सत्यमेव जयते

# Government of India

**Central Water Commission**

**Ministry of Water Resources, River Development & Ganga Rejuvenation**

**National Hydrology Project (NHP)**

***INTERNATIONAL COMPETITIVE BIDDING***

**Request for Expression of Interest (REoI) for Consultancy Services**
**for**
**"Physical based mathematical modelling for estimation of Sediment Rate and Sediment Transport in Seven River Basins"**
**for**
**National Hydrology Project**

**April, 2019**

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**GOVERNMENT OF INDIA**
**CENTRAL WATER COMMISSION**
**NATIONAL HYDROLOGY PROJECT**

**REQUEST FOR EXPRESSIONS OF INTEREST**

CONSULTANCY SERVICES FOR PHYSICAL BASED MATHEMATICAL MODELLING FOR ESTIMATION OF SEDIMENT RATE AND SEDIMENT TRANSPORT IN SEVEN RIVER BASINS

No. NH/2018-RDC-1/03 Date: 29.04.2019

## Expressions of Interest (EOI)

The Government of India has applied for a loan from the World Bank under the National Hydrology Project (NHP) and intends to apply part of the loan proceeds to make payments under the contract for Physical Based Mathematical Modeling estimation of sediment rate and sediment transport in five river basins.

NHP is countrywide project, with 49 Implementing agencies (IAs) including eight central agencies, 39 state-UT level agencies and two river basin organizations (RBO). The National Hydrology Project (NHP) is proposed to be an eight-year project starting from November, 2016. It aims for Integrated Water Resources Management to enable improved decisions in water resources planning and operations. This requires not just improved water information systems and Decision Support Systems, but also enhanced institutional capacity – both technical capacity and policy & planning capacity. The Project Development Objective of the project is proposed **"to improve the extent, quality, and accessibility of water resources information and to strengthen the capacity of targeted water resources management institutions in India".**

One of the most important issues in the planning of storage reservoirs is the loss in the storage capacity due to silting. The sediment entering into a storage reservoir gets deposited progressively with the passage of time and thereby reduces the dead as well as live storage capacity of the reservoir. Further, it also affects the braiding characteristics & course of alluvial rivers impacting the ecology and biology of the nearby settlements. Hence, it is necessary to assess the rate of sedimentation at the planning stage and accordingly a portion of the capacity of the reservoir can be reserved for silt deposition. The assessment of sediment generation from various parts of the catchment also helps in identifying/ prioritising the vulnerable areas to soil erosion and take appropriate mitigation measures like catchment area treatment, construction of sediment retention structures etc. The phenomenon of generation of sediment from the catchment and river banks is complex in itself. Current understanding of the factors affecting soil erosion and sedimentation include soil characteristics, meteorological characteristics such as intensity and duration of precipitation, wind velocity, exposure conditions and topography of the soil cover and land use conditions and land management practices. The morphological characteristics such as soil texture, channel geometry, longitudinal slope, flood intensity, flood retention structures play an important role in transport of the sediment generated from the catchments. Integration of sediment

generation, transportation and deposition would give a picture of sediment flow in rivers and would be useful in sediment management. This study proposes to establish a methodology for modelling of sediment generation from catchments, its transportation mechanism through channels/rivers and its retention/deposition by flood water retention structures like reservoirs.

**Objectives of consultancy:**

The broad objective of consultancy is

(a) To compile all information/data related to sediment generation, sediment transport, river morphology, sediment deposition in flood retention structures, catchment area treatment, sediment retention structures in a proper database in GIS compatible format.
(b) To understand the sediment generation phenomenon, sediment transport mechanisms, morphological characteristics of the rivers, and the sediment deposition mechanisms of identified river basins.
(c) To assess the present conditions and the critical areas/ reaches in the catchment by conducting ground reconnaissance, after identification of the same through modelling exercise. The scale for the exercise has to be judiciously chosen and agreed upon by the client and the consultant.
(d) To develop mathematical models for each river basin covering sediment generation, sediment transport, silting/de-silting of rivers, erosion/deposition in river banks etc.
(e) To study the likely impact of land use and land cover changes in the catchment, climate changes, river fluviological characteristics, landforms, the impact of flood retention structures and other storage structures on the sediment generation, sediment transport, river morphology and sediment deposition.
(f) To assess the likely sedimentation rate from various parts of the catchment, rate of sediment movement in the rivers, morphological parameters of the rivers, sediment deposition profile in flood detention structure for each river basin with confidence level.
(g) To evaluate braiding patterns of the river by using Plan -Form Index (PFI) criteria along with its threshold classifications.
(h) To identify critical and other vulnerable locations in the catchment/ reaches in rivers.
(i) To suggest suitable catchment treatment/ river training works for restoration of critical locations/ reaches depending on site conditions.

**SCOPE**

The above studies are proposed to be carried out in two packages. Package – I include Ramganga Basin and Barak Basin. Package – II include Narmada Basin, Cauvery Basin and Three West Flowing rivers in western Ghats viz Kuttiadipuzha Basin, Peechi Basin & Mangalam Basin.

The Scope of the Consultancy is broadly divided in two phases as follows:

**Phase-I:** Development of the comprehensive sedimentation model/ suite of models for establishing the sediment generation phenomenon and identification of critical areas within the basin, creation of watershed/ sub-basin wise zones based on potential of sediment generation (i.e., prioritisation of watersheds for treatment planning), development of a GUI based on the finalized/ accepted mathematical model for estimation of sediment generation and transportation and deposition rate in the sub-basin, morphological characteristics of the river along with critical reaches prone to silting/ de-silting, possible engineering or biological interventions/ works that are technically & economically feasible in reducing the rate of sedimentation, model simulated quantitative reduction in rate due to interventions, creation of dissemination web based GIS portal and dissemination of model output in defined platform.

**Phase-II:** Operation, Maintenance & updating of the model for geographical transposability during upgradation period of 1 year.

The Broad scope of the study will consist but not limited to the above in brief. The final Terms of Reference and the scope of the study would be issued along with the Request for Proposals.

**DURATION:**

Total schedule time for completion of the work of sediment modeling, establishing sedimentation rate and river morphological studies for the above mentioned packages shall 24 months followed by Operation & Maintenance and upgradation period of 1 year. Studies and preparation of comprehensive reports of all the basins within the package may be taken up simultaneously.

One year is kept for Operation, Maintenance and upgradation devoted to Technical Support after Implementation. The consultant should provide a separate cost for Technical Support Services for a period of 12 months after model implementation and acceptance, to support the model operation and fine-tuning.

**IMPLEMENTATION ARRANGEMENT**

For the sake of clarity, the study may be divided into following components:

(A) Sedimentation
   i. Study and modelling of sediment generation from catchment
   ii. Study and modelling of the sediment (both suspended load and bed load), its generation, transport and deposition mechanism through rivers
   iii. Study and modelling of sediment deposition due to interventions and structures.

(B) The study and modelling of morphological characteristics of the rivers
   i. Identification of Critical reaches for erosion as well as sedimentation with major causative catchment physiographic parameters of erosion area, LULC, soil type, erosion length of the river etc.

ii. Identification of the most suitable sedimentation/ morphological modelling model under the Indian conditions of topography, geology, meteorology and data availability.
iii. Channel profile may be developed for river reach under consideration. The proper interpretation w.r.t. bed formations, aggradation, degradation etc. may be made as a part of the study.
iv. Analysis of shifting of the banks of the river at an appropriate interval as well as covering critical reaches of the river irrespective of river RDs interval.
v. Detailed Analysis of Historical remote sensing imageries for river morphology and river bank shifting

The Project Implementation plan of the Consultancy is broadly divided into two phases.

**Phase I:**

1. Task 1: Review of Data availability, Data Collection, delineation, layer generation and its Compilation
2. Task 2: Study of sediment generation phenomenon, sediment transport mechanism sediment deposition mechanism and its modelling
3. Task 3: River Morphological Studies
4. Task 4: Capacity Building and Training
5. Task 5: Key Deliverables and Reporting including Inception report, monthly progress reports, data collection & compilation report, draft final reports of sedimentation modelling, final report and user manual.

**Phase II:**

- Operation, Maintenance, updating and fine tuning of the model during Upgradation period of 1 year
- Capacity building and training on updating of the model, workshop comprising 50 officials from Central/State Govt. officials on complete system including updating of the models.

Central Water Commission now invites eligible consultants to indicate their interest in providing the above required consultancy. Interested consultants must provide information demonstrating that they have the required qualifications and relevant experience to perform the Services (brochures, description of similar assignments, experience in similar conditions, availability of appropriate skills among staff, etc.).

**Consultants may associate with other firms in the form of a joint venture or a sub-consultancy to enhance their qualifications The EOI submitted by consultants in association should clearly indicate the nature of the association if it is a joint venture or a sub-consultancy. In case of Joint venture, the name of the lead firm should be clearly stated and the JV should not have more than three members including the lead. The consultants firm may submit the EOI as per Performa attached at Annexure-I to VII.**

The short-listing criteria, are as follows:

a) The Firm / research institute must have been in business for at least the last ten years (Copy of the Certificate of Incorporation or Memorandum of Articles) in providing international consultancy services in the water sector, with particular emphasis and a track record of successfully delivering major analytical projects that directly interface with water resources policy or management.

b) Organization set-up, structure and availability of key professionals (Modeler, hydrologist, RS Specialist, Database specialist etc.) of required qualification with the firm i.e. Technical team and expertise available with the organization (attach short CVs for reference only).

c) The firm / research institute must have carried out the work of Demonstrated experience in Hydrological/ sedimentation modelling at basin/ sub-basin scale for an area of at least 10,000 Sq. Km encompassing the key components of Sedimentation studies namely input data development and its validation, model development for high flow and low flow season, remote sensing based river morphology, testing and verification on the selected river basins, analyses of model results, development of user friendly model interface/dashboard for linking the model with online data bases. The Firm / research institute must have experience of working with governments/ state owned enterprises.

d) The firm(s) / research institutes, including the JV partners and sub-consultants, should have at least 40% of the key professionals, including Team Leader as permanent employees.

e) The Firm should have sound financial performance and resources i.e. the firm should have average Annual turnover (last five financial years) of more than USD 2.70 million. -In case of JV, the lead member shall have minimum USD 1.90 million of average annual turnover and other members shall be minimum USD 0.80 million.

f) In case of Research Institute meeting the eligibility requirements intending to apply solely or as JV for these studies, the average annual turnover clause at (e) above would not be applicable.

In case of JV among research Institute and any private entities, the annual turnover shall be as under:

i) If the lead is private member, he shall have minimum USD 1.9 million of average annual turnover, ii) if private entity is only a member partner, he shall have minimum USD 0.80 million

**The attention of interested Consultants is drawn to paragraph 1.9 of the World Bank's Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers dated January 2011 ("Consultant Guidelines"), revised Jul 2014, setting forth the World Bank's policy on conflict of interest.**

**A consultant will be selected in accordance with the Least Cost Selection (LCS) method set out in the Consultant Guidelines. Interested Consultants may obtain further information from the Contact Person (mentioned below) between 10 AM and 5 PM on all working days.**

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E-mail: rdcdte-cwc@nic.in

The bidders are required to follow the following instructions as detailed below:

## 1. Instruction to bidders

i). e-EoI will be available on the NHP's website at URL http://nhp.mowr.gov.in. The prospective bidders are required to register on e-procurement website i.e. https://eprocure.gov.in/eprocure/app at no cost and prior to the submission of proposals. The bidders are also required to have a Digital Signature (DSC) from one of the Government of India authorized Certifying Authorities in order to submit a proposal on line at the web address indicated above (https://eprocure.gov.in/eprocure/app), The list of the authorized Certifying Authorities can be found on http://www.cca.gov.in/cca/.

ii). The prospective bidders are required to submit the bid online at NIC e-procurement website i.e. https://eprocure.gov.in/eprocure/app from 03.05.2019 (09.00AM) to 10.06.2019 (03.00 PM).

iii). Intending Bidders are advised to visit again NIC e-procurement web site URL https://eprocure.gov.in/eprocure/app and NHP website http://nhp.mowr.gov.in.at least 1 days prior to closing date of submission of tender for any corrigendum / amendment.

**Annexure-I**

**Expression of Interest Form for Consulting Engineering Firm or Joint Venture (To be filled up by each of the constituent in case of a Joint Venture)**

*1.*

| Consultant | Date of Establishment | Country | Type of organization | | | |
|---|---|---|---|---|---|---|
| | | | *Individual* | *Partnership* | *Corporation* | *Other* |
| *Name* | | | | | | |

2. *Corporate/registered Office / Business Address / Telephone Nos. / Cable Address/ E-mail address of consultant and its branch offices for Consultant (including members in case of JV)*
3. *Consultant's firm name and year of establishment (including that of members in case of JV)*
4. *Narrative description of Consultant firms if any (Use other sheet, if necessary)*
5. *Name of, not more than two (2) principals who may be contacted with title, telephone number/ fax number, E-mail address.*

***Annexure-II***

**Financial Statement of the three financial Years**

| ***Sr. No.*** | ***Particulars*** | | ***2017-2018*** | ***2016-2017*** | ***2015-2016*** | ***2014-2015*** | ***2013-2014*** |
|---|---|---|---|---|---|---|---|
| *1.* | *Annual turnover from Consulting business* | *Lead member* | | | | | |
| | | *other member(1)* | | | | | |
| | | *other member(2)* | | | | | |
| *2* | *Net Profit.* | *Lead member* | | | | | |
| | | *other member(1)* | | | | | |
| | | *other member(2)* | | | | | |

***Notes:***

i. Values should be duly certified by statutory body like Chartered Accountant or Independent Auditors who are competent to do so as recognized by the Government of India.

ii. The amount shall be stated in Indian Rupees (INR).

iii. For the purpose of short listing, conversion to Indian Rupees shall be based average of the buying and selling rates of Reserve Bank of India as on the Proposal submission date.

iv. In case the exchange rate for any currency is not available as per the provision of this section, then Ministry of Water Resources, RD & GR reserves the right to use the rate available from an alternative source at its sole discretion.

***Annexure-III***

## Organizational Strength

### 1. Staff strength of the Organization/s

| S No. | Area of Expertise* | Total No. of Staff | No. with Doctoral Degree | No. with Post-graduate Degree | No. with Graduate Degree | No. of Permanent Employees | No. of years with the firm |
|---|---|---|---|---|---|---|---|
| i. | Senior Hydrologist | | | | | | |
| ii. | Geomorphologist | | | | | | |
| iii. | Hydrologic/Hydraulic Modeler | | | | | | |
| iv. | Junior Hydrologist | | | | | | |
| v. | Remote Sensing expert | | | | | | |
| vi. | IT Programmer / Database Specialist | | | | | | |

**** Area of Expertise***

| Project Position | Minimum Qualifications and Experience |
|---|---|
| Team Leader/Senior Hydrologist | 1. Masters in Hydrology, Hydraulic and / or Water Resources engineering.<br>2. At least 15 years working experience in water resources.<br>3. Preferably having sound knowledge of hydrological, hydrodynamic & Sediment modelling tools used in Sedimentation & Morphological studies. |
| Deputy Team Leader/ Geomorphologist | 1. Bachelor's Degree in Geology / Geography / Civil Engineering / Environmental or related field<br>2. Masters degree in Geomorphology / sedimentology / geology or related field<br>3. At least 12 years working experience in geomorphological / sediment transport / geological studies<br>4. Preferably having knowledge of hydrological, hydrodynamic & Sediment modeling tools used in Sedimentation & Morphological studies. |
| Hydrologic/Hydraulic Modeler | 1. Degree in Hydrology, Hydraulic and / or Water Resources engineering.<br>2. At least 10 years working experience in sediment transport/ sedimentation/ Hydrological modeling with efficient working knowledge of GIS. |

| | |
|---|---|
| | 3. Extensive knowledge of hydrological and hydrodynamic modeling tools used in sedimentation analysis; should have a very good experience with sedimentation and morphological modeling.<br>4. Proven experience in setting up models for sedimentation in large river basin.<br>5. Experience in the study of morphological conditions of rivers, Engineering/ non-engineering Catchment Area Treatment Methods. |
| Junior Hydrologist | 1. Degree in Hydrology, Hydraulic and / or Water Resources engineering.<br>2. At least 10 years working experience in sediment transport/ sedimentation/ Hydrological modeling with efficient working knowledge of GIS.<br>3. Extensive knowledge of hydrological and hydrodynamic modeling tools used in sedimentation analysis; should have a very good experience with sedimentation and morphological modeling.<br>4. Desirable: experience in application Software Development / design in Water resources sector; experience in setting up models for sedimentation in large river basin; experience in the study of morphological conditions of rivers, Engineering/ non-engineering Catchment Area Treatment Methods |
| Remote Sensing expert | 1. Masters Degree in Remote Sensing / Geo-informatics / Geology or related field<br>2. 5 year experience in Remote Sensing for river mapping, experience in integrating global satellite derived data; experience in hydrologic application, 3D analysis, morphological mapping<br>3. Extensive knowledge in GIS customization, preparation and integration of GIS datasets, |
| IT Programmer / Database Specialist | 1. Graduate in Engineering in Computer Science/IT Database<br>2 year experience in data base applications for Database specialist ; |

***Annexure-IV***

**Office Logistics and Software Availability**

a) Office space in sq. m. and ownership status

b) List of Hydro-Metrological along with Modelling Software available

| Name of Software | Whether Web Enabled? | Number of Concurrent Users | Cost of Purchase In Rs. | Year of Purchase | Utility and Functions of the Software |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

***Annexure-V***

**Details of Experience**

| Sr. No | Projects Name / Year | Type of services rendered including' (A, B, C, D, E) | Cost of the assignment of category 'A' Rs. in Cr. | Cost of the assignment of category 'B' Rs. in Cr. | Cost of the assignment of category 'C' Rs. in Cr. | Cost of the assignment of category 'D' Rs. in Cr. | Cost of the assignment of category 'E' Rs. in Cr | Client (With complete address, contact person, telephone No. Fax No and E mail address) | Fee in INR (Applicant's share in case of JV/ Consortium) | Completion certificate from client (Reference page no) | Duration in months | Funding Agency | Sole / JV/ Consortium (if JV-state Lead /Partner with share) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 1 | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | |

A. Sedimentation analysis and its modeling and sediment transport modeling

B. Hydrological analysis and modelling, validation and filtering of hydro-meteorological data sets

C. Morphological studies

D. Dashboards for hydro-meteorological applications

E. Capacity building and trainings in the field of hydro-metrological analysis, sediment analysis etc.

***Note:*** Only those assignments shall be considered for which consultant has provided services as lead member in case that work is done by a JV/ Consortium. Each assignment shall be supported by following details:

Name of Overall assignment : .....

Location of Overall assignment : .....

Owner's Name and Address : .....

Completion (Actual/Estimated vis-à-vis Stipulated): .....

Description of assignment: .....

Description of Services provided by the firm: .....

Authorized Signatory

Name of the client:

***Annexure-VI***

## Employer's References

***Annexure-VII***

**Undertaking**

I certify that the information in the above Expression of Interest forms is true to the best of my knowledge. I also understand that any misleading or wrong information will disqualified this application straightaway.

*President/*Managing Director

or

*Authorized Signatory of Applicant*