THE NORTHERN COLLECTOR WATER TUNNEL PHASE 1 PROJECT

HARAMBEE

Kenya VISION 2030

ATHI WATER

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BACKGROUND

Nairobi City is the international, regional, administrative and economic hub for Kenya. The city generates approximately 60% GDP. Nairobi, the capital of Republic of Kenya, is facing chronic water shortage including its surrounding area. This is because the proposed additional water source, the Northern Collector Scheme, was not implemented as proposed in 1998. The scheme was initially planned as part of Third Nairobi Water Supply Project. The target year for implementation of the Northern Collector Phase 1 was year 2010. The expected average production capacity of the now proposed Northern Collector tunnel Phase 1 project is 1.6m3/sec (140,000m3/day) with an 84% reliability. The safe yield at Ndakaini dam will however be 1.24m3/day with a 90% reliability.

The present water deficit in Nairobi City is 125,000m3/day. In line with the National Development Plan, Vision 2030, the Government of Kenya has prioritized improvement of water services in Nairobi City and the surrounding areas. To achieve this objectives the Northern Collector Tunnel Phase 1 project is a priority project.

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FEASIBILITY AND VALIDATION OF 1998 PROJECT PROPOSAL

A number of studies have been carried out on the Northern Collector System, which have involved detailed data collection and analysis to assess its viability.

The initial studies are documented in Feasibility Reports of 1998, carried out by M/S Howard Humphreys and Partners Ltd under the Third Nairobi Water Supply Project. The 1998 report investigated to greater detail the technical and economic viability of the Northern Collector Scheme as a source of water after Ndakaini Dam. The report recommended implementation of the Northern Water Collector Tunnel Phase 1 project by the year 2010. Due to funding challenges the project was not implemented as planned.

In the year 2012, Athi Water Services Board through Egis/MIBP JV carried out the Feasibility Study and Master Plan for Developing New Water Sources for Nairobi and Satellite Towns. This study validated the 1998 report and further recommended implementation of the Northern Collector Tunnel project.

Additional hydrological reviews for the project were undertaken by M/s GIBB Africa as part of the ESIA Study process further validating the hydrological and ecological viability of the project.

PROJECT DEFINITION AND SCOPE

The NCT 1 project is located along the eastern fringes of the Aberdare Conservation Area approximately 60 km North of Nairobi City. The works are located in Kangema and Kigumo Sub-Counties of Muranga County.

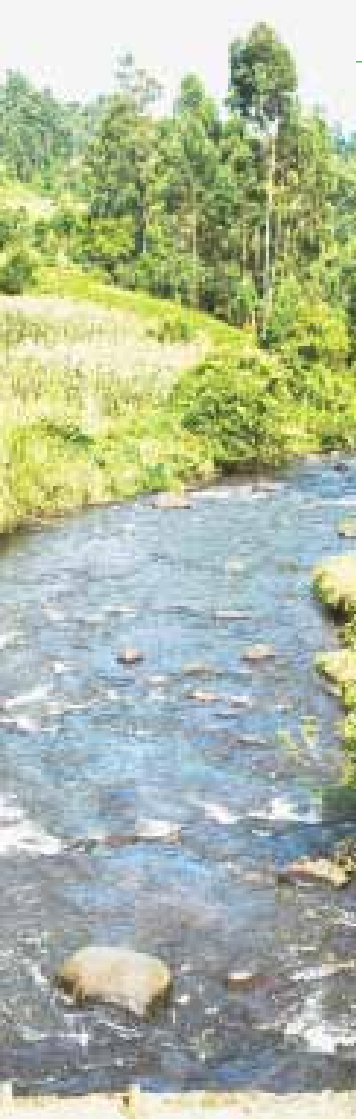
The project involves:

- Construction of river intake structures at Maragua, Gikie and Irati rivers
- Construction of access adits at Gikigie, Irati and Kaanja;
- Construction of 11km long, 3.0 diameter main water tunnel from Maragua intake to Githika outfall. The tunnel will be fully concrete lined. A valuation roll completed in December 2015 indicate that 221 people currently live on top of the tunnel.

The other program components involve:

- Construction of high level Water Treatment Plant at Kigoro and the water transmission pipelines to Nairobi City of capacity of 140,000m3/day
- Construction of Muranga and Kiambu County community water supply projects to ensure water supply to host communities is also improved.
- Construction of Nairobi city water distribution network to ensure equitable distribution.
- Improvement of water services in Nairobi Satellite towns within Kiambu and Kajiado Counties.

View of project are a



ENVIRONMENTAL AND SOCIAL IMPACT

A consultative environmental and social impact assessment for the project was undertaken. The ESIA study report defined the probable project impacts and mitigation measures. A detailed Environmental Management Plan has been developed and a Monitoring plan drawn. Modalities of ensuring compliance with the Environmental Management Plan have been put in place. Notable areas include:-

Water Flows in Rivers Maragua, Gikigie and Irati

The detailed design for the Northern Collector Water Transfer Project phase 1, has considered all findings of the hydrological and ecological studies to ensure that the project shall neither result in low river flows nor divert water during low river flow seasons. The flows used for the design are such that the environmental and ecological requirements as defined by Trout Fish habitat, downstream water rights and compensation flow as a whole are guaranteed.

The river flow data for the previous 40 years for each of the rivers was obtained and analysed in the hydrological study. The ecological requirements have been defined following analysis of ecological evidence for all flora and fauna including Trout fish. The reserve flows for the three rivers have therefore not only been defined as per the Water Resource Management Authority (WRMA) guidelines but also the findings of these analytical studies. Cumulatively the reserve flows for the three rivers adopted for design is 141,696.00 m3/day against the WRMA standard definition of 93,744.00 m3/day.

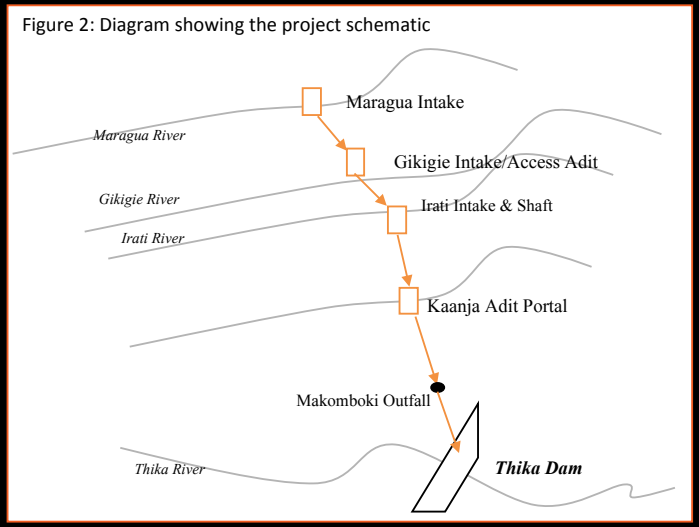
The design of the intake structures is such that an unregulated compensation flow channel is provided for at an invert level lower than the tunnel invert level to ensure water only gets into the tunnel after the reserve flows for current/future downstream users and river environmental flows has been released. That means the NCT will not have impact on the frequency of rivers experiencing low flow conditions or drying up, because before these conditions occur, the abstraction will automatically stop because water will only flow through the unregulated compensation flow channel into the river and not into the tunnel which is at a higher level. Certainly as per the design they will be absolutely no abstraction during low river flows.

Downstream water rights and Future demand

In the calculation of downstream water needs, the abstraction capacities of all existing downstream consumptive demands which include domestic, industrial, irrigation and other miscellaneous abstractors which are distributed along the river profiles were taken as occurring at the proposed NCT1 intakes. Details of the existing and planned water abstraction capacities, including information on current irrigation and hydro-power projects within the river systems, were obtained from WRMA offices and abstraction licences, Water Service Providers in Murang'a County as well as design reports obtained from Tana Water Services Board (TWSB). A minimum factor of safety of 1.2 was then used in carrying out the water balance analysis.

Although Section 32 (2) of the Kenyan Water Act, 2002 states that "the use of water for domestic purposes shall take precedence over the use of water for any other purpose…" the potential impact of the project on existing hydro-power generation schemes was also studied. The cumulative impacts of the project on existing hydro power generation was found to be a reduction of 2.32% of the Mean Annual Inflow to Masinga reservoir.

Figure 2: Diagram showing the project schematic



Proposed Access Road to Outfall portal site

Abstraction of Flood waters

As per the design philosophy of the intake structures explained in (a) above it's clear that the Northern Collector Tunnel Project will mostly abstract flood waters. This will help in mitigating the negative impacts of flooding downstream and related landslides.

To ensure that positive impacts such as irrigation and storage reservoirs downstream and other water uses during heavy rains are not jeopardized, the Northern Collector Tunnel Phase 1 project design has been restricted to cumulatively abstract only 43% of the maximum flood waters leaving 57% available for investments in storage infrastructure. From drainage patterns, the average maximum flood water at the three rivers abstraction points is 1,198,368m3/day, NCT1 will abstract 513,388 m3/day. Since existing and known plans for future irrigation schemes were considered in defining the compensation flows, this covers any other future and unknown possible abstraction. Further, the balance of flood passed downstream of the weirs of about 684,980 m3/day is expected to increase downstream due to increase in water shed areas.

DRY WEATHER FLOW

WET WEATHER FLOW

Maragua river facing downstream from the bridge

Maragua river view

Irati river view upstream from bridge

Irati river view (pipe submerged)

Sustainability of Aquatic Life

In addition to ensuring sufficient water requirements for the aquatic flora and fauna, the river structures have been designed to ensure free migration of the evidenced trout fish in all the three rivers. Fish ladders and fish passes have been provided for and sized accordingly.

Ground Water aquifers and surface water resources

To ensure there are no effects to ground water sources, a fully lined tunnel will be constructed. This will ensure there's no infiltration of underground water into the tunnel or exfiltration out of the tunnel. During construction contact grouting will be done to the outside rock to ensure structural integrity and to avoid flow of groundwater from an aquifer into and around the outside of the tunnel.

Although the tunnel is ultimately not expected to have any impacts on ground and surface water resources, Athi Water Services Board (AWSB) has undertaken a baseline study of the resources on top of the tunnel and surrounding the tunnel corridor. The baseline survey report is available in our website at http://awsboard.go.ke/2016/01/06/baseline-survey-for-wells-and-boreholes-along-the-nct-1-corridor. AWSB will monitor these water resources during and after construction. Should there be any negative impact on these water resources during construction while the lining and grouting is still ongoing, AWSB will supply all impacted people with water free of charge. Should there be any unexpected negative impact on these water resources after construction, AWSB would implement alternative water supply schemes for all impacted people. The water resource monitoring results will be made available to Muranga County and the public. A valuation roll completed in December 2015 indicate that 221 people currently live on top of the tunnel.

Environmental sustainability and Catchment Protection

Water resource management and environmental conservation are the mandate of the Water Resource Management Authority (WRMA) and Water Resource User Associations (WRUAs). AWSB as a user department, is however very keen on environmental conservation. As such AWSB has been assisting the Chania WRUA in following up on the proposal for Lower Chania Catchment Protection to ensure it's submitted to World Bank through WRMA for financing under the Water Security and Climate Resilience Project.

In consultation with the Water Resources Management Authority, Maragua WRUA and Murang'a County Government AWSB will support Upper Maragua WRUA in the updating of the Maragua Sub-Catchment Management Strategy.

AWSB is and will also continue to support and be involved in tree planting together with Water Resource User Associations. It should be noted that no deforestation will carried out in order to pave way for the tunnel construction.

In addition, AWSB has committed to undertake an integrated water masterplan for Muranga County.

Social Considerations

As part of the Northern Collector Tunnel Phase 1 project, the GOK through Athi Water will undertake the following activities that will improve the living standards and increase water supply to communities along the tunnel and its surrounding:

- Purchase an Ambulance for Gikoe dispensary to be used by the project and the surrounding communities along the tunnel
- Give priority for employment in the Project to people from Murang'a County.
- Construct permanent residency for the supervision team in Kinyona, Gikoe and Mununga which will revert to the Muranga County government
- Ensure excavated material that is not utilized by the project will be committed for use by Muranga County government
- Ensure roads are maintained during construction
- Engage Muranga University in project activities like geotechnical investigation and supervision of specialized works.

Host Community Benefit Projects in Muranga County

No	Project Name	Scope and Target Areas	Status	Status
1.	Muranga Bulk Water Supply (undertaken by TWSB)	Laid 81Km water pipelines, Constructed 11000m3/day water tworks and 2000m3/day concrete tank, Augmented sewerage system in Muranga town to serve 189,000 persons in Muranga South and Muranga Town. The system is designed/ expected to serve 417,000 persons by 2030.	Completed	Kshs 1.6 Billion
2.	Muranga Community Water Project	Construction of two 4000m3/day water treatment units and laying of 147Km water pipelines to improve water supply service from 10hrs to 24hrs to 400,000 people by 2030 in Kandara, Kigumo, Kangema, Kiharu, and Maragua constituencies of Muranga County.	Works are 85% done. Completion in April 2016	Kshs 749 million
3.	Gatanga Community water project	Construct intakes along the Kiama and Kimakia rivers, 2 No. 3000 m3/day water treatment plant and lay 35km pipelines boosting water supply from 6hrs to 16hrs to 70,000 people in the lower areas of Kiunyu and Gatunyu areas of Gatanga Constituency.	Works at 70% done. Completion in March 2016	Kshs 264 million
4.	Gatango water project	construction of intake works, 30km water mainlines and 4 no storage tanks to improve water supply to 140,000 people in Gaturi and Kamacharia wards	Tender documentation	Kshs 170 million
5	Ithanga Water Project	Construction of river intake weir on Thika river, 47Km water mains, 6000m3/day water treatment plant to improve supply in Ithanga	Awaiting signing of FC	Kshs 1.4 Billion
6	Gatagwagwa storage tank	Construction of 225m3 clear water storage tank to complement gatagwagwa community water project	Completion in April 2016	Kshs 3.3 Million
7	Gikoe Community Dispensary	Improvement of Gikoe dispensary and purchase of an ambulance to serve people from Kigumo constituency and surrounding areas.	Ongoing. Completion in March 2016	Part of NCT1 works
8	Ichichi, Kiruri and Makomboki	Rehabilitation of 3 intake weirs, construction of 225m3 storage tanks, water pipeline extension to serve approximately 50,000 people in Gitwe-Kanderendu in Kugumo upstream of Thika Dam, Makomboki, Ichichi/Githaini, Karurumo and Kiruri communities along the tunnel.	Design Stage	Kshs 170 Million

Host Community Benefit Projects in Kiambu County

No	Project Name	Scope and Target Areas	Status	Cost
1	Independent Mataara and Komothai Water Production Plants	Construction of 32,000m3/day 5No. water treatment plants to benefits 128,000 people in Karimenu, Karure, Ndarugu/Gatundu South	Operational	Kshs 800 Million
2	Improvement of community water supply schemes	Drilling and Equipping of 15 No. boreholes to serve 1000 people in Kiambu, Thika, Limuru and Kikuyu	Completion in March 2016	Kshs 200 Million
3	Kiambu Water Supply Works (Wassip AF)	Construct intakes along the Kiama and Kimakia rivers, 2 No. 3000 m3/day water treatment plant and lay 35km pipelines boosting water supply from 6hrs to 16hrs to 70,000 people in the lower areas of Kiunyu and Gatunyu areas of Gatanga Constituency.	Works at 70% done. Completion in March 2016	Kshs 264 million
4	Ruiru Water Supply Project:	Works 60% done. Completion in April 2016	Kshs 530Million	Kshs 170 million
	Construct 13,000m3/d WTP, River Intake weir of 4000m3/day, transmission Pipelines and 5,000m3 Tank to benefit 68,000 residents of Ruiru and Juja Towns	Main works operational. Tank to be complete in February 2016	Kshs 970Million	Kshs 1.4 Billion
5	Tigoni, Githunguri and Komothai Water Supply Schemes	Construction of 1000m3/day treatment plant, laying of 145km pipeline to benefit 10,000 people in Tigoni and Githunguri areas	Completion in March 2017	Kshs 300 million
6	Jacaranda-Githurai Water Supply Project	Construction of 135km water mains to improve water supply to 188,000 people in ruiru, Githurai 45, part of Mwiki and Mwihoko	Advance procurement of consultant ongoing	Kshs 1.3 Billion

PROJECT IMPLEMENTATION

Following completion of the detailed designs and obtaining the necessary regulatory approvals, implementation of the Northern Collector Tunnel Phase 1 project commenced on 24th February 2015.

To facilitate speedy implementation an implementation framework has been prepared for the project to ensure continued consultations with stakeholders, quality assurance, continuous technical and environmental soundness and that the project does not result in adverse environmental effects.

The Ministry of Water and Irrigation is establishing a project steering committee comprising representatives from National and County governments to oversee the implementation of the project. In addition, Athi Water Services Board is currently supporting the recruitment of a high level Independent Panel of experts comprising of tunnel expert, geotechnical expert, hydraulic/hydrology expert, dam expert, community water supplies expert and an environment/ecological expert. Selection of the independent panel of experts will be coordinated by the Kenya Water Services Regulatory Board (WASREB). The selection panel will constitute independent relevant professionals from the Institute of Engineers of Kenya, the Geological Society of Kenya, the Hydrological Society of Kenya and the Environment Institute of Kenya. This panel will play an independent advisory role to the project steering committee on project implementation modalities.

The Northern Collector Water Transfer Tunnel Phase 1 is the first inter-basin water transfer project following the enactment of the new constitution and formulation of county governments. It is considered that there's potential for future additional benefit sharing between the County of origin, Muranga County, and the water receiving county, Nairobi City, once the country has established a legal framework for inter-county water transfers. More information on the 4th Nairobi water supply program and the Northern collector tunnel Phase 1 project can be obtained from our website: www.awsboard.go.ke

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