Introduction: The following aspects were considered in general for the selection of the dam site for Wah Umiam Stage-III ; topographical features of the site, preliminary geological and geo-technical considerations, accommodation of spillway arrangement to pass the design flood, location of Energy Dissipation arrangement, availability of Construction Materials, location of proposed u/s and d/s projects, environmental Requirements etc. Further, during 65th meeting of the Environment appraisal committee for river valley and hydro electric projects dated 23rd March 2013 (minutes enclosed) it was advised that the clear riverine free flow of 1 km should be kept between Full Reservoir Level (FRL) of the downstream project i.e Wah Umiam Stage-III then Mawphu HEP and Tail Water Level (TWL) of any upstream project i.e Wah UMiam Stage-II then Umduna. Hence on these criteria's and recommendations various alternatives for dam axis of Wah Umiam Stage-III have been considered for further exploration:

A. Old PFR Location (about 1km downstream of proposed Power House location of upstream project - Umduna HEP now Wah Umiam Stage-II)

B. Alt-1 about 2km downstream of Umduna HEP now Wah Umiam Stage-II Power House Location

C. Alt-2 about 2.5km downstream of Umduna HEP now Wah Umiam Stage-II Power House Location

D. Alt-3 about 3.1km downstream of Umduna HEP now Wah-Umiam Stage-II Power House Location

E. Alt-3A about 70 m downstream of Alt-3.

1. Old PFR (2010) Location:

- This location is about 1.2 km downstream of upstream project power house location. The upstream project TWL is EL 542.68 m and FRL of this project was at El 540.00 m. Considering the average slope of 1 in 22 m there will be a free stretch of river of about 50-60 m between two projects.
- The river is filled up with big boulders (average ~5 m dia.). Width of river is about 100 m and more than 50 % bed is exposed with in-situ rock. The river starts flowing in sharp bend after about 300-400 m downstream of the proposed dam location.
- Sound rock shall be available at shallow depth at both the abutments.
- **Based on parameter of comparison by the project consultant M/s EIPL at Table-1 below the same was not selected**.

2. Alternative -1:

- This alternative is located at about 2 km downstream of PH location of Umduna HEP now Wah Umiam Stage-II HEP and about 350 downstream of Umtong Nalla. This is located immediate downstream of first bend where the river is about 110 to130m wide. Left abutment is flatter and covered by slope wash material whereas slope of the right bank is reasonably steep with most of the area exposing bed rock. **Consequently, the length of dam at this location would be more hence un- economical**.
- The downstream reach is defined by a mild curvature and do not have sufficient straight reach for accommodating energy dissipation arrangement. At this location, considering the river slope of 1 in 25, a head of about 40 m is anticipated to get reduced comparing the same with PFR location.
- Moderate to thinly foliated granite gneiss is seen to be exposed herewith foliation striking perpendicular to the river. The upstream of dam location has a sharp bend and manifest number of small to medium side scar indicating instability in close proximity of the dam alignment.
- **Based on parameter of comparison by the project consultant M/s EIPL at Table-1 below the same was not selected**

3. Alternative -2:

- This alternative is located at about 2.5 km downstream of PH location of Umduna now Wah Umiam Stage-II HEP and about 200 m downstream of confluence of a small left bank Nallah and immediate downstream of second bend.
- The river width at this location is about 100 to120m.
- Upstream location shows mild bend whereas downstream reach provides about 150 to 200 m straight course which may not be adequate for accommodating spillway and energy dissipation arrangement.
- The left abutment falls in a ridge between two left bank nallah (Umtong nallah and Weisu nallah) and HRT alignment will cross very deep Weisu nallah in the upstream reach. **Locating an adit for HRT in this reach shall be difficult.**
- At this stretch river slope seems to be 1 in 25 which would result a loss of head of about 60 m when compared the same with PFR location.
- **Both the banks at this location are subdued and are covered by deep slope wash material of unknown thickness**. However sporadic bed rock exposures constituted of granite gneiss with mica rich bands exist.

- **Based on parameter of comparison by the project consultant M/s EIPL at Table-1 below the same was not selected**

4. Alternative -3:

- This alternative is located at about 3.1 km downstream of PH location of Umduna now Wah Umiam Stage-II HEP and about 250m downstream of confluence of right bank Weisu nallah.
- River is about 70-80 m wide. Right bank is consistently very steep and exposes bedrock upto about 70m
- Initial slope of left Bank is steep upto about 30m above the present River bed level after which the slope becomes gentle. About 300m long straight course exist in the downstream reach, which can be considered acceptable for accommodating energy dissipation arrangement.
- The HRT alignment is found to be more favorable as the same is not intersecting any major nallah.
- At this location considering the river slope of 1 in 25, head of about 80 m is anticipated to get reduced comparing the same with PFR location.
- The discharge from the two perennial nallah Umtong & Weisu shall contribute towards the overall discharge.

A comparison has been presented in following table considering various aspects.

Table 1: Comparative of Alternatives (Score out of 10)

Parameter of comparison	PFR (2010) Location	Alt-1	Alt-2	Alt-3
River Bed Geology	8	6	6	8
Left Abutment Geology	6	5	4	5
Right Abutment	6	8	5	8
River Width	7	6	5	8
Straight reach at upstream	8	5	5	5
Straight reach at downstream	7	5	5	6
HRT Alignment	7	7	6	9
Flow increments	0	0	1	3
Head unutilised	10	8	7	6

Total	**59**	**50**	**44**	**58**
Environmental aspects	0	2	10	10
Total with Environmental considerations	**59**	**52**	**54**	**68**

From the above table, the PFR location was the preferential location without environmental aspects. Since MoEF instructed NEEPCO to maintain a free reach of a minimum of 1 km between two consecutive projects, the PFR location does not satisfy the condition. **Out of alternatives 1, 2 and 3, the alternative-3 was chosen for the further detailed investigation on the basis of above summarized points**.

5. Alternative -3A:

- During the sub-surface investigations at dam **alternative-3** DH-07, drilled at axis Alt-3 encountered deep overburden down to 30.5m on the left bank of dam axis. Such depressed bed rock profile indicates possible scouring/erosion of bed rock close to concave side of the curvature along the river beyond the rock ledge.
- In view of the above and to find a suitable location, 70m downstream of Alternate-3, a drill hole DH-09 was drilled on the left bank. The drill hole revealed the availability of bed rock at a shallow depth and accordingly this alignment was favored.
- In view of these observations, Alternative-3a, located 70m downstream of Alternate-3 and 340m downstream of Weisu nallah was finalized for taking up further detailed investigation **and it's the final dam axis location for Wah Umiam Stage-III HEP.**