

STUNG TASAL DAM PROJECT CAMBODIA FOR IRRIGATION AND FLOOD MANAGEMENT

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SYNOPSIS

Agriculture is a major component of Cambodia's economy contributing about 30% of the country's GDP. However, because of general lack of dependable irrigation facilities, most of agriculture is rainfed. As a result, the crop yields are low and uncertain which is one of the causes of widespread poverty with about 36% of the population living below the poverty line. The Government of Cambodia therefore considers it absolutely essential to expand irrigated agriculture with focus on constructing storage reservoirs to avoid dependence on uncertain rainfall.

The Prek Thnot river basin with a Catchment area of 5740 sq km has no major or medium reservoirs to meet the growing irrigation requirements. There are in all 85 small and medium irrigation schemes with a total command area of 17501 ha. Most of these are fed from run-of-the-river diversions or small water harvesting structures which do not provide assured irrigation especially during periods of deficit rainfall. The largest of the schemes comprising of a regulator on Stung Tasal, one of the tributaries, and canal systems on either side has a command area of about 10,000 ha. In order to provide assured irrigation water for this scheme and other smaller schemes with a total command of about 2000 ha, an 18 m high concrete faced rock-fill dam is being constructed about 45 km upstream of the regulator.

Apart from providing assured irrigation, the dam will also moderate a 100 year flood of 2029 cumec to 304 cumec thereby providing considerable relief to the population in the downstream.

This project will serve as a fore-runner for more such projects to be taken up in the Prek Thnot basin in future.

WAPCOS Ltd. is the Project Developer for this project.

1.0 INTRODUCTION

Agriculture is a major component of Cambodia's economy contributing about 30% of the Gross Domestic Product (GDP). About 71% of the working population is engaged in agriculture. Because of general lack of dependable irrigation facilities, most of the agriculture is rainfed. As a result, the crop yields are low and uncertain, which is one of the major causes of widespread poverty with about 36% of the population living below the poverty line.

Rice being the principal agricultural crop, achieving food security through increased rice production has the highest priority in the agriculture sector. It is therefore, considered absolutely essential to expand irrigated agriculture by providing proper irrigation facilities and to promote modern farming techniques.



With the above objective in view, the Royal government of Cambodia has evolved several strategies and action plans from time to time. Notable among these are the National Strategic Development Plan (NSDP), the National Water Resources Policy (NWRP) and the National Strategic Plan for the Water Sector.

As part of the on-going programmes of agriculture development in the country, the Government of Cambodia commissioned a comprehensive study for agricultural development in Prek Thnot river basin. The Master Plan submitted in May, 2008 envisages wide ranging programmes for agricultural development which interalia include optimal utilization of waters from the existing ponds, small reservoirs and run-of-the-river diversion schemes.

The Target Area of the Master Plan is located about 40 km west of Phonm Penh, the capital of Cambodia. Most of the Target Area is under the command of the existing North Main Canal and the South Main Canal which take off from the Roleang Chrey Regulator on river Stung Tasal, a tributary of Prek Thnot. The Master Plan envisages, among other things, rehabilitation of the Regulator and the canal system. Apart from the two canal systems, irrigation of isolated agricultural lands is also done from about 17 water harvesting structures which are in the form of ponds with small catchment areas.

Since the two canal systems depend on run-of-the-river diversions, water availability is not assured especially during the dry season. There is, therefore, a long felt need for constructing a dam/dams in the upper reaches of the Prek Thnot River and /or its tributaries. It is expected that a dam on one of the major tributaries would not only provide assured supply of water for irrigation but would also moderate the floods in the downstream thereby providing relief to the farmers who presently suffer considerable losses due to the river spilling over its banks and inundating their crops.



As a first step towards optimal development of the water resources of the Prek Thnot river basin, the Government of Cambodia identified a potential dam site on Stung Tasal

about 45 km upstream of Roleang Chrey Regulator. The short/medium term objective of the project is to implement Integrated River Basin Management and Development of Stung Tasal sub-basin as a pilot project. The long term objective is to achieve Integrated Management and Development of the whole Prek Thnot river basin for poverty alleviation and economic growth by

- (i) Construction of dams/reservoirs
- (ii) Providing flood protection to more areas
- (iii) Expansion of irrigated area, increasing irrigation intensities in existing irrigated lands, and improvement of drainage network
- (iv) Expansion of agro-based industries/opportunities
- (v) Improvement in road transportation especially in rural areas

Under an agreement for a Line of Credit of US\$ 15 million for the project from the Government of India, WAPCOS Ltd has been appointed as the Project Developer.

2.0 PREPARATION OF DESIGN ENGINEERING REPORT

Based on the Government of India guidelines and relevant BIS Codes, WAPCOS prepared a Design Engineering Report (DER) on Stung Tasal Dam Project. The DER provided the requisite technical details and supporting material for inviting Bids for award of project works on Engineering Procurement and Construction (EPC) basis. The decision of the Royal government of Cambodia and Government of India to award the work of a major water resources development project involving construction of a large dam on EPC basis was a bold one and was intended to achieve the following main objectives:



- (i) Implementation of the project within a shortest possible time
- (ii) Testing the EPC model for large dam projects under the supervision and control of the Government agencies of the two countries, in order to open up the sector for greater participation of the private sector in future. The underlying idea is to improve the overall efficiency in project formulation and implementation and technology upgradation
- (iii) Capacity building of the technical and management personnel of the Cambodian Ministry of Water Resources and Meteorology (MOWRAM) in EPC contract management.

3.0 TECHNICAL FEATURES OF THE PROJECT

(i) Stung Tasal Catchment

The catchment area of Stung Tasal upto the dam site is 465 sqkm. It consists of various litho units mainly quartzites and quartzitic sand stones. The slope of the river from its origin to the dam site is as follows:

Upper catchment	9 km	1 in 15
Middle catchment	20 km	1 in 85
Lower catchment	16 km	1 in 115

The general drainage pattern is parallel to sub-parallel and the drainage density is low.



(ii) Geology

The main geological formations at and around the dam site are heterogeneous combination of igneous, metamorphic and sedimentary rocks with general strike in the East-West direction and dip varying from 60° to 70° . These rocks are hard with low potential for erosion.

In view of the nature of rocks in the catchment, mentioned above and low drainage density the sediment yield from the catchment is quite low and is of the order of .036 ha m/sq km/year.

(iii) Hydrology

(a) Dependable flows at the dam site are:

Dependability %	Flows (cumec)
50	154.11
75	133.42
90	98.29

The design flood of 2029 would be moderated to 304 cumec.

(b) Reservoir data

Average river bed level	89.2 m
Dead storage level	94.2 m
Full reservoir level	107.2 m
Maximum water level	108.7 m
Gross storage at FRL	147.62 MCM
Dead storage	8.01. MCM
Live storage	139.61 MCM

(c) Dam data

Type of dam	Concrete faced rock fill dam
RL of top of dam	110.2
Length of dam	650 m
Length of spillway	90.5 m
RL of spillway crest	107.2 m
Length of Auxillary spillway	28.5 M.

(d) Irrigation

About 30100 ha of land between the dam site and Roleang Chrey regulator are available for cultivation. These are located in 15 river side terraces on either side about 4 to 10 m above the river bed. The entire area is under rainfed cultivation.

The Roleang Chrey Regulator is the key structure for the existing irrigation system in the Target Area under the Master Plan. There are in all 85 irrigation schemes with a total of 17,501 ha of Command area. Out of these, 67 schemes are fed from small ponds and other water harvesting structures, but these sources do not provide assured irrigation especially during periods of deficit rainfall. The Stung Tasal Dam project would strengthen irrigation in an area of 8000 ha under some of these schemes and provide assured irrigating through lift schemes in about 2000 ha of culturable lands on river side terraces upstream of the Regulator. Three manually operated circular gate valves have been provided in the body of the main spillway for irrigation releases.



Rehabilitation of the existing irrigation infrastructure under the Roleang Chrey Regulator and development of new infrastructure for lift irrigation schemes upstream of the Regulator are beyond the scope of Stung Tasal Dam Project.

(e) Domestic and Industrial Water Supply

The Government of Cambodia does not envisage any separate allocation of water for these uses from Stung Tasal Dam Project.

(f) Hydro power development

Hydropower development by utilizing the irrigation releases has not been found to be economically viable. In view of the over-riding priority for irrigation, trade-off between irrigation and hydropower has not been considered desirable.

(g) Flood Management

Provision of a dedicated flood cushion in the reservoir has not been found to be economically viable. However, the reservoir would moderate a design flood of 2029 cumec to 304 cumec. The overall flood moderation benefit, though incidental and not always assured, will provide considerable relief to the farmers in the downstream. A 28.5 m long auxiliary spillway has been provided which along with the main spillway will evacuate the PMF, thereby providing the requisite safety to the dam.

(h) Flushing of silt from reservoir

For occasional flushing of silt from the reservoir three under sluices each 5m x 5m have been provided with radial gates. The main objective is to prevent excessive accumulation of silt in the vicinity of the inlets of the irrigation sluices. In order to enhance the life of the radial gates, cladding of stainless steel plates has been provided.

(i) Concrete Faced Rock Fill Dam

Originally a rockfill dam with impervious clay core was envisaged. However, on detailed examination of the core material it was found that it was highly dispersive and its treatment with lime, gypsum or aluminium sulphate would be too expensive and it would be difficult to ensure the requisite quality during construction. It was therefore decided to provide a Concrete Faced Rockfill Dam (CFRD). The main components of CFRD are a homogeneous rockfill section, a filter zone and an impervious R.C.C. facing duly supported at the base with an R.C.C. plinth founded on and anchored with the bed rock.



(j) Environmental Aspects

Detailed environmental impact assessment of the project has been carried out covering the following main aspects:

- Land environment
- Water resources
- Water quality
- Terrestrial flora
- Terrestrial fauna
- Aquatic ecology
- Socio-economic environment

In addressing various issues under each of these aspects, expected impacts and remedial/preventive measures have been specified and the agencies responsible for taking

various measures have been identified. Environmental monitoring programme for project construction phase and project operation phase have been prepared.

(k) Infrastructure Works

Infrastructure works like residential and non-residential buildings, internal roads etc have been provided to meet the requirements during the project construction phase and also for the project operation phase.

4.0 PROJECT IMPLEMENTATION

The Design Engineering Report, prepared by WAPCOS, was duly approved by the Governments of Cambodia and India for funding under the Line of Credit from Government of India. This was followed by following activities:

- (i) Preparation of tender documents for inviting bids for award of work on EPC basis.
- (ii) Invitation of bids and award of work to an Indian contractor.
- (iii) Preparation of detailed construction drawings by the EPC contractor and their approval by MOWRAM/WAPCOS
- (iv) Construction of works as per approved drawings.

The dam project is presently in progress and is expected to be completed by the end of 2013.

5.0 PROJECT BENEFITS

The project, on completion, would help in increasing cropping intensity as well irrigation intensity in its command. Due to assured irrigation, crop yields are expected to increase by 0.8 Tonnes/ha.

The B.C. ratio of the scheme is 1.77 and inter rate of return is expected to be 13%.

6.0 CONCLUSION

This project will serve as a fore-runner for similar such projects to be taken up in the Prek Thnot basin in future.

