

# Assignment

**1.** The Ministry of Water Resources decided to generate hydro power from Beshlo River, in Abay River Basin. The 100 percentage exceeded discharge available in the stream is minimum which generates a minimum amount of power (firm power) which will not full fill the required demand, So to increase the power production capacity of this river it is decided to construct artificial barrier structure (dam) to balance the demand and the available flow. The feasibility study shows three dam sites with the following characteristics. If you were the engineer who called up on this to decide the suitable site, which site you may select and what type of dam you may recommend. Why? Justify it.

**GD<sub>1</sub>:** This site has a U-shaped and a narrow stream flowing between high rocky walls, the right and left bank is composed of basement complex. Below the river bed small depth of sand cover over the foundation is followed by very sound rock and a large amount of rock material available for the purpose of aggregate. Whole foundation is a gneiss type rock that is highly watertight.

**GD<sub>2</sub>:** The GD<sub>2</sub> dam site is of V-shaped valley, where the accessibility of the site is difficult and the geology of the foundation at the site is deep deposits laying over good sound rock. The topography of the site permits a separate spillway having a saddle of deep narrow gorge with steep banks. The construction material is available within a distance of less than 5 miles.

**GD<sub>3</sub>:** Is a wide valley having sound rock just at the river bed and with smaller dam height than the other two sites the required amount of water will be reserved. On the other hand the site located just at a confluence of two rivers. The reservoir area behind the dam inundates large command area and there is loss in aesthetic value of the society which is living for centuries if the project is implemented. And also there must be evacuation of peoples from the area and resettle them in some other areas.

**2.** For the following cross Sectional View of earthen dam, draw the seepage (pneumatic) line and determine;

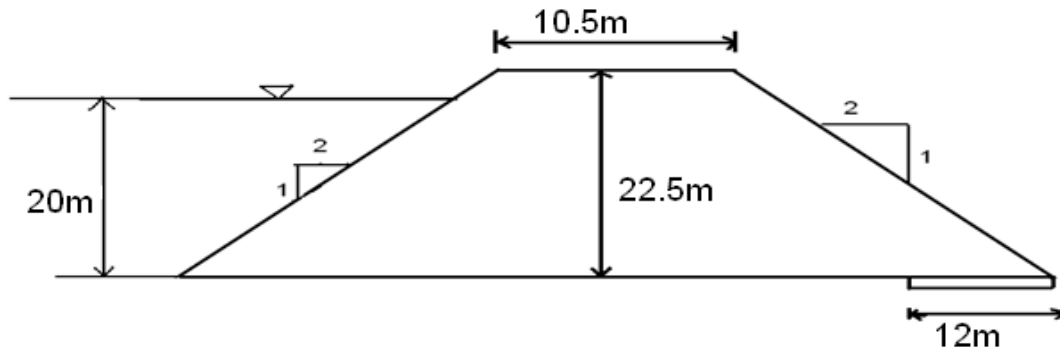
- Factor of safety for the downstream face
- The amount of seepage discharge that pass through the body of the dam

After different trials the critical slip surface radius and its subtended angle to be 45m and 58° respectively.

Use

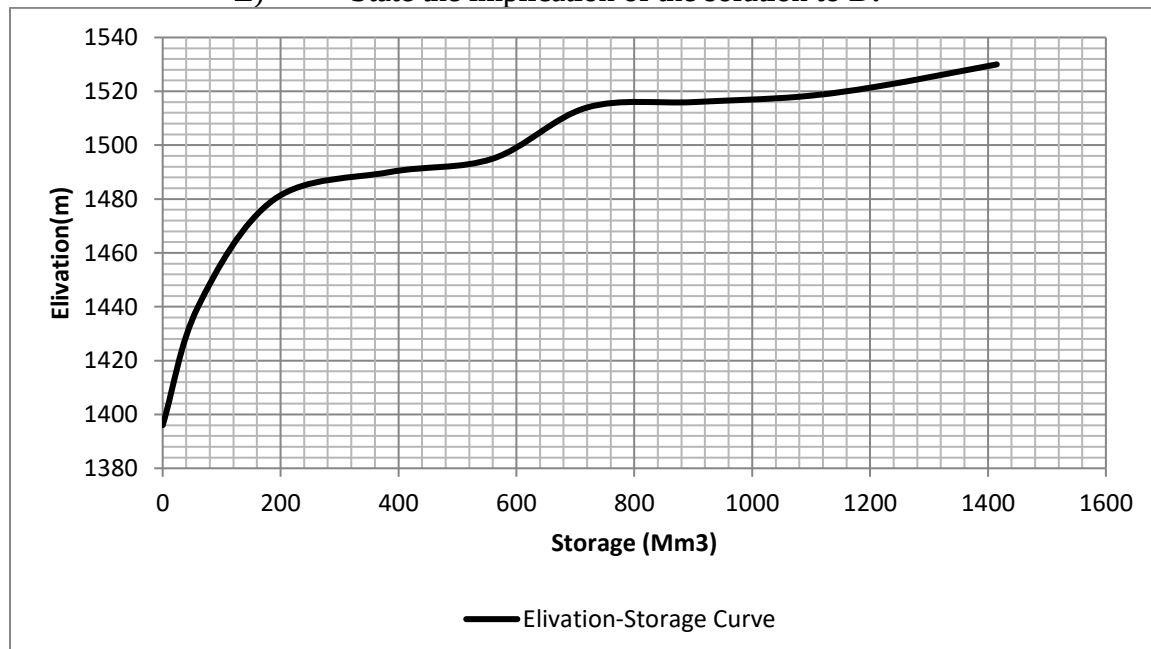
- Scale 1:500
- Permeability Coefficient (K) =  $5 \times 10^{-6} \text{ m}^2/\text{s}$
- $\phi = 25^\circ$
- $\gamma_{\text{submerged}} = 1.2 \text{ t/m}^3$
- $\gamma_{\text{saturated}} = 2.2 \text{ t/m}^3$

$$\gamma_{\text{dry}} = 1.83 \text{ t/m}^3$$



3. From the prefeasibility study of BORKENA River the investigation group formed by the collaboration of wollo University and Amhara Water Resources and energy Bureau have identified that dam must be constructed to counteract the unfailing annual event of flood problem over the community living the river side. The group recommends to construct concrete gravity dam at the proposed dam site and to use this structure for multi purposes, the sum of the volume of water needed to meet the required demand and the volume of dead storage is  $1.32 \times 10^9 \text{ m}^3$ . The area elevation curve developed for this catchment at dam site is given below. If the type of dam to be constructed is concrete gravity dam, and the bed elevation is at 1396m. use the  $\gamma_c = 25 \text{ KN/m}^3$  and  $\gamma_w = 10 \text{ KN/m}^3$

- A) Design the dam using simple step method.
- B) Do the stability analysis for reservoir full condition.
- C)  $\sigma_z$ , Vertical normal stress and stress distribution diagram.
- D)  $\sigma_z'$ , effective stress distribution with uplift pressure.
- E) State the implication of the solution to D.



**4.** Given a particular gravity dam profile with the following data.

|                         |                                     |
|-------------------------|-------------------------------------|
| Height of the dam = 63m | Free board = 3m                     |
| U/S slope 0.2H: 1V      | Height of U/S inclined face = 20m   |
| Top width = 10m         | Total base width = 54m              |
| D/S slope 0.8H: 1V      | Tail water depth = 10m              |
| US seismic zone 2       | Wind velocity at the site = 80Km/hr |

Expected depth of silt deposit = 10m  
Fetch distance of reservoir from dam site = 40m  
Location of uplift drainage from the heel of the dam = 9m

**Required:**

Draw the profile, show the direction and location of all forces and quantify their magnitudes in diagram check the stability (overturning and sliding) and stress both sides