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Contribution of Gaharwa Lake to Sustainable Solution for Availing Sufficient Domestic water

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Abstract

Rwanda Government, via its Ministry of Infrastructure (MININFRA) and authority in charge of Water and Sanitation Corporation (WASAC) has instigated copious initiatives aimed at finding durable ensues to water scantiness in some country districts especially in Bugesera District. To date it lived by 453451 peoples with only 3600 m^3/d available from Ngenda Water Treatment Plant (WTP) intents to treat cyohoha Lake. This research is conducted to handle water scantiness issues in Bugesera District with the aid of Gaharwa Lake. For attaining research directs, forms and onsite interrogates have been conducted, and Hazen–Williams equation has been used in designing processes. Therefore, the water treatment plant was designed with an awareness of water quality and quantity, population growth rate. Findings indicated that analyzed water quality parameters were bottled up by low turbidity: 4.2 NTU, Zn: 0.12 mg/L, NO_3: 0.4 mg/L, Manganese: 0.047 mg/L, NH_3-N: 0.04 mg/L, Fe^{2}+: 0.61 mg/L, PH: 6.6, Fluoride: 0.11 mg/L, Alkalinity: 2 and Total hardness of 2.6 and water quantity should be 40723.8 m^3/d. Additionally, The entire amount necessitated for the proposed Gaharwa WTP is 632,950.1957 USD. Eventually, Gaharwa Lake can be utilized as ensues to water scantiness in the Bugesera district. This research will greatly contribute to the lives of Rwandan people as well as Country Vision.

Keywords: Hazen-Williams equation • Gaharwa Lake • Water Treatment Plant • Water quality parameters

Introduction

Water is a vital natural resource that instantly affirms life and it is crucial for mankind such as sustainable economic growth and prosperity. Also, it is, it is pivotal in natural ecosystems and climate control [1]. However, it is a limited resource, less than 1% of the worlds freshwater are available for direct human consumption [2]. In addition, global warming, expeditious human population growth and economic development, inappropriate waste and waste management, housing styles, and geographical location limit access to safe drinking water. Rural residents have more difficulty accessing clean water than urban dwellers [3,4]. To date, any country takes water as a strategic natural resource for economic, social, and cultural development. Also, Rwanda has a dense hydrological network composed of many rivers, streams, and wetlands that drain water into lakes and other for reservoirs. However, it is highly dependent on agriculture meanwhile water plays a huge role in its agriculture, which increases the importance of this resource [5].

Furthermore, the Rwanda Government is escalating for accessing the green durable and economical method to avail copious domestic water countrywide. Thereby, Water acts as a central element for human life as it plays a crucial role in comforting human needs like health protection, ecosystem restoration, food, and energy production as well as for social and sustainable economic development [6]. Vigorously, raising water demand highlights the need for more effective policies and practices for water resources management equitably and sustainably. Water demand for energy, agriculture, infrastructure, industry, and household is protruded to be increased by 27 per cent in the next thirty years means from 0.12 billion m^3 to 3.37 billion m^3 [7]. Commonly, better management of water resources along with access to mended water supply and sanitation plays an important role in influencing the well-being of communities in developing countries and national development plans [8,9]. There have been numerous attentions from local governments, government agencies, and NGOs, but the burden is still mainly on developing countries [10]. And the most affected areas are sub-Saharan African countries [11-13]. By the middle of this century, water scarcity will affect 2 to 7 billion people [14]. Also, Rwanda is one of the most populous countries in Africa [15]. In this country, National Strategy for Transformation (NST1), particularly as it pertains to water availability and sanitation services. The NST1 highlights that 100 per cent of households should have access to clean drinking water by 2024. This will depend on the treatment and distribution capacity. To this day, the availability of safe drinking water does not meet the population needs. This implies a scant in water distribution [16].

Generally, water supply and sanitation in Rwanda are stamped by a tremendous rate compare to the past years in the rural area. However, in the Bugesera district, the increment of drinking water is not achieved at the required extent where only 44% of people have access to treated water [17]. Even if, Rwanda has committed to attaining very ambitious targets by focusing to raise rural and urban water supply coverage by aiding the districts to plan, design, finance, and implement water infrastructure projects. Also, Bugesera district hydrographical network is mainly marked by 3 rivers, namely Akanyaru, Akagera, and Nyabarongo [18]. Without taking into account Rivers, Bugesera is marked with nine lakes including Rweru, Cyohoha north, cyohohoha South, Gashanga, Kidogo, Rumira, Mirayi, Kirimbi, and Gaharwa. Among them seven lakes were formed as a ensue of Akagera river overflow, except lake Rweru and lake Cyohoho South, other lakes have little effect on rainfall formation and are mainly responsible for fishing, tourism, irrigation, and farming [19]. Furthermore, Apart from those lakes and rivers, this region faces the problem of water scantiness emanated from people dispersion and flat topography count a few springs source, this can be indicated by how most residents fetch

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water from Nyabarongo River for domestic purposes, the water stream that snails through the thickly settled and industrious City of Kigali [19].

Mainly, it is pivotal to contemplate all the factors that impart to water scantiness. The extent to which water supply is scarce depends on the local geography of the area. Also, in Rwanda, there is no more monitoring of water quality and few types of research indicated that major water pollutants are sediments and nutrients transported into watershed with soil topography (steep-slope) [20]. Therefore, it is said that water scantiness is an extremely subjective, regional, and intermittent problem, and these problems can be related to two main features: Quantity and Quality, Normally most cities utilize water from the water purification facilities. Thereby, balancing the available water and its growing needs under population growth rate and the changing climate can be a crucial alternative for water resources management [21]. Moreover, Bugesera located at a low rainfall zone receiving an annual average of around 900 mm. The days are generally hot and dry while nights are usually cool also, Climate change could cause water scantiness owing to rainfall decline and aquifer depletion is the last treasure for the future. Eventually, there is the availability of such 67% of humidity, these show that surface water such as river water and other sources of water are available and groundwater could be exploited by people for different purposes [22].

These indicate that Bugesera district could be provided with abundant safe water; this includes improving rural water supply infrastructures and ensuring sustainable operation and maintenance. For ensuring sufficient revenue to finance these improvements, there will be needed an assessment of the water pricing structure that can ensure recovery of treatment, distribution, maintenance, and expansion costs for services [23].

Materials and Methods

To compass the purports, the following procedures have been contemplated to procure perfect, updated, and comprehensive findings. Data was gathered by reading various books, reports, and scientific published articles. Additionally, It is crucial to supply well purified and distributed water in society. In such instances site visit with sample collection was made for Gaharwa Lake and Ngenda river. Also, Arithmetic Increase Method is used to estimate the recent population and Future forecasting population in the District. Moreover, the various materials and laboratory equipment have been used in data collection, processing, and analysis for procuring the findings of the standards and water should be free from pathogens, hazardous chemicals including radioactive materials, and plenty of quantity. Besides, the water should not have an objectionable colour, odour, or taste and should be neither unduly corrosive nor unduly encrusting [24].

Study area description

This study was conducted in bugesera district located in Eastern Province, Southeast of Kigali, Rwanda capital city as shown in Figure 1. To date, Bugesera district has a total surface area is 1,334 km^2 [25] and its population is estimated at 453451 people.

The population of Bugesera district

The district is composed of 15 Sectors, 72 Cells, and 581 Villages with a total population of 363,339 people [26]. Its Average Annual Growth Rate is 3.1% as it is shown in Table 1.

Demographic characteristics of Bugesera district

Based on the 2012 population census, we have enumerated the present population in 2020. However, the Bugesera district population has been estimated by using Arithmetic Increase Method [27] (Table 1).

The arithmetic increase method is based on the assumption of the population increases at a constant rate. Thus $P_{year}=P_0+kt$.

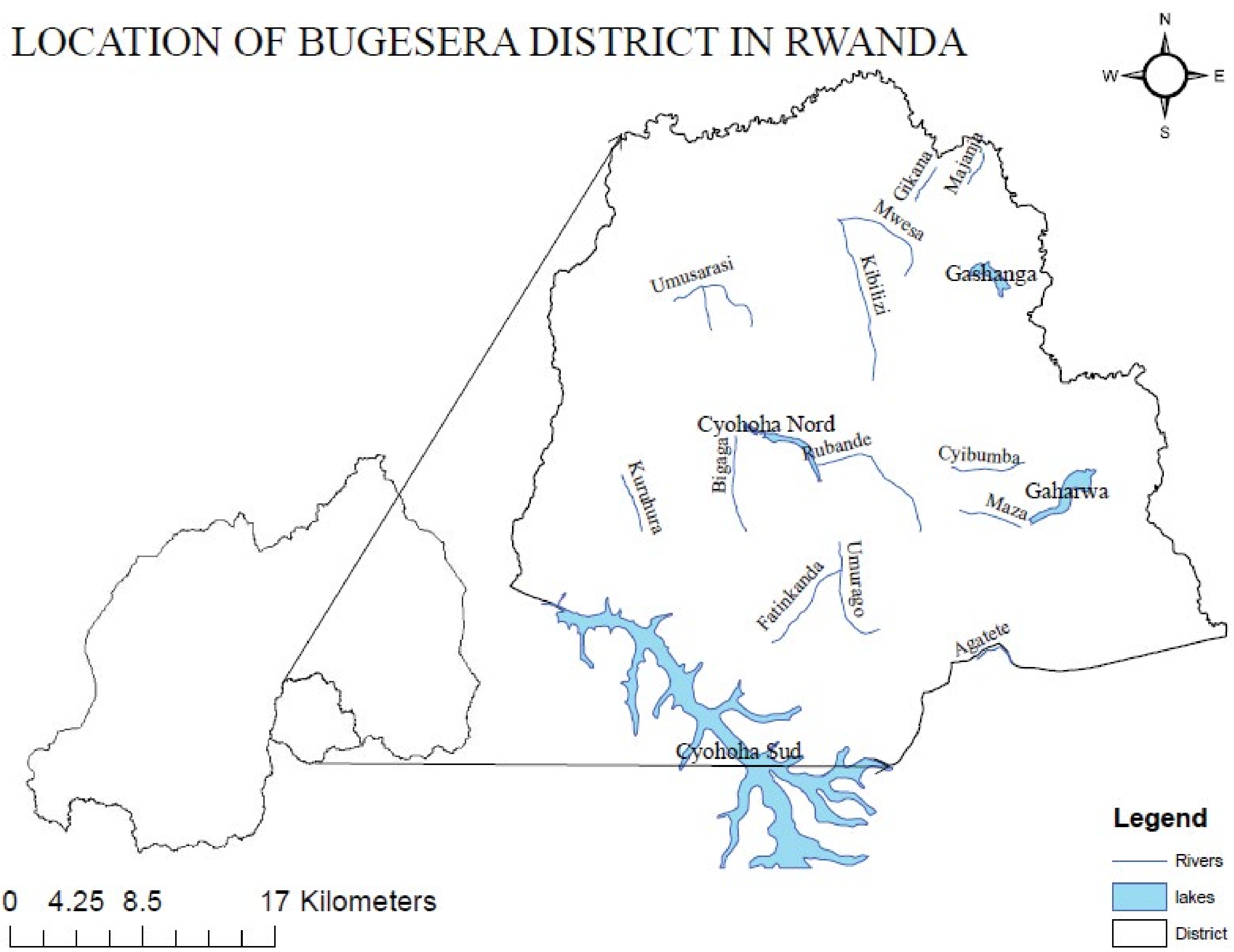

Figure 1. Location of Bugesera district.

Where: dp/dt =K (constant); P_{year}= population after time t (year) and P_0= estimated initial population.

To date, the Whole estimated population in this year 2020 is 453451 People, where P_0=363,339 People and t=8 years

Results and Discussion

Existing water consumption status and Actual water demand

Although Bugesera district is consist of rivers and lakes. However, their people suffer from potable water for different activities like domestic works, drinking, and other activities related to the water need. Potable water used in the Bugesera district is supplied by two sources which are Genda WTP that treats Cyohoha lake and Rwakibirizi water source which is located in Nyamata both produce a discharge of 3200 m^3/d and 400 m^3/d respectively and both sources make a total of 3600 m^3/d. Now-a-days Bugesera district is habited by 453451 people. Bugesera district needs per capita of 60l/person/day. Now the actual water demand per day are 453451 × 60l/person/day=27207060 l/d=27207 m^3/d.

Future forecasting and projected water demand

Population forecasting of Bugesera district and projected water demand

Based on the 2020 population, we should enumerate the population in 2040. Bugesera district in 2040 (20 years) by using Arithmetic Increase Method P2040 will be 678731 people. The future period for which a provision is made in the water supply scheme known as the design period. Also, our work was based on a design period of 20 years. Therefore, the projected water demand will be 40723.8 m^3/d.

Water quality measurement

Except for Zn and pH values higher than those from Lake Ngenda as shown in Table 2. Raw water property from Ngenda Lake is no more multifarious with Raw water property from Gaharwa Lake which implies that Gaharwa lake can also be treated and used as a drinking water source for the local community.

Local community's perceptions about water scantiness

According to the forms and onsite interrogates that have been conducted, the respondents said that supplied quantity is not satisfactory in contrast to the Bugesera population. Additionally most respondents reported that they are often faced with difficulties availability and irregularity of water distribution. This direct emphasizes proposing new water treatment to satisfy the local community as shown in Figure 2.

Gaharwa WTP design

The water treatment plant (WTP) is priced at 632,950.1957 USD as shown in Tables 3 and 4 and is designed to provide 40723.8 m^3 per day, which is Bugesera district estimated demand in 2040. for providing this demand, firstly know the efficiency of the plant so that you can calculate the water amount entered the plant known as flow (Qd), which is generally expressed in m^3/sec but it can be l/s, Ml/day, or l/c/d. Discharge flow in the water supply system, are classified as production, delivery, consumption, and leakage [28]. Moreover, there are several equations usually utilized to estimate flow resistance in channels and pipes for instance the Manning equation, dimensionally homogeneous Manning formula, Chezy equation, Darcy–Weisbach equation, and Hazen–Williams equation [29]. However, the Hazen-Williams equation is Commonly used for channel and pipes design: $V=K_{HW}C_{HW}R^{0.63}S^{0.4}$; Thus, Discharge (Q)=Area (A)*V. Where: V=cross-sectional averaged velocity, R= hydraulic radius, S= slope of the energy grade line, Discharge (Q), Cross-sectional Area of the pipe (A),K_{HW} (unit conversion factors) = 0.849, C_{HW}= Hazen–Williams coefficient.

Therefore, Drinking-Water Treatment processes involve pathogens removal and other contaminants from the water source to make it safe for humans consumption. Widely, before clean water be pumped into the water distribution system, there are various technologies and processes which can be used to decontaminate or treat that water. Commonly, during the Gaharwa water treatment design, we considered retention time (T) of 5 min, 30sec, 10-30min, 20 min for the intake, coagulation, flocculation, sedimentation process respectively, Where two Coagulation, flocculation, and Sedimentation tanks were designed. Additionally, the system efficiency of the proposed plant is assumed as follows. From the reservoir tank to the point of use (90%), infiltration tank (95%), in sedimentation tank (90%), coagulation, and flocculation (98%).

Table 1. Population of Bugesera district in 2012.

District	2002 Total Population	2012 Population			Population change (2002-2012) (%)	Average Annual Growth Rate (3.1)
		Male	Female	Total		
Bugesera	266,775	177,404	185,935	363,339	36.2	3.1

Table 2. Water quality parameters.

Ngenda raw water property	Gaharwa lake raw water property
Turbidity: 960 NTU	Turbidity: 4.2 NTU
PH: 6.0	PH: 6.6
Ca hardness: 1 ml ^{0}F	Ca^{2+}: 1 ^{0}F
Fe^{2+}: 2.01 mg/l	Fe^{2+}: 0.61 mg/l
Mg: mg/l	Mg: mg/l
Total hardness	2.6
Cu^{2+}: 0.19 mg/l	Copper: no copper find
Iron: 2.01 mg/l	Iron: : 0.61 mg/l
Al^{3+}: mg/l	Al^{3+}: mg/l
Mn: 0.127 mg/l	Mn: 0.047 mg/l
Zn: 0.01 mg/l	Zn: 0.12 mg/l
NO_3: 3.8 mg/l	NO_3: 0.4 mg/l
NO_2: No nitrite found	NO_2: No nitrite found
Fluoride: 0.11 mg/l	Fluoride: 0.11 mg/l
NH_3-N: 0.71 mg/l	NH_3-N: 0.04 mg/l
	Alkalinity: 2
Sulfate: 16 mg/l	Sulfate: 1 mg/l

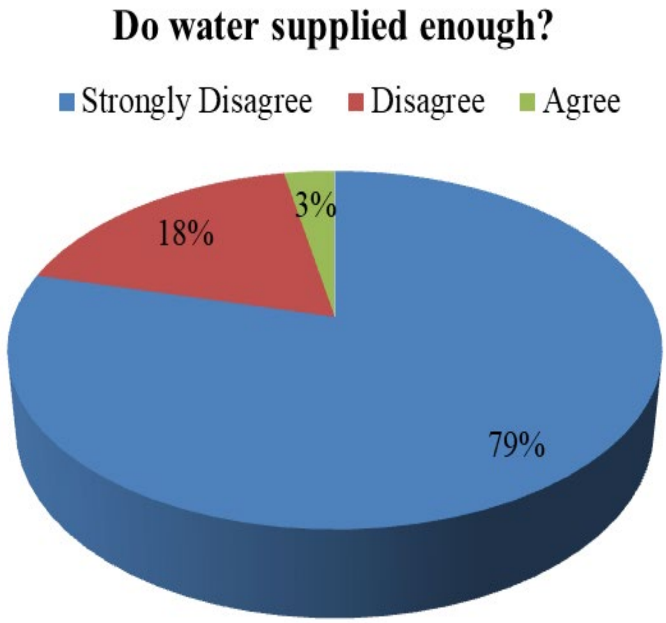

Figure 2. Local community's perception.

Table 3. Typical demand regime to be followed.

No	Time (from-to)		Duration (hrs.)	%Demand
1	20	5	9	30
2	5	13	8	40
3	13	20	7	30

Hence the overall efficiency is 75%. Hence, the design for the following inlet discharge (Q) is 40723.8 m^3/d /0.75= 54298.4 m^3/d.

Design of pipeline toward intake structure

To design pipeline and pump toward the Coagulation tank, 1.5 m/s was assumed as velocity because there is a great pipe needed for whole water. Therefore A=0.41 m^2 and D=0.72 m from intake 10 m away.

Design of the intake structure

For designing the intake structure, 5 min should be taken as detention time (T) of intake. Therefore Volume (V) = 188.53 m^3. also, the rectangular shape was chosen for design where width was double of length and assuming water depth of 2.5 m, so intake structure should be designed with H=2.5 m, and A=75.41 m^2. An additional freeboard of 0.5 m to height during construction should be taken.

Coagulation tank design

Coagulation tank should be patterned with 30 seconds as retention time, these will furnish 18.85 m^3 as coagulation tank volume, also water depth of 1.5 m and a freeboard of 0.5 m during construction should be used. Therefore using length to width ratio equal to 2, findings should be 2.5 m for width and 5 m for length.

Flocculation tank

Flocculation tank should be designed at a retention time of 15 min (consequently 10-30 min: references do not define nominal flows and it appears that earlier texts based detention times on mean, or nominal flows rather than on maximum plant capacity) [30]. Therefore Volume (V) = 565.6 m^3, also Two flocculation tanks will be used. Where V_{each}=282.8 m^3, water depth=3 m with Adding freeboard of 0.5 m to height during construction and length to width ratio should be considered (same as coagulation tank).

Sedimentation tank

For effective working coagulation and flocculation efficiency should be assumed as 98% and input flow to sedimentation tank should be enumerated as Q=98% of designed discharge, which will be 53212.432 m^3/d, by Using two sedimentation tanks, therefore Q_{each}=26606.216 m^3 /d; detention time=20 min range between (900 sec-1200 sec), L/W=2 [31]. Thus, Volume (V) = 369.53 m^3. Moreover, a Sedimentation tank should be made with two parties where the upper portion is rectangular (3/4 of total volume) and the lower part is trapezoidal (1/4 of total volume). Therefore for designing a rectangular part Volume (V) should be 277.14 m^3 and Area (A) =138.57 m^2 with 2 m as assumed depth (remember L/W=2). Finally, the area of the Trapezoidal lower part should be 92.38 m^3, according to the trapezoidal design formula where A = (B-my)y; m=8.3 m therefore Y1=4.73 m and Y2=0.79 m.

Filtration tank

Considering this tank, design should be consider flow capacity and efficiency of 90%. Therefore Q=47891.18 m^3/thus two tanks are needed where Q_{each} =23945.59 m^3/d. normally, from literature, Rate of filtration=144 $m^3/m^2 \times$ d (6000l/h × m^2), A=166.28 m^2, L/W=2, finally remember that H=Free board+ Water depth+ sand+ gravel, where (Free board=0.3; water depth=1; sand=0.5; gravel=0.6) H=0.3+1+0.5+0.6=2.4 m.

Pipe design from filtration tank to reservoir tank

This pipe 23945.59 m^3/day of the Filtration, the tank should be taken into consideration and Hazen–Williams equation should be used to design the pipe. Therefore V=0.849 × CHWR0.63S0.4 (m/s), Where CHW= Hazen–Williams coefficient, R= hydraulic radius of pipe= ¼ × D (m) and S=Slope of energy line (m/m) [29]. For designing we have to consider Slope equal to 4:10, CHW=140, R=0.072 m, D=0.14 m and A=0.016 m^2.

Reservoir tank design

For the efficacious design of Reservoir design, we should consider 95% as efficiency. Therefore Q=45496.621 m^3/d and Hourly discharge =1895.69 m^3/h.

Using a demanding regime as shown in Table 3. We can calculate the required tank volume to store water during low demand to be used during the high demand period.

Table 4. Estimation and costing of proposed Gaharwa WTP.

Bills of Quantities: Measured Works - Water Tank Plants					
Item	**Description**	**Unit**	**Quantity**	**Rate Per Unit (RWF)**	**Amount (RWF)**
1	**Preliminary works** General site installation and construction works		1	9,000,000	9,000,000
	Full studies, Hydraulic design of the system, Development of structural, Drawings, Stability test	Lump-Sum	1	3,000,000	3,000,000
2	Hydraulic equipment		1	70,000,000	70,000,000
3	**Reinforcement or Steelwork** High yield tensile steel bar reinforcement to BS 4449 as described including cutting to lengths, bending, hoisting, and fixing including all necessary tying wire and spacing blocks.		1	500,000,000	500,000,000
	Construction of WTP (a) Intake				
	Excavation and earthworks. Excavate foundation trench not exceeding 1.5 m deep commencing from stripped levels.	Cum	33.136	8,000	265,089.60
	Filling: 200 mm Hardcore filling consolidated under floors including 100 mm selected sand blinding.	Cum	4.4532	40,000	178,129.60
	Plan *in-situ* concrete 1:4:8 as described. 100 mm Blinding layer: under foundations.	Cum	2.2196	200,000	443,928.00
	Construction of WTP (b) Coagulation				
	Excavation and earthworks.: Excavate foundation trench not exceeding 1.5 m deep commencing from stripped levels.	Cum	9.8604	8,000	78,883.20
	Filling 400 mm Hardcore filling consolidated under floors including 200 mm selected sand blinding.	Cum	1.7642	40,000	70,566.40
	Plan *in-situ* concrete 1:4:8 as described. 200 mm Blinding layer: under foundations.	Cum	0.8821	200,000	176,416.00
	Construction of WTP (c) Coagulation				
	Excavation and earthworks. Excavate foundation trench not exceeding 1.5 m deep commencing from stripped levels.	Cum	9.8604	8,000	78,883.20
	Filling: 400 mm Hardcore filling consolidated under floors including 200 mm selected sand blinding.	Cum	1.7642	40,000	70,566.40

Bills of Quantities: Measured Works - Water Tank Plants					
Item	**Description**	**Unit**	**Quantity**	**Rate Per Unit (RWF)**	**Amount (RWF)**
1	**Preliminary works** General site installation and construction works		1	9,000,000	9,000,000
	Full studies, Hydraulic design of the system, Development of structural, Drawings, Stability test	Lump-Sum	1	3,000,000	3,000,000
2	Hydraulic equipment		1	70,000,000	70,000,000
3	**Reinforcement or Steelwork** High yield tensile steel bar reinforcement to BS 4449 as described including cutting to lengths, bending, hoisting, and fixing including all necessary tying wire and spacing blocks.		1	500,000,000	500,000,000
	Construction of WTP (a) Intake				
	Excavation and earthworks: Excavate foundation trench not exceeding 1.5 m deep commencing from stripped levels.	Cum	33.136	8,000	265,089.60
	Filling: 200 mm Hardcore filling consolidated under floors including 100 mm selected sand blinding.	Cum	4.4532	40,000	178,129.60
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	Filling: 400 mm Hardcore filling consolidated under floors including 200 mm selected sand blinding.	Cum	1.7642	40,000	70,566.40
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	Construction of WTP (c) Coagulation				
	Excavation and earthworks: xcavate foundation trench not exceeding 1.5 m deep commencing from stripped levels.	Cum	9.8604	8,000	78,883.20
	Filling: 400 mm Hardcore filling consolidated under floors including 200 mm selected sand blinding.	Cum	1.7642	40,000	70,566.40

	Plan *in-situ* concrete 1:4:8 as described. 200 mm Blinding layer: under foundations.	Cum	0.8821	200,000	176,416.00
	Construction of WTP (d) Flocculation				
	Excavation and earthworks. Excavate foundation trench not exceeding 1.5 m deep commencing from stripped levels.	Cum	68.684	8,000	549,472.00
	Filling 400 mm Hardcore filling consolidated under floors including 100 mm selected sand blinding.	Cum	18.546	40,000	741,824.00
	Plan *in-situ* concrete 1:4:8 as described. 100 mm Blinding layer: under foundations.	Cum	4.6364	200,000	927,280.00
	Construction of WTP (e) Sedimentation				
	Excavation and earthworks. Excavate foundation trench not exceeding 1.5 m deep commencing from stripped levels.	Cum	98.207	8,000	785,657.60
	Filling 400 mm Hardcore filling consolidated under floors including 100 mm selected sand blinding.	Cum	28.443	40,000	1,137,715.20
	Plan *in-situ* concrete 1:4:8 as described. 100 mm Blinding layer: under foundations.	Cum	7.1107	200,000	1,422,144.00
	Construction of WTP (f) Filtration				
4	**Excavation and earthworks.** Excavate foundation trench not exceeding 1.5 m deep commencing from stripped levels.	Cum	119.92	8,000	959,363.20
	Filling 400 mm Hardcore filling consolidated under floors including 100 mm selected sand blinding.	Cum	35.912	40,000	1,436,486.40
	Plan *in-situ* concrete 1:4:8 as described. 100 mm Blinding layer: under foundations.	Cum	8.978	200,000	1,795,608.00
	Construction of WTP (g) Reservoir				
	Excavation and earthworks. Excavate foundation trench not exceeding 1.5 m deep commencing from stripped levels.	Cum	181.94	8,000	1,455,552.00
	Filling 400 mm Hardcore filling consolidated under floors including 200 mm selected sand blinding.	Cum	63.389	40,000	2,535,552.00
	Plan *in-situ* concrete 1:4:8 as described. 200 mm Blinding layer: under foundations.	Cum	31.694	200,000	6,338,880.00
Total water tank plants to summary					**603,624,413**

1st regime: From 20-5;

For this regime, water should be supplied in 9 h, therefore Volume (V)=17061.23 m^3 where demanded volume (Vd)=12217.14 m^3, thus the efficiency from the reservoir to the point of use is 90%. Thereafter demand volume from reservoir tank (Vd)=13574.6 m^3 and water in tank=3486.63 m^3.

2nd regime: From 5-13;

Here, water should be supplied in 8 h, therefore Volume=15165.52 m^3 where demanded volume from the reservoir (Vd) =18099.46 m^3 and water in tank=552.69 m^3.

3rd regime: From 13-20;

For this regime water supplied in 7 h, therefore supplied water is 13269.83 m^3, demanded volume (Vd) from the reservoir is 13574.6 m^3 where the efficiency from the reservoir to the point of use is 90%, thus water in the tank should be 247.92 m^3.

Finally, it should be noted that the water in the tank should not be negative so that the proposed demand regime will be safe enough to meet the supplied water into the reservoir tank. By considering the maximum water in the tank which is 3486.63 m^3, the designed tank will have a capacity greater than the maximum water, and overflow can be avoided. Let design a tank for of 3500 m^3 capacity with a circular shape assuming water depth (H) of 6 m. Thus (Area), A=583.3 m^2, Diameter (D) =27.2 m Radius (R) =13.6 m, Height of tank= water depth (H) +free board =6.5 m (Table 4).

Conclusion

The researchers were mainly aimed at finding a durable ensues method to avail sufficient domestic water in Bugesera district through the proposed Water treatment plant of Gaharwa Lake, where the volume capacity of the designed tank was determined to be 3500 m^3 and The Hourly discharge is 1895.69 m^3/h. generally, Basing on the findings of this project, the cost of construction of the Gaharwa treatment Plant is 603,624,413 Rfr (Rwandan Francs); The treatment was designed to operate under the inlet discharge of 54298.4 m^3/d For 678731 people in 2040. Gaharwa River was chosen because of low cost, low turbid water (4.2 NTU), less heavy metals, low quantity of organic and inorganic pollutants which requires fewer amounts of chemical dosages. Moreover, Gaharwa Lake locates at the center of Bugesera district implies that the water supply and distribution system is easier. This research will greatly contribute to solving the water scantiness problem in the Bugesera district and will enhance the living conditions of the population in the District as well as other regions that share the same characteristic as the Bugesera district. Further researches should use other alternatives methods for availing sufficient and safe water around the country; these will lead to a sustainable solution to water scantiness in the country.

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