



CIN: L40101HR1975GOI032564

Regd. Office: NHPC Office Complex, Sector-33, Faridabad-121003(Haryana)

Dated: 06.04.2026

Corrigendum -4

Name of the Work: - "Lot-2: Construction of Head Race tunnels including Intakes, Pressure Shafts, Penstocks, Power House Cavern, Transformer cum GIS Cavern, Draft Tube Gate Operation Chamber including Gate shafts, Downstream Surge Cavern, Tail Race Tunnels, Pothead Yard, Adits including approach roads of Kamala H.E. Project (1720MW), Kamle district, Arunachal Pradesh"

Tender ID.: 2025_NHPC_884444_1

Sl. No	Clause No./ Ref.	Existing Bid Conditions/ Description	Amended Bid Conditions/Description
VOLUME-0: NIT, ITB, BIDDING DATA & QUALIFICATION FORMS:			
1.	Vol.0, Sec.0, NIT, Cl. 4.1.1, Page No. 9	4.1.1 General Construction Experience The Bidder (Sole Contractor or Lead Partner of JV) should have the General Construction Experience as Principle Contractor or Partner of JV or Sub-contractor approved by Employer, of substantially completed a major Civil Structure in a Water Resources/ Hydro Power Development Project or other Civil/Infrastructure Works during last twelve (12) years of following value: 1. One similar work costing not less than INR 2,510 Crore including taxes or 282 Million USD or 2. Two similar works each costing not less than INR 1,569 Crore including taxes or 176 Million USD or 3. Three similar works each costing not less than INR 1255 Crore including taxes (40%) or 141 Million USD. Similar Works / Major Civil Structure shall mean Dam/ Barrage, Tunnel, Power House, surge Shaft/Pressure Shaft. 	4.1.1 General Construction Experience The Bidder (Sole Contractor or Lead Partner of JV) should have the General Construction Experience as Principle Contractor or Partner of JV or Sub-contractor approved by Employer, of substantially completed a major Civil Structure in a Water Resources/ Hydro Power Development Project or other Civil/Infrastructure Works during last twelve (12) years of following value: 1. One similar work costing not less than INR 2,510 Crore including taxes or 282 Million USD or 2. Two similar works each costing not less than INR 1,569 Crore including taxes or 176 Million USD or 3. Three similar works each costing not less than INR 1255 Crore including taxes (40%) or 141 Million USD. Similar Works / Major Civil Structure shall mean Dam/ Barrage, Tunnel, Power House, surge Shaft/Pressure Shaft and other Infrastructure Works.

2.	Vol.0, Sec.0, NIT, Cl. 4.1.2.1, Page No. 10	<p>4.1.2.1 UNDERGROUND POWER HOUSE</p> <p>a) Completion of an Underground / Sub-Surface / Surface Power House in Hydroelectric Projects.</p> <p style="text-align: center;">AND</p> <p>b) Completion of at least one cavern of minimum 17m width and minimum 42m height.</p>	<p>4.1.2.1 UNDERGROUND POWER HOUSE</p> <p>a) Completion of an Underground / Sub-Surface / Surface Power House in Hydroelectric Projects of minimum 50MW capacity.</p> <p style="text-align: center;">AND</p> <p>b) Completion of at least one cavern of minimum 17m width and minimum 42m height</p>
3.	Vol.0, Sec.0, NIT, Cl. 4.1.2.2, Page No. 10	<p>4.1.2.2 Tunnel: Experience of tunneling with Drill and Blast Method (DBM)/Tunnel Boring Machine/Road Headers/NATM:</p> <p>a) Completion of excavation of at least one tunnel of minimum 8m with minimum length of 1.0 km in Ongoing/Completed Project.</p> <p style="text-align: center;">AND</p> <p>b) Completion of concrete lined tunnel of minimum 3.0 km (length from one project) of 3.0 m finished diameter in Ongoing / Completed Projects.</p> <p>Note:</p>	<p>4.1.2.2 Tunnel: Completion of excavation of at least one tunnel of minimum 7.2m and completion of concrete lined tunnel of 6.25m finished diameter in Ongoing/Completed Project with minimum length of 1.0 km in Ongoing/Completed Project.</p> <p>Note:</p>
4.	Vol.0, Sec.0, NIT, Cl. 4.6, Page No. 14	<p>4.6 Joint Venture Bidders: Joint Venture bidders shall comply with the following minimum qualifying requirements:</p> <p>(i) The number of partners in the Joint Venture not to exceed three (3) with one of the Partners designated as Lead Partner.</p> <p>(ii) The Lead Partner to fully meet the following:</p> <p>a) General Experience Criteria as mentioned at 4.1.1</p> <p>b) Specific Construction experience Criteria mentioned at 4.1.2.1 (Underground Power House)</p> <p>c) Average annual turnover (4.2(i)) not less than 50% of criteria specified under Financial Capacity.</p> <p>d) Working Capital Criteria (4.2(iii))</p> <p>(iii) The other partner(s) to individually meet the following requirements:</p> <p>a) Specific Experience Criteria under 4.1.2.2 (Tunnel) or 4.1.2.3 (Pressure Shaft).</p> <p>b) Average annual turnover (4.2(i)) not less than 20% of criteria specified</p>	<p>4.6 Joint Venture Bidders: Joint Venture bidders shall comply with the following minimum qualifying requirements:</p> <p>(i) The number of partners in the Joint Venture not to exceed three (3) with one of the Partners designated as Lead Partner.</p> <p>(ii) The Lead Partner to fully meet the following:</p> <p>a) General Experience Criteria as mentioned at 4.1.</p> <p>b) Specific Construction Experience Criteria mentioned at 4.1.2.1 (Underground Power House) and/or 4.1.2.2 (Tunnel works).</p> <p>c) The number of JV partners, including the Lead Partner, shall be restricted to 2 (Two), under following conditions:</p> <p>(i) The Lead Partner itself meets the specific experience criteria under 4.1.2.1 (Underground Power House) and either of 4.1.2.2 (Tunnel) or 4.1.2.3 (Pressure Shaft).</p>

	<p style="text-align: center;">under financial capacity.</p> <p>(iv) All the partners of the Joint Venture to individually fulfill the Net Worth and Insolvency criteria specified under Financial Capacity.</p> <p>(v) The Joint Venture to collectively satisfy, as a whole, the specified financial as well as technical requirements.</p> <p>(vi) The Bid Capacity requirement shall be satisfied by individual partner of Joint Venture in proportion to their participation share of work in Joint Venture.</p> <p>(vii) The parties shall be required to form the Joint Venture before applying for the tender which shall be evinced by submitting a copy of the Joint Venture agreement already entered into for the purpose. The Joint Venture agreement should contain the roles and responsibilities of each constituent, the proposed participation share of each partner along with the items of work to be executed by each partner. It shall also be brought out in the Joint Venture agreement that in case the Contract is awarded to the Joint Venture, each partner of the Joint Venture shall be responsible for execution of that item of work for which he claims to have specific technical experience.</p> <p>(viii) Lead partner of the Joint Venture should have at least 50% share</p>	<p>(ii) The Lead Partner itself meets the specific experience criteria under 4.1.2.2 (Tunnel) and either of 4.1.2.1 (Underground Power House) or 4.1.2.3 (Pressure Shaft).</p> <p>d) The number of JV partners, including the Lead Partner, shall be restricted to 3 (Three) in case the Lead Partner meets either of the specific experience criteria under 4.1.2.1 (Underground Power House) or 4.1.2.2 (Tunnel works). In this case the other partners have to meet the specific experience criteria not met by the Lead partner.</p> <p>e) Average annual turnover (4.2 (i)) not less than 50% of criteria specified under Financial Capacity.</p> <p>f) Working Capital Criteria (4.2(iii))</p> <p>(iii) The other partner(s) to individually meet the following requirements:</p> <p>a) The Specific Experience Criteria not met by the Lead Partner as deliberated under S.No. (ii) above.</p> <p>b) Average annual turnover 4.2 (i) not less than 20% of criteria specified under financial capacity.</p> <p>(iv) All the partners of the Joint Venture to individually fulfill the Net Worth and Insolvency criteria specified under Financial Capacity.</p> <p>(v) The Joint Venture to collectively satisfy, as a whole, the specified financial as well as technical requirements.</p> <p>(vi) The Bid Capacity requirement shall be satisfied by individual partner of Joint Venture in proportion to their participation share of work in Joint Venture.</p> <p>(vii) The parties shall be required to form the Joint Venture before applying for the tender which shall be evinced by submitting a copy of the Joint Venture agreement already entered into for the purpose. The Joint Venture agreement should contain the roles and responsibilities of each constituent, the proposed participation share of each partner along with the items of work to</p>
--	--	---

			<p>be executed by each partner. It shall also be brought out in the Joint Venture agreement that in case the Contract is awarded to the Joint Venture, each partner of the Joint Venture shall be responsible for execution of that item of work for which he claims to have specific technical experience.</p> <p>(viii) Lead partner of the Joint Venture should have at least 50% share.</p>
5.	Vol.0, Sec.0, NIT, Cl. 4.7, Page No. 15	<p>4.7 Bidders with Sub-Contractors:</p> <p>In case the Bidder does not have all requisite specific experience and also does not wish to enter into a Joint Venture or wants to restrict the joint venture partnership, he can associate sub-contractor(s) for specified activities in which he does not have the relevant experience as brought out below. The criteria to be met by such Bidder shall be as follows:</p> <p>(i) The Bidders himself to fully meet the following:</p> <p>a) General Experience Criteria as mentioned at 4.1.1</p> <p>b) Technical/Specific Construction experience Criteria mentioned at 4.1.2.1 (Underground Power House).</p> <p>c) All criteria mentioned under Financial capacity in para 4.2</p> <p>d) Bid Capacity as mentioned in Para 4.3.</p> <p>(ii) The Bidders can propose the subcontractor(s) to meet the Specific Construction experience mentioned at 4.1.2.2 (Tunnel) or 4.1.2.3 (Pressure Shaft) which is not met by the the bidder.</p> <p>(iii) The number of sub-contractors not to exceed two(2) for meeting the specific experience criteria.</p> <p>(iv) The Bidder and his proposed sub-contractor(s) should submit separate undertaking that the Bidder/Sub-contractors shall be responsible for execution of that item of work for which they claim to have specific experience.</p> <p>(v) The Bidders and his proposed sub-contractor(s) should collectively satisfy, as a whole all the Technical Experience requirements.</p> <p>(vi) Sub-contractor(s) shall submit</p>	<p>4.7 Bidders with Sub-Contractors:</p> <p>The bidder can associate sub-contractor(s) for specified activities in which he does not have the relevant experience as brought out below. The criteria to be met by such Bidder shall be as follows:</p> <p>(i) The Bidders himself to fully meet the following:</p> <p>a) General Experience Criteria as mentioned at 5.1.</p> <p>b) Technical/Specific Construction experience Criteria mentioned at 4.1.2.1 (Underground Power House) and/or 4.1.2.2 (Tunnel works).</p> <p>c) All criteria mentioned under Financial capacity in para 4.2</p> <p>d) Bid Capacity as mentioned in Para 4.3.</p> <p>(ii) In case,</p> <p>a) The bidder meets the criteria under 4.1.2.1 (Underground Power House), the bidder can propose subcontractor(s) to meet the Specific experience criteria for 4.1.2.2 (Tunnel works) and/or 4.1.2.3 (Pressure Shaft).</p> <p>b) The bidder meets the criteria under 4.1.2.2 (Tunnel works), the bidder can propose subcontractor(s) to meet the Specific experience criteria for 4.1.2.1 (Underground Power House) and/or 4.1.2.3 (Pressure Shaft).</p> <p>(iii) The number of sub-contractors not to exceed two (2) for meeting the specific experience criteria.</p> <p>(iv) The Bidder and his proposed sub-contractor(s) should submit separate undertaking that the Bidder/Sub-contractors shall be responsible for</p>

		<p>Performance Bank Guarantee equivalent to 5% of value of Work sublet in addition to the Performance Bank Guarantee/Insurance Surety Bond for whole contract submitted by the Bidders on award of Work.</p> <p>(vii) All the Proposed sub-contractor(s) to individually fulfil the Insolvency criteria specified under Para 4.4.</p>	<p>execution of that item of work for which they claim to have specific experience.</p> <p>(v) The Bidders and his proposed sub-contractor(s) should collectively satisfy, as a whole all the Technical Experience requirements.</p> <p>(vi) Sub-contractor(s) shall submit Performance Bank Guarantee equivalent to 5% of value of Work sublet in addition to the Performance Bank Guarantee/Insurance Surety Bond for whole contract submitted by the Bidders on award of Work.</p> <p>(vii) All the Proposed sub-contractor(s) to individually fulfil the Insolvency criteria specified under Para 4.4.</p> <p>(viii) The firm acting as a sub-contractor for any bidder shall not participate in more than one tender either as a sole contractor or in JV or as a sub-contractor to another bidder, for this work. Any such participation will result in disqualification of all related bids. An undertaking to this effect from the sub-contractor shall be submitted by the bidder along with the bid.</p>
--	--	---	--

VOLUME-1: INSTRUCTION TO BIDDER (ITB):

6.	Vol.0, Sec.0, ITB, Cl. 27.1, Page No. 43	<p>27. CLARIFICATION OF BIDS</p> <p>27.1 To assist in the examination, evaluation, and comparison of bids, the Employer may, at its discretion, ask any bidder for clarification of its Bid, including breakdowns of unit rates as per the format given in Data Sheet – 11 under Section 8. The request for clarification and the response shall be through letter/e-mail but no change in the price or substance of the bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetical errors discovered by the Employer in the evaluation of the Bids in accordance with Clause 28 hereof.</p>	<p>27. CLARIFICATION OF BIDS</p> <p>27.1 Bidder is instructed to read the instructions for submission of bids very carefully. The bid submitted by bidder should be completed in all respect in terms of conditions of tender document tailing which bid may be rejected outrightly.</p> <p>To assist in the examination, evaluation, and comparison of bids, the Employer may, at its discretion, ask any bidder for clarification of its Bid, including breakdowns of unit rates as per the format given in Data Sheet – 11 under Section 8. The request for clarification and the response shall be through letter/e-mail but no change in the price or substance of the bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetical errors discovered by the Employer in the evaluation of the Bids in accordance with Clause 28 hereof.</p>
----	---	--	---

VOLUME-1: INFORMATION FOR BIDDERS (IFB):

7.	Vol.1, Sec.1, IFB, Cl. 4.0 (3),	<p>4.0 HYDROLOGY</p> <p>flood values for non-monsoon for various return periods</p>	<p>Return period flood for different working seasons at Dam site is enclosed as Annexure-6.</p>
----	--	--	--

	Page No. 28-30 (Added)		
8.	Vol.1, Sec.1, IFB, Cl. 4.0 (3), Page No. 29	4.0 HYDROLOGY 3. Climatology [.]. Maximum and minimum temperatures as observed at Tamen are 43°C and 7°C respectively. [...]	Month wise average Maximum and minimum Ambient temperature is enclosed as Annexure-1 .
9.	Vol.1, Sec.1, IFB, Cl. 10.0 (4), Page No. 46	4.0 ARRANGEMENTS OF CONSTRUCTION POWER FOR CONTRACTOR'S USE FOR MAIN WORKS AND THEIR ESTABLISHMENT Presently, there is no power supply available The penal interest rates will be same as applicable for mobilization advance. NHPC will deduct the financial advantage corresponding to Energy Consumed by contractor on monthly basis from each RA bill/payment due to contractor. The Formula for calculating Financial Advantage shall be as described in the Particular Conditions of the Contract (PCC). However, during non-availability of power.....during the infrastructure development phase.	4.0 ARRANGEMENTS OF CONSTRUCTION POWER FOR CONTRACTOR'S USE FOR MAIN WORKS AND THEIR ESTABLISHMENT Presently, there is no power supply available The penal interest rates will be same as applicable for mobilization advance. NHPC will deduct the financial advantage corresponding to Energy Consumed by contractor on monthly basis from each RA bill/payment due to contractor. The Formula for calculating Financial Advantage shall be as described in the Particular Conditions of the Contract (PCC). However, during non-availability of power.....during the infrastructure development phase.

VOLUME-2: GCC, PCC & FORMS AND PROCEDURE:

10.	Vol.2, Sec.3, PCC Cl. 4.2, Para 4 Page No. 17	The Contractor within 90 days of issue of Letter of Acceptance shall provide an additional security for Sub-Contractor's performance from his Sub-Contractor, if required, under the Contract. The Performance Security shall be in the form of a bank guarantee / insurance surety bond, as stipulated by the Employer in the Appendix to Tender.	The Contractor within 28 days of issue of Letter of Acceptance shall provide an additional security for Sub-Contractor's performance from his Sub-Contractor, if required, under the Contract. The Performance Security shall be in the form of a bank guarantee / insurance surety bond, as stipulated by the Employer in the Appendix to Tender.																					
11.	Vol.2, Sec.3, ATT Cl. 8.7, Annexure-III Page No. 70 & 77	Interdependent Milestones with HM Works: <table border="1" data-bbox="352 1693 906 1890"> <thead> <tr> <th>S. No.</th> <th>Description of Activities</th> <th>Completion month from LOA</th> </tr> </thead> <tbody> <tr> <td>IMS01</td> <td>Handing over of intake structure to HM Agency for erection of Intake Gates</td> <td>30th month</td> </tr> <tr> <td>IMS02</td> <td>Handing over of 2 no. Vertical Pressure shafts to HM Agency.</td> <td>46th month</td> </tr> <tr> <td>IMS03</td> <td>Handing over of 2 no. Vertical Pressure shafts in addition to IMS01 to HM Agency.</td> <td>53rd month</td> </tr> <tr> <td>IMS04</td> <td>Handing over of TRT to HM Agency for erection of TRT Gates</td> <td>62th month</td> </tr> </tbody> </table>	S. No.	Description of Activities	Completion month from LOA	IMS01	Handing over of intake structure to HM Agency for erection of Intake Gates	30 th month	IMS02	Handing over of 2 no. Vertical Pressure shafts to HM Agency.	46 th month	IMS03	Handing over of 2 no. Vertical Pressure shafts in addition to IMS01 to HM Agency.	53 rd month	IMS04	Handing over of TRT to HM Agency for erection of TRT Gates	62 th month	<table border="1" data-bbox="938 1588 1398 1926"> <thead> <tr> <th>Sl. No.</th> <th>Activity Name</th> <th>Target Month</th> </tr> </thead> <tbody> <tr> <td>IMS03</td> <td>Handing over of 2 no. Vertical Pressure shafts in addition to IMS02 to HM Agency</td> <td>53</td> </tr> </tbody> </table>	Sl. No.	Activity Name	Target Month	IMS03	Handing over of 2 no. Vertical Pressure shafts in addition to IMS02 to HM Agency	53
S. No.	Description of Activities	Completion month from LOA																						
IMS01	Handing over of intake structure to HM Agency for erection of Intake Gates	30 th month																						
IMS02	Handing over of 2 no. Vertical Pressure shafts to HM Agency.	46 th month																						
IMS03	Handing over of 2 no. Vertical Pressure shafts in addition to IMS01 to HM Agency.	53 rd month																						
IMS04	Handing over of TRT to HM Agency for erection of TRT Gates	62 th month																						
Sl. No.	Activity Name	Target Month																						
IMS03	Handing over of 2 no. Vertical Pressure shafts in addition to IMS02 to HM Agency	53																						

VOLUME-5: TENDER DRAWINGS

12.	Tender Drawings (New Added)	Power Intake	Drawing showing Excavation plan of Power intake and Dam is enclosed as Annexure-2 .
-----	-----------------------------	--------------	--

12.	Tender Drawings (New Added)	Power Intake	Drawing showing Excavation plan of Power intake and Dam is enclosed as Annexure-2.
VOLUME-6: DATA SHEET			
13.	Vol. 6, Sec 8, Data Sheet 3, Page No. 8	Data Sheet-3 Equipment and Plants	Revised Data Sheet-3 Construction Plant/Equipment is placed as Annexure-3
14.	Vol. 6, Sec 8, Data Sheet 3C, Page No. 11-12	Data Sheet-3C List of Key Construction Plant/Equipment	Revised Data Sheet-3C List of Key Construction Plant/Equipment is placed as Annexure-4
15.	Vol. 6, Sec 8, Data Sheet 6, Page No. 19 to 28	Data Sheet-6 Construction Methods	Revised Data Sheet-6 Construction Methodology is placed as Annexure-5

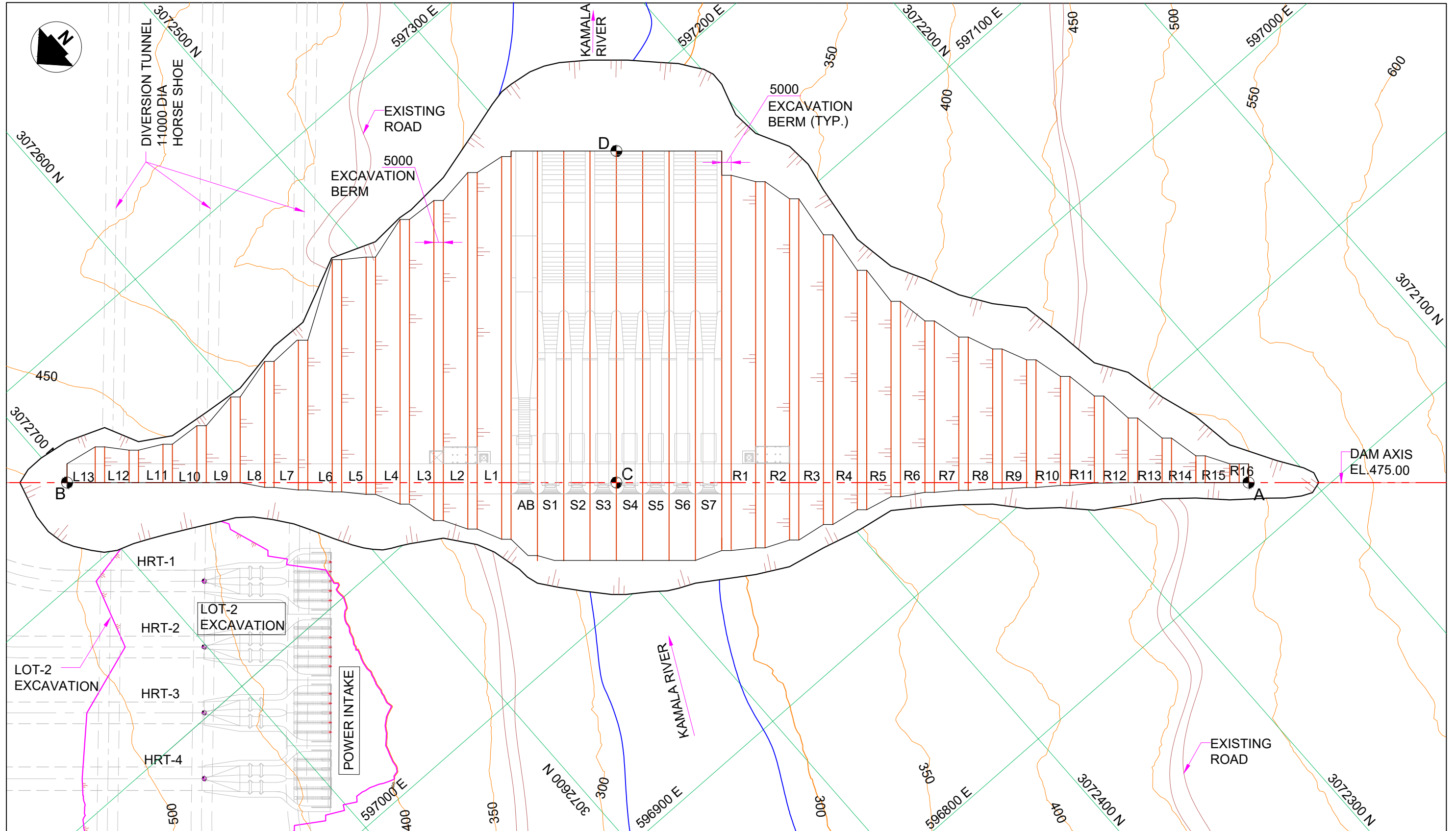
All other terms & conditions of the tender document shall remain unchanged.

General Manager (CC-I)
E-mail: contcivil-co@nhpc.nic.in

Annexure-1

Monthly Maximum and Minimum Temperature Data at Tamen (°C)

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	30.0	33.0	37.0	38.0	41.0	42.0	43.0	43.0	41.0	38.0	36.0	30.0
Min.	8.0	7.0	10.0	10.0	14.0	16.0	20.0	20.0	19.0	16.0	11.0	8.0



KAMALA HE PROJECT
DAM EXCAVATION PLAN

DATA SHEET – 3

Construction Plant / Equipment:

Name of Bidder or Partner of a joint venture
--

The Bidder should indicate availability of all construction plant / equipment (Key construction plant / equipment as per Data Sheet 3 C and additional construction plant / equipment proposed by bidder), for the Contract, in separate sheets in a form as shown below :

List of All Construction Plant / Equipment :

No.	Name of Equipment	Capacity or production rate	Nos. of unit	Year of manufacture	Current ownership *1	Current location (country)	Estimated purchase price (INR\US\$ per unit)
A	List of Key Construction Plant / Equipment (as per Data Sheet 3C)						
1							
2							

B	List of Additional Construction Plant / Equipment proposed by bidder						
1							
2							

*1: Classify as I for owned (Lead Partner or other Partner), or II to be leased and III to be purchased.

Separate Form-3A should be prepared for all construction plant / equipment listed in this Data Sheet-3.

Separate Form-3B should be prepared for deployment schedule of all the above construction plant / equipment.

NB:

- 1a. All the Key Construction plant / equipment shall be new.
- 1b. The list of additional construction plant /equipment proposed by the Bidder (at Sl. No. B in the above table) shall be at least 50% new in terms of capacity for each type of equipment (fraction to be rounded off on higher side) and balance 50% additional construction plant / equipment shall not be older than (3) three years.
2. The construction equipment planning should commensurate with construction methodology, availability of construction material and overall construction programme.
3. The period of (3) three years for old equipment shall be considered from the date of invoice to the date of invitation of techno-commercial bid.

LIST OF KEY CONSTRUCTION PLANT/ EQUIPMENT FOR KAMALA HE PROJECT LOT-2 TENDER PACKAGE

Sl. No.	Description of Plant / Equipment	Power Rating per each qty (Approx)	Capacity / Production output	Unit	Quantity (In nos.)
1	Hyd. Excavator 2.0 cum	254 HP	130	Cum/hr	11
2	Tunnel Excavator 0.75 cum with short boom	131 HP	50	Cum/hr	4
3	Loader cum Excavator 1.0/0.25 cum	74 HP	20	Cum/hr	2
4	Crawler Dozer 200 F.H.P	200 HP	200	Cum/hr	1
5	Rear Dumper 25 MT	300 HP	25	MT	54
6	Tipper / Dumper 10 MT	150 HP	10	MT	10
7	Two Boom Drill Jumbo	135 KW	100	M/Hr	7
8	Raise Borer	300KW	0.5	M/Hr	1
9	Air Track/Wagon Drill	155 HP	18	M/Hr	11
10	Jack Hammer / Pavement Breaker	140 HP	6	M/Hr	11
11	Compressed Air (cfm)	0.24 KW/CFM	-	CFM	3850
12	Shotcrete Machine (Wet type) with Spraying Arms	285 KW	-	-	3
13	Batching & Mixing Plant, 160 cum./hr.	420 KW	160	Cum/hr	1
14	Batching & Mixing Plant, 250 cum./hr.	650 KW	250	Cum/hr	1
15	Aggregate Processing Plant 300 TPH	780 KW	300	TPH	1
16	Aggregate Processing Plant 500 TPH	1300 KW	500	TPH	1
17	Concrete Vibrator Electric / Pneumatic	1.5 KW	-	-	10
18	Tower Crane 3T@45m	92 KW	3	MT	2
19	Concrete Pump 38 cum./hr.	45 KW	38	Cum/hr	11
20	Truck mounted concrete pump 60 cum/hr with 30-35m placer boom	180 HP	60	Cum/hr	1
21	Concrete Bucket 1 cum.	-	1	Cum	4
22	Transit Mixer 6 cum.	280 HP	6	Cum	20
23	Grout Pump 20 kg/sq.cm	5 KW	20	Kg/sq. cm	6
24	Tunnel gantry of 10 m dia-Hydraulic with 1 Traveller	-	-	-	2
25	Tunnel gantry of 7.5 m dia.-Hydraulic with Traveller	-	-	-	2
26	Hydraulic Tunnel gantry form of 12.5m dia. 12 m long with 1 traveller- Hydraulic	-	-	-	1
27	Hydraulic Tunnel gantry form of 11.5 m dia. 12 m long with 1 traveller- Hydraulic	-	-	-	3
28	Tunnel gantry 3.5 m dia- Mechanical	-	-	-	1
29	Concrete Shutter	-	-	-	L.S.
30	Excavator Mounted Rock Breaker 20 T	200 HP	-	MT	1

LIST OF KEY CONSTRUCTION PLANT/ EQUIPMENT FOR KAMALA HE PROJECT LOT-2 TENDER PACKAGE					
Sl. No.	Description of Plant / Equipment	Power Rating per each qty (Approx)	Capacity / Production output	Unit	Quantity (In nos.)
31	Mobile Crane 10 MT Pick & Carry	50 HP	-	MT	1
32	EOT Crane 15-20 T	20 KW	-	MT	1
33	Electric Winch 10 T	20 KW	-	MT	2
34	Vibratory Compactor 10 T	120 HP	-	MT	1
35	Dewatering Pump 10 HP	7.5 KW	-	Nos	28
36	Dewatering Pump 25 HP	19 KW	-	Nos	6
37	Dewatering Pump 35 HP	26 KW	-	Nos	4
38	Dewatering Pump 50 HP	37 KW	-	Nos	2
39	Ventilation System	1000 KW	-	-	L.S.
40	Explosive Van 10 T	-	-	-	1
41	Steel Rib Bending M/c	-	-	-	1
42	Hydra Lift	-	-	-	2
43	Water Tanker / Sprinkler 10/20 KL	-	-	-	1
44	Petrol/Diesel Tanker 10 KL	-	-	-	1
45	Truck 10 T	-	-	-	2

CONSTRUCTION METHODOLOGY, KAMALA HE PROJECT 1720 MW

LOT-2 PACKAGE

GENERAL:

The Kamala Hydroelectric Project with total installed capacity of 1720 MW (8X210 MW-Main Units & 1X40 MW-Auxiliary Unit) is envisaged as a storage scheme with approved flood moderation for utilizing the flows of Kamala River to harness the head created by constructing a 216 m high concrete gravity dam of 628 m length at top with FRL at EL 455.00 m. An underground Power house (8 x 210 MW) is proposed on left bank side of the river. It is a medium head scheme with rated net head of 144.50 m. An auxiliary Power house (1 x 40 MW) is also envisaged on the left bank.

The Kamala Hydroelectric Project is located near Tamen village which is located 55 km from Ziro, the district headquarter of Lower Subansiri district in Arunachal Pradesh. The project site is connected to Ziro and other places through an all-weather district highway which crosses the river Kamla near Tamen and goes both to U/s & D/s sides along the river. On the U/s side, it leads to the project site (about 3 km) and further to Kamporijo and beyond and on the D/s side it leads to Daporijo about 105 km away. The nearest rail head is North Lakhimpur in Assam which is about 185 km from Tamen. The nearest domestic airport is also at North Lakhimpur whereas the nearest international airport is at Dibrugarh / Guwahati in Assam. All the major components of the project are located on left bank.

Construction methodology and selection of equipment has been planned with the aim to commission the project in the scheduled time. The construction methodologies for different components of the project are as under in which the indicated time period is 12 months for all underground works & 8 months for surface works with full progress rate and 50% progress during peak monsoon season of 4 months.

1. POWER INTAKE STRUCTURE:

The intake structure consisting of 4 nos. Power Intake is proposed on the left bank. The top of the intake structure is at EL 475.0 m with invert elevation at EL 405.0 m and having 2 nos. gate each for HRT 1, 2 & 3 having opening size of 5.1m (W) x 11.5m (H) and 2 nos. gate for HRT 4 having opening size of 5.5 m (W) x 12.5m (H).

Construction of Power Intake involves approx. 240000 cum common excavation and approx. 342000 cum rock excavation. Open Excavation of Power Intakes shall be done with conventional method of drilling and blasting for rock excavation. Air Track/Wagon Drill and Jack Hammer shall be deployed for drilling. Hydraulic Excavator of 2.0 cum bucket capacity shall be deployed along 25T dumpers for mucking. Excavation of Power Intake shall take about 12 months.

Concreting of Intake structures involve about 368800 cum concrete. Concreting of Intake Structure involves plum concrete in foundation of Structure and then structural concrete over it. Concreting of intake is to be carried out from El. 396.36 m to El. 475 m in height approx 79 m. Concreting will be done in lift height of 1.5 / 2 m. 2 nos. Tower Crane of 3T@45 m radius shall be installed to cover the entire stretch of Power Intake. Further, 1 no. Truck mounted concrete pump of 60 cum/hr with 30-35 m placer boom shall also be used for concreting of Intake. Concrete from batching plant will be transported to intake through Transit mixers & filled into 1.0 cum bucket. The bucket shall be lifted by the tower crane and carried to the location of placement for concrete pouring. Concreting of Power Intake shall take about 15 months.

The following equipment shall be provided for excavation of Intake Structures: 2.0 cum. Hydraulic Excavator, 25T Rear Dumper, Air Track/Wagon drill, Jack Hammer, Air Compressor, 200 HP / 100 HP Dozer, Shotcrete Machine, Grouting pump. For concreting the equipment shall be Concrete Vibrators, Tower cranes of 3T@45 m radius, Truck mounted concrete pump of 60 cum/hr with 30-35 m placer boom, 38 cum/hr Concrete pump, 6 cum. Transit Mixer, 1.0 cum Concrete Bucket, Formwork & 160 cum/hr B&M plant installed for Intake/HRT, 300 TPH APP, etc.

2. HRT

4 nos. horse-shoe shaped HRT of finished diameters 11.5 m (HRT1, 2 & 3) & 12.5 m (HRT4) and lengths 515 m to 832 m are envisaged on the left bank. 1 no. Adit of size 7 m x 9.5 m, D-shape & length 457 m shall be provided to facilitate construction of the HRTs. Excavation of Adit will be completed in 5 months. Excavation of HRTs shall be carried in Heading-Benching by DBM. HRT 1 & 2 shall be excavated simultaneously with 1 set of common excavation equipment to be used in staggered manner. HRT 3 & 4 shall be excavated simultaneously with 1 set of equipment each. Total time for excavation of HRTs shall be 15 months.

Equipment required for HRT excavation will be Two boom drill jumbo, 2.0 cum Hyd. Excavator, 25T Rear Dumper, Air Track/Wagon drill, Jack hammer etc. Concreting of HRTs (overt & invert) shall be completed in 7 months by deploying 12 m long Tunnel gantries (Dia. 12.5 m / 11.5 m dia) with one traveller, Concrete pump 38 cum/hr, 6 cum Transit mixer, concrete vibrators, 160 cum/hr B&M plant etc.

Total completion time for excavation and concreting of HRTs shall be 22 months with additional 1 month time for construction of HRT portals.

3. PRESSURE SHAFTS:

A. HORIZONTAL PRESURE SHAFT:

Eight nos. main horizontal Pressure Shafts having total length 172 m each (top & bottom) and one no. Auxiliary unit Penstock bifurcated from Pressure Shaft-1 at lower bottom portion, have been provided to carry water from reservoir to the Power House complex for power generation. These horizontal Pressure Shafts carry the water from power intake structure to their respective vertical Pressure Shafts. For ease of excavation, the excavated shape of Power Tunnels is horseshoe and finished shape is circular having 7.1 m dia. (PS-1, PS-2, PS-5 to PS-8) and 6.5 m dia. (PS-3 to PS-4). Auxiliary unit Penstock is circular in shape having 2.5 m finished dia. & length 48 m.

For ease of construction, 1 no. D-shape Adit to HRT/Pressure Shaft Top of 457 m length & size 7 m (W) x 9.5 m (H), 1 no. Adit to Pressure Shaft Top Erection Gallery of length 466 m & size 7.0 m (W) X 9.5 m (H) and

1 no. Adit to Lower Horizontal Pressure Shaft of length 580.5 m & size 7.0 m (W) X 9.0 m (H), have been provided. The excavation shall be done by conventional drill and blast method. Excavation of main horizontal pressure shafts shall be taken up through heading-benching method whereas excavation of auxiliary horizontal pressure shaft shall be taken up through full face excavation method. After completion of excavation, steel Liners shall be erected.

The construction of Adit to HRT/Pressure Shaft Top, Adit to Pressure shaft Top Erection Gallery & Adit to Lower Horizontal Pressure Shaft shall be completed in 5, 6 & 7 months respectively. Excavation of 2 nos. Horizontal Pressure shafts shall be taken up simultaneously with one set of equipment each for top & bottom portions with the equipment to be used in a staggered manner. After completion of excavation of first 2 nos. PS, excavation of next 2 nos. PS will be taken up. The excavation of all 8 nos. Horizontal Pressure Shaft shall be completed in 11 months. After that excavation of Horizontal Aux. Penstock shall be started and completed in 0.5 month.

The steel lining of Horizontal Pressure Shafts shall be completed in 5 months each.

B. VERTICAL PRESSURE SHAFT:

Eight steel lined circular Pressure shafts of 7.1 m dia. (PS1, PS2, PS5 to PS8) and 6.5 m dia. (PS3 to PS4) and vertical height 127 m each are proposed to be constructed through Raise Borer by making a pilot hole of 450 mm dia. which is further reamed to 1.8 m dia. Thereafter, the enlargement/ slashing of Vertical Pressure Tunnel / Shaft shall be done in section(s) through Drill Blast method.

The muck shall be disposed-off through bottom Adit to Lower Horizontal Pressure Shaft having length 580.5 m and size 7.0 m X 9.0 m D-shaped. Bottom Adit is required to be constructed through Heading & Benching by DBM method before start of construction of vertical Pressure tunnels / shaft.

One vertical pressure shaft shall be excavated in approx. 5 months (2 months by Raise Borer & 3 months for slashing/enlargement). It is mentioned that 1.5 month shifting time will be required for re-installation of Raise Borer from one P/S to another and during this period, slashing/enlargement in one P/S shall be under progress. Therefore, the excavation of all 8 nos. Vertical Pressure Shafts shall be completed in approx. 32 months. The steel lining of Vertical Pressure Shafts shall be completed in approx. 5 months each.

Major equipment proposed for excavation of Pressure Shafts are Two boom drill jumbo, Raise Borer, 10 MT Tipper, 25T Rear Dumper, Rock bolter, Air Track/Wagon drill, Jack Hammer, Air Compressor, Shotcrete Machine, Grouting pump, 2.0 cum Hydraulic Excavator, Tunnel Excavator 0.75 cum (with short boom). Major equipment proposed for concreting are Vibrators, 6 cum. Transit Mixer, 38 cum/hr. concrete pump, 250 cum/hr B&M plant.

4. POWER HOUSE:

8 X 210 MW + 1 X 40 MW (1720 MW) Underground Power House is located on the left bank of the river and is fed by eight unit penstocks & 1 auxiliary unit penstock. The size of Power House cavern is 380 m (L) X 24 m (W) X 59.4 m (H).

MAT:-

The Construction of MAT portal (excavation and concreting) shall be completed in 1.5 months. Further, excavation of MAT having total 800 m length and D shape size 8 m x 9 m shall be constructed in 12 months period by deploying 2-boom drill jumbo, 2.0 cum Hydraulic Excavator, 25T Rear Dumpers, Air Track/Wagon drills, air compressors, etc. Therefore, total time period for MAT excavation including portal development is 13.5 months.

Overt & Invert Concreting of MAT shall be completed in 5.5 months by deploying 12 m long Tunnel gantry 9 m dia. with one traveller, Concrete pump 38 cum/hr, 6 cum Transit mixer, concrete vibrators, shotcrete m/c etc.

Construction Adit:-

Thereafter, construction Adit of approx. 430 m length D shape 7 m finished dia. for approach to Power House Cavern top shall be constructed in 5 months.

Power House Excavation:-

The Construction adit would be extended up to the full length of powerhouse in a period of 4 months. This tunnel is further widened to full width of power house in a period of 5 months, by providing adequate supports at the roof and side walls. Benching of the cavern shall be started by making a suitable ramp of approx 1:8 slope from the construction adit and muck shall be hauled from the construction adit. This benching excavation may take 4 months' time period. Concreting of EOT crane beam on the rock ledge shall be taken up after excavation and will be completed in 2.5 months. Before concreting of crane beams, split blasting of the rock in its vicinity will be done by line drilling so that further benching of powerhouse cavern does not damage the concreting of the crane beam.

After reaching to the level of service bay / MAT, excavation shall be taken up from MAT. The ramp constructed shall be excavated and will be removed from MAT. Approximately 3.5 months shall be required for the excavation. Further, Benching from this level shall be carried out in the same fashion as above by making a ramp in the upstream wall and the muck will be hauled through MAT. Approximately 3.5 months shall be required for this excavation. Leaving a bench of approximately 10 m wide in the sidewall (towards control room) the cavern will be benched down by making a ramp in the downstream wall. This benching will require another 3 months.

As the TRT and the draft tube shall be through, the excavation of the cavern below this level would be carried out through TRT. All the remaining ramps and bench left shall be removed from TRT. Another 2.5 months have been provided for this activity.

The excavation of Power House (excluding construction adit) would be completed in **28 months**.

Following equipment shall be used for excavation of Power House: Two boom drill jumbo, 25T Rear Dumper, Air Track/Wagon drill, Jack Hammer, Air Compressor, 2.0 cum. Hyd. Excavator etc.

Concreting of Sub structure & super structure of Power House having concrete quantity of 96500 cum shall be carried out with the E&M works of Power house. After completion of excavation of Power House, erection of permanent EOT shall be done on casted concrete beam. Further concreting of Columns, beams and raft at service bay shall be taken up after removal of ramp from service bay to opening of Penstocks levels.

Concreting of columns and beams at MIV Floor Level shall be commenced after excavation of Draft Tube Pits. Thereafter, Base raft concreting up to Draft Tube bottom including drainage gallery shall be taken up. Next to it, concreting in Machine Hall, MIV pedestal, around spiral casing, dewatering sump etc. shall be done.

Following equipment shall be used for concreting of Power House:-

6 cum Transit Mixer, Air Compressor, 38 cum/hr concrete pump, Vibrators, 15-20 MT EOT Crane, Mobile Crane, Form work, 250 cum/hr B&M plant, 500 TPH APP etc.

5. TRANSFORMER CUM GIS CAVERN:

Excavation of Transformer cum GIS cavern having size of 375 m (L) x 16.5 m (W) x 27 m (H) would be completed in approx. **25 months** with similar excavation equipment as deployed for Power House. Concrete quantity of 17021 cum shall also be done with similar concreting equipment as deployed for Power House.

6. CABLE TUNNEL:

A cable tunnel, approx. 300 m length, finished size 6.5 m (W) x 6.5m (H), D-shaped having a slope of about 1V:1.94H, has been envisaged for bringing the power cables from Transformer Hall to Pothead Yard.

Excavation of Cable Tunnel shall be done through DBM by deploying Air Track/wagon Drill, Jack Hammer, Winch, trolley & rail arrangement etc with average progress of approx. 15-20 m/month and shall be completed in approx. 15-20 months.

7. DOWN-STREAM SURGE CAVERN:

One no. D/s Surge cavern of dimension 276m (L) x 12m (W) x 42.85m (H) has been proposed with 8 nos Unit tunnels & 1 no. Aux. tunnel connected to the Surge Cavern and further connected to individual main TRTs as well as connecting aux. TRT with DT1, 2 & 3. Excavation of Surge Cavern will be done in a similar way to that of Power House cavern i.e. by first constructing a 110 m long D-shaped adit of 7m dia. And then expanding the adit throughout the length of the cavern followed by side slashing & subsequent benching.

The excavation of complete Surge Cavern shall be completed in 16 months. Following equipment shall be used for excavation and concreting of the downstream surge cavern.

Excavation:- 2 boom drill jumbo, 25 MT Dumper, Air Track/Wagon drill, Jack Hammer, 2.0 cum Hydraulic Excavator, Air Compressor, Tunnel Excavator 0.75 cum (with short boom), Dozer 100 HP etc.

Concreting:- 6 cum. Transit Mixer, 38 cum/hr concrete pump, Vibrators, 15-20 MT EOT Crane, Formwork, Shotcrete Machine, Grouting pump, 250 cum/hr B&M plant etc.

Concrete Lining of Surge Chamber and Gate Shafts are envisaged to be completed with HM works.

8. DRAFT TUBE GATE OPERATION CHAMBER

Draft tube gate operation chamber, having size of 276 m (L) X 7.0 m (W) X 12.0 m (H) has been proposed at downstream of transformer cavern with draft tube gate shaft of size 6.2 m (L) x 1.5 m (W) x 48.7 m (H) to cater to the inspection / maintenance requirements of turbines. To facilitate construction of DT GOC, 1 no. D-shaped Access tunnel branching out from MAT of length 144 m has been provided. Construction of draft tube GOC shall be done by conventional Drilling & blasting method and excavation of gate shafts shall be done by full shaft sinking/top down excavation method through DBM by deploying Air Track/wagon Drill, Jack Hammer Winch, trolley etc arrangement Or through Raise Borer depending upon the availability of access to bottom.

The excavation of complete DT GOC shall be completed in 12 months and excavation of gates shafts including 8 nos. main & 1 no. auxiliary gate shaft

shall be done in approx. 12 months taking excavation of two shafts at a time in staggered manner. Following equipment shall be used for excavation and concreting:-

Excavation:- 2 boom drill jumbo, Raise Bore/ Gantry crane, Winch, trolley, 25 MT Dumper, 10T Tipper, Jack Hammer, Air Track/ Wagon drill, Air Compressor, Tunnel Excavator 0.75 cum (with short boom), 6 cum. Transit Mixer etc.

Concreting:- 6 cum. Transit Mixer, 38 cum/hr concrete pump, Shotcrete Machine, Grouting pump, Vibrators, 250 cum/hr B&M plant etc.

Concrete Lining of DT GOC and Gate Shafts are envisaged to be completed with HM works.

9. TAILRACE TUNNELS:

Four nos. Tailrace tunnel connect the Powerhouse cavern at its downstream side to the Kamala river at its left bank. Eight nos. draft tube tunnels are provided starting from the downstream of Power house. These tunnels are merged into eight nos. Unit tailrace tunnels of 7.5 m finished diameter and lengths varying from 210 m to 240 m. Further downstream, these eight unit TRTs are combined to 4 nos. Tailrace tunnel of 10 m diameter horse-shoe shape. The lengths of main TRTs vary from 300 m to 450 m.

The construction adit to TRT is having approx. 625 m length and D shape 7 m Dia. shall be constructed in approx. 7 months.

Excavation of Main Tailrace Tunnel shall be done by drill blast method by heading and benching and excavated dia. of TRT shall be 11.8 m. Heading height and benching height shall be 7 m & 4.8 m respectively. Total time required for excavation of TRTs shall be 7 months.

Total Overt and Invert concreting quantities involved in Main TRTs shall be 37576 cum and 11846 cum respectively. Overt & Invert concreting and Grouting of 2 nos. Main TRT shall be completed in 4.4 months with 2 set of equipment. During Invert concreting & grouting, the Tunnel Gantry shall be shifted to other TRTs. So, total concreting time shall be approx. 8 months for concreting/grouting of all 4 nos. TRT.

Similar to Main TRTs, excavation of 8 nos. Unit/branch TRTs having finished dia. 7.5 m, Horseshoe shape, excavated dia. 9 m & length varying from 210 m to 240 m shall be done by drill blast method by heading & benching method. Time required for excavation of one Unit/branch TRTs shall be 3.5 months. It has been planned to deploy 2 set of equipment for excavation of 4 nos. Unit/branch TRTs simultaneously considering drilling & mucking in staggered manner. Therefore, total time of excavation of all 8 nos. Unit/branch TRTs with 2 set of equipment shall be approx. 7 months.

Unit/branch TRTs shall involve Overt and Invert concreting of about 52717 cum. Concreting shall be completed in approx. 2.25 months in one Unit/branch TRT. Total 2 set of Tunnel Gentries & other equipment will be required to execute concreting of 2 nos. Unit/branch TRT simultaneously. Total time required for concreting of all 8 nos. Unit/branch TRTs shall be approx. 9 months which shall be started after completion of concreting in one main TRT.

Following equipment shall be used for excavation and concreting:-

Excavation:- 2 boom drill jumbo, 2.0 cum Hyd. Excavator, 25T Rear Dumper, 10T Tipper, Jack Hammer, Air Compressor, Crawler drill etc.

Concreting:-

6 cum. Transit Mixer, Air Compressor, 38 cum/hr. concrete pump, Vibrators, Shotcrete Machine, Grout pump, Tunnel gantry (Hydraulic) 10 m dia of 12 m length and Tunnel Gantry (hydraulic) 7.5 m dia of 12 m length and 250 cum/hr B&M plant etc.

AUXILIARY TRT:

1 no. Aux. TRT of finished dia. 3.5 m horseshoe shape, length 333 m (concrete lined) & approx. 127 m (steel lined) has been envisaged for channelizing Aux. unit discharge into Kamala River through DTs.

Excavation of Auxiliary TRT shall be done in 3.5 months for concrete lined portion & 1.25 months for steel lined portion. The concrete lining of Aux. TRT shall be done in similar manner as described above for TRT/Unit TRT and only concrete lining portion shall be completed in 3 months.

Following equipment are proposed to be used for excavation and concreting of Auxiliary TRT:

Excavation:- Tunnel Excavator 0.75 cum (with short boom), 10T Tipper, Jack Hammer, Air Compressor, Air Track/Wagon drill, Shotcrete Machine, Grouting pump, Rock breaker etc.

Concreting:- 6 cum. Transit Mixer, Air Compressor, 38 cum/hr. concrete pump, Vibrators, Tunnel Gantry-Mechanical 3.5 m dia, etc.

TRT OUTLET STRUCTURE:

Construction of TRT outlet structures involves 192156 cum common excavation and 426587 rock excavation. The same shall be completed in 11 months. Concreting of TRT outlet structures involve 29258 cum and shall be completed in 5 months.

Following equipment are proposed to be used for TRT outlet structures:

Excavation:- 2.0 cum Hyd. Excavator, 25T Rear Dumper, Jack Hammer, Air Compressor, Air Track/Wagon drill, Rock breaker etc.

Concreting:- 6 cum. Transit Mixer, 38 cum/hr. concrete pump, Vibrators, 250 cum/hr B&M plant etc.

10. POT HEAD YARD:

An outdoor Pot head yard of size 135 m (L) x 50m (W), has been envisaged at EL. 440 m. Common excavation of 140000 cum and Rock excavation of 60000 cum will be completed in 4 months. Total concrete involved in Pot Head Yard shall be about 12550 cum and concreting of Pot head yard shall be completed in 3 months.

Major equipment used for excavation & concreting shall be 2.0 cum. Hyd. Excavator, Air Track/Wagon drill, Jack hammer, 25 MT Dumper, 100 HP Crawler Dozer, 10 T Vibratory Compactor, 6 cum. Transit Mixer, 38 cum/hr concrete pump, Vibrators, 250 cum/hr B&M plant etc.

KAMALA H.E. PROJECT						
Return period flood (m³/sec) for different working seasons at Dam site						
Return Period (year)	(1st Oct-31st May) 8 months	(1st Oct-15th May) 7.5 months	(16th Oct-31st May) 7.5 months	(1st Oct-30th April) 7 months	(16th Oct-15th May) 7 months	(16th Oct-30th Apr) 6.5 months
2	2173	1904	1983	1822	1641	1475
5	2822	2562	2610	2502	2119	1981
10	3251	2998	3025	2953	2435	2315
25	3794	3548	3549	3523	2834	2737

Note: All discharges are in cumec.