

REPUBLIC OF RWANDA



RWANDA WATER RESOURCES BOARD
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ANNUAL WATER STORAGE STATUS REPORT FOR 2020 -2021

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1. Introduction

Artificial water storage has, and will continue to have, a large role to play in both emerging and mature economies. The ability to store and manage water is pivotal to meet demand for different uses. Controlling water flows to deliver the preferred amount of water at the right time is essential in order to support efficient food and energy production and contribute to the flood control.

In this past years Rwanda has suffered of severe water shortages in different catchments, even though large amounts of water continue to annually flood out to sea from the country. The problem is that the sporadic, spatial and temporal distribution of precipitation rarely coincides with demand. Whether the demand is for natural processes or human needs, the only way water supply can match demand is through storage. The main water storage system being applied in Rwanda is the construction of dam which is defined as a barrier built across a watercourse for impounding water.

Natural' variability in rainfall and temperature mean that in many places access to freshwater is already unpredictable. For many smallholder farmers, reliable access to water is the difference between plenty and famine. The classic response is to store water behind dams or in tanks or ponds when it is abundant and where it can be conserved for times of shortage. Water storage spurs economic growth and helps alleviate poverty by making water available when and where it is needed.

1.1. Need for Water Storage in Rwanda

Even though Rwanda has abundant water, but has insufficient water storage capacity. Inadequate storage leaves farmers vulnerable to the vagaries of climate. Rwandan farmers are heavily reliant on rain fed subsistence agriculture. The lack of storage infrastructure means farmers have limited ability to cope with droughts and floods. These limitations are estimated to cost the economy one-third of its growth potential. Investment in appropriate Water storage is an urgent option to increase agricultural productivity and to ensure that farmers have options for coping to the coming climate changes.

Water storages are designed and/or operated to provide services like electricity generation, water supply, flood and drought management, irrigation, fisheries, environmental services and recreational activities, etc. While these objectives (renewable and power services, water quantity management, ecosystem services, economic growth and local livelihoods) can conflict at times, they are also often complementary.

1.2. Advantages of water storage

Advantages of water storages are summarized below:

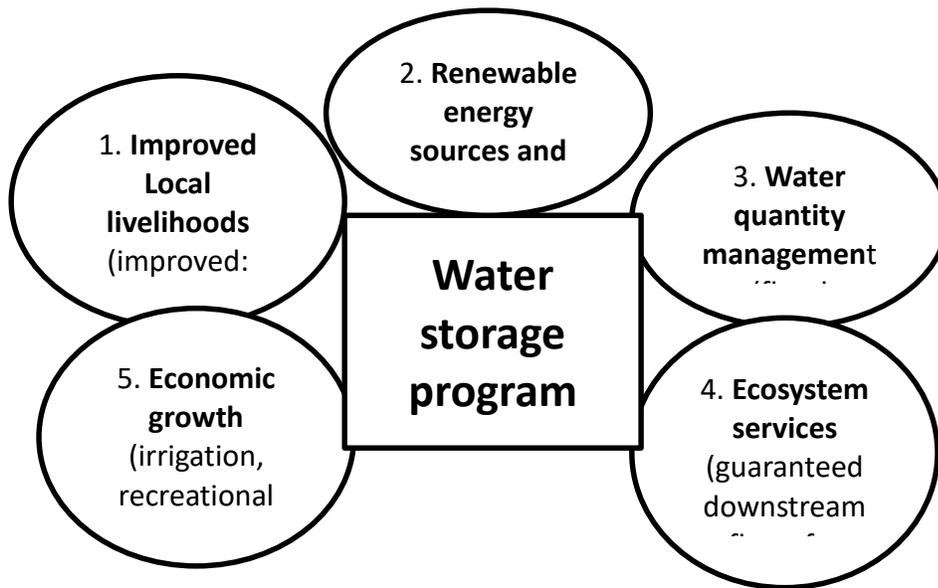


Figure 1: water storage program and its importance

2. Existing Water storage

In Rwanda three main artificial storages are considered. These storages are Water ponds, valley dams and Dams. The Water ponds storages are mainly used for small scale irrigation, Valley dams for livestock watering and dams are used for Irrigation and hydropower generation.

2.1. Water ponds

The water ponds adopted in Rwanda are underground of 120cubic meter to 480cubic meter ponds lined with black plastic dam sheet, to limit the loss through seepage. The water ponds are used mainly for small scale irrigation. The information on water ponds was collected from different sources including RAB, MINAGRI projects, District for VUPs interventions and private initiatives.

The following figure shows the typical water pond constructed for Serving the small scale irrigation.



Figure 2: Water pond lined with plastic sheeting

The table below summarized the data on water ponds in different districts:

No	District	Number of ponds of 120 m ³	Volume (m ³)	Number of pond of 250m ³	Volume (m ³)	Number of ponds of 480 m ³	Volume (m ³)	total ponds	Total storage for ponds
1	Bugesera	183	21,960		7		15	183	21,982
2	Gakenke	8	960		0		0	8	960
3	Gasabo	27	3,240		0		0	27	3,240
4	Gatsibo	69	8,280		0		0	69	8,280
5	Gicumbi	17	2,040		0		0	17	2,040
6	Gisagara	17	2,040		0	14	6720	31	8,760
7	Huye	25	3,000		0	1	480	26	3,480
8	Kamonyi	12	1,440		0		0	12	1,440
9	Karongi	6	720		0		0	6	720
10	Kayonza	39	4,680		0	1	480	40	5,160
11	Kirehe	86	10,320	72	18000	14	6720	172	35,040
12	Muhanga	1	120		0		0	1	120
13	Ngoma	15	1,800		0		0	15	1,800
14	Ngororero	11	1,320		0		0	11	1,320

15	Nyamagabe	9	1,080		0		0	9	1,080
16	Nyanza	61	7,320		0	10	4800	71	12,120
17	Nyarugenge	1	120		0		0	1	120
18	Ruhango	50	6,000		0	10	4800	60	10,800
19	Rulindo	20	2,400		0		0	20	2,400
20	Rutsiro	1	120		0		0	1	120
21	Rwamagana	33	3,960					33	3,960
Total		691	82,920		18007	50	24015	813	120,982

2.2. Valley dams

or livestock water consumption and most of them are located in the eastern part of the country. They are constructed in the valley for collecting runoff. Today the improvement is being done on the reservoir area by lining it with clay to minimize the loss of water through seepage and hence taking the name of valley tanks.

Valley dams have been introduced in Eastern Zone of Rwanda to face water scarcity challenges for a significant number of cattle located in the drier Districts of Eastern Province namely Nyagatare, Gatsibo and Kayanza. The valley dams are mostly used for livestock watering. However during dry seasons we have found that some of the get dry and can't serve the purpose of storing water for livestock. This calls for rehabilitation and and training of users for proper maintenance as stipulated in the monitoring report.

Status of the valley dams is presented n the following figure.



Figure: Valley dam and livestock using water from it

Note: It is important to note that we did not find proper information of the registration of land used for valley dams and this need to be properly packaged for best management of Water Resources

Location of valley dams in different District

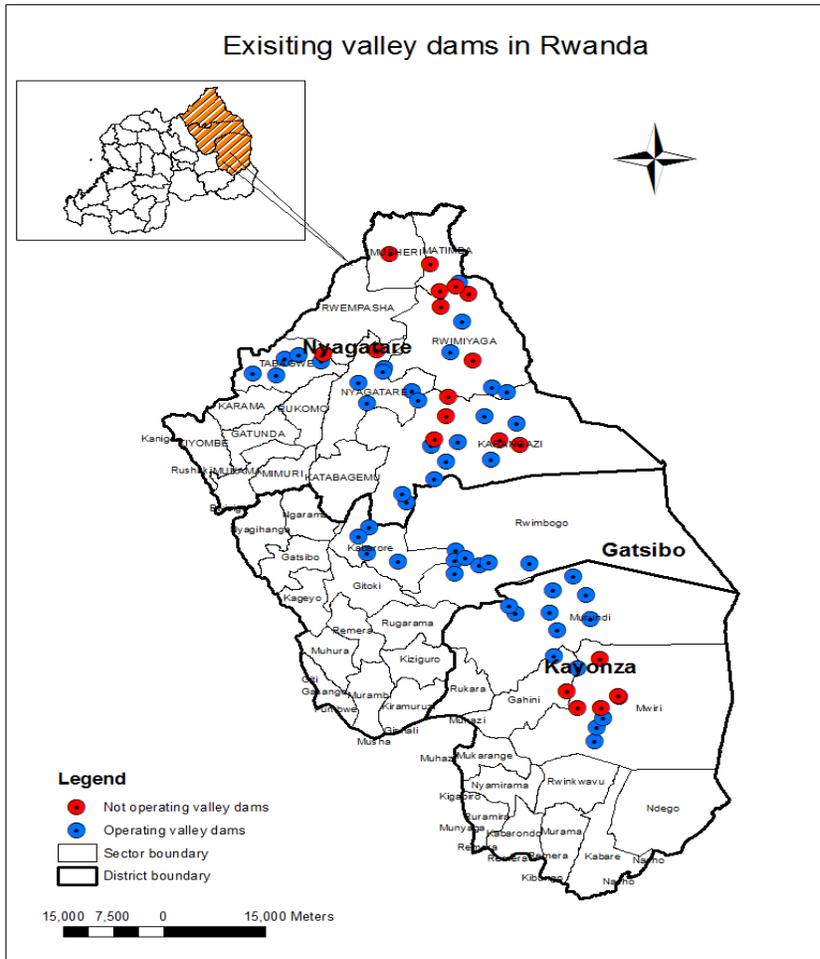


Figure 3: Map showing the location of different valley dams

A big number of valley dam was observed in Nyagatare District with 42 valley dams, followed by kayoza with 23 Valley dams while the low number was observed in Gatsibo with 12 valley dam. This may be driven by the need for livestock watering in Nyagatare where the big number of livestock is observed and the climate is much hot in Nyagatare and kayonza Districts compared to Gatsibo District.

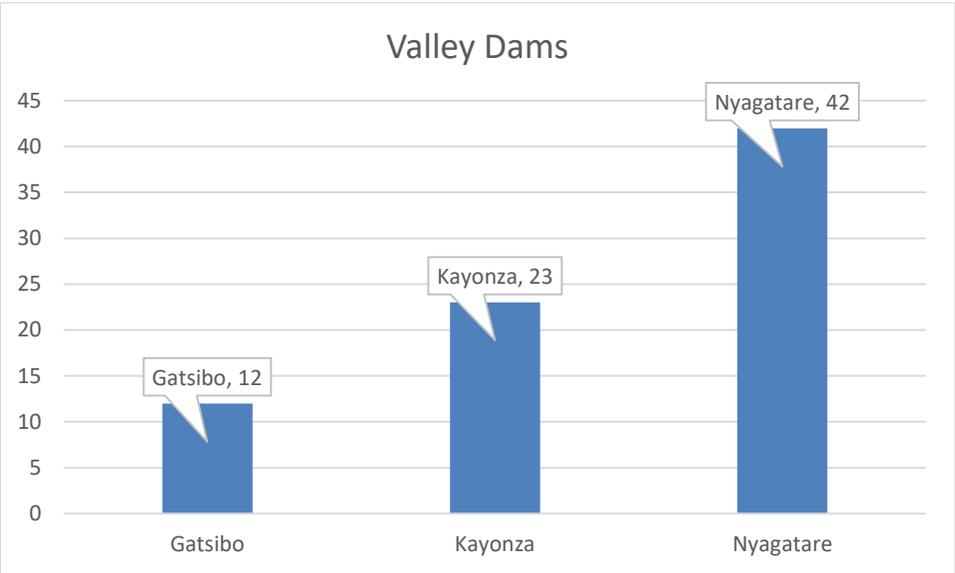


Figure 4: Distribution of valley Dam per District

2.3. Dams

Reservoirs created by dams not only suppress floods but also provide water for such activities as irrigation, human consumption, industrial use, aquaculture, and navigability. In Rwanda, the majority of dams are for irrigation and most of them are earth dams.

2.3.1. Distribution of Dam per uses

Among 45 dams identified in Rwanda only Nyabarongo I is used for hydropower, while Kadahokwa and AIDR dams are used for water supply, other dams are for irrigation either for marshland and hillside irrigation.

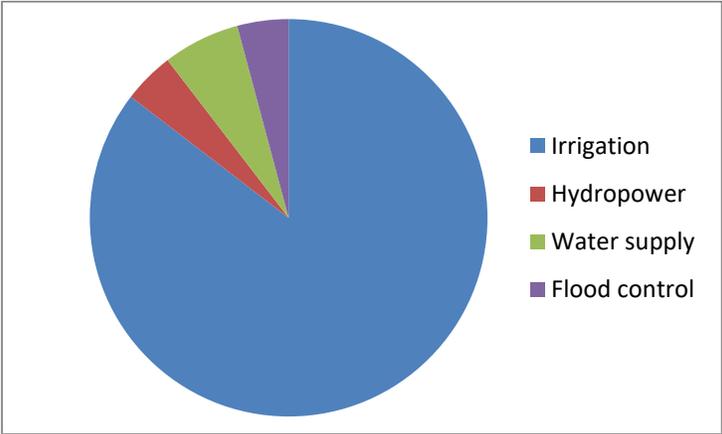
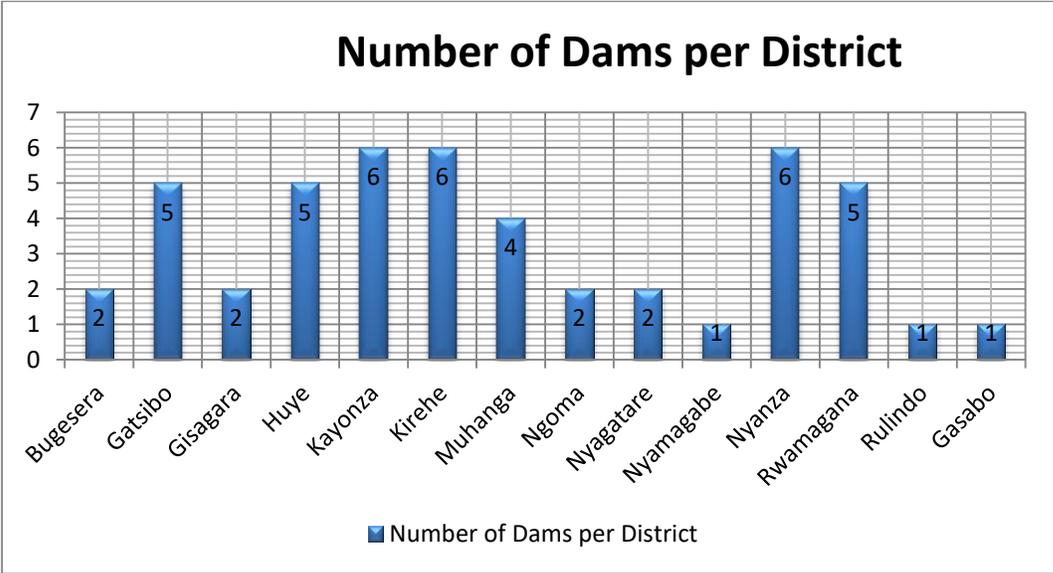


Figure 5: Distribution of Dam per use

2.3.2. Distribution of dam per District

The maximum of six dam was found per District in Nyanza, Kirehe and Kayonza followed by Gatsibo and Huye with 5 dam for each District as shown on the following figure.



2.3.3. Mapping of dams

A total of 48 dam have been monitored. Among them there are 2 for flood control, 2 for Hydropower, 3 for Water supply and the rest are for irrigation.



Figure 6: Photo of Nyabarongo I hydropower



Figure 7: Muyanza dam

4. Recommendations

Water storage development in Rwanda is key to adaptation to climate change. Therefore its implementation requires the collaboration of different institutions using water and the Ministry of Environment having water resources in its attribution.

Therefore we recommend the following:

- Recognize, quantify and optimize all benefits and value created at reservoirs for all multi-purpose water users;
- To incorporate flexibility options for design and operation of reservoir to be able to adapt to the evolution of social & environmental requirements, climate change, etc.;
- Put in place state regulations on water storage development (dams and water structures are long term investments and highly capitalistic);
- Highlight the role of water storage for climate mitigation & adaptation;
- Address mitigation of sedimentation issue by involving different stakeholders;
- Customize water storage models to local context according to strong and best practices ;

ANNEXES

Annex 1: Water Storage-Irrigation, water supply and hydropower dams

No	Dam Name	District	Dam type	Height(m)	Developer	Use	Volume
1	Agasasa	Nyanza	earthfill dam	10	RSSP/MINAGRI	Irrigation	374,000
2	Base	Ruhango	earthfill dam	9	Agricultion Allemand	Irrigation	250,000
3	Bugugu	Rwamagana	Homogenous earthfill	3	MINAGRI	Irrigation	576,000
4	Bushoga	Nyagatare	earthfill dam	4	RSSP	Irrigation	120,000
5	Cyabayaga	Nyagatare	earthfill dam		MINAGRI	Irrigation	200,000
6	Cyarubare	Kayonza	Homogenous earthfill	4	LWH/RSSP	Irrigation	70,000
7	Cyili	Huye	earthfill dam	9.5	RSSP/MINAGRI	Irrigation	950,000
8	Cyimpima	Rwamagana	Earthfill dam	9	Chinese	Irrigation	636,000
9	Cyunuzi	Kirehe	earthfill dam	7	KWAMP	Irrigation	318,000
10	Gacaca	Kayonza	Homogenous earthfill	9.5	RSSP3	Irrigation	2,500,000
11	Gashaka	Kayonza	Homogenous earthfill	4	MINAGRI	Irrigation	850,000
12	Gashara	Rwamagana	Homogenous earthfill	5	MINAGRI	Irrigation	637,000
13	Gatare/Rwabikwano	Bugesera	embankment	4	RSSP	Irrigation	150,000
14	Gitinga(Ruramira)	Kayonza	Homogenous earthfill		MINAGRI	Irrigation	1,500,000
15	Kadahokwa	Huye	earthfill dam		WASAC	Irrigation	600,000
16	Kadiridimba	Kayonza	earthfill dam		Old	Irrigation	50,000
17	Kajevuba	Gasabo	earthfill dam	5	QWMD	Irrigation	180,000
18	kanyonyomba A	Gatsibo	earthfill dam	9	LWH/RSSP	Irrigation	500,000
19	Kayonza-4/Cyarubare	Kayonza	Homogenous earthfill	9.5	LWH	Irrigation	1,600,000
20	Kiliba	GATSIBO	earthfill dam	8.5	RSSP	Irrigation	400,000
21	Kinoni 1	Kirehe	earthdam		KWAMP	Irrigation	250,000
22	Kinoni2	Kirehe	earthdam	16	KWAMP	Irrigation	300,000
23	Kiruhura-Rwintare	Bugesera	earthfill dam	4	RSSP	Irrigation	60,000

24	Mahama	Kirehe			KWAMP	Irrigation	1,000,000
25	Rusuri-Rwamuginga	Huye	earthfill dam	6	RSSP	Irrigation	180,000
26	Kanyonyomba B Munago	Gatsibo	earthfill dam	5	LWH/RSSP	Irrigation	120,000
27	Mushaduka	Gisagara	earthfill dam	13.7	RSSP/MINA GRI	Irrigation	450,000
28	Muyanaza	Rulindo	earthfill dam	26	LWH	Irrigation	2,260,000
29	Mwambu	Ngoma	Homogenous earthfill		MINAGRI	Irrigation	
30	Ngoma 22 (Rurenge)	Ngoma	earthfill dam		JICA/RAB	Irrigation	2,450,000
31	Ntende	Gatsibo	earthfill dam	4.5	RSSP	Irrigation	700,000
32	Nyamugari	Kirehe	embankment	13.71	KWAMP	Irrigation	550,000
33	Nyanza 23/Rwabicuma	Nyanza	zoned earthfill dam	19	LWH	Irrigation	1,820,000
34	Nyarubogo	Nyanza	earthfill dam	9	RSSP/MINA GRI	Irrigation	450,000
35	Rugende	Rwamagana	Homogenous earthfill	13.5	RSSP3	Irrigation	1,350,000
36	Rugeramigozi 1	Muhanga	earthfill dam	6	RSSP/MINA GRI	Irrigation	270,000
37	Rugeramigozi 2	Muhanga	earthfill dam		AAA	Irrigation	260,000
38	Runukangoma	Huye	earthfill dam		AAA/WWH	Irrigation	300,000
39	Rwamagana-34	Rwamagana	Homogenous earthfill	14	LWH	Irrigation	1,000,000
40	Rwangingo-Karangazi	Gatsibo	earthfill dam		RSSP	Irrigation	3,500,000
41	Rwasave/Cyadisha	Huye	earthfill dam			Irrigation	450,000
42	AIDR	Muhanga	earthfill dam	9	AIDER	water supply	400,000
43	Kadahokwa	Huye	earthfill dam		Huye	Water Supply	600,000
44	Bishya	Nyanza	earthfill dam	11	Nyaza	Water supply	1,600,000
45	Rwinkwavu	Kayonza	earthfill dam	9.5	RSSP	Irrigation	4,200,000
46	Sagatare	Kirehe	embankment	6.5	KWAMP	Irrigation	280,000
47	Kageyo	Kayonza	embankment	8	RCSP	Irrigation	3,500,000
48	KIBUZA/Kamonyi	KABUZA	EMBANKMENT	6	KAMONYI-FONERWA	Irrigation	65,000

49	Nyabarongo I	Mushishi ro	concrete	44.5	REG	Hydropower	35,000,000
50	Rukarara	Rukarara	Concrete	10	MININFRA	Hydropower	125,000
	Total						75,951,000

Annex 2: Storage capacity of water ponds in different district of Rwanda

No	District	Number of ponds of 120 m ³	Volume (m ³)	Number of pond of 250m ³	Volume (m ³)	Number of ponds of 480 m ³	Volume (m ³)	total ponds	Total storage for ponds
1	Bugesera	183	21,960		0		0	183	21,960
2	Gakenke	8	960		0		0	8	960
3	Gasabo	27	3,240		0		0	27	3,240
4	Gatsibo	69	8,280		0		0	69	8,280
5	Gicumbi	17	2,040		0		0	17	2,040
6	Gisagara	17	2,040		0	14	6720	31	8,760
7	Huye	25	3,000		0	1	480	26	3,480
8	Kamonyi	12	1,440		0		0	12	1,440
9	Karongi	6	720		0		0	6	720
10	Kayonza	39	4,680		0	1	480	40	5,160
11	Kirehe	86	10,320	72	18000	14	6720	172	35,040
12	Muhanga	1	120		0		0	1	120
13	Ngoma	15	1,800		0		0	15	1,800
14	Ngororero	11	1,320		0		0	11	1,320
15	Nyamagabe	9	1,080		0		0	9	1,080
16	Nyanza	61	320		0	10	4800	71	12,120
17	Nyarugenge	1	120		0		0	1	120
18	Ruhango	50	6,000		0	10	4800	60	10,800
19	Rulindo	20	2,400		0		0	20	2,400
20	Rutsiro	1	120		0		0	1	120
21	Rwamagana	33	3,960		0		0	33	3,960
22	Kigali City	601	72,120		0		0	601	6,683
Total		1,292	155,040		18,000	50	24,000	1,414	131,603

Annex 3: Valley Dams and their estimated volumes

No	Name	District	X	Y	storage
1	Ndago 1	Kayonza	572155	4791992	50,000
2	Rugeyo	Kayonza	572361	4794520	50,000
3	Kageyo	Kayonza	573345	4796072	3,500,000
4	Rwisirabo 2	Kayonza	575794	4799747	50,000
5	Rwisirabo2 (dam sheet)	Kayonza	575616	4799790	50,000
6	Rwisirabo 1	Kayonza	572999	4797748	50,000
7	Sabasengo	Kayonza	572868	4806153	50,000
8	Buhabwa	Kayonza	560353	4813945	50,000
9	Cyamburara	Kayonza	559325	4815210	50,000
10	Kwa Karamba	Kayonza	565444	4814078	50,000
11	Gakoma 1/ Kwa Karugenge	Kayonza	566523	4811051	55,000
12	Ku Cya musenyeri	Kayonza	565859	4817957	1,500,000
13	Mucucu/Kwa Makanika	Kayonza	570863	4817089	50,000
14	Kwa Sekimondo	Kayonza	568841	4820387	50,000
15	Mu giperefe	Kayonza	569599	4804570	50,000
16	Byimana	Kayonza	568024	4800681	50,000
17	Kiyanja	Kayonza	569554	4797740	50,000
18	Rukore	Kayonza	566007	4806668	50,000
19	Gapfubyi	Kayonza	571480	4813017	50,000
20	Simbwa	Gatsibo	538616	4828793	50,000
21	Kibondo	Gatsibo	537044	4827217	50,000
22	Gatoki	Gatsibo	538282	4824258	50,000
23	Nyabikiri(kwa sakure)	Gatsibo	551427	4824758	50,000
24	Kwa busungu	Gatsibo	551235	4823105	50,000
25	Kwa mutini	Gatsibo	551312	4820854	50,000
26	Kwa murekwa	Gatsibo	554969	4822217	50,000
27	Munini	Gatsibo	556422	4822733	50,000
28	Gikobwa	Gatsibo	562389	4822482	50,000
29	Kwa cyangwate	Gatsibo	552919	4823478	50,000
30	Kwa sosi	Gatsibo	542827	4822853	50,000
31	Gatebe 1	Nyagatare	223036	9852634	50,000
32	Gatebe 2	Nyagatare	225170	9851795	50,000
33	Rusa	Nyagatare	220151	9857226	50,000
34	Rukundo	Nyagatare	216748	9858688	50,000
35	Bwera	Nyagatare	218463	9863987	50,000
36	Rubira	Nyagatare	219545	9868647	50,000
37	Kwa Rugondo/Agatindo	Nyagatare	218067	9870659	50,000
38	Rutungo	Nyagatare	217544	9869982	50,000

39	Gashwenu	Nyagatare	215279	9866451	50,000
40	Rugaga	Nyagatare	215181	9869232	50,000
41	Bwera	Nyagatare	213692	9873707	50,000
42	Musheri	Nyagatare	207690	9875528	50,000
43	Nkuna	Nyagatare	214492	9836855	50,000
44	Nyagashanga	Nyagatare	216206	9839949	50,000
45	Rwabiharamba	Nyagatare	217943	9843226	50,000
46	Kanyange 2	Nyagatare	222844	9840291	50,000
47	Akayange	Nyagatare	227139	9842780	50,000
48	Akayange(kwa semana)	Nyagatare	226691	9846463	40,000
49	Akayange(kwa musoni)	Nyagatare	224065	9843664	50,000
50	Akayange(kwa turagara)	Nyagatare	221958	9847647	50,000
51	Byimana	Nyagatare	216240	9847787	50,000
52	Kamate	Nyagatare	216420	9851120	45,000
53	Kwa Ndereya	Nyagatare	214352	9843664	50,000
54	F	Nyagatare	213938	9842561	50,000
55	Ruziranyenzi	Nyagatare	209685	9834310	50,000
56	Rundiyo(Kwa kagarama)	Nyagatare	210339	9832919	50,000
57	Kwa Kayigiro	Nyagatare	197853	9858311	50,000
58	Bitibyoma(kwa karekezi)	Nyagatare	197581	9857091	50,000
59	Nyagasigati(kidakamirwa)	Nyagatare	194290	9858125	50,000
60	Kangoma	Nyagatare	192169	9857616	50,000
61	Mutozo	Nyagatare	190837	9854628	50,000
62	Kabusunzu	Nyagatare	187366	9854914	50,000
63	Gihorobwa	Nyagatare	203129	9853365	50,000
64	Rutaraka	Nyagatare	204380	9849915	50,000
65	Kamagire	Nyagatare	211020	9852055	50,000
66	Rwakigeli	Nyagatare	212091	9850374	50,000
67	Mugari	Nyagatare	206732	9855405	50,000
68	Burumba	Nyagatare	206925	9855979	50,000
69	Kabare	Nyagatare	205894	9858949	50,000
70	kamiramigezi	Nyagatare			73,130
71	Gikobwa	Gatsibo			60,000
72	Mucucu (Nyirinkwaya)	Kayonza			45,000
73	Mucucu (taremwa)	Kayonza			38,000
74	Gakoma (kwa Murekezi)	Kayonza			65,000
75	Gisunzu (kageyo)	Kayonza			50,000
76	Valley dam yo kuri RDB	Nyagatare			50,000
77	Akayange (kwa Bugabo)	Nyagatare			45,000
	Total				8,766,130

Annex 4: Coordinates for different dams

No	Name	X	Y	Z(m)	Districts	Sectors
1	Gatare-Rwabikwano	507393	4747300		Bugesera	Mareba
2	Kiruhura-Rwintare	503673	4747754		Bugesera	Mareba,Nyarugenge
3	Kajevuba	517702	4797746	1436	Gasabo	Bumbogo
4	Kiliba	541992	4816195	1418	Gatsibo	Rugarama
5	Rwangingo	532244	4823872	1415	Gatsibo	-
6	Ntende	545787	4812731	1389	Gatsibo	Rugarama
7	Kanyonyomba	540558	4806141	1486	Gatsibo	Kiziguro
8	Munago	538437	4804209	1509	Gatsibo	Kiziguro
9	Mushaduka	481292	4719925	1500	Gisagara	Musha
10	Cyili	480400	4720750	1419	Huye	Kinazi, Rusatira
11	Kadahokwa	466499	4710621	1727	Huye	Gishamvu
12	Rusuli	474175	4723063	1642	Huye	Ruhashya
13	Cyarubare	469776	4725108	1630	Huye	Rusatira
14	Runukangoma	465968	4727931	1575	Huye	Rwaniro, Simbi
15	Cyadisha	474185	4717776	1679	Huye, Gisagara	Mbazi, Save
16	Gatinga	553702	4783278	1407	Kayonza	Ruramira
17	Gacaca	558214	4808265	1359	Kayonza	Murundi
18	Gashaka	560355	4787047	1472	Kayonza	Mukarange
19	Rwinkwavu	563870	4774584	1416	Kayonza	Rwinkwavu
20	Kadiridimba	565646	4782893	1358	Kayonza	Rwinkwavu
21	Kayonza4	570245	4773527	1451	Kayonza	Rwinkwavu
22	Cyunuzi	566910	4754555	1367	Kirehe	Mushikiri
23	Sagatare	573227	4746772	1405	Kirehe	Musanza, Kirehe
24	Kinoni 1	581029	4746531	1438	Kirehe	Kigina, Kigarama
25	Mahama	590742	4750927	1312	Kirehe	Mahama
26	Nyamugali	583796	4746054	1375	Kirehe	Nyamugali
27	Kinoni2	581684	4743043	1362	Kirehe	Kigarama
28	Rugeramigozi I	472586	4766929	1800	Muhanga	Nyamabuye, Shyogwe
29	Rugeramigozi II	475848	4768273	1816	Muhanga	Shyogwe
30	AIDER	473784	4764078	1758	Muhanga	Shyogwe
31	Nyabarongo HP	459243	4780182	1503	Muhanga, Ngororero	Mushishiro, Nyange
32	Ngoma 22	557265	4768481	1378	Ngoma	Rurenge
33	Mwambo	557680	4766008	1379	Ngoma	Rurenge
34	Cyabayaga	531747	4844056		Nyagatare	Nyagatare
35	Bushoga	533261	4847900		Nyagatare	Nyagatare
36	Rukarara	441788	4730247		Nyamagabe	
37	Base	467950	4751637	1616	Nyanza	Rukingo
38	Nyamagana	471528	4740792	1744	Nyanza	Busasamana
39	Nyarubogo	486403	4738201	1386	Nyanza	Kibirizi, Muyira
40	Agasasa	484730	4732391	1432	Nyanza	Kibirizi, Ntyazo
41	Nyanza 23	465922	4738404	1607	Nyanza	Rwabicuma
42	Bishya	469542	4743450		Nyanza	Mukingo
43	Bugugu	546986	4782121	1393	Rwamagana	Kigabiro
44	Gashara	545334	4778514	1372	Rwamagana	Rubona
45	Cyimpima	549116	4779304	1368	Rwamagana	Kigabiro
46	Rwamagana 34	538681	4779049	1397	Rwamagana	Nzige, Mwurire
47	Rugende	531199	4783106	1387	Rwamagana, Gasabo	Gahengeri, Muyombo
48	Muyanza	508870	4810454		Rulindo	