HEPP (Hydroelectric Power Plant) Project in Nepal

Design of Power Waterway

Student

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Definition of Task: ABSTRACT

Along the Arun River in north east Nepal, a peak run-of-river hydroelectric power plant has to be designed and built in the following years. This report describes the research carried out, and preliminary design of the peak run-of-river power plant as part of a school project.

The Arun River originates in the Himalayan Mountains in Tibet. Along the river, several hydroelectric power plants are already built, e.g. Arun III hydroelectric power plant.

The task of this paper is to describe the preliminary design of the intake structure and the settling basin of the hydroelectric power plant. The hydraulic design criteria are described as basis for the design.

Result: The total amount of discharge is divided over four intakes. To prevent any vortices occurring in the intake tunnel, a minimum water column is necessary above the water level of the intake tunnel. This result in the fact that at least four intakes are required.

Per intake a discharge of 70 m3/sec is required for the total energy production. In image 1, an overview is given of the design of the intake. The black lines outline the part which has to be excavated first.

The intake structure will be built in the rocks, which have to be excavated. A total of 705.330 cubic metres has to be excavated, whereas a total of 103.240 cubic metres concrete has to be installed for the intake structure. The longitudinal profile and front view profile of the excavation for the intake structure are given in image 2 and 3 underneath.

The intake exists of a hydraulic smooth approaching channel containing a trash rack. The flow is then concentrated to a smaller rectangular surface. Here, the stoplogs and control gate are placed to stop the flow, if necessary. These gates are operated by a gantry crane. Subsequently the flow passes through a transition stage at with the rectangular surface is passes into the circular tunnel and from the circular tunnel into the settling basin.

At the settling basin, the suspended particles bigger than 0,2 mm will settle before entering the headrace tunnel. Taken into account the total construction cost and construction feasibility, the most optimal is building four desilting chambers. A cross section of one desilting chamber is given in image 4.

Designing a horizontal inclined intake structure and a tunnelling conveyance system, the design is best protected against high seismic activities, as that is common in the region the Arun river is located.

The lining of the headrace tunnel will be carried out in concrete, as the rock quality at the site is too poor for unlined tunnels. The penstock is steel lined to overcome the static pressure and water hammer pressure.

Image 1 – Overview of intake structure
Own presentment

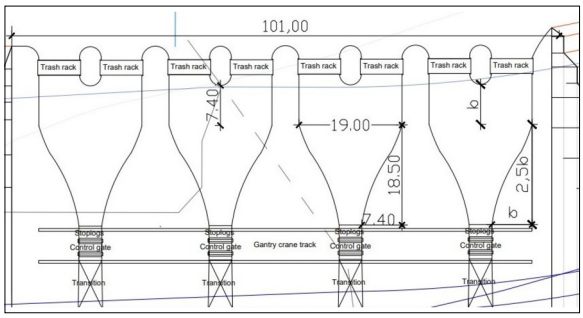


Image 2,3 - Longtudinal profile of excavation & Front view of excavation
Own presentment

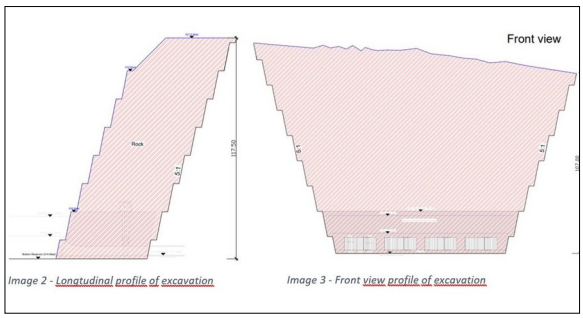
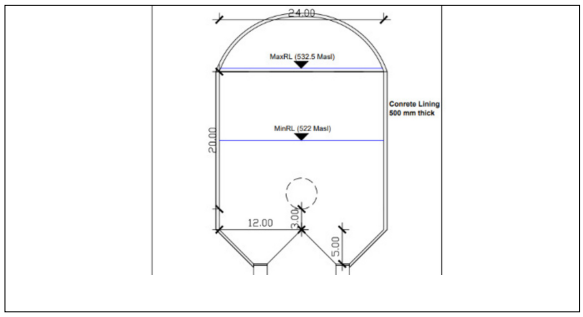


Image 4 - Cross section of desilting chamber
Own presentment



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Subject Area
Civil Engineering