

A preliminary geotechnical feasibility study of the Godavari-Krishna link canal in Andhra Pradesh

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Introduction

Water resources in our vast country are unevenly distributed both in space and time, even during the monsoon period. As a result, development, conservation and optimum utilisation of water resources is one of the main criteria for the country's sustainable development. In the process of harnessing and proper distribution of water resources in scientific manner, it is considered that the inter linking river basins is the best suitable proposition. Inter basin transfer of water is a part of efficient management of water resources on the basis of need and equity. The basic philosophy of inter basin transfers presumes the need to correct the natural imbalance leading to largely inequitable distribution of water resources.

Government of India formulated National Perspective Plan for water resources development, which comprises predominantly two components, namely, (i) The Himalayan rivers development and (ii) the Peninsular river development. The Peninsular component envisages diversion of surplus water through the main link canals, such as, Mahanadi-Godavari link, Godavari-Krishna link, Krishna-Pennar and Pennar-Palar etc. The present study is focussed on the Godavari-Krishna Link Canal, which is an important component of the peninsular part for which preliminary feasibility study is completed and presently detailed feasibility studies are in progress. The inter linking of river basins and transfer

of water from the Godavari to Krishna is proposed through three link canals at different levels in Andhra Pradesh.

Polavaram - Prakasam link canal

The lower link canal is proposed to transfer 1200 Mm³ of water through gravity flow from the proposed Polavaram Barrage (FRL +45.72 m) on the river Godavari near Rajahmundry town to the existing Prakasam Barrage (FRL +13.73 M) on the river Krishna near Vijayavada.

The canal is aligned along the east coast cutting across the prominent streams like Erra kalava and Tammileru, which have a record of flash floods almost every year and inundate large areas. The proposed link canal needs to cross these valleys with suitable aqueducts/super passages. Prominent length of the canal alignment will be within alluvial soils, mostly sandy soil, which is likely to have low cohesion and low angle of repose, necessitating to provide flat side slopes and lining to the canal.

Inchampalli low dam - Nagarjunasagar Tail pond link canal

The middle level link canal is proposed from the proposed Inchampalli Low Dam (FRL +95 m) on the river Godavari to the proposed Nagarjunasagar Tail Pond (FRL +75.50 m) on the river Krishna, 20 km

downstream to the existing Nagarjunasagar Dam. The water is proposed to be lifted from the proposed Inchampalli Low Dam to RL +107 m, which will act as a common point for both middle and upper level link canals. The 394.55 km long middle level link canal take off from the common point, carry 5,218 Mm³ water, utilises 1,757 Mm³ of water for irrigation of 2,97,489 ha of land enroute and ultimately transfer 3,213 Mm³ of water into Nagarjunasagar tail pond.

Major part of the canal alignment is covered with red sandy soil and black soils. The area is predominantly occupied with sandstone, shale of Gondwana Group of rocks in the initial reach. Subsequently, the canal alignment passes through migmatites (of Peninsular Gneissic Complex), which were intruded by basic dykes. Towards end part of the canal, rock formations belonging to Kurnool Group are met with. It is broadly surmised that the thickness of overburden soils in granite terrain is upto a maximum of 5 m, whereas it extends 5 to 15 m depth in formations of Gondwana Group and 1-5m depth in formations of Kurnool Group. The Thickness of weathered bed rock vary from top 5-15m in granite terrain, upto 10m in Gondwana rocks and upto 5m in Kurnool rocks. Below that, generally, fresh bedrock is available.

In the course of the canal alignment, it crosses a number of major and minor streams enroute. It also crosses several roads and a few rail lines. The necessary cross drainage structures were identified and proposed locations were assessed for their geological suitability. A 14.4 m dia, 12.5 km long tunnel is proposed at the water divide between the Godavari basin and the Krishna basin. The geotechnical appraisal of the proposed tunnel alignment is also attempted and found suitable to have the tunnel. It is also suggested to extend the length of the tunnel on either side, instead of having a deep cut of canal. A minimum sub-surface exploratory programme by way of drilling boreholes was suggested to

explore sub-surface geological condition and for a detailed geotechnical appraisal. It is noted that the canal passes through some coal bearing horizons near Manuguru and Kothagudem areas and cement grade limestone areas towards end portion of the canal. These losses seem inevitable in the proposed alignment under consideration. These aspects need to be addressed for effective utilisation of resources.

Inchampalli low dam – Nagarjunasagar link canal

The 300 km long upper link canal take 1,096 Mm³ of Godavari water from the common point at RL +107 m, further lifts in 4 stages upto RL +213.54 m, then onwards carry the water through gravity canal. The canal utilise 1,043 Mm³ of water for irrigation enroute and ultimately joins the existing Nagarjunasagar reservoir (FRL +179.832 m) at FSL +199 m. The canal alignment passes through sedimentary formations like sandstone, shale, dolomitic limestone belonging to Lower Gondwana Formation of Palaeozoic to Mesozoic Age in its initial reach. The canal in the remaining part passes through granite and its variants viz., granite gneiss, biotite gneiss, migmatite with xenoliths of older metamorphics and with younger intrusives comprising dolerite, pegmatite and vein quartz belonging to Peninsular Gneissic Complex of Precambrian Age. It is broadly observed that the formations are completely weathered to moderately weathered down to 10 to 15 m depth below which, slightly weathered to fresh rock is available.

A 17 m dia, 9.15 km long tunnel is proposed at the ridge portion between the Godavari and the Krishna basins. It is indicated that fresh rock is available at the tunnel grade. A number of cross drainage/cross masonry structures are proposed along the canal alignment where it crosses major streams like Munneru, Vattivagu, Akeru, Palleru, Tattivaivagu, Peddavagu, Halia, Shashlervagu, Gudipallivagu etc.

Locations for the proposed structures were identified and their preliminary geotechnical feasibility was also ascertained. As most of these locations are covered with thick alluvial soils, it was suggested for sub-surface exploration by way of drilling bore

holes at selective locations to decipher sub-surface geological conditions. The preliminary studies carried out indicate that the proposed Link Canal alignments are geotechnically feasible.