# Potential Inter-basin Water Transfer from the Kelani River to Mahaweli River, Sri Lanka to Mitigate Water Issues

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***Abstract*—Proper water resource management is one of the most critical problems in the world. However ongoing climate change on top of urbanization and population growth adversely impacts water resources management. Therefore, to reach the localized goals, inter-basin water transfer has been given significant attention. This paper aims to understand the importance of inter-basin water transfer from one of the water-rich basins (Kelani River Basin, Sri Lanka) to a water-stressed river basin (Mahaweli River Basin, Sri Lanka). The need for such water transfer is presented and the potential way of water transfer is understood. To be cost-effective, the proposal understands an open channel with a minimum distance of an underground tunnel to flow under gravity force. The benefits of water transfer are qualitatively evaluated under the themes of flood management, agricultural development, and hydropower development. Therefore, a sustainable water management system is expected under the inter-basin water transfer. Nevertheless, the importance of having a comprehensive hydrological and geotechnical analysis is highlighted in the paper.**

***Keywords*—flood mitigation, inter-basin water transfer, hydropower generation, water scarcity, water resource management**

## I. Introduction

Water scarcity is one of the most impacted problems for the people who live in arid environments. The United Nations Sustainable Development Goal number 6 claims that more than 40% of the world's population is under what is scarcity [1]. On the other hand, some other countries have experienced intense rainfalls which finally lead to disastrous floods [2, 3]. Recent disastrous floods have caused higher damage not only to developing countries but also to developed countries [4–6]. More importantly, some countries and regions experience both arid environmental conditions and flood conditions. Therefore, the management of water resources is highly important. Nevertheless, it is one of the most difficult management practices in the world due to many social, environmental, and economic reasons [7, 8].

Ongoing climate change has significantly impacted water resources throughout the world [9–14]. Some countries experience intense and heavy rainfalls [15, 16] whereas some other countries experience droughts [17, 18]. The related issues concerning the water resources management with ongoing climate change have not only influenced the drinking water supply systems but also many other aspects like agricultural, hydropower development, recreation, etc. Therefore, water resources management is always a tricky question to answer with many chained but important related aspects.

Inter-basin water transfer from water-rich catchments to arid catchments has taken significant attention in proper water resource management. Literature showcases many successful engineered projects [19–22] while some others had/have many issues [23, 24]. Most of these issues are related to environmental issues. Usually, inter-basin water transfer is done with a very high engineering analysis with a detailed understanding of the environmental impact. Therefore, Environmental Impact Assessment (EIA) is compulsory for all these projects under the guidance of the corresponding countries' environmental laws.

More than 160 water transfer projects were carried out globally till 2015 to reduce issues with water resources, such as water shortages and uneven distribution [25]. It is crucial to take lessons from regions of the world where resource management programs have been tried. The South-North Water Transfer Project (SNWTP), which connects four major river basins, three megacities, six provinces, and hundreds of millions of water users in China, lies among the most ambitious inter-basin water transfer schemes in the world [26–28]. It is a complex of diversion channels that plan to carry tens of billions of cubic meters of fresh water annually more than 1,000 km away from the south of China which is rich with plenty of water to the drier north. To perform environmental work, the project interacts with the physical properties of rivers, lakes, and groundwater storages. It promises to continue harming the environment in source regions. Similar future interventions in China's hydrological environment are encouraged by these effects. The initiative also poses fundamental challenges to the regional governance systems already in place by calling for water management at a scale higher than the basin scale and giving central governments more authority than provincial and local governments [29].

The idea of inter-basin water transfer is in the discussion for two major rivers in Sri Lanka, which are the Mahaweli River and Kelani River. The Mahaweli River is the longest and the most utilized in Sri Lanka while the Kelani River has

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higher flows as it is in the wet zone of the country. The occurrence of extreme low pressure due to Southwest Monsoon (SWM) and Northeast Monsoon (NEM) in the Bay of Bengal, has a direct impact on rainfall in Sri Lanka [30]. Sri Lanka is an area of land that is vulnerable to natural disasters because of its geographical location, geomorphic features, and climatological circumstances, particularly floods [31]. The main causes for the devastating floods within the island are due to abnormally high seasonal precipitation related to the La Nina phenomena and cyclonic storms that originate in the Bay of Bengal [32]. Usually, the southwest monsoon impacts the country's southwestern quadrant, which encompasses the major river basins of the Aththanagalu, Kelani, Kalu, Gin, and Nilwala Rivers. Floods are common in this section of the country during May and June when the southwest monsoon begins, and late October, when the northeast monsoon begins. Extreme flooding has occurred on occasion as a result of tropical cyclones, which can strike at any time of year [33]. If, as the ever-changing global climate system indicates extreme precipitation events to become more often in the twenty-first century [34], the Kelani River basin is one of the most vulnerable river basins for floods causing significant flood damages as the river travels through the main commercial capital of the country [35]. Floods in the Kelani River Basin are significant since its outfall is close to the capital city of Colombo. When the Kelani flood levels at the Nagalagam (Colombo) gauge are between 5.0 ft. and 7.0 ft., they are considered mild floods. When the level exceeds 7.0 feet, the flood is classified as a significant flood, and when it hits 9.0 feet, the flood is classified as dangerous [36].

In the other hand, to cater the required amount of water even in the drought season to the dry zone, mahaweli development program (mdp) has been built on the mahaweli river basin in early 1977. mdp, sri lanka's largest and most extensive physical and human resource development initiative, has concentrated on the construction of a number of reservoirs, hydroelectricity plants, and the development of a significant amount of land with irrigation. Following the implementation of mdp, mahaweli water barely irrigates only one-sixth of irrigable lands in the arid zone [37]. But, with respect to the water-climate-food-energy nexus, mdp was displaying significant shortcomings resulting shortage of water for cultivation purposes. Therefore, water transfer from the kelani river to the mahaweli river has been in the discussion for some time; however, a proper scientific analysis is yet to be tabled.

Even though the political and economic status of the country is in unstable conditions, several sectors including the agricultural sector have been prioritized with several funding and loan schemes. Out of them, it is emphasized that specific loan amounts have been allocated for the "mahaweli water security investment program" which was proposed with definite objectives to find solutions for the water issues prevailing in the mahaweli river basin, years ago [38]. Accordingly, it is obvious that, for sustainable solutions proposed for the water deficit in mahaweli river, funding will be allocated definitely by the government. Therefore, this paper aims to understand the best location for a potential transfer while understanding flow situations in both rivers as a concept note.

## II. Study Area

Sri Lanka, a country rich with water resources comprising 103 rivers originating from the central highlands of the country. Out of these, the Mahaweli River Basin (MRB) and Kelani River Basin (KRB) are responsible for a sizable share of the nation's water resource management infrastructure [39]. Mahaweli River Basin is the longest river in the country having a length of 335 km, occupying an area of 10448 km$^2$ accounting for 16% of the country's total geographical land [40]. Within the riverine system, several reservoirs and powerhouses have been constructed for irrigation and hydropower generation, which include hydroelectric power facilities, anicuts, canals, and tunnels. Mahaweli water, which currently includes 10049 km of canal networks, irrigates 3650 km$^2$ of paddy crops in the lowlands of the country. Additionally, the Mahaweli hydropower complex comprises seven large power plants with a combined capacity of 775 MW, which yearly add around 17% of the island's total hydropower potential to the national grid. Currently, MRB is home to over 15% (2.8 million) of Sri Lanka's population, with about 166,269 of those houses located in the Mahaweli settlement regions [41].

On the other hand, Kelani River Basin (KRB), lies between Northern latitudes 6° 47' and 7° 05' and Eastern longitudes 79° 52' and 80° 13' and the basin area is approximately 2230 km$^2$, with two unique kinds, the upper basin being hilly and the lower basin, which is located below Hanwella, having plain characteristics [32]. Millions of residents in Greater Colombo rely on the Kelani River for drinking water. The KRB is home to over 10,000 enterprises and businesses, which provide a diverse range of job possibilities. These river basins are given in Fig. 1.

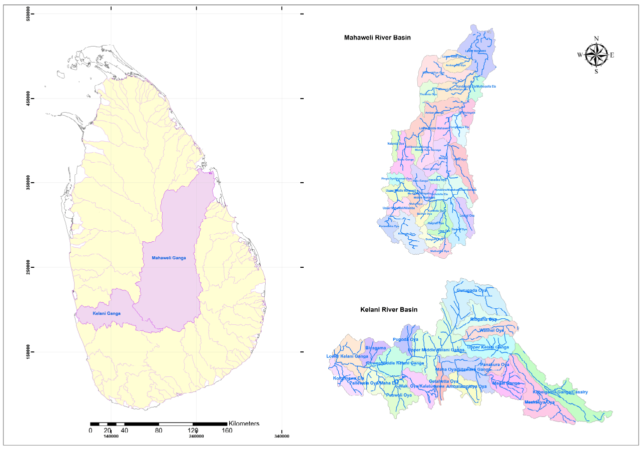


Fig. 1. The study area of MRB and KRB.

Sri Lanka is an excellent example of a range of climatic variations despite its modest size. Geographic and topographical elements, particularly the rainfall pattern, have a significant impact on Sri Lanka's climate [42]. According to the distribution of annual rainfall, Sri Lanka is classified into three climatic zones; humid zone (wet zone) where annual rainfall records more than 2500 mm, the intermediate zone where annual rainfall lies between 1750 mm and 2500 mm, and the arid zone (dry zone) which experience annual rainfall less than 1750 mm [43].

MRB, which flows through all three zones, mainly belongs to the dry zone [40] while KRB lies totally inside the humid zone [39]. In combination with regional and local topographic features, the seasonal rainfall cycle has a nature that provides widely diverse rainfall qualities, both spatially and temporally. The Central Highlands which control the predominant winds from monsoons that are filled with moisture, act as a crucial climatic barrier [44]. Four distinct rainy seasons experienced throughout the year have been categorized as, First Inter Monsoon (FIM) occurring from March to April, Southwest Monsoon (SWM) occurring from May to September, Second Inter Monsoon (SIM) occurring from October–November, and Northeast Monsoon (NEM) occurring from December to February [45]. The NEM brings heavy precipitation to the country's dry zone, whereas the humid zone receives virtually little during this time. The FIM and SIM bring precipitation to the entire country, while the southwestern monsoon brings significantly high precipitation to the humid zone in the country [39].

However, long-lasting climatic phenomena like El Nino, La Nina, and the Indian dipole index can alter the usual weather in a significantly short time [46]. Recent research demonstrated how El Nino and La Nina occurrences affect seasonal rainfall [44]. Jayawardene et al. [34] discovered that during La Nina more Southwest monsoon precipitation (May–September) were recorded at a few climate stations selected for the study and it emphasize the impact of La Nina on rainfall during SWM. Therefore, it is very important to understand the impact of climate change on water resources management.

## III. Problem Identification and Research need

The extreme low-pressure occurrences due to SWM and NEM in the Bay of Bengal, have a direct impact on rainfall in Sri Lanka [30]. Sri Lanka is an area of land that is vulnerable to natural disasters because of its geographical location, geomorphic features, and climatological circumstances, particularly floods [31]. The main causes for the devastating floods within the island are due to abnormally high seasonal precipitation related to the La Nina phenomena and cyclonic storms that originate in the Bay of Bengal [32]. Usually, the southwest monsoon impacts the country's southwestern quadrant, which encompasses the major river basins of the Aththanagalu, Kelani, Kalu, Gin, and Nilwala Rivers. Floods are common in this section of the country during May and June when the southwest monsoon begins, and late October, when the North-East monsoon begins. Extreme flooding has occurred on occasion as a result of tropical cyclones, which can strike at any time of year [33].

If, as the ever-changing global climate system indicates extreme precipitation events to become more often in the twenty-first century [34], the Kelani River basin is one of the most vulnerable river basins for floods causing significant flood damages as the river travels through the main commercial capital of the country [35]. Floods in the Kelani River Basin are significant since its outfall is close to the capital city of Colombo. The three most damaging floods were those that occurred in 1947, 1989, and 2016. The 1989 flood was more violent compared to the 2016 flood, according to an analysis of the severity of the flood (water levels at high flood levels were 2.27 m in 2016 and 2.74 m in 1989), showing that both flood occurrences are distinct from one another [47].

On the other hand, Mahaweli River Basin is the most utilized river basin in Sri Lanka for agricultural and hydropower development purposes. However, water for irrigation is limited during the dry season for MRB. Therefore, severe issues can be seen with agriculture. A study conducted by De Silva [48] reveals that according to the sources of the Ministry of Agriculture, a scarcity of rain and irrigation water in June 2012 put 20,000 hectares of paddy crop in threat. At the same time, she emphasized that compared to the yield in the Yala season in 2008, there was a 47% drop in the production in 2009. Accordingly, she has initiated her study considering the rainfall in time durations of 30 years (1961-1990), and 10 years (1999-2008) and has predicted rainfall for 2050s in areas of dry zone where Mahaweli river mainly belongs such as Vavuniya, Anuradhapura, Trincomalee, Mannar and Eluwankulama to understand the reasons for present water crisis for agricultural activities and to recommend possible adaptation measures. The findings reveal that Yala season paddy cultivation should be commenced only if there is additional irrigation water as the rainfall would not be adequate and emphasize that it is important to find additional water for irrigation [48].

Interviewees revealed that rice farmers were deeply concerned about inadequate water resources, particularly in the yala season in the dry zone of the country. According to the most recent data, droughts have prevented farmers from cultivating over 35,000 acres in the Polonnaruwa District during the 2014 Yala season [37].

In addition, the country's electricity generation through hydropower is severely affected. On-going climate change has triggered these issues, and a sustainable solution is appealing. Accordingly, it can be identified that as a result of anomalous climatic change within the country, two opposing phenomena, water scarcity for agricultural purposes in the dry zone and flooding in the wet zone in Sri Lanka occur from April to September relating to Mahaweli River Basin and Kelani River Basin. Even though many actions have been taken to resolve the above issues related to the two rivers including the Mahaweli Development Program, very limited studies have been focused on investigating transferring excess water from the KRB to MRB as a solution to the floods occur at the lower basin of KRB and lack of water for irrigation in the MRB. Approximately 3,200 MCM of water are currently diverted from the Mahaweli River each year for irrigation, covering an area of 146,000 ha. When the proposed Mahaweli Development projects are executed to cater to the water demand, this will rise to 4,300 MCM to accommodate the rough demand of 5,300 MCM yearly for irrigation and 160 MCM for drinking water supply. It is noted that even though there will be a deficit of water of about 1,200 MCM it must be satisfied now [49].

Although it might seem like far fledged idea, it may be possible to transfer water to MRB from KRB, when the KRB has more water than it needs. If such a link is built, the extra water can be redirected to the MRB, and it will aid in dry zone irrigation while also assisting in flood control related to the Kelani River Basin. Benefits in agriculture and hydropower generation can be significant during the dry season for MRB. Therefore, this study focuses on initiating the above concept with the analysis of the best path for construction of a channel connecting the two rivers to get activated in the future, when in need.

## IV. Methodology

Inter-basin transfer from the Kelani River to the Mahaweli River was proposed by the canal construction. Two locations for the proposed channel were selected each from KRB and MRB. The minimum distance, elevation, and land use were the principal factors considered in the selection of these locations. After selecting the end terminals of the proposed canal, the path of the flow was identified catering to the gravity flow to minimize the construction cost. For proposing the route, 1:10000 geo-referencing maps (Sheet no. 68_02 and 68_07) were used. Initially, the contour lines in the study area were developed and by considering the elevation, the route of the proposed canal was generated. In the occasion where an open channel was not able to cater to the gravity flow, an underground tunnel was proposed.

The land use along the proposed canal was analyzed by land use maps and satellite images. Hence, a land use map was generated for the MRB and KRB and Google Earth was also used to identify the surface variations. The land use maps were created using high-resolution satellite images from Google Earth and verified using data from Landsat missions. Using the partially automated classification plugin in QGIS 3.16 long-term release, the classification was carried out for seven land-use classes, namely, bare area, built-up areas, cultivation area, forest area, rock area, water area, and others.

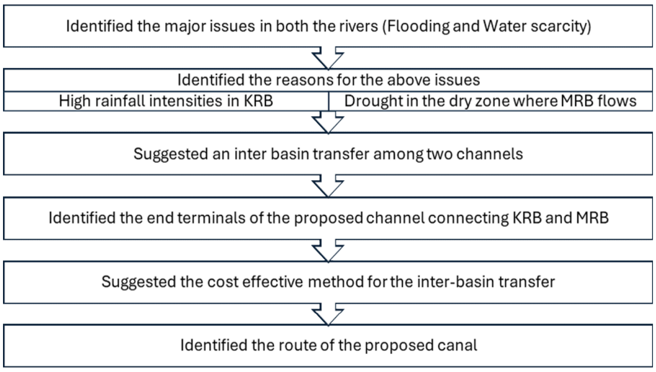

Fig. 2. Flow chart representing the methodology followed to find the route of the proposed canal.

### A. Flow Rate via the Proposed Canal

The average flow volume increment in the Upper Kelani River Basin (UKRB) during the SWM season was calculated and accordingly, the flow rate via the proposed tunnel was decided. For the computation of flow rate, the storage capacity of the upper terminal was identified, and the volume of rainwater precipitated was calculated by considering the average monthly rainfall data. Furthermore, the new flow rate of the Mahaweli river basin due to extra water from Kelani River basin was calculated. Then a detailed literature survey was conducted to identify the impact on MRB from the water delivered by the proposed canal. At the same time, the amount of water that can be catered by the proposed canal during SWM period was calculated and its importance and impact on agricultural activities in the dry zone was analyzed.

Furthermore, to get a rough value for the amount of hydropower that can be generated, which can be generated due to the head difference of the proposed canal was calculated. was identified. On the assumption of using 70% efficient turbine, the hydropower generated by a flow $1 m^3 s^{-1}$ was calculated using the hydro power calculation formula.

## V. Results and Discussion

### A. Terminals of the Proposed Canal

Norton (06º54’49’’ N, 80º31’18’’ E) a village in KRB was selected as the upper terminal of the proposed canal, which is located in the upper Kelani River Basin, connected to Kehelgamuwa Oya. Kehelgamu Oya and Maskeli Oya are two tributaries of KRB, which meet upstream of Kithulgala. Previous research has revealed that the upper catchment rainfalls that occurred in upper KRB were largely responsible for the lower KRB Floods, even though the lower basin’s weather was favorable [50]. Additionally, water from Norton Bridge reservoir which is along Kehelgamu Oya is transferred to Old Laxapana Hydroelectric Power Station. During the SWM season, high rainfalls result in overflows in Wimalasurendra Reservoir which is upstream of Norton. Therefore, Norton is one of the best locations for transferring water from upper KRB.

Diyagala (06°58’03’’N 80°31’01’’E) was chosen as the terminal of the proposed canal connecting to MRB. The SWM season for the upper MRB catchment shows a significant difference between maximum and minimum streamflow and therefore MRB is capable of transporting an extra amount of water supplied by the KRB through the proposed canal. The difference between minimum and maximum streamflow in the catchments located in the upper MRB varies from around 15.5 $m^3/s$ to 180 $m^3/s$ which is exhibited during different seasons of the year [51]. Furthermore, the land use in the upper MRB allows for further increasing the capacity of the river in case if needed when transferring water through the proposed canal. It is noted that bed load concentration has been drastically increased in MRB, thus river capacity could be increased in the future [52].

The upstream part of MRB in the central hill country (wet zone) receives substantial rainfall, while the downstream region only receives lower rainfall, during the SWM period [4]. But, unlike the other rivers in the dry zone, MRB has a proper cascade system to carry water even to the lower reaches of the river to a distance of more than 150 km [5]. Therefore, Diyagala in the Upper Mahaweli River Basin (UMRB) fits as the other terminal of the proposed channel in every aspect.

### B. Route of the Proposed Canal

The canal was proposed to cover a total length of 8102 m, and out of the total distance, 7614 m was proposed as an open channel, while 488 m was proposed as an underground tunnel (refer to Fig. 3). The tunnel distance was kept as much as possible to reduce the cost of construction.

In addition, the open channel was on other types of land use which do not include built-up areas, rock areas, cultivated areas, bare lands, and water areas (refer to Fig. 4). On the other hand, the proposed underground tunnel runs under the bare land. Therefore, it is evident that the proposed canal does not make a significant impact on the existing biodiversity in the study area. As per the calculation depicted in Section V.C, it is noted that to allow a flow rate of 1.49 $m^3/s$ the capacity of the channel can be calculated as per the material used for the channel construction.

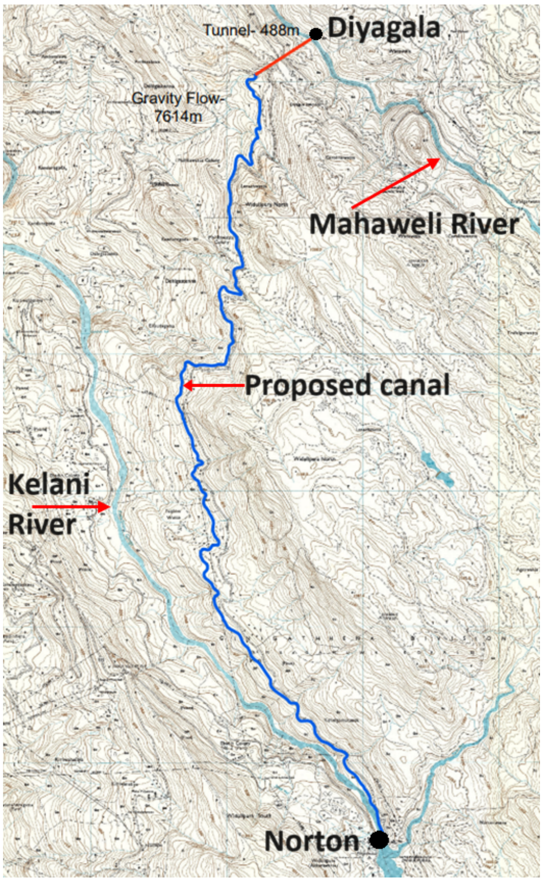

Fig. 3. Proposed canal from Kelani River to Mahaweli River.

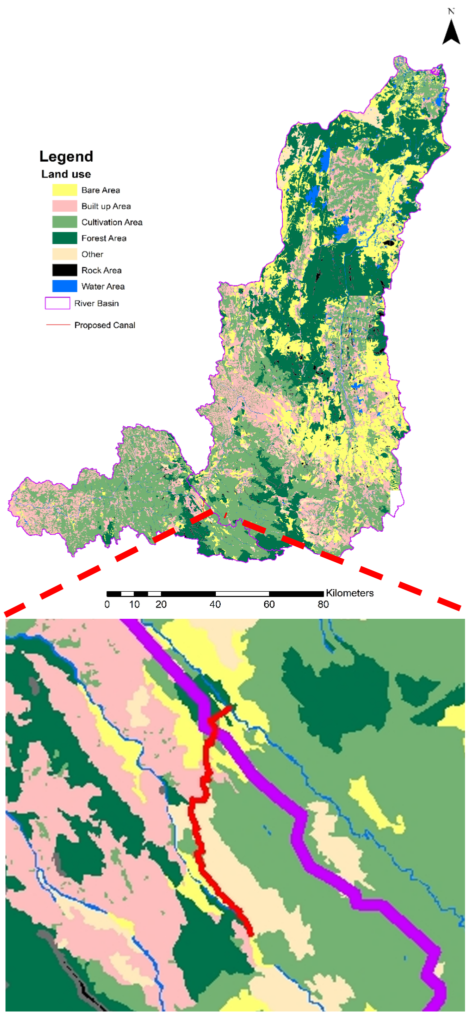

Fig. 4. Land use map of the MRB and KRB and the proposed canal.

### C. *Future Potential of the Proposed Canal*

Initial calculations showcased that significant excess water can be transferred to the Mahaweli River from the Kelani River at the proposed locations during the SWM season. In the aspect of environmental flows and ecological impacts in transferring water among the two rivers, it is evident that water that will be transferred to the MRB from Norton, in the upper KRB is unpolluted, unlike the water in the lower KRB which mixed up with industrial waste and other pollutants. Hence, it ensures that the water quality of MRB will not be influenced due to receiving water from KRB which will also contribute to protecting the biodiversity and species in MRB.

On the other hand, the flow rate of the MRB will increases due to the proposed canal and it will eventually be beneficial in the generation of hydroelectricity and, accordingly the end terminal of the proposed canal was chosen at Diyagala considering the larger capacity it has. Furthermore, the intervention of major and minor structural components due to the proposed canal will impact on the depth, substratum and other morphological features due to sediment transportation and other phenomenon in both the rivers.

However, a detailed hydrological analysis has to be carried out to draft sound conclusions. Nevertheless, the proposed canal would bring many advantages to both river basins.

As per the climate data, average monthly rainfall at Norton was taken 200 mm (source Department of Meteorology, Sri Lanka). During Southwest monsoons, Kelani River water at Norton get spilled and hence, runoff and ground water infiltration can assume to be zero. The area of the catchment of Norton is 19.4 km$^2$ and storage of the Norton dam = 3900000 m$^3$. Simple calculations are given below.

| | |
|---|---|
| Average increment of volume at Norton in a month | = Monthly rainfall $\times$ Area |
| | $= 0.2\ \text{m} \times (19.4 \times 1000000)\ \text{m}^2$ |
| | $= 3880000\ \text{m}^3$ |
| Volume increment per day | $= 3880000\ \text{m}^3/30$ |
| | $= 129333\ \text{m}^3$ |
| Flow rate | $= 129333\ \text{m}^3 / 24 \times 60 \times 60\ \text{s}$ |
| | $= 1.49\ \text{m}^3/\text{s}$ |

Hence it is evident that there is enough water after spilled from the Norton Pond which can be used to divert into the MRB through the proposed tunnel.

Both the terminals of the channel and the entire proposed channel lies in the central highlands of Sri Lanka with cooler climates with lower temperatures and humidity and hence, the rate of evaporation can be relatively low. In such cases, the loss due to evaporation might be minimal compared to the total volume of water transported.

#### 1) *Agricultural development in MRB*

According to the statistical data on paddy cultivation in Sri Lanka, it is evident that most of the paddy cultivation is done in the dry zone of the country, and Anuradhapura district, plays a vital role in providing paddy to the nation compared to the other districts [53]. However, Anuradhapura district receives significant rainfalls over October, November, and December from the NEM. The district receives its minimum rainfall during the Yala season (April to September). However, with the proposed channel, the water scarcity issue of the dry zone could be eliminated by providing water from KRB to the MRB due to the sufficient rainfall occurring in the Norton, which belongs to the central highlands. Further, it can be proposed that by installing gate-controlled structures, water can be allowed to transfer at any time of the year, the gravity flow of the tunnel would not impact the cost and the best cascade system already available within the MRB would allow water to flow to downstream of the river basin. As per the above calculation, nearly 129000 $m^3$ of water can be transferred to the Mahaweli river basin for agricultural purposes.

*2) Flood mitigation in KRB*

Many factors interact to induce flooding in the lower KRB, but largely heavier rainfall in the upper KRB causes the river to overflow its capacity. Written documentation indicates that the most destructive flood in recent memory happened in 2016, and then there were significant flooding episodes in 2017 and 2018 related to KRB [54]. On 14th May 2016, the Department of Meteorology, Sri Lanka released an extreme weather forecast predicting that heavy storms (more than 150 mm/day) would be expected to blanket the southwest and western regions of the nation. On the 15th, 16th, and 17th of May 2016, Norton experienced 201.5 mm, 200.5 mm, and 109.4 mm of rainfalls (source Department of Meteorology, Sri Lanka). Similar higher rainfalls were observed in all the rain gauges in the KRB. It is well noted that the rainfall that occurred in the upper basin has impacted floods in the lower KRB. Had the excess flows up to Norton been diverted to MRB during these times, one of the most disastrous floods could have been mitigated. This could have saved many lives including property damages. Even though the upper catchment of both the rivers subjected to heavy rainfall during southwest monsoons, only floods occur in the lower basin of the Kelani River basin. The prominent cascade system in the Mahaweli river basin allows the water to reach the lower basin and still the water deficit occurs there. Therefore rather than a provision of other solutions such as dams, the proposed inter-basin transfer helps to reduce the flooding during the rainy season to KRB which saves the country's commercial capital. In the other hand, it is prominent that a considerable amount of water can be transferred from the upper catchment of the Kelani River basin through the proposed channel as per the above calculation which will govern in flooding in lower basin.

*3) Hydro electricity generation*

The hydraulic head difference of the proposed canal is around 30 m where the elevation of Norton was 850 m and Diyagala was 820 m in MSL (mean sea level). Therefore, the excess water transfers from Norton to Diyagala can be used to generate hydropower. The potential electricity generation from 1 $m^3/s$ at a 70% efficiency of a turbine would be around 200 kW ($\eta\rho QgH=((70/100\times1000\times1\times9.81\times30))/1000$). However, the harvested energy would be higher depending on the flow transferred. Therefore, there is a high economic potential for the proposed inter-basin transfer.

In addition, the transferred water would be additional flows to the cascaded hydropower schemes in MRB. Therefore, the cumulative effects in generating hydropower can be expected from downstream hydropower stations in MRB. This is an additional benefit to the inter-basin transfer. Hydropower is considered one of the cleanest energy sources and it is renewable. Therefore, this could enhance the economic stability of the country by reducing fossil-powered electricity generation.

## VI. Conclusions

This study proposes water transferring from the Kelani River to the Mahaweli River at the upper catchment levels, to cater the solutions for a few major issues currently existing in Sri Lanka. Due to the prevailing climate change, the wet zone of the country receives heavy rainfall causing flash floods in the lower KRB due to SWM, while the dry zone experiences water scarcity to perform agriculture during the Yala agricultural season. Therefore, a canal is proposed to transfer the excess water from Kelani River to Mahaweli River. Transferring water from the Kelani River to the Mahaweli River in Sri Lanka could offer several significant benefits, particularly for agricultural productivity, flood management, and overall water resource management. Here's a detailed look at how such a transfer could be advantageous: The Mahaweli River basin is a crucial area for agriculture in Sri Lanka. By transferring water from the Kelani River, which is also a substantial water source, there would be more water available for irrigation. This can lead to improved crop yields and more consistent agricultural production. With more reliable water sources, farmers could potentially grow crops during dry seasons or drought periods, thus increasing the overall agricultural output and contributing to food security. The Mahaweli River is a vital resource for many areas. Transferring water from the Kelani River can help in balancing the water load, reducing the stress on the Mahaweli's existing resources and improving overall water availability in the basin. Regions that face water scarcity issues would benefit from a more even distribution of water, helping to mitigate the effects of droughts and ensuring more stable water supplies.

Managing the flow of water through strategic transfers can help in controlling flood risks. By channeling excess water from the Kelani River during periods of high flow to the Mahaweli River, it's possible to manage flood levels more effectively in both river basin. Effective flood management can minimize damage to infrastructure, agriculture, and communities. Proper planning and execution of water transfers can lead to better flood control measures and reduced disaster risk.

A reliable water supply can support various economic activities, from agriculture to hydroelectric power generation. This can lead to increased employment opportunities, improved livelihoods, and overall economic growth in the affected regions. Investing in water transfer infrastructure can potentially save costs associated with drought management, flood damage, and water scarcity. Long-term planning can yield significant economic benefits. The study needs a comprehensive hydrological analysis; however, the concept, has several other advantages that were identified from the proposal.

- The transfer would provide a sufficient amount of water to the lower Mahaweli River Basin which can be effectively used for agricultural purposes during the Yala season and when in need.

- The impact of floods can be minimized in the lower Kelani River Basin during the southwestern monsoon period.
- The Hydropower electricity generation could be enhanced due to the head difference of the proposed canal.
- In addition, cumulative hydropower generation enhancement can be expected from the Mahaweli cascade system.

Nevertheless, a comprehensive hydrological analysis with an extended water budget analysis is needed for a sound understanding of the project. In addition, a geotechnical analysis is required to understand the impact of the inter-basin transfer. These would lead the concept to be initiated as an engineering project.

## Data Availability Statement

Data will be available only for research purposes from the corresponding author.

## Conflict of Interest

The authors declare no conflict of interest.

## Author Contributions

LYH and RNJKA conducted the research and wrote the paper; MG supervised and reviewed the paper; NR and UR conceptualized, supervised and reviewed the paper. All authors have approved the final version.

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