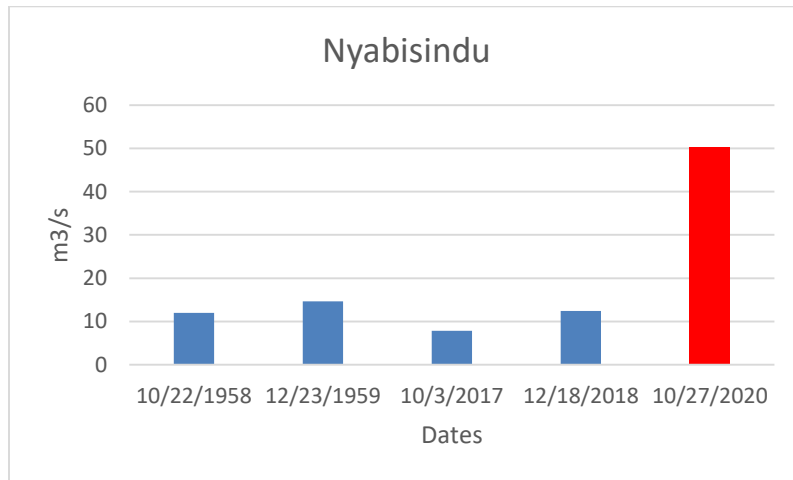
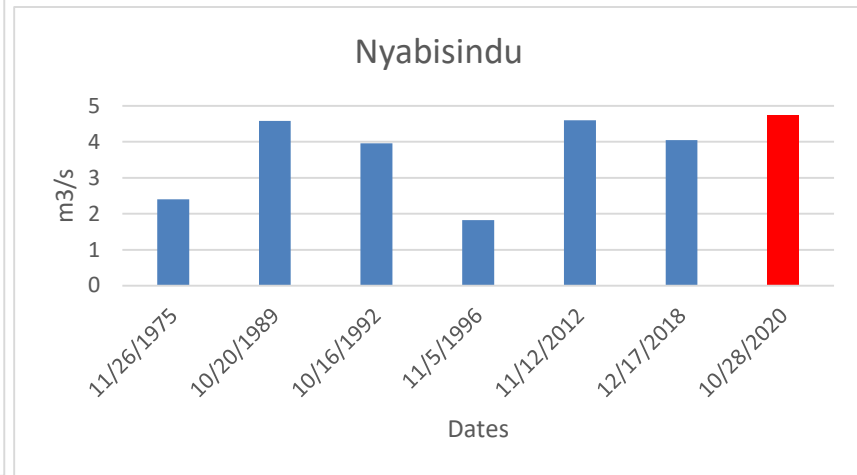
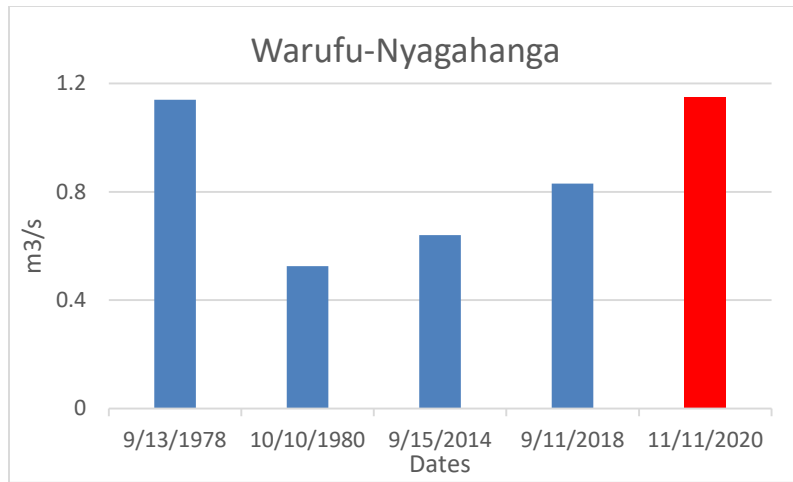
Hydrological stations	River	Catchment Level 1	Status of stations	Comments/ recommendations
Bihingora	Bihongora	Kivu	<ul style="list-style-type: none"> Staff gauge is frequently covered by sediments 	<ul style="list-style-type: none"> This handled by relocating it towards the river vicinity
Ruliba	Nyabarongo	Nyabaringo Lower	<ul style="list-style-type: none"> Much sediments accumulated in short period 	<ul style="list-style-type: none"> Need for regular sediment removal
Ururumanza	Ururumanza	Akanyaru	<ul style="list-style-type: none"> Water flow not reaching the staff gauge 	<ul style="list-style-type: none"> Need reinstallation
Nyabisindu	Mwogo	Nyabarongo Upper	<ul style="list-style-type: none"> The staff is located in swamp and it is not easily accessible 	<ul style="list-style-type: none"> Need to be relocated and stilling well fixation.
Ruhwa	Ruhwa	Rusizi	<ul style="list-style-type: none"> The staff gauge is surrounded by sediments, water doesn't reaching it in dry season 	<ul style="list-style-type: none"> Need of sediment removal and installation of stilling well for automatic station fixation.

			<ul style="list-style-type: none"> • It is also installed on the side of Burundi; 	<ul style="list-style-type: none"> • It should be relocated to the side of Rwanda.
Rubyiro	Rubyiro	Rusizi	<ul style="list-style-type: none"> • Water doesn't reach the staff gauge in dry season. 	<ul style="list-style-type: none"> • There is a need to relocate it and install the stilling well for automatic station fixation.
Kabuga-Muvumba	Muvumba	Muvumba	<ul style="list-style-type: none"> • Bridge construction works have removed the whole station 	<ul style="list-style-type: none"> • Bridge construction works should reinstall after completion of their works
Kanzenze-Akagera	Akagera	Akagera Upper	<ul style="list-style-type: none"> • This hydro station has been removed by road construction works 	<ul style="list-style-type: none"> • It is planned to reinstall it after road construction works

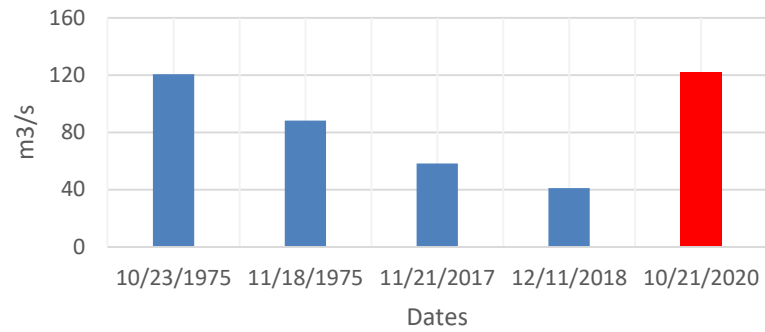
2. Data analysis and discussion

The comparison of 2020 collected data is done by comparing discharges of 2020 collected data to the past years discharges; the graphs below has 2020 year data plot in red and long-term years in blue. It doesn't mean that the plot represent the whole season as it was taken one day but it gives the overview of the season in comparison with other seasons.

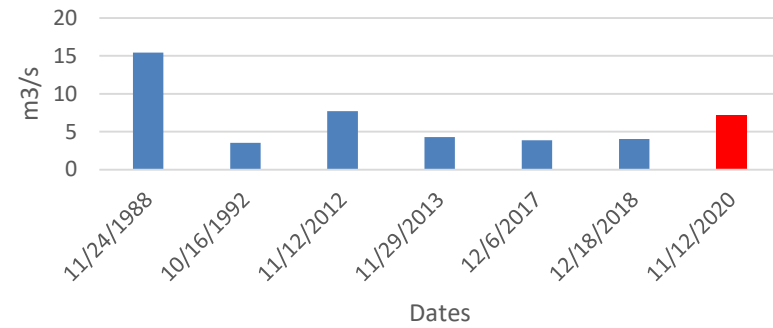




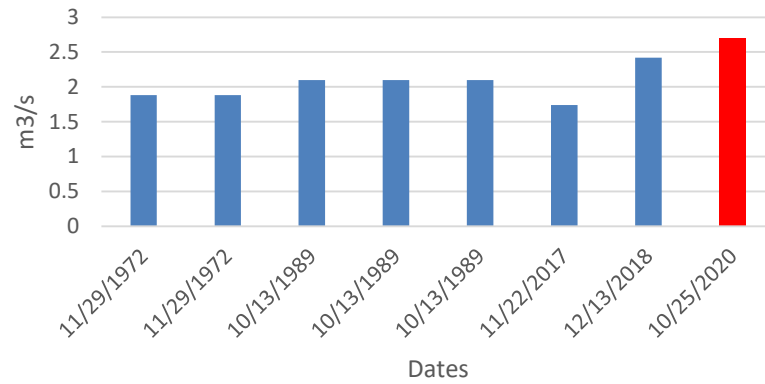
Ngaru-Nyabarongo



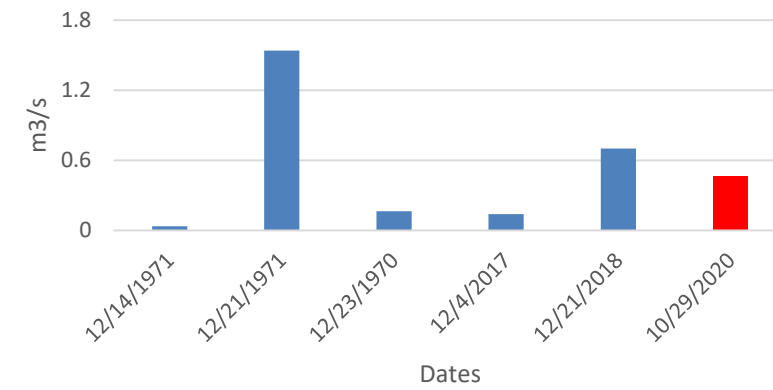
Mudasomwa



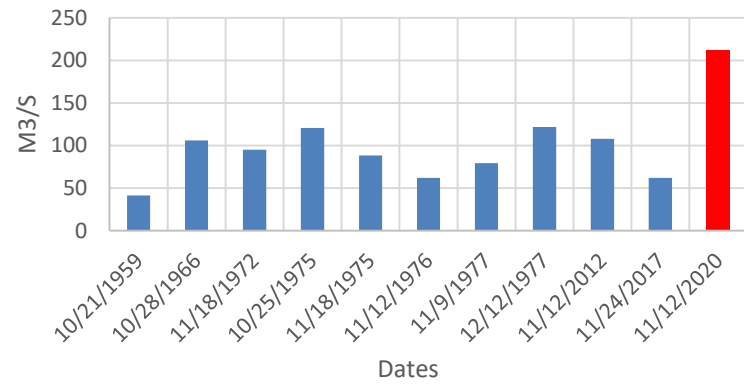
Sebeya



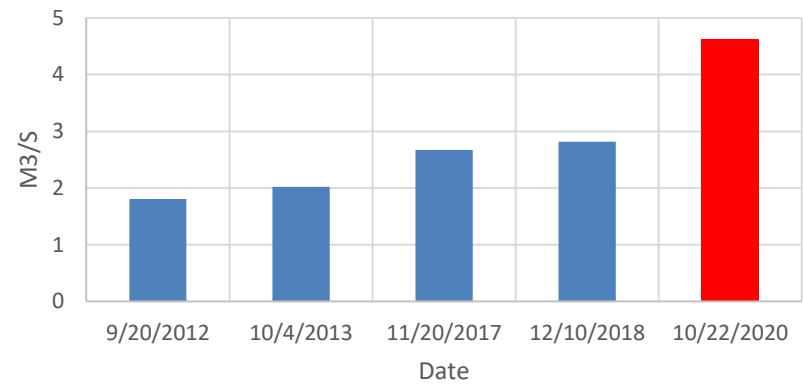
Ururumanza



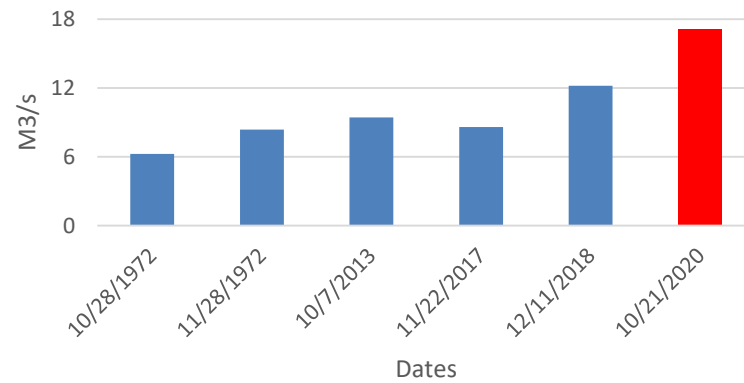
Ruliba



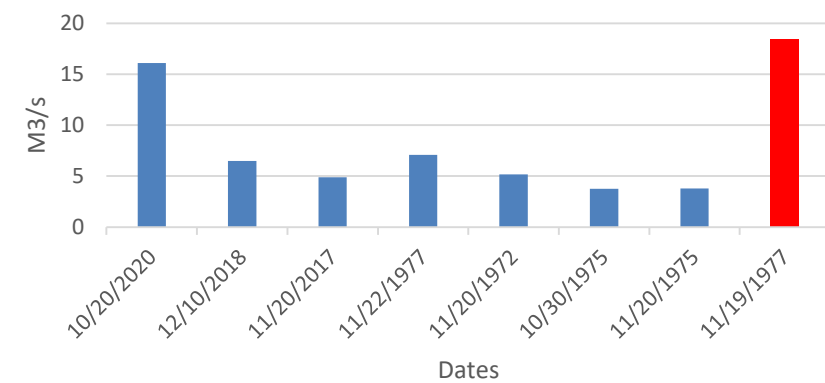
Kinoni-Base



Nyakinama



Nemba

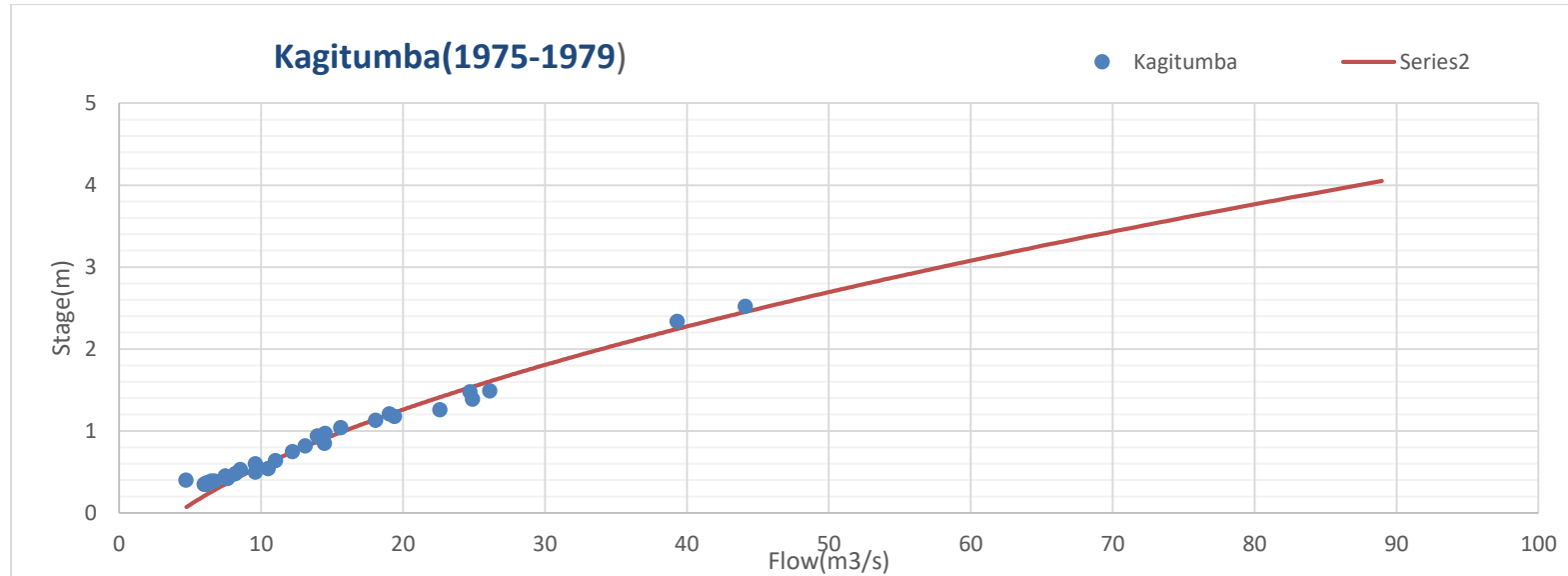


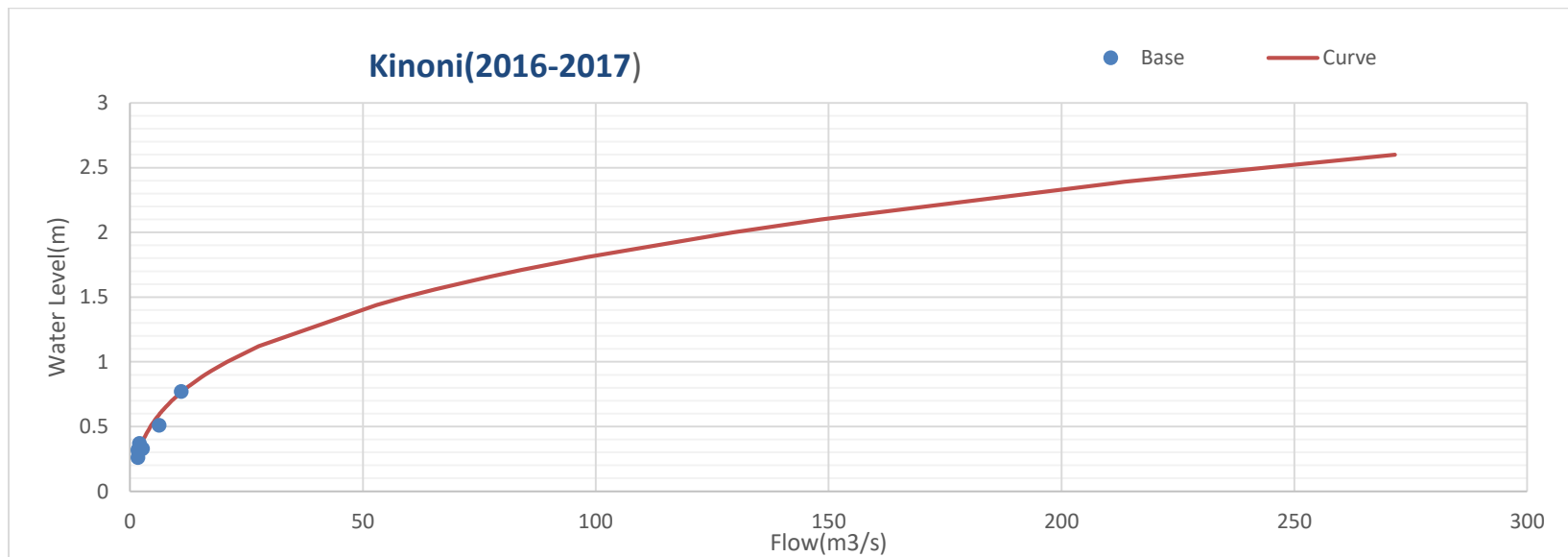
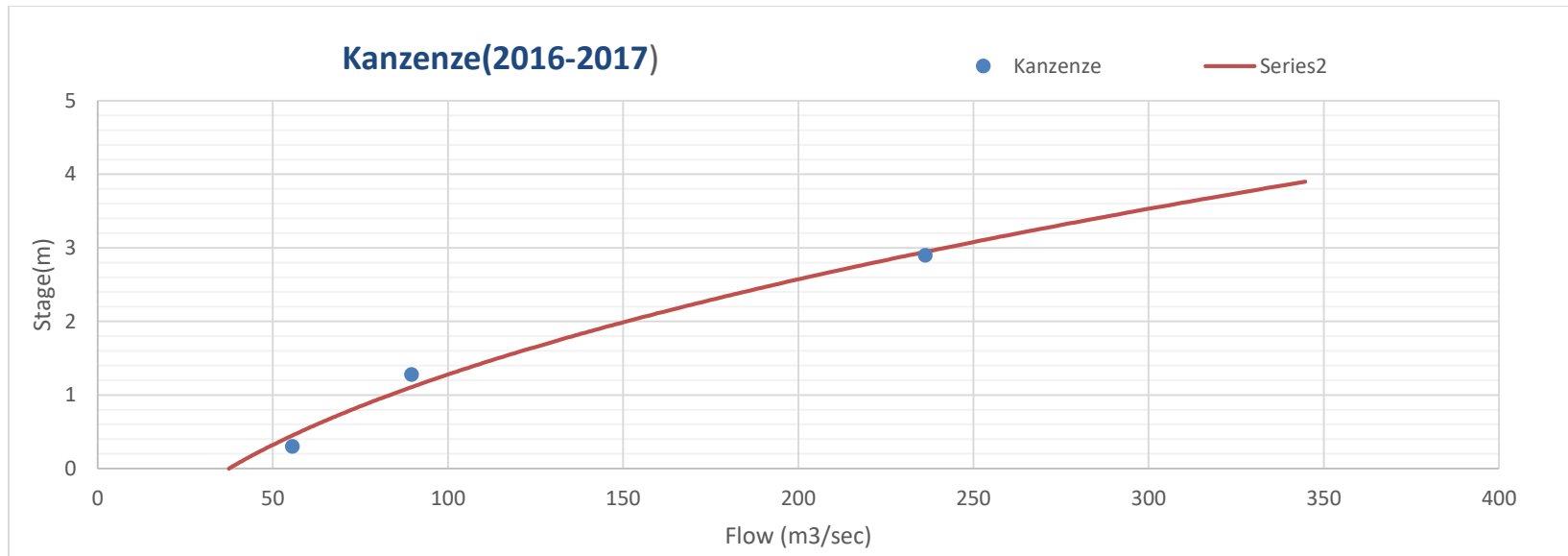
3. Appendix

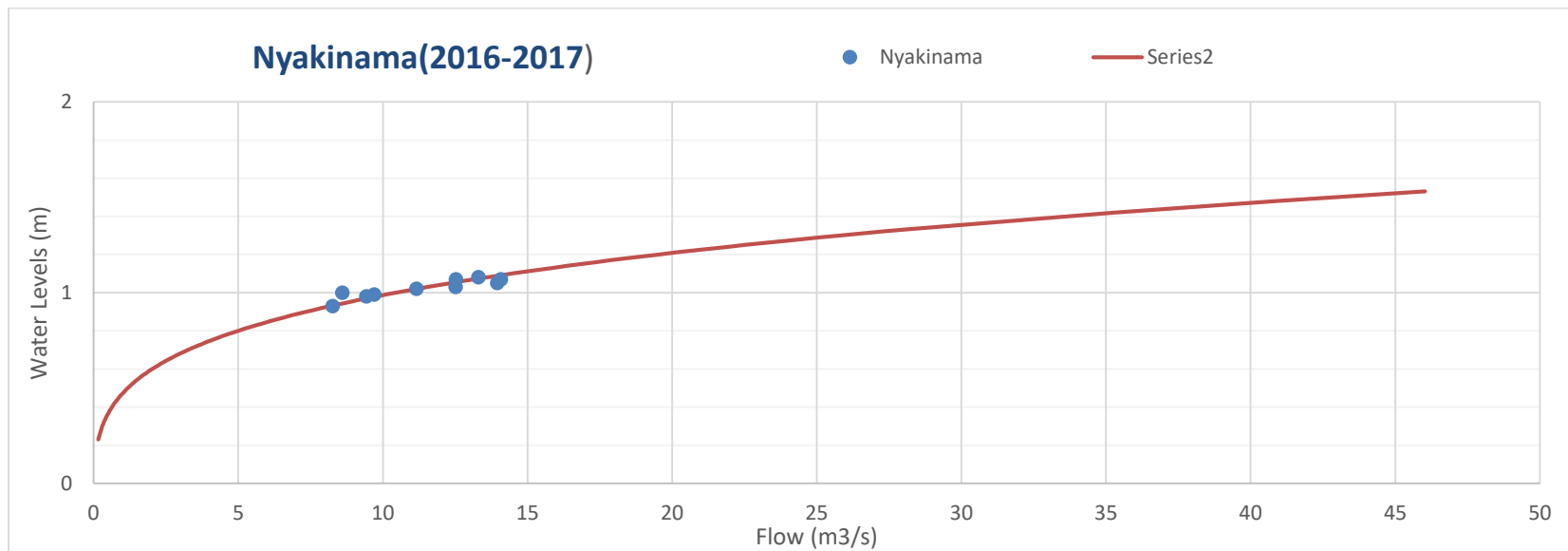
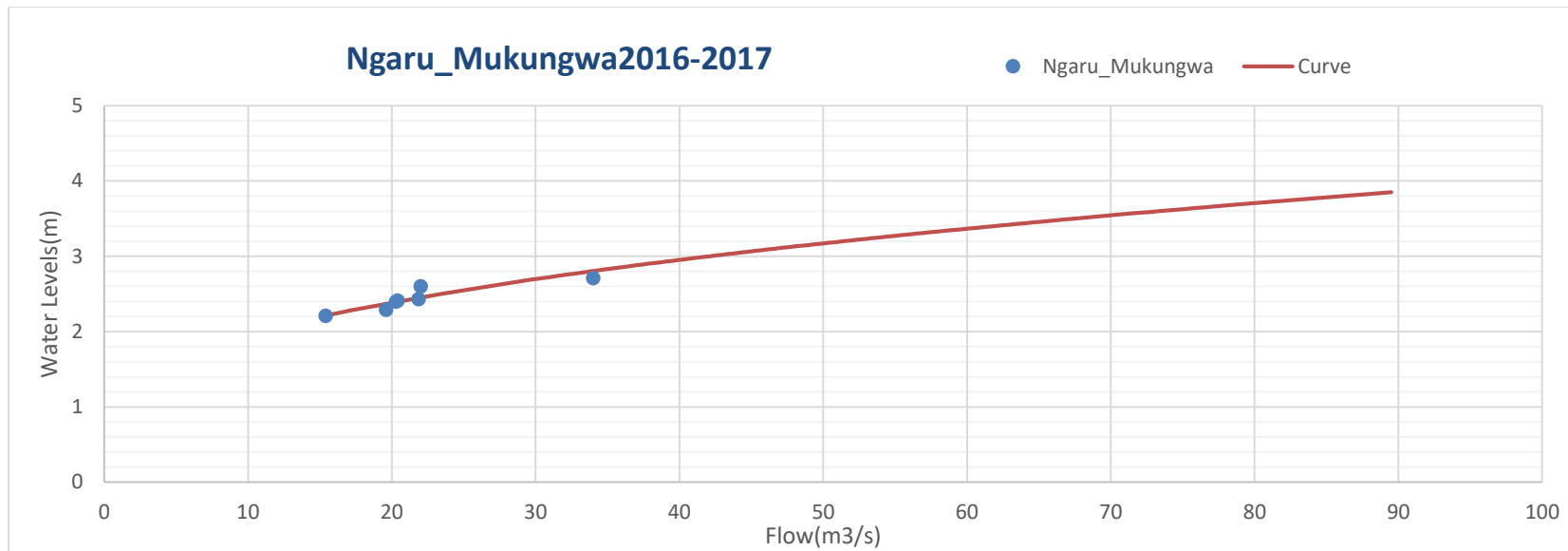
3.1. Database for hydrological stations

Table 4: Database for recent hydrological measurements.

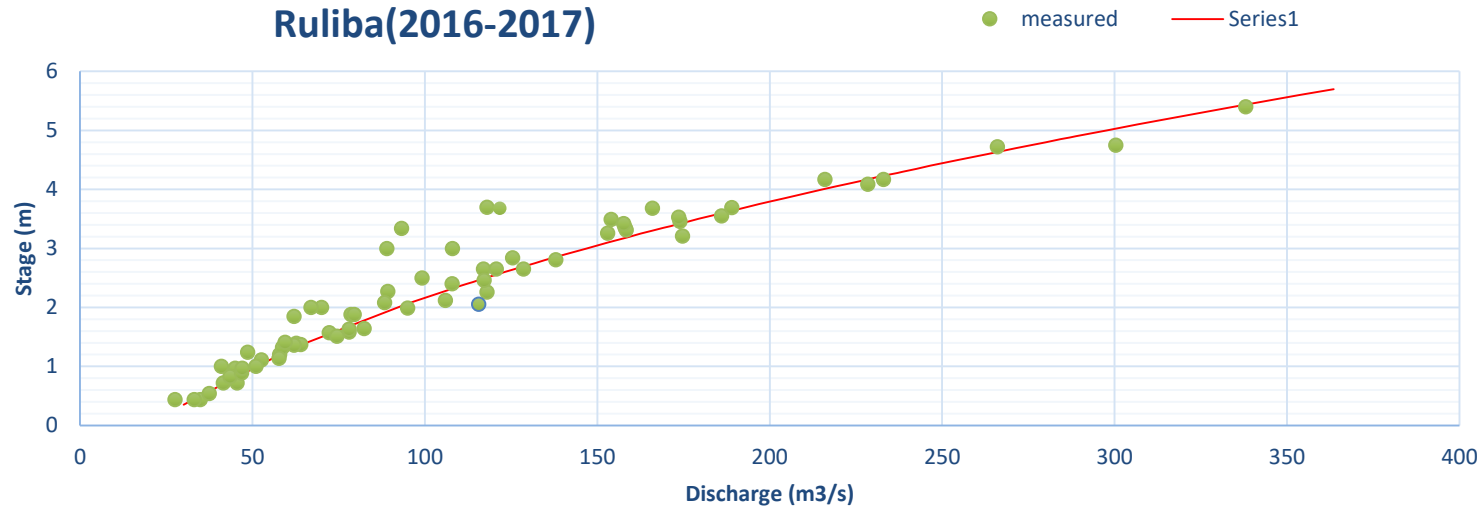
3.2. Rating curves



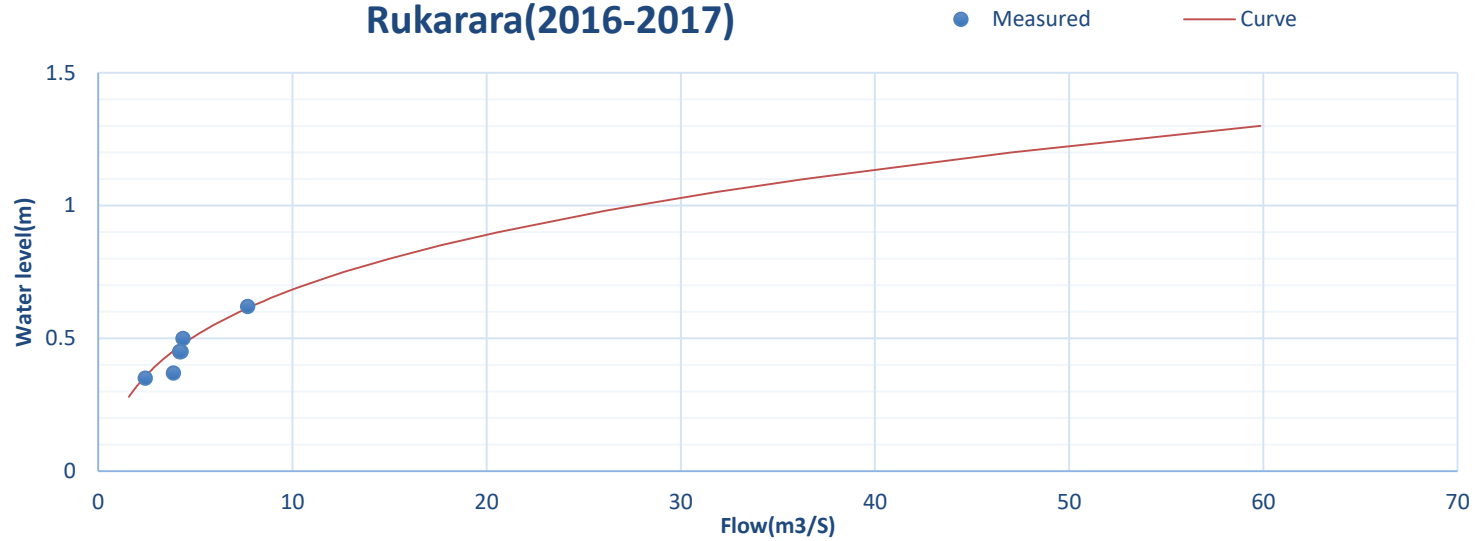


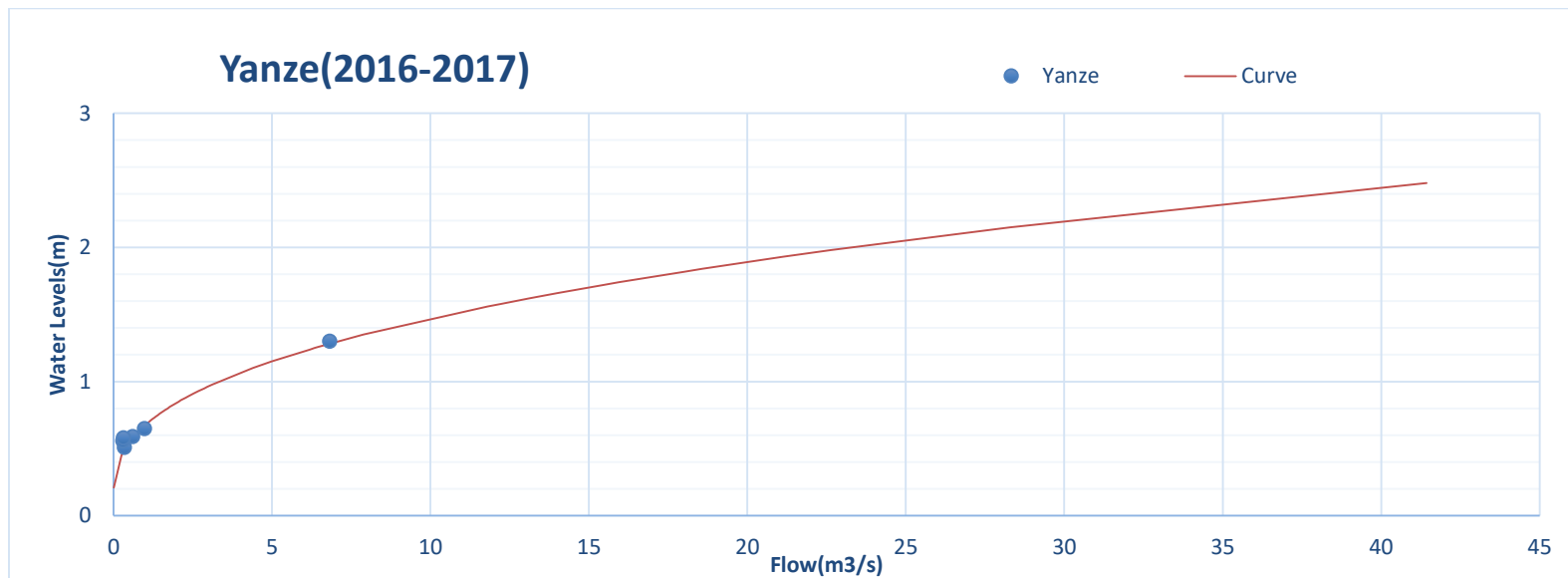
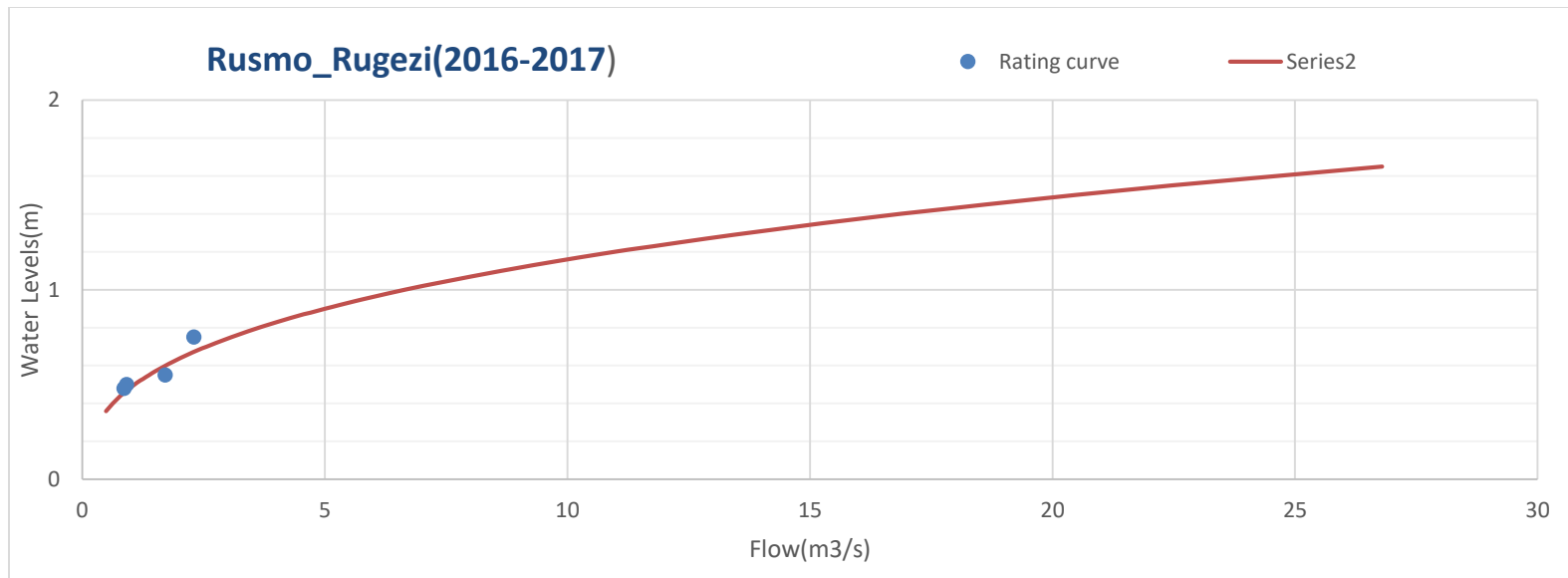


Ruliba(2016-2017)

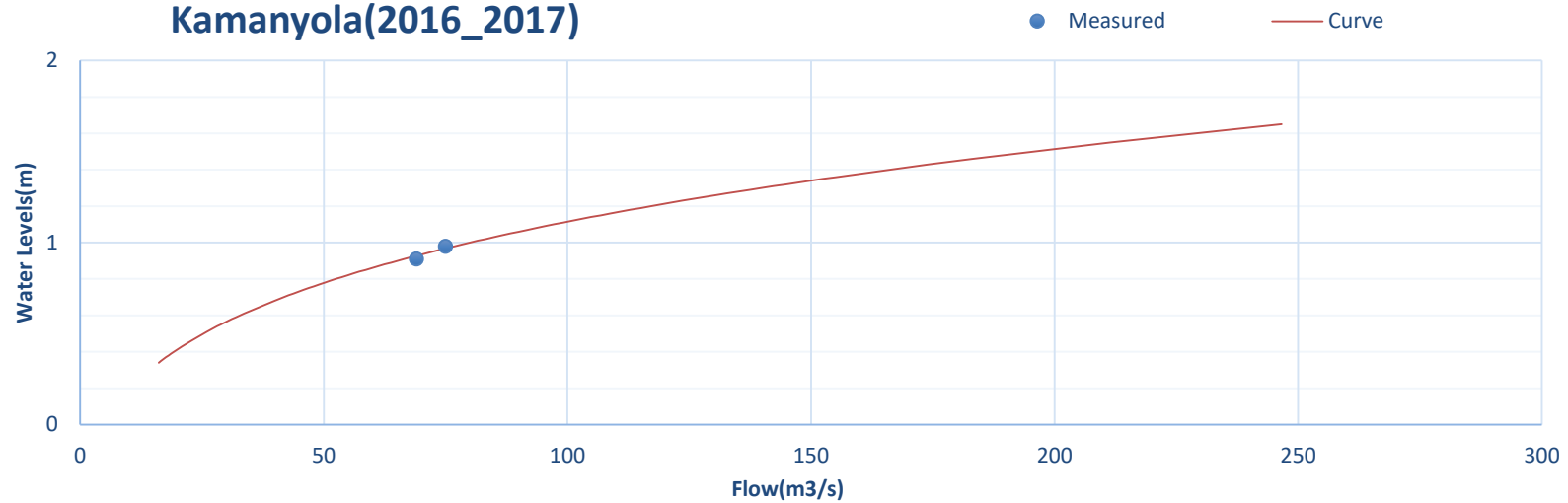


Rukarara(2016-2017)





Kamanyola(2016_2017)



Nyundo-Sebeya(1974-2014)

