

2.7. Employment Generation (Direct and Indirect) due to the Project

About 500 workers (skilled and unskilled) would be engaged temporarily during peak construction period. About 70% of unskilled workers and 30% of semi-skilled workers shall be selected from within the Gram Panchayat area covering the project area and nearby area. During construction and after completion of the project about 135 staff shall be permanently required for operation and maintenance of dam/reservoir and operation of powerhouse.

3.0 PROJECT DESCRIPTION

3.1. Type of Project Including Interlinked and Interdependent Projects, if any.

The project is a standalone Pumped Storage Project conceived as a grid-interactive pumped storage hydropower project designed to supply electricity during peak demand hours and support grid frequency regulation in the Eastern Regional Grid. The scheme of operation considered for the project is daily regulation to meet the demand of about 8 hours of peak power daily. Off-peak pumping hours are considered as 9.13 hours daily. It is per se an independent project and is not interlinked with any other project.

3.2. Location

Gosaintari Pumped Storage Project (920 MW) is proposed in Rajauli Block in Nawada District of Bihar. The upper reservoir is proposed on the right bank of the lower reservoir at the hilltop. The lower dam is located across the Job Nallah / Stream, 1.5 km upstream of the Job reservoir. (*EXHIBIT-1_INDEX PLAN*)

3.3. Details of Alternate Sites

Four alternative layouts have been studied and examined for various aspects and environmental perspectives.

Alternate-1: The proposed installed capacity for this alternative is 920 MW. The lower reservoir is proposed to be located on job nala, while the upper reservoir (Option-I) is planned on the right bank of the lower reservoir. The upper reservoir will be created by cutting / dressing the hill at top by 60 meters in certain areas and other components including an approach channel, intake, penstock/pressure shaft, underground powerhouse complex, tailrace tunnel, and tailrace outlet at suitable location along with the water conductor system. The L/H ratio would be 3.68. The tentative hard cost would be Rs 4602 crores (*EXHIBIT-3A_GENERAL LAYOUT PLAN ALT-1*)

Alternate-2: The proposed installed capacity for this alternative is 940 MW. The lower reservoir is proposed to be located on job nala, while the upper reservoir (Option-II) is also planned on the right bank of the lower reservoir, situated at the hilltop. The upper reservoir will

be created by cutting / dressing the hill by 68 meters in certain areas and proposing other components including an approach channel, intake, penstock/pressure shaft, underground powerhouse complex, tailrace tunnel, and tailrace outlet at suitable location along water conductor system. The L/H ratio would be 5.81. The tentative hard cost would be Rs 5293.47 crores, which is highest among all alternatives. (EXHIBIT-3B_GENERAL LAYOUT PLAN ALT-2)

Alternate-3: In this alternative, lower reservoir is proposed to be located on job nala, same as above two alternatives, while the upper reservoir (Option-III) is planned on the left bank of the lower reservoir, situated at the hilltop. The upper reservoir will be created by cutting the hill by 98 meters and proposing other components including an approach channel, intake, penstock/pressure shaft, underground powerhouse complex, tailrace tunnel, and tailrace outlet at suitable location along water conductor system. The installed capacity for this alternative is 640 MW. The tentative hard cost would be Rs 4848 crores, the third lowest of all alternatives. This alternate has the disadvantage of the more L/H ratio (6.21). (EXHIBIT-3C_GENERAL LAYOUT PLAN ALT-3)

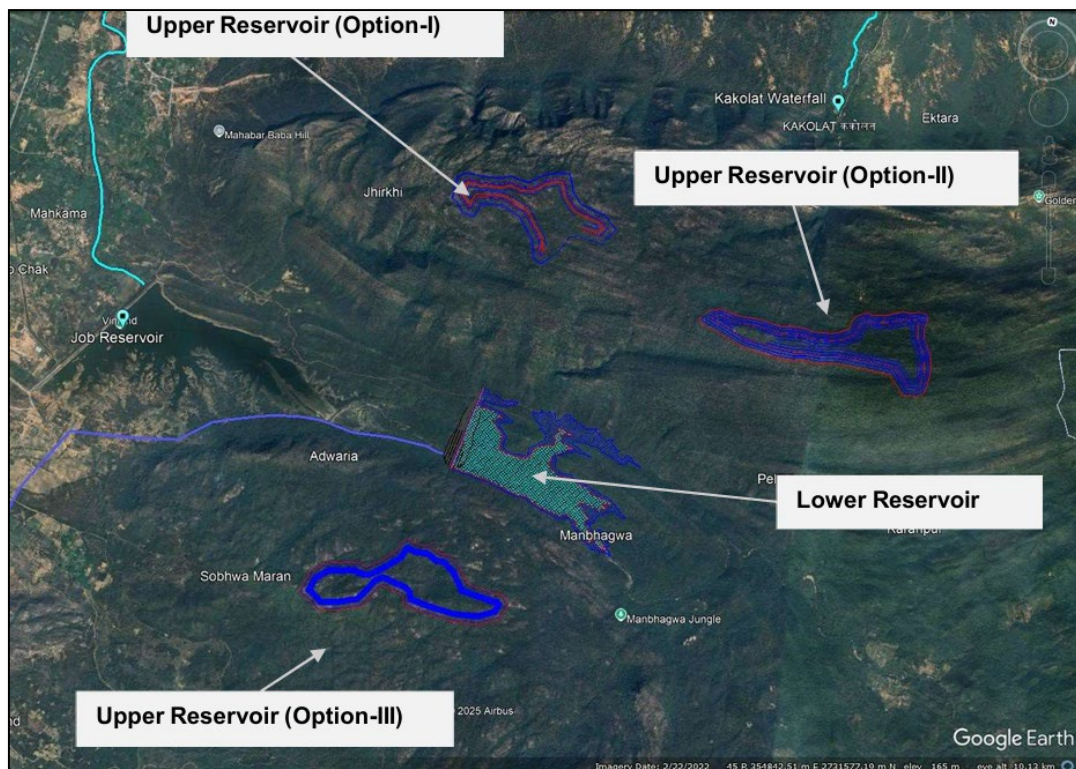


FIGURE 2: PLAN SHOWING LOWER RESERVOIR AND ALL ALTERNATES OF UPPER RESERVOIR

Alternate-4: This alternative is further modification/ optimization of Alternative-1, where the inclined Pressure shaft with vertical drop of more than 400m is changed to horizontal and vertical pressure Shaft with two vertical drops proposed less than 250m. The lower Reservoir dam also shifted around 450 m upstream. The upper Intake of this layout is well adjusted

within the natural existing hillock and the reservoir is created by abutting a circular rockfill bund on both side of this hillock. The Water Conductor System is a straight line considering the top view, which will reduce the bend losses in the total head loss of the system. The installed capacity for this alternative is 920 MW. The L/H ratio would be 5.05. The tentative hard cost would be Rs 4394 crores. (*EXHIBIT-4A_GENERAL LAYOUT PLAN; EXHIBIT-4B_L-SECTION LONG WCS-1*).

It is brought out here that **Alternate-4** has the least Cost per MW of all options. It covers the least forest area and total project area among all alternatives. Considering the geology of the area, and ease of construction of Pressure Shaft, this option is also considered for long-term stability. Therefore, **Alternate-4 is preferred and selected for further studies and development**. Comparison table of all alternatives is provided in **Annexure-I**.

3.4. Reservoir

The Area-Capacity Curve of Upper and Lower reservoirs for Alternative – 4 is as below:

Table 3.1 : Area Capacity of Upper Reservoir

Elevation (m)	Area (m ²)	Area (Ha)	Interval	Volume (MCM)	Cumulative (MCM)
553.75	438058.2142	43.81			
554	439257.2934	43.93	0	0.110	0.11
555	444063.6661	44.41	1	0.442	0.55
556	448886.1274	44.89	1	0.446	1.00
557	453724.6774	45.37	1	0.451	1.45
558	458579.3161	45.86	1	0.456	1.91
559	463450.0434	46.35	1	0.461	2.37
560	468336.8594	46.83	1	0.466	2.83
561	473239.7639	47.32	1	0.471	3.30
562	478158.757	47.82	1	0.476	3.78
563	483093.8386	48.31	1	0.481	4.26
564	488045.0088	48.80	1	0.486	4.74
565	493012.2674	49.30	1	0.491	5.24
566	497995.6146	49.80	1	0.496	5.73
567	502995.0502	50.30	1	0.500	6.23
568	508010.5743	50.80	1	0.506	6.74
569	513042.1868	51.30	1	0.511	7.25
570	518089.8877	51.81	1	0.516	7.76
571	523153.677	52.32	1	0.521	8.28
572	528233.5548	52.82	1	0.526	8.81
573	533329.5209	53.33	1	0.531	9.34
574	538441.5754	53.84	1	0.536	9.88
574.75	542286.1742	54.23	0.75	0.405	10.28

9.0 ANALYSIS of PROPOSAL

9.1. Financial and Social Benefits with Special Emphasis on the Benefit to the Local People Including Tribal Population, If any, In the Area

Some of the Financial and Social benefits from the project shall *inter alia* include

- (i) Average annual generation of 2552 MU of energy with 95% plant availability;
- (ii) Increased vegetal cover due to implementation of CAT Plan and Green Belt Development Plans
- (iii) Employment Potential during construction and after construction.
- (iv) Overall development of area by implementing CSR initiatives and Watershed Development Plans.

Sl. No.	Description	Alternative-1	Alternative-2	Alternative-3	Alternative-4
1	LOCATION				
(a)	State	Bihar	Bihar	Bihar	Bihar
(b)	District	Nawada	Nawada	Nawada	Nawada
2	DAMS				
	UPPER RESERVOIR				
(a)	FRL	574.75 m	610.75 m	357 m	574.75 m
(b)	MDDL	554 m	590 m	336.25 m	554.0 m
(c)	Gross Storage	10.28 MCM	7.82 MCM	14.46 MCM	10.28 MCM
(d)	Live Storage	10.17 MCM	7.59 MCM	14.45 MCM	10.17 MCM
(e)	Length of Dam	3300 m	4763 m	4824 m	3300 m
3	LOWER RESERVOIR				
	FRL	191 m	191 m	191 m	191 m
	MDDL	180 m	180 m	180 m	169 m
	Gross Storage	16.23 MCM	14 MCM	24.06 MCM	9.27 MCM
	Live Storage	8.10 MCM	7.6 MCM	14.6 MCM	8.10 MCM
	Length of Dam	815 m	805 m	906 m	352 m
4	WCS				
(a)	Pressure Shaft (PS)	2 Nos. × 6.4 m dia × 777 m L	2 Nos. × 6.4 m dia × 810 m L	4 Nos. × 5.20 m dia × 488 m L	2 Nos. × 6.4 m dia × 688 m L
(b)	Unit PS	4 Nos. × 4.5 m dia × 100 m L	4 Nos. × 4.5 m dia × 60 m L	—	4 Nos. × 4.5 m dia × 360 m L

Sl. No.	Description	Alternative-1		Alternative-2		Alternative-3		Alternative-4	
(c)	Draft Tube (DT)	4 Nos. × 6.0 m dia × 50 m L		2 Nos. × 6.0 m dia × 50 m L		4 Nos. × 5.20 m dia × 50 m L		4 Nos. × 6.0 m dia × 50 m L	
(d)	Tail Race Tunnel (TRT)	2 Nos. × 7.80 m dia × 440 m L		2 Nos. × 7.8 m dia × 1440 m L		4 Nos. × 6.30 m dia × 406 m L		2 Nos. ×7.8 m dia × 493 / m L	
(e)	WCS Length	1367 m		2360 m		944 m		1890 m	
(f)	L/H Ratio	3.68		5.81		6.21		5.05	
5	POWER HOUSE								
	Type	Underground		Underground		Underground		Underground	
6	Electro-Mechanical Equipment								
	PUMP TURBINE								
(a)	Type	Vertical Reversible Francis Pump Turbine		Vertical Reversible Francis Pump Turbine		Vertical Reversible Francis Pump Turbine		Vertical Reversible Francis Pump Turbine	
7	PROJECT AREA (Ha)	Alt-1		Alt-2		Alt-3		Alt-4	
		Forest	Non-Forest	Forest	Non-Forest	Forest	Non-Forest	Forest	Non-Forest
1	Site Office / Accommodation / Contractor Facility		10		10		10		17.92
2	Concrete Batching Plant								2
3	Approach Road to Project Component	29.93		15		13		29.93	
4	Labour Camp								1.2
5	Muck Disposal Area		65		81		135		28

Sl. No.	Description	Alternative-1		Alternative-2		Alternative-3		Alternative-4	
6	Crusher		5		5		5		1
7	Upper Reservoir	89.5		87		89.4		92.5	
8	Lower Reservoir	134.3		124		197.6		73.62	
9	WCS, PH, ADITS	29.17		38.5		30.76		29.17	
10	Water Pipeline Route	3.20	4.49	3.20	4.49	3.20	4.49	3.20	4.49
	Total Forest / Non-Forest Area (Ha)	286.1	84.49	267.7	100.49	333.96	154.49	228.42	54.61
	TOTAL AREA (Ha)	370.59		368.19		488.45		283.03	
7	INSTALLED CAPCITY (MW)	920		940		640		920	
8	GENERATION HOURS	8 hours		8 hours		8 hours		8 hours	
9	ANNUAL POWER								
(a)	Annual average generation (95% machine availability)	2552 MU		2607.56 MU		1768.9 MU		2552 MU	
(b)	Net Rated Head	371.4		405.7 m		152 m		374.2 m	
10	Financial Aspect								
	Total completion Cost (in crore)	5373		6187		5679		5128	
	Cost per MW (in crore)	5.84		6.6		8.9		5.6	
11	RANK	2		3		4		1	

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