

No. एचएच/पर्या-एलईए/662

Date: 31.01.2024

To,  
Dr. P. V. Raju  
Group Director, Water Resources  
Remote Sensing Applications Area  
National Remote Sensing Centre  
ISRO, Dept. of Space, Govt. of India  
Hyderabad

**Sub: Letter of Award (LOA) for the work – “Monitoring, Modelling and Management of Glacial Lake Outburst Flood (GLOF) of Hydroelectric Projects of NHPC”.**

**Ref:** 1) Trailing e-mail between from 05.12.08.2022 to 12.01.2024, 2) Minutes of Meeting for meeting held on 28.12.2023.

Sir,

With reference to the proposal submitted by you vide letter referred under S. No. 1 and subsequent deliberations, we are pleased to award the work pertaining to “Monitoring, Modelling and Management of Glacial Lake Outburst Flood (GLOF) of Hydroelectric Projects of NHPC” to National Remote Sensing Centre, Hyderabad as per following terms and conditions.

**1. Aim of the proposed study:**

The aim of the study is “Monitoring, Modelling and Management of Glacial Lake Outburst Flood (GLOF) of Hydroelectric Projects of NHPC” for 26 projects of NHPC in 9 Basins (Annexure-I) with emphasis on 2 Hydro-projects in 2 basins.

**2. Scope of Work:**

Capacity building of NHPC officials by NRSC on monitoring of glacial lakes using satellite data. Prioritization of Glacial lakes for 26 NHPC hydropower stations and GLOF modeling for selected glacial lakes (jointly by NRSC & NHPC). Development of framework for Early Warning System (EWS) and establishment of EWS for selected glacial lakes in two hydropower projects in two basins on pilot basis (jointly by NHPC and NRSC).

### 3. Responsibilities

#### First Party: NRSC

1. To share existing glacial lake database prepared under National Hydrology Project to NHPC officials.
2. To participate in the joint execution of Technology Transfer training to NHPC so as to equip them independently executing studies in selected hydropower stations.
3. To generate methodology guidelines and manuals (Hard and soft copies) required for training.
4. To provide necessary technical support, coordination and guidance for the overall project execution.
5. Requisition of satellite data and any other ancillary data essential for the work.
6. NRSC & NHPC will form a Joint Technical Team to develop the approach methodology to rank and prioritise glacial lakes for GLOF risk and its implementation.
7. To rank and prioritise glacial lakes for GLOF risk for selected 26 (9 basins) NHPC hydropower stations at respective catchment scales using satellite data derived parameters and field collected data.
8. To model GLOF inundation simulation of selected potential glacial lakes for GLOF risk for selected 26 (9 basins) NHPC hydropower stations.
9. NRSC will handhold NHPC in monitoring, prioritise glacial lakes and GLOF modeling.
10. NRSC & NHPC will form a Joint Technical Team to develop methodology and framework for early warning system which includes hydrologic and hydraulic modeling components.
11. NRSC will handhold NHPC in developing hydrologic and hydraulic modeling system and establishing early warning system for prioritized glacial lakes each in 26 hydropower projects in 9 basins.
12. NRSC to recruit 02 No. Temporary Research Staff through NISG.
13. NRSC to provide technical support in developing interface/dashboard incorporating EWS of selected glacial lakes in 26 hydropower projects.

#### Second Party: NHPC

1. The entire cost of project to be funded by NHPC for the total project duration.
2. Allocation 02 (two) NHPC Officers to associate with NRSC for the Phase-1 study period.
3. Participation in the joint execution of Technology Transfer training programme.

4. Establishing Remote Sensing & GIS Lab with necessary and hardware to carry out the study.
5. NRSC & NHPC will form a Joint Technical Team to develop the approach methodology to rank and prioritise glacial lakes for GLOF risk and its implementation.
6. Assistance in ranking and prioritisation of glacial lakes for GLOF risk for selected 26 (9 basins) NHPC hydropower stations at respective catchment scales using satellite data derived parameters and field collected data.
7. Assistance in modeling GLOF inundation simulation of selected potential glacial lakes for GLOF risk for selected 26 (9 basins) NHPC hydropower stations.
8. NHPC & NRSC will form a Joint Technical Team to develop methodology and framework for early warning system.
9. NHPC to arrange India Meteorological Department (IMD) precipitation forecast data for the purpose of EWS covering the catchment areas of all 26 hydropower stations.
10. NHPC to share the discharge data to NRSC at G&D sites located upstream of all 26 hydropower stations for calibration and validation of hydrologic model.
11. NHPC shall assist NRSC in development of hydrologic and hydraulic modelling system and establishing early warning system for prioritized glacial lakes each in 26 hydropower projects in 9 basins with hand holding of NRSC.

#### 4. Financial Outlay:

The total cost of first phase of project is Rs. 120.76 lacs inclusive of taxes. The further details are as mentioned below:

Phase-I Period	18 Months		
Terms of payment	Break up of Fund Transfer by the Collaborator		
	Year-1 (Rs. in lacs)	Year-2 (Rs. in lacs)	Total (Rs. in lacs)
1) Training*	2.50	2.50	5.00
2) NRSC Manpower and Temporary Research Staff (02 No.)*	30.50	14.25	44.76
3) Travel	2.00	1.00	3.00

4) Contingency (3%)	1.05	0.53	1.58
5) High Resolution DTM*	48.00	0.00	48.00
6) GST (18%)	6.49	11.93	18.42
	<b>90.54</b>	<b>30.21</b>	<b>120.76</b>

#### 5. Completion Time:

The time of completion of this study in all respect including submission of final report shall be 18 months from the award. The project shall start from 01.04.2024. Detailed breakup of the timeline is given hereunder:

Tentative Start Date/ End Date	List of Activities
<b>HY1</b>  <b>Start Date:</b> 01-Apr-2024  <b>End Date:</b> 30-Sep-2024	<ul style="list-style-type: none"> <li>Conducting one week training programme to NHPC officials at NRSC. Guidance to NHPC for establishment of necessary hardware and software. Technical guidance and hand holding to NHPC officials for monitoring and prioritising of glacial lakes and GLOF modeling of glacial lakes for remaining selected basins. (2nd 1-Week customised training to NHPC Officials)</li> <li>NRSC &amp; NHPC will form a Joint Technical Team to develop the approach methodology, its implementation and Technical Report preparation. Ranking and prioritisation of glacial lakes for GLOF risk for selected 26 (9 basins) NHPC hydropower stations at respective catchment scales using satellite data derived parameters and field collected data.</li> <li>A progress report has to be submitted in hard &amp; Soft Copy by NRSC at the end of HY-1</li> </ul>

<p><b>HY2</b></p> <p>Start Date: 01-Oct-2024</p> <p>End Date: 30-Mar-2025</p>	<ul style="list-style-type: none"> <li>Modelling of GLOF inundation simulation for selected glacial lakes for GLOF risk in selected 2 NHPC hydropower stations using free DEMs available through web sources and high resolution DTM. NRSC &amp; NHPC will form a Joint Technical Team to develop the approach methodology, its implementation.</li> <li>NRSC &amp; NHPC will form a Joint Technical Team to develop the approach methodology and framework for early warning system (in the form of alert). The methodology includes hydrologic and hydraulic modelling components.</li> <li>A progress report has to be submitted in hard &amp; Soft Copy by NRSC at the end of HY-2</li> </ul>
<p><b>HY3</b></p> <p>Start Date: 01-Apr-2025</p> <p>End Date: 30-Sep-2025</p>	<ul style="list-style-type: none"> <li>Develop hydrologic and hydraulic modelling system and procurement of necessary equipment and installation of early warning system for glacial lakes in 2 hydropower project on pilot basis.</li> <li>A progress report has to be submitted in hard &amp; Soft Copy by NRSC at the end of HY-3</li> </ul>

#### 6. Data Confidentiality:

The report shall be submitted to NHPC Limited and the same shall be the sole property of NHPC Limited. Any part of the study/report shall not be reproduced/ published in any form without prior permission of NHPC Ltd.

#### 7. Report Accepting Authority:

The report shall be submitted to:

**Executive Director, EDM Division**

**NHPC Office Complex, Sector-33,**



Regd. Office: NHPC Office Complex, Sector-33, Faridabad-121002 (Haryana).  
CIN: L40101HR1975GOI032564, Website: [www.nhpcindia.com](http://www.nhpcindia.com)  
Corporate Office, Sector-33, Faridabad, Haryana  
Email: [envdivmgn-co@nhpc.nic.in](mailto:envdivmgn-co@nhpc.nic.in)



**Faridabad – 121003, Haryana**

A draft report encompassing the results shall be submitted by NRSC to NHPC Ltd., for review before the end date of the Project and the same shall be finalized on or before the end date after incorporating suggestions of NHPC Ltd.

- 8. Payment Terms:** The part payment shall be done in advance, i.e. 90% of total amount remaining shall done after submission of report for HY-1 and HY-2.

**9. Schedule of Payment:**

The work is envisaged to be started from 01.04.2024. Ninety percent (90 %) of the payment shall be done in advance and rest 10 percent shall be done after submission and acceptance of 5 copy of work completion report of first year. The payment schedule is as follows:

S. No.	Year	Period	Amount (Rs. In lacs)
1	First	1 year	First instalment (90%) after signing of MOU (Rs.108.68 lakhs)
2	Second	6 months	Second instalment (10%) after one year (Rs.12.08 lakhs on 01-Apr-2025)
	Total		120.76

**10. General Conditions:**

- NHPC Responsibilities: NHPC Ltd. shall provide manpower (2 officers) as and when required for assisting NRSC Hyderabad with the execution of the project.
- Procurement of High Resolution DTM (Tandem-X) shall be done for the two basins identified jointly by NHPC and NRSC.
- NRSC shall provide all the raw & processed data including satellite imageries to NHPC in Hard Disk drives.
- Report Preparation: After completion of study, NRSC will provide draft report and after its acceptance, soft and hard copy (five copy) of the final report will be submitted to NHPC.

- e) NHPC shall depute officers during field visit and ground truthing work. The expenditure involving travel, boarding, & Lodging and site visit of NRSC officials shall not be borne by NHPC. However, appropriate logistic support shall be provided wherever required.

**11. Deliverables / Outputs:**

- a) Satellite data for 9 basins and respective DEM.
- b) Training and manpower development for 6-10 NHPC officials.
- c) High resolution DEM for 2 basins identified for detailed hydrological modelling.
- d) Repository of potential glacial lakes and in 9 basins with their classification and categorization w.r.t risk potential in form of maps as well as geodatabase.
- e) Development of methodology for GLOF Risk assessment and 1-D and 2-D flood modelling (Hydrologic and hydraulic modelling system).
- f) NRSC shall submit all the raw & processed data including satellite imageries to NHPC in Hard disk drives.
- g) Final report comprising of study outcomes.

**h) Engineer in-charge:**

*Deputy General Manager (Environment), NHPC Ltd., CO shall act and represent NHPC as Engineer in-charge at all time during the currency of the Contract.*

**i) Paying Authority:**

The payment shall be released by Sr. Manager (Finance), Misc. Bills, NHPC Ltd., Corporate Office

**j) Time Extension:**

Work is of prime importance and time schedule is to be strictly adhered to barring exceptional circumstances which are beyond the control (For which NRSC is not liable), NHPC Ltd. Shall determine the extension of time and shall notify to NRSC accordingly.

**k) Arbitration:**

In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between central public sector enterprises(CPSEs)/port trusts inter se and also between CPSEs and Govt. Departments/organizations (excluding

disputes concerning railways, income tax, customs and excise departments), such dispute or difference shall be taken up by either party for resolution through AMRCD as mentioned in DPE OM No.0S/000 3/20 19-FTS-10937 dated 14.12.2022.

**l) Force Majeure:**

NRSC, Hyderabad and NHPC Ltd., shall indemnify either party for non-fulfilment of their respective obligation under this agreement due to the exigency of one or more of the force majeure events such as acts of God, war, flood, epidemics, riots, earthquakes, civil commotions, etc. (Including *bandh* called by political and non-political parties), provided on the occurrence and cessation of any such events, the party affected thereby shall give a notice in writing to the other party within one week of such occurrence or cessation. If the force Majeure conditions continue for beyond one month, the parties shall jointly decide about the future course of action.

- m)** You are requested to start the work immediately and the same may be confirmed to this office. The notification of award is being issued to you in duplicate. We request to you to return its duplicate copy duly signed and stamped on each page by authorized representative as a token of acknowledgement and confirmation of this offer.

Thanking you,  
Yours Sincerely



उप महाप्रबंधक (पर्यावरण)  
Dy. General Manager (Environment)  
एन एच पी सी लिमिटेड / NHPC Limited  
(भारत सरकार का उद्यम / A Govt. of India Enterprise)  
सेक्टर-33, फरीदाबाद / Secto-33, Faridabad

For and on behalf of NHPC Ltd.

Copy to:

1. Executive Director (R&D), for kind information please.
2. Senior Manager (Finance), for information & necessary action please.



## ANNEXURE-A

### GENERAL CONDITION OF CONTRACT

#### 1. Definition of Terms

In the Contract, the following expression shall, unless the contract otherwise requires, have the meaning hereby respectively, assigned to them.

- i. The ' Corporation ' shall mean the NHPC Limited, Sector 33, Faridabad, and Haryana 121003 and shall include its successors and permitted assigns.
- ii. The party shall mean ' NRSC Dehradun ' whose services has been accepted by the Corporation and shall include the party's heir's legal representative successors and permitted assigns.
- iii. The ' Site ' shall mean NHPC Locations via. Power Stations / Projects, Corporate Office and Other Offices of NHPC Ltd.
- iv. 'Month ' shall mean calendar month.
- v. "Writing shall include any manuscript, type written or printed, statement, under or over signature or seal, as the case may be.
- vi. Head of EDM Division or his representative shall represent the Corporation for the execution of work.

#### 2. NRSC, Hyderabad to inform itself fully

The ' NRSC, Hyderabad ' shall be deemed to have carefully examined the general conditions, specification & schedules and also to have satisfied itself as to the nature and character of the plant and equipment as the case may be, to be audited under the contract of work to be executed and where necessary, of the site conditions and other relevant matters and details.

Charge shall not be in any way relieving the 'NRSC, Hyderabad' of its responsibility for executing the work in terms of contract.

### 3. Subletting of Contract

The Party shall not be without the prior consent in writing of the Engineer - in - Charge, which shall not be unreasonably withheld, assign or sublet or transfer its contract.

### 4. Power to vary or Omit Work

- i. No alteration, amendments, omission, additions, substitution or variations of the work ( herein after referred as ' variation') under the contract shall be made by the Party except as directed in writing by the Engineer - In - Charge , but the Engineer in - Charge shall have full power , subject to the provisions herein after contained , from time to time during the execution of the contract by notice in writing to instruct the Party to make such variations which will not result in change of the scope of the contract and the Party shall carry out such variations and be bound by the same conditions as if the said variations occurred in the contract .
- ii. In the event of the Engineer - in - Charge requiring any variations, reasonable and proper notice shall be given to the Party to enable it to make arrangements accordingly.
- iii. For every case in which the ' NRSC, Hyderabad ' shall receive instructions from the Engineer - in - Charge for carrying out any work, which in the opinion, of the Party involve a claim for additional payment, the Party shall, as soon as reasonably possible after the receipt of such instructions, Inform the Engineer - in - Charge of such instructions, inform the Engineer - in - Charge of such claim for additional payment.

### 5. Negligence

If the ' NRSC, Hyderabad ' neglects to carry out the work or shall refuse or neglect to comply with any reasonable order given to it in writing by the Engineer - in - Charge or shall contravene any provisions of the contract , the Corporation may give 7 days ' notice in writing to the Party , neglect or contravention complained of and if the Party shall fall to comply with the notice within

reasonable time from the date of serving thereof in the event of neglect or contravention capable of being made good within that time , then in such case if the Corporation shall think fit , it shall be lawful for it to take the work of R & D project from ' NRSC, Hyderabad 's hand and give it to the another firm on contract at a reasonable price at the cost of the Party.

If the cost of executing the work , as aforesaid , shall exceed the balance due to the party and party fails to make good the deficiency , it shall be lawful for the Corporation to make good such deficiency in the manner it may consider deem fit in terms of the contract .

#### **6. Compliance with Regulations**

The Party shall comply with all applicable laws, ordinances, codes, approved standards rules and regulations and shall procure all necessary municipal and governments' permits, licenses etc. if required, at its own cost. The contract shall leave the Corporation and Engineer - in - Charge harmless as a result of any infractions thereof.

#### **7. Engineer - In - Charge**

Decision In respect of all matters, which are left to the decision of the Engineer - in - Charge, shall if so required by the party, give in writing a decision thereon and its reasons for such decision. If the decision is not accepted by the Party, the matter will at the request of the Party be referred to arbitration under the provisions for arbitrations hereinafter contained but subjected to this right of reference to Arbitration. Such decision shall be final and binding on the Party.

#### **8. BREACH OF CONTRACT**

In case of a non - performance in any form or shape of the convenient and condition in this contract by the 'NRSC, Hyderabad' , the Corporation shall have power to annual , rescind , cancel , or terminate the contract and upon its notifying in writing to the ' NRSC, Hyderabad ' that it has so done , this contract shall absolutely determine. The decision of Corporation in this regard shall be final and binding.

#### **9. CONTRACT DOCUMENTS & MISTAKES TO BE TREATED AS CONFIDENTIAL**

All documents , correspondence, decision and other matters concerning the contract shall be considered as confidential and restricted nature by the 'NRSC, Hyderabad' and 'NRSC, Hyderabad' shall not divulge or allow access hereto unauthorized person or any kind .

**Annexure-II**

List of Power Stations and Hydro-projects and respective basins:

S. No	Basin	River	Project
1	Beas	Parbati	Parbati-II Dam
		Parbati	Parbati-III Dam
2	Chenab	Chenab	Salal Dam
		Chenab	Sawalkot
		Chenab	Dulhasti Dam
		Chenab	Kiru
		Marusudar	Pakal Dul
		Chenab	Dugar
3	Indus	Suru	Chutak barrage
		Indus	Nimmo Bazgo dam
4	Jhelum	Jhelum	Uri-II Dam
		Jhelum	Uri-I Dam
		Kishanganga	Kishanganga
5	Ravi	Tributaries of Ravi	Bairasiul
		Ravi	Chamera-I PS
		Ravi	Chamera-II PS
		Ravi	Chamera-III PS
		Sewa	Sewa
6	Ganga/ Sharda	Sharda	Tanakpur Barrage
		Sharda	Dhauliganga dam
7	Brahmaputra	Subansiri	Subansiri Lower
		Dibang	Dibang
8	Teesta	Teesta	TLDP-IV Dam
		Teesta	Teesta-V
		Rangit	Rangit
		Teesta	TLDP-III Dam



