3212

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL PRINCIPAL BENCH, NEW DELHI

Original Application No. 303 of 2023

Karanvir Thaman

....Petitioner/Applicant

Versus

State of Punjab and Others

.....Respondents

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NOTARY RAJNI BALA Advocate Distt. Ferozepur (Pb) Regd. No. 4476 Exp. Dt. 25/03/30 GOVT. OF INDIA

Submitted by

(Krishan Kumar)

Principal Secretary to the Government of Punjab, Department of Water Resources, Chandigarh

Place: Chandigarh

Dated: 03-10-25

NOTARY
RAJNI BALA
Advocate
GOVT. OF INDIA

3214

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL PRINCIPAL BENCH, NEW DELHI

Original Application No. 303 of 2023

Karnvir Thamman (aged about 52 years) S/o Sh. Sham Lal Thamman, R/o Imli Wala Mohalla, Banur, Tehsil & District SAS Nagar, Mohali Punjab), Mobile No. 9872305234, Email Address:shentythamman@gmail.com

.....Applicant

Versus

1. State of Punjab through its Chief Secretary, Punjab Civil Secretariat, Chandigarh, Contact No. 0172-2740156, Email Address:-cs@punjab.gov.in.
2. Department of Water Resources, Government of Punjab, through its Principal Secretary, Room no. 606, 6th floor, sector-9, Mini Secretariat, Chandigarh. 16009, Email-ps@punjab.gov.in Contact no-0172-2742307.
3. Director, Department of Rural Development and Panchayat, Government of Punjab, Vikas Bhawan, Sarovar Path, Phase 8,Sector 62, SAS Nagar (Mohali)- 160062, Contact No.0172-5062522, Email Address:- dir.rdp@punjab.gov.in
4. Punjab Pollution Control Board, Punjab Zonal Office-1, Vatavaran Bhawan, Nabha Road, Patiala through its Secretary, Contact no. 0175-2215793, Email chairman.ptl.ppcb@punjab.gov.in

5. Deputy Commissioner cum District Magistrate Ferozepur, Deputy Commissioner Office 1st Floor, DC Office, District Administration Complex, Ferozepur Cantt 152001, Contact no. 01632-244054, Email-dc.frz@punjab.gov.in

6. Deputy Commissioner, Tarn Taran, District Administrative Complex, Harike Road, Tarn Taran, Punjab. Pin Code- 143401, Contact no. 01852- 2241101, Email-dc.ttn@punjab.gov.in

.....Respondents

Status Report by way of Affidavit of Krishan kumar, Principal Secretary to Government of Punjab, Department of Water Resources Chandigarh in compliance of order dated 28.07.2025.

RESPECTFULLY SHOWETH:-

I, the above named deponent do hereby solemnly affirm and declare as under:-

1. That the present Original Application is pending for adjudication before this Hon'ble Tribunal and is listed for hearing on 07.10.2025.
2. That on previous date of hearing i.e 28.07.2025, this Hon'ble Tribunal was pleased to pass the following orders:

"2. The progress which has been made thereafter has not been placed on record. Shri Hardeep Singh Mendiratta Chief Engineer, Water Resource Department appearing virtually has submitted a revised MoU has been entered into with the Survey of India for supplying the satellite imagery for demarcation of flood plain. No such details are on record even the date of the

MoU or revised MoU with Survey of India have not been disclosed.

3. In such circumstances, we require the Principal Secretary, Water Resources Department, Govt. of Punjab to file a fresh affidavit within two weeks disclosing the steps which have been taken for the demarcation of flood plains on the above stretch and the progress, in this regard.."

3. That it is respectfully submitted that a status report by way of affidavit dated 23.07.2025 was submitted by the department before this Hon'ble Tribunal, explaining that the Department of Water Resources, Punjab, is in the process of signing MOU with the Survey of India to provide services for Digital Elevation Modeling and Digital Ortho-Imagery for Flood Risk Mitigation/Mapping of the area along River Satluj. In this regard, a meeting was held between Chief Engineer, Drainage – cum – Mining & Geology, Department of Water Resources, Punjab, and Director, Survey of India, Chandigarh, on dated: 18.07.2025, deliberating about the terms & conditions of MOU.

4. That the issue under consideration of this Hon'ble Tribunal is related to the demarcation of Flood Plain Zoning of river Sutlej in assured 47 kms stretch falling under District Ferozepur and Taran Taran, for maintaining river ecology. This Hon'ble Tribunal vide orders dated 27.05.2024 directed to carry out the demarcation of Flood Plain Zoning by adopting the proper acceptable methodology as done while demarcating flood plain zone of river Yamuna by obtaining the map from survey of India with one meter contour.

5. That in this regard it is respectfully submitted that the Chief Engineer (HSO), CWC, New Delhi has also sought DEM data with finer resolution for carrying out studies related to flood management/carrying capacity of

river Satluj, for which DEM applications by LiDAR (Remote Sensing Technique) was required in a length of 98 KM of River Sutlej from downstream Nangal Dam to Rahon- Macchiwara Bridge. (A copy of Letter of CWC, New Delhi is annexed herewith as **Annexure R-1**).

6. That it is further submitted that to get the services of Survey of India in this context, the Water Resources Department had initially procured the cost estimation from the Surveyor General of India, Dehradun, Uttrakhand, for Acquisition, Processing and Delivery of Digital Elevation Model (DEM) & Digital Ortho Rectified Image (ORI) for Flood Risk Mitigation Mapping of Area along Rivers: Sutlej, Beas & Ghaggar. Whereas, the office of Surveyor General of India vide letter no. 1152/1147-Project (PHHC GD)/16636 Dated: 25.07.2024, had provided a cost estimate as Rs. 27.87 Cr. A copy of Letter dated: 25.07.2024, along with cost estimate is annexed herewith as **Annexure R-2**).

7. That due to fund limitations, the Water Resources Department, Punjab, restricted the combined project to get the flood plain zoning of River Sutlej in a total reach of 145 KM, covering 98 KM (as per requirement of the CWC, New Delhi) and 47 KM (matter under consideration of the Hon'ble Tribunal).

8. The Project amounting to Rs. 5.83 Cr named as: "Provision of Services for Acquisition, Processing and Delivery of Digital Elevation Model & Digital Ortho-Image for Flood Risk Mitigation/Mapping of Area along River Sutlej", is proposed under non-structural measure head, contingency fund 'State Disaster Mitigation Fund'. The relevant information about project provision is annexed as **Annexure R-3**.

9. That as per the set procedure of State Disaster Mitigation fund (SDMF), the approval of project involves sanction by Technical Advisory Committee (TAC), then by Project Appraisal Committee (PAC) & finally

by State Executive Committee (SEC). therefore, the DPR was submitted by the Water Resources Department, Punjab, vide Memo No. 1666/CE/DRG/2024 Dated 09.10.2024, to the Department of Revenue, Rehabilitation & Disaster Management, Govt. of Punjab, which was cleared by the TAC vide Memo No. 2/1/2022-2 DM-1/18848-57 Dated 12.11.2024. Copies of Memo dated 09.10.2024 and 12.11.2024 are annexed as **Annexure R-4 & R-5** respectively.

10. That after receiving clearance of the DPR from TAC, the project was submitted to the Project Appraisal Committee (PAC) by the Water Resources Department, Punjab, vide Memo no. 2137-40/CE/DRG/2024 dated 23.12.2024 & the appraisal was done on dated 31.01.2025. copies of Memo dated 23.12.2024 & Minutes of meeting dated 31.01.2025 are annexed herewith as **Annexure R-6 & R-7** respectively.

11. That after the appraisal of the project by the PAC, the project was put forth before the State Executive Committee (SEC) by the Department of Revenue, Rehabilitation & Disaster Management, Govt. of Punjab, itself. The meeting for which was held on dated 04.06.2025 & project was approved by the SEC. Minutes of meeting dated 06.05.2025 are annexed as **Annexure R-8**.

12. That the technical sanction was given by the Water Resources Department, Punjab, on dated 30.06.2025 (**Annexure R-9**). Afterwards, the department remained in continuous liaison with the Survey of India, for processing of the Digital Elevation Modelling(DEM) and Digital Ortho-Imagery for Flood Risk Mitigation/Mapping of the area along River Satluj. The complete details have been provided in the Status Report dated: 23.07.25.

13. The it is respectfully submitted that finally the MOU has been signed between the Water Resources Department and the Survey of India on

NOTARY RAJNI ALAG Advocate GOVT. OF INDIA

28.08.2025. As per the MOU, the time frame to be taken by the Survey of India is Ten (10) Months, subject to natural and administrative constraints. Copy of MOU is annexed herewith as **Annexure R-10.**

In view of the submission made herein above, it is respectfully prayed that the above Status Report may kindly be taken on record and sufficient long time may kindly be granted to the State of Punjab to complete the Flood Plain Zone work, in the interest of justice.

Deponent

(Krishan Kumar)
Principal Secretary to the Government of
Punjab, Department of Water Resources,
Chandigarh

Place: Chandigarh

Dated: 03-10-2025

Verification:-

Verified that the Contents of Para No. 1 to 13 of above affidavit are true and correct to my Knowledge as per information derived from the official record. No part of it is False and nothing has been concealed therein.

Deponent

(Krishan Kumar)
Principal Secretary to the Government of
Punjab, Department of Water Resources,
Chandigarh

Place: Chandigarh

Dated: 03-10-2025

ATTESTED
to be true photocopy
5/10/2025
RAJNI BALA
Notary App. By Govt. of India
Distt. Courts & Teh. Complex,
FEROZEPUR (PB.)

Annexure R-1

सेवा में,

मुख्य अभियन्ता
सिंधु बेसिन संगठन, केन्द्रीय जल आयोग,
कमरा नं. 617, ब्लॉक-4, 6वीं मंजिल,
केन्द्रीय सदन, सेक्टर 9-ए,
चंडीगढ़-160009

विषय/Sub : Maintaining Full Reservoir Level (FRL) in Bhakra Dam & Pong Dam- reg.

संदर्भ/Ref :Minutes of Meeting.पत्रसंख्या: T-11075/2/2023-FFM-Part-1 दिनांक: 23.08.2024.

महोदय,

Please refer to Minutes of Meeting(MoM) of the 4th meeting of the committee constituted for joint flood management study in wake of the extensive floods in the States of Himachal Pradesh, Punjab and Uttarakhand in 2023 held on 22nd August, 2024 at New Delhi under the chairmanship of Chairman, CWC circulated vide letter dated 23.08.2024 (attached). In the minutes under item No. 3,Chairman, CWC indicated that "that the issue of the Satluj river carrying capacity can be addressed separately once the states of Himachal Pradesh and Punjab provide a detailed Digital Elevation Model (DEM) with finer resolution". Further, Chairman, CWC directed to share all relevant data as well as information with Hydrology Studies Organisation of CWC for carrying out any studies related to flood management/ carrying capacity of river Beas downstream of Pong Dam within the mandated ToRs of the committee. However, no such DEM and all relevant data have been provided till date by states of Himachal Pradesh and Punjab

In view of above, it is requested kindly coordinate with the Govt. of Himachal Pradesh and Govt. of Punjab to provide the requisite data/information in terms of aforesaid MoM.

This issues with the approval of Chief Engineer (HSO), CWC, New Delhi.

Encl: As above.

भवदीय,

Signed by Goverdhan Prasad
Date: 15-05-2025 12:19:13
Reason: Approved

(गोवर्धन प्रसाद/Goverdhan Prasad)
निदेशकDirector

प्रतिलिपि:

1. Chief Engineer (FMO), CWC, New Delhi.
2. Chief Engineer, Drainage, WRD, Punjab
3. Chief Engineer, HPJSV, Himachal Pradesh.
4. Sr. Joint Commissioner (Indus), Indus Wing, Ministry of Jal Shakti, New Delhiwrt to letter No. Y-13011/3/ Dated 03.04.2025.

भारतीय सर्वेक्षण विभाग
SURVEY OF INDIA

सर्व शिक्षा अभियान
सब पढ़ें सब बढ़ें

टेलिफैक्स Telefax +91-135-2744064, 2743331
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भारत के महासर्वेक्षक का कार्यालय
Office of the Surveyor General of India
हाथीबड़कला एस्टेट, डाक बक्स सं. 37
Hathibarkala Estate, Post Box No. 37
देहरादून - 248 001 (उत्तराखण्ड), भारत
DEHRADUN - 248 001 (UTTARAKHAND), INDIA

NO. T- 1152 /1147-Project (PHHC GD)/16636 **Date:25 July, 2024**

To,

The Chief Engineer,
Drainage-cum-Mining and Geology,
Department of Water Resources,
Chandigarh.

SUB: Work of provision of services for acquisition, processing and delivery of Digital Elevation Modelling and Digital Ortho-Image for flood risk mitigation / mapping of area along river Sutlej, Beas and Ghaggar. - Reg.

Ref: Your office letter no. 923/PA/CE/D.g./2024 dated 17-06-2024.

With reference to the letter cited above, a Detailed Proposal prepared by SOI and approved by the Surveyor General of India is enclosed herewith.

Also, following may be noted:

1. It is to be noted that the proposal is prepared considering the area as provided in the project report submitted through referenced letter.
2. The cost as submitted are estimates only. The final cost of the project will be discovered after open tendering and subsequent price discovery.

In case of any queries, please feel free to contact this office.

This is for your information and further necessary action, please.

(Misal Roshan Srivastava)
Superintending Surveyor,
for Surveyor General of India
e-mail :misal.srivastava.soi@gov.in
sgo.technical.soi@gov.in
Tel No. : 0135 - 2747058

Copy to : Sr. PS to SGI, for kind information please.

PROJECT PROPOSAL

for

PROVISION OF SERVICES

for

ACQUISITION, PROCESSING AND DELIVERY

of

DIGITALELEVATION MODEL [DEM]

&

DIGITAL ORTHO RECTIFIED IMAGE[ORI]

for FLOOD RISK MITIGATIONMAPPING OF

AREA ALONG RIVERS: SUTLEJ, BEAS & GHAGGAR

Prepared by	Prepared on request of
SURVEY OF INDIA **DEPARTMENT OF SCIENCE & TECHNOLOGY** **GOVERNMENT OF INDIA**	**WATER RESOURCES DEPARTMENT,** **GOVERNMENT OF PUNJAB**

1. Introduction:

The extensive flooding in the state of Himachal Pradesh, Punjab and Uttarakhand in 2023 necessitated a review of issues related to flood management in these States. A Committee was thus constituted by Department of Water Resources, RD&GR(Flood Management Wing),under the Chairmanship of the Chairman of Central Water Commission (CWC), through their orderno. I/87733/2023 dated 04-09-2023. The mandate of the committee is to conduct a joint flood management study in wake of the extensive floods in the state of Himachal Pradesh, Punjab and Uttarakhand. In its 2nd meeting dated 29-02-2024, the committee decided that the State Governments of these three states shall prepare DEM of area covering Satluj, Ghaggar and Beas rivers, in their own territorial extent, as per the standards & specifications of SoI.

Consequently, O/o Chief Engineer/ Drainage-Cum - Mining & Geology, Water Resources Department, Chandigarh, Punjab has requested Survey of India to get this work done for the state of Punjab. A detailed proposal for preparing Orthometric Height (~MSL) based Digital Elevation Model and Digital Ortho Rectified Imageof river basinsup to 5km from each bank for flood risk mitigation/mapping of area along river Sutlej, Beas and Ghaggar. (Attached as Annexure as received from WRD, Got of Punjab)

The Project is prepared with following advantages in mind

1. The generation of a digital elevation model plays a major role in Modernization of flood monitoring system.
2. The project has been prepared for flood mitigation measures by means of Digital Elevation Model (DEM) [i.e. both Digital Surface Model (DSM) and Digital Terrain Model (DTM)] using Remote sensing techniques i.e both LiDAR and Optical Sensorsfor area covering River Sutlej, River Beas &River Ghaggar.By using DEM, flood routing and topography of river basins up to 5km from each bank of the rivers can be determined and used for better preparedness of Department of Water Resources and local administration, so that they can conduct flood preparation works effectively.
3. The Digital computational data gathered by DEM project will be easily accessible and usable to the administrative agency or the Stake holder on local scale.
4. Project will modernized and enhance the ability of the concerned department and institution to understand the terrain significantly and topography of rivers, to take preventive measure by the data accumulated by the DEM.
5. Digital Ortho rectified Imagery [ORI] will also be generated for understanding the topographical features in the project area. This will aid in better understanding of the project area and in turn will result in more efficient decision making. Also, it will be used as reference with future surveys for change detection in the river basin area.
6. The project will enable the authorities to assess the impact of both natural and man-made features upon flood risk by identify the topography of river basin up to 5km from each bank.

2. Project Area:

The area for which the 'Provision of services for Acquisition, Processing and Delivery of DEM and Digital Ortho Rectified Imagery data', in the flood plains of Sutlej, Beas and Ghaggar river basins is required, covers the river bed (with or without water),up totheir banks and a buffer zone of 5(five) km on

either side of the river banks. The total area is approximately 7350 square km as provided by Water Resource Department, Govt of Punjab.

Project area for tendering purpose will be as per the 1:50,000 Toposheet published by Survey of India. The actual area of the project will be as per the ground reality. The same will be determined by ORI generated in the Subject Project. A maximum 25% variation between planned project area and actual project area will be permissible. In case, there is variation of more than 25%, then the same will be considered under this project's scope only after the approval of the project sanctioning authority/approving authority.

The river Sutlej passes through the districts of Ropar, SBS Nagar, Ludhiana, Jalandhar, Moga, Ferozepur, Fazilka, Tarn Taran and Kapurthala. The river Beas passes through the districts of Gurdaspur, Hoshiarpur, Amritsar, Tarn Taran and Kapurthala. The river Ghaggar passes through the districts of Patiala, Sangrur and Mansa.

Sl. No.	Description	Approximate Area (sq km)#
1	River Sutlej	3060
2	River Beas	1200
3	River Ghaggar	3090

#provided by Govt of Punjab.

3. Scope of Work:

1) Provision of Ground control/Check Points:
   a. This part includes planning, creation, observation, computation, of Ground Control/Check Points.
   b. Existing CORS (Continuously Operating Reference Station) of Survey of India and Control points established under various mapping work shall be utilized for provisioning the Horizontal Control/Check points for the project.
   c. Provision of Vertical Control/Check Points will be based on the Geoid Model developed by SoI based on Indian Vertical Datum.
   d. High Precision levelling/ DT Levelling would be carried out if necessary for achieving the objectives of the Project.
   e. About 75 Control Points per 1000 sq km and about 100 check points per 1000 sq km will be provisioned in the project.

2) Aerial Data Acquisition [LiDAR+ Optical]{including planning and other preparatory works}:
   a. Flight planning, sensor calibration, Flight execution as per plan, QA/QC for review of flight line alignment, raw data validation for completeness, avoiding data voids, strip matching, pre-processing of on-board GNSS/IMU data for trajectory file and other pre-processing steps needed for point cloud extraction/ preparing data for post-processing stage.
   b. Obtaining necessary clearances from relevant ministries as per the extant rules of GoI and other agencies for flying over the survey area and to acquire data.
   c. Mobilization of all necessary equipment, software and hardware for carrying out the activity.

d. Assistance from Govt. of Punjab will be required wherever necessary for getting necessary administrative approvals and smooth execution of survey and mapping related activities such as data acquisition, field validation, etc.
e. Acquisition of Raw Digital data by Aerial Platform for generating Digital Elevation Model (DEM) of 0.25mvertical accuracy (RMSE) and Digital Ortho Rectified Imagery of 10cm GSD (Ground Sampling Distance) with 0.20m Horizontal Accuracy. LiDAR survey and Digital photogrammetry of the area shall be carried out by the SOI through outsourcing using Aerial platform with onboard LiDAR and Optical Sensors integrated with on-board GNSS and IMU to generate Digital Elevation model (DEM) of 0.25m accuracy (RMSE) and Ortho rectified image of 10cm GSD with 0.20m Horizontal Accuracy.
f. If the case arises in which Aircraft flying is not permissible in any particular area pocket as per the extant rules, UAVs with Optical &LiDAR Sensors will be the platform for data acquisition in such area pockets. This will ensure continuity of Data (DEM/ORI, Contours) in such area pockets.

3) Post Processing for generation of DEM [DSM and DTM] and Digital Ortho Rectified Imagery:
   a. This part includes generating Digital Surface Model (DSM) from raw/ pre-processed data and performing necessary editing/ filtering of non- ground points (vegetation, built-up areas, bridges, elevated structures etc.) for generating bare-earth DEM [DTM] of 0.25m accuracy (RMSE).
   b. Conversion of Ellipsoidal Height Based DEMs to Orthometric height DEMs usingGeoid model developed by SoI.
   c. Generationof Ortho-imagery of 10 cm GSDwith 0.20m Horizontal Accuracy (RMSE).
   d. QA/QC at various stages of project including horizontal and vertical accuracy validation as per specifications.
   e. Proper Cataloguing of all data.

4) Feature Extraction: Topographical features shall be derived from Ortho-rectified image using suitable GIS software. The base map shall comprise of various layers in GIS format as per the requirements of the project.Geospatial Data Model used in NHP project by SOI will be deployed for better consistency of data.

5) Generation of Final Deliverables: Map template on 1:25k scale in .pdf and Geo package (open source). Contour at 0.5 m interval in vector format (.shp). Geospatial Data Model used in NHP project by SOI will be deployed for better consistency of data.

6) Final Deliverables: QA/QC of the final deliverables and proper cataloguing of raw data, project files and documents, map templates, etc. before delivery.

7) Storage and Management of Data acquired/Generated:
   a. Several Terra Bytes (TB) of Data will be acquired and generated during the course of the project. Hence, to store and maintain a copy of all the data generated in the

project, a robust storage will be provisioned compatible with Geo-ICT Infrastructure of SOI.

b. A similar storage will required to be provisioned in Government of Punjab also for maintaining a copy of all the data for records and further utilization by Govt of Punjab.

8) Training: Training of Govt of Punjab Officers and Staff as per the requirement at National Institute of Geo-informatics Science and Technology (NIGST), Hyderabad, the training institute of SOI. The Training related costs will be borne by Govt of Punjab.

4. Roles and Responsibilities:

a. Survey of India:

i. SOI will plan, execute including outsourcing and deliver the project. This will result in generation of SOI mandated fundamental theme as per NGP-2022 i.e ORI and DEM. Procurement of goods and services will be done as per the extant Public Procurement Rules and Guidelines of Government of India.

ii. SOI will hand hold and provide training as per the requirement of Govt of Punjab at NIGST, Hyderabad for geospatial skill development of its officers and staffs..

iii. One copy of the data and maps will be maintained by SOI as per the mandate of NGP-2022 as a part of National Digital Spatial Framework.

b. Govt. of Punjab (GoP):

i. Assistance from Govt. of Punjab will be required wherever necessary for getting necessary administrative approvals and smooth execution of survey and mapping related activities such as data acquisition, field validation, etc.

ii. GoP will provide funds to SoI through Government approved channel.

5. Deliverables:

1) Ellipsoidal height (WGS-84) based Digital Elevation Model (DSM & DTM) with 0.15 m vertical accuracy (RMSE).
2) Orthometric Height Based Digital Elevation Model (DSM & DTM) with 0.25 m vertical accuracy (RMSE). Orthometric height DEM will be generated using Geoid Model developed by SOI.
3) Ortho-Rectified Imagery at 10cm GSD with horizontal accuracy of 0.20 m accuracy or better (RMSE) in Geo-Tiff format.
4) Contour at 0.5 m interval in vector format (.shp).
5) Topographical maps on 1:25k scale in '.pdf' and 'Geo-package' (open source). Geospatial Data Model will be as per NHP project.

6. **Fund Provision and Cost Estimate*** **(Total Area of 7350 sq km):**
   1) Funds for the project will be provisioned by Govt of Punjab.
   2) Cost Estimate:

Sl No.	Activity	Cost (in Rs per sq km)	Amount (Rs)
1	Provision of GCP and vertical control	1700	1,24,95,000
2	Data Acquisition	16,000	11,76,00,000
3	Data processing	1,250	91,87,500
4	ORI & DEM Generation	1,450	1,06,57,500
5	Post processing (DEM editing, DTM & contour generation, etc.)	2750	2,02,12,500
6	QA/QC of ORI/DEM	1000	73,50,000
7	**Total (1 to 6)**	**24,150**	**17,75,02,500**
8	Feature Extraction including QA/QC	4000	2,94,00,000
9	**Total (7+8)**	**28,150**	**20,69,02,500**
10	Storage with Smart Rack	@500TB [usable]	75,00,000
11	**Total(9+10)**		**21,44,02,500**
12	@10% of Sl.No. 11, for unforeseen expenses.		**2,14,40,250**
13	@20% of Sl.No. 11, to cover expenses incurred towards usage of SOI equipments and other expense on travel etc. of SOI personnel - For control provisioning, Levelling, WorkStations etc. to be used for QA/QC/Audit of Deliverables etc.		**4,28,80,500**
14	**Grand Total (11 to 13)**		**27,87,23,250**

*These are estimates only. The final cost of the project will be discovered after open tendering and subsequent the price discovery.

7. **Time Schedule**: 12 months [subject to the natural constraints and administrative clearances or any other unforeseen exigencies].

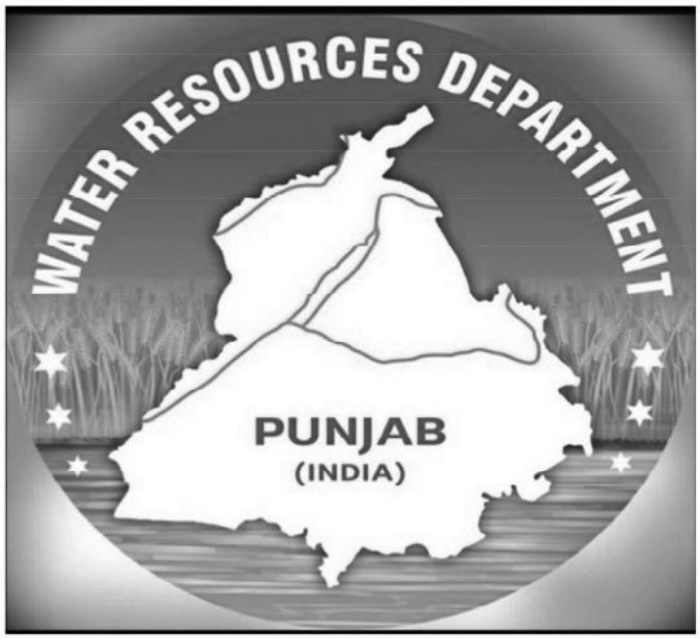
8. **Relationship** between SOI, GoI and WRD, Govt of Punjab shall be Principle-to-Principle. Any dispute will be settled mutually by both the Departments, if necessary.

Annexure R-3

GOVERNMENT OF PUNJAB

WATER RESOURCES DEPARTMENT,

PUNJAB



DETAILED PROJECT REPORT (DPR)

FOR

PROVISION OF SERVICES FOR ACQUISITION, PROCESSING AND DELIVERY OF DIGITAL ELEVATION MODEL AND DIGITAL ORTHO-IMAGE FOR FLOOD RISK MITIGATION/MAPPING OF AREA ALONG RIVER SUTLEJ, BEAS AND GHAGGAR.

Submitted by: -

Executive Engineer, Ludhiana
Drainage -cum- Mining and Geology
Division Ludhiana, WRD, Punjab.

EXECUTIVE SUMMARY

Punjab, located in the northwest region of India, shares its borders with Pakistan on the West, the Indian States of Jammu and Kashmir on the North, Himachal Pradesh on its North-east and Haryana & Rajasthan to its South. The state spans an area of 50362 square kilometers and occupies 1.54% of India's total geographical area. Its capital city is Chandigarh. As of Census 2011, the total population of Punjab stands at 277.04 lacs, with the rural population accounting for around 173.05 lacs and the urban population at 103.99 lacs. Punjab is divided into twenty-three districts, each under the administrative control of a District Collector. The state also boasts 169 urban local bodies

Punjab, known as the granary state of India, heavily relies on agriculture for its input-output system. Timely irrigation plays a vital role in sustaining agriculture, as most of it depends on monsoon. Unfortunately, global warming has already impacted monsoons, making it more important than ever to have proper irrigation systems in place. This is especially true for agriculture in the rain-fed, drought-prone, desert, and high-hill regions with scanty rains. Punjab's agriculture provides essential food security for the country, but the expansion of economic activities and high-yielding cash crops has led to an increasing demand for water, causing great stress on available water resources in the State.

In the circumstances when the temperature is rising globally and glaciers are melting, increasing the river levels and thereby may lead to devastating effects on the areas near these rivers; it becomes essential to make strategies for flood risk mitigation which may help in reducing the stress on the river infrastructure and the precious lives, livestock and livelihood is saved.

To relieve stress, there is a greater need for an efficient flood mitigation system with the help of the community awareness which can help for protection of the lives, livestock lives, livelihood, and infrastructure such as roads, bridges, etc. Given that water is a precious natural resource, every single drop must be utilized efficiently. As this project has been prepared for flood mitigation measures by doing Digital Elevation Modelling (DEM) using LiDAR and Remote sensing technique in River Sutlej, River Beas & Ghaggar River by which flood routing and topography of river can be determine for better preparedness done by Department of Water Resources and local administration can conduct flood preparation works effectively.

Preparation of Proposal under SDMF:-

- The proposal has been prepared following the Guidelines issued by the National Disaster Management Authority, Government of India vide dated 14.01.2022, 28.02.2022 and 06.03.2023.
- It is hereby clarified that the funds requested under proposed DPR shall not be used for general environment improvement or landscape beautification and for funding the existing Government programmes/ongoing schemes etc.
- It is clarified that funds shall not be utilized for regular maintenance and upkeep of any structure or engineering measure aimed at mitigation.
- It is clarified that funds shall not be utilized towards the establishment expenditure such as salaries, office expenditures etc.

DECLARATION

It is certified that:

i) Funds available under SDMF shall not be used for general environmental improvement or landscape beautification and for funding the existing Government programmes/ongoing schemes etc.

ii) Mitigation Fund should generally not be used for maintenance and upkeep of any structure or engineering measure aimed at mitigation. This fund should be used for developing and implementing new projects. The mitigation measures that have been implemented, should be maintained through other sources of funding.

iii) Resources under Mitigation Fund cannot be used towards the establishment expenditure such as salaries, office expenditure etc. to be incurred by the Disaster Management Authorities or other entities, except for payment of remuneration to technical staff included in the project's costs. Such payments will be as per the GFR2017 and extant Government of India guidelines.

Sub Divisional Officer
Phillaur Bandh Sub Division
Ludhiana

Executive Engineer/Ludhiana
Drainage-cum-Mining & Geology Division
Water Resources Department, Punjab

DECLARATION

1. Pursuant to the recommendation of the Technical Advisory Committee (TAC), it is hereby declared that the social auditing of the project will be conducted by forming committees consisting of key stakeholders at the village level, which may include Sarpanches, Namberdars, or other relevant stakeholder.
2. Furthermore, it is affirmed that all statutory regulations have been taken into account during the project's formulation, and the project proponent will strictly adhere to the statutory norms and guidelines throughout its implementation phase.

Sub Divisional Officer
Phillaur Bandh Sub Division
Ludhiana

Executive Engineer/Ludhiana
Drainage-cum-Mining & Geology Division
Water Resources Department, Punjab

1.0	**Applicant Details**			
1.1	Name of Applicant Department / Organization	Executive Engineer, Ludhiana Drainage cum Mining & Geology Division, WRD, Ludhiana, Punjab.		
1.2	Type of Organization	State Government Department		
1.3	Address	Ludhiana Drainage cum Mining & Geology Division, WRD, Ludhiana, Punjab		
1.4	State/UT	Punjab		
1.5	District	Ludhiana		
1.6	City	Ludhiana		
1.7	Pin code	141013		
1.8	Project Point of Contact	Executive Engineer, Ludhiana Drainage cum Mining & Geology Division, WRD, Ludhiana, Punjab.		
1.9	Name	**Designation**	**Phone Number**	**E-mail**
1.9.1	Er. Rajat Grover	Executive Engineer	+91 98031 70324	xenldhdrg@gmail.com
2.0	**Project Details**			
2.1	Project Overview			
	Project Title	PROVISION OF SERVICES FOR ACQUISITION, PROCESSING AND DELIVERY OF DIGITAL ELEVATION MODEL AND DIGITAL ORTHO-IMAGE FOR FLOOD RISK MITIGATION/MAPPING OF AREA ALONG RIVER SUTLEJ, BEAS AND GHAGGAR.		
	Type of Project	Non-Infrastructure Project		
	Total Estimate Budget	Rs. 5,83,75,312/-		
	Duration of Project	6 months		

2.2	Project Description	
	Summary of the Project	Since, the Punjab had faced heavy floods in the past, therefore during the monitoring of rainfall status & discharge in rivers, it is felt that a devastating situation may arise this year as well if timely action is not taken. As the project is more focused on the River Sutlej, Beas and Ghaggar. So, if we study the course of the rivers and Population getting affected by these rivers the following data is derived: - The river Sutlej passes through the districts of Ropar, SBS Nagar, Ludhiana, Jalandhar, Moga, Ferozepur, Fazilka, Tarn Taran, Kapurthala and affects almost 129 Lakh population of these districts of Punjab. The river Beas passes through the districts of Gurdaspur, Hoshiarpur, Amritsar, Tarn Taran and Kapurthala and affects almost 83 Lakh population of these districts of Punjab. The river Ghaggar passes through the districts of Patiala, Sangrur and Mansa and affects almost 44 Lakh population of these districts of Punjab. Also last year, in River Sutlej, Beas & Ghaggar, flood water was flowing at its peak & situation was drastic in surrounding villages/Towns/urban & rural area and this flow of water in aforesaid rivers was not gradual & it kept fluctuating during the floods season. Thus, it was very difficult to monitor the discharge of floods in these systems and some part of manpower which can be used for flood preparations or remedial measures to the flood affected area, was struck only to monitor the periodic discharge in these systems. Therefore, it is necessity to establish a digital model to study the topography of area by DEM based on LiDAR in these rivers so the extend of endangerment can be accessed timely and data for the same can be provided to local authorities & local communities i.e it is required to make it withstand the floods in the forthcoming season. To further mitigate the risk of flood and to save human lives & livelihood of the community, it is very important to carry out flood mitigation work urgently. This Project comes under the ***Flood & Urban Flooding-Non-Structural Mitigation Measures.***
	Goals	• To get the Digital representation of topography of adjoining villages to the river by which flood routing can be determined by the using 3D model of DEM applications by LiDAR (Remote sensing technique) so that prior to Floods, endangered areas can be identify and preventive flood measures can be adopted and Such areas can be vacant to safeguard the lives of local inhabitants if necessary. • The data accumulated by the DEM project with the help of LiDAR can be helpful in flood routing and evacuation plan can be prepared to safe guard the lives of local inhabitants.
	Project Location	

Site No	Village	Block	District	State	Geographical Coordinates
	N/A				
	Objectives And Outcomes				
	Objective 1				
	Modernization Monitoring Network	**Outcome-1**	The generation of a digital elevation model plays a major role in Modernization of monitoring system by providing variety of technique such as digitizing contours from existing topographic maps, topographic leveling, EDM (Electronic Distance Measurement), differential GPS measurements, Digital photogrammetry, RADAR remote sensing (InSAR), Light Detection and Ranging (LiDAR)		
		Outcome-2	The project will enable us to assess the impact of both natural and man-made features upon flood risk by identify the topography of river and adjoining areas.		
		Outcome 3	The data availability to all concerned officials/community engaged in remedial tasks which would help the flood preparedness and awareness.		
	Objective 2				
	Transformation Knowledge Access	**Outcome-1**	The project will build on the advances in cloud computing, internet, mobile devices, and other communication tools to modernize the access and visualization of topography information of river surfaces by different stakeholders.		
		Outcome-2	The Digital computational data gathered by DEM project will be easily accessible and transformed by the administrative agency or the Stake holder on local scale.		
		Outcome 3	The evacuation situation can be done before adverse situation which would safeguard the vulnerable areas.		

	Objective 3		
	Strengthening Institutions	**Outcome-1**	Project will complement technology with investments in people and institutional capacity. Support will be provided for developing centers of expertise, innovative learning approaches, collaboration with academic and research institutes, and outreach programs. Office and equipment will be modernized to streamline work flows to effectively leverage the technology investments.
		Outcome-2	Project will modernized and enhance the ability of department and institution to understand the terrain significantly and topography of rivers to take preventive measure by the data accumulated by the DEM.
		Outcome 3	Project will provide the base precise data with characteristic behavior of floods in the region by which well prepared guideline and regulatory rules can be amended as per requirements.

	Assessments and Other Details	
	Hazard Assessment	**Type of Hazard: Flooding** **History of Hazard:** The region surrounding the Sutlej River, Beas River & Ghaggar River has a documented history of recurrent flooding events. Historical records indicate significant flood events in the years 1988, 1993, 1995, 2008, 2019, and 2023. These floods have been attributed to various factors including heavy rainfall, snowmelt, and fluctuations in river discharge. The floods have resulted in erosion, breaches in embankments, inundation of agricultural lands and communities, displacement of residents, and economic losses. **Methodology Followed for Assessment:** The hazard assessment was conducted using a combination of historical data analysis, hydrological modeling, and risk mapping techniques. Historical flood records were analyzed to identify patterns, trends, and magnitudes of past flood events. **Summary of Results:** • The hazard assessment identified flooding as a significant and recurring threat to the region surrounding the Sutlej River, Beas and Ghaggar. • Historical analysis revealed a pattern of frequent flood events, with notable occurrences in multiple years. • The assessment underscored the urgent need for comprehensive flood mitigation measures such as flood protection works, evacuation of local areas/effect communities from area/land under endangerment of floods or its effects and community resilience-building initiatives, to mitigate the impact of future flood events and safeguard lives, livelihoods, and critical infrastructure in the region such as houses, domestic animals, kettles etc.

	Vulnerability and Capacities Assessment:	**The assessment evaluated vulnerabilities and capacities across four key dimensions: physical, social, economic, and ecological.** **Physical Vulnerabilities:** Identified critical infrastructure Including embankments, roads, bridges, utilities as highly susceptible to flood damage. **Social Vulnerabilities:** Social survey revealed that 15 districts with population nearly 256 Lakhs vulnerable to flooding, with marginalized communities disproportionally affected. Focus group discussions highlighted concerns regarding limited access to resources, inadequate evacuation, routes, and insufficient community preparedness and response mechanisms. Examined the impact of flooding on communities, considering factors such as demographics, access to resources, social cohesion, and resilience networks. **Economic Vulnerabilities:** The assessment indicated significant economic loss due to flooding particularly in the agricultural sector. Floods in past had loss of livestock were reported in pas flood event occurred during previous floods impacting the lives and livelihood of farmers and rural households, income sources, agricultural productivity, local industries, and employment opportunities. **Ecological Vulnerabilities:** Field assessments identified vulnerable ecological zones including wetlands, riparian habitats and wildlife corridors. Flooding posed risk to Biodiversity, ecosystems, water quality threatening the ecological integrity of the region. **Community Interaction:** The assessment engaged with the community through a series of surveys, discussions, and interviews: **Household Surveys:** Households were surveyed to assess vulnerability levels, gather demographic data and identify specific needs and concerns related to flooding. In this survey it observed that due to lack of predetermination of approach of flood water & inundation period plays a major role in flood mitigation measures. **Focus Group Discussions:** Focus group discussions were conducted with community members, local authorities, and experts to explore social, economic, and ecological vulnerabilities and capacities. **Key Informant Interviews:** Key informant interviews were held with community leaders, government officials, and subject matter experts to gather insights into flood-related issues and potential mitigation strategies. **Result:** The community interaction revealed impacts of flooding on vulnerable populations, critical infrastructure and ecological systems. These findings informed the development of targeted interventions and strategies to enhance community resilience, improve flood preparedness and response, development in the region.

	RISK ASSESSMENT	**Rationale for Choosing the Project:** The decision to pursue the flood protection project stems from the urgent need to mitigate the risks posed by recurrent flooding in areas affected by floods. The floods of 2023 resulted in significant erosion along the embankment of the River Sutlej, River Beas & Ghaggar resulting in several breaches in their embankments and erosion of cultivated lands threatening the safety and livelihoods of the community. Without intervention, the potential for embankment breaches and catastrophic damage to property and infrastructure is high. Therefore, digitalization of related data like discharge in rivers, flood plain zoning of area adjourn to the rivers and limits of damage for different intensity of floods plays a major role in flood mitigation measures. **Project Costs:** The estimated project costs include: 1. Provision of Services for preparation of DEM: ₹ 5,51,25,000/- 2. Publication charges: ₹ 10,000/- 3. Purchase of DGPS: ₹ 15,00,000/- 4. Purchase of High-performance computer: ₹ 5,00,000/- 5. Contingency Charges: ₹ 1,37,812/- 6. Cultural Cess: ₹ 5,51,250/- 7. Third Party Audit Charges: ₹ 5,51,250/- **Total Project Costs: ₹ 5,83,75,312/-** **Project Benefits:** **Qualitative Benefits:** 1. **Risk Reduction:** The project will reduce the risk of embankment erosion and breaches, enhancing the safety and security of the community during flood events. 2. **Environmental Protection:** The DEM of the rivers will help preserve the natural environment by preventing erosion and protecting riparian habitats along the River Sutlej, Beas and Ghaggar. **Quantitative Benefits:** 1. **Economic Savings:** Avoidance of flood-related damages property, agricultural losses and infrastructure damage will be saved over the project's lifespan. 2. **Infrastructure Protection:** The project will safeguard critical infrastructure like schools, community halls/buildings & roads, bridges, and utilities.

	Stakeholder Analysis:	**1. Local Community:** **Role:** The primary beneficiaries and recipients of flood protection measures. They are directly impacted by flooding events and will benefit from the project's implementation; therefore, it is also purposed to form a social audit committee comprising of local community comprising Sarpanch, Nambardar and farmers for social audit of the project and role of this committee is to be regular checking of project. **2. Local Authorities (District Administration, Gram Panchayats):** **Role:** Responsible for governance, policymaking, and decision-making at the local level. They have jurisdiction over public infrastructure and resources. **3. Government Agencies (Water Resources Department, SDMF):** **Role:** Responsible for managing water resources, disaster preparedness, and emergency response at the state or regional level. **4. Private Sector (Contractors, Engineers, Suppliers):** **Role:** Provide goods and services related to project implementation, such as construction, engineering, and materials supply. **5. Environmental Groups and Conservationists:** **Role:** Advocate for environmental protection and conservation of natural resources, including rivers, wetlands, and wildlife habitats.

	Mitigation Strategy:	**Mitigation Measures:** • **Surveying of River topography for preparation of DEM using LiDAR:** The primary mitigation measure involves surveying of rivers and adjoining areas to prepare DEM using LiDAR for River Sutlej, Beas & Ghaggar to avail the topography and terrain surfaces which will be helpful for predetermination of flood routing. • **Rationale for Mitigation Measures:** i) **Effectiveness**. Preparation of DEM has been identified as effective measure to frame a database of vulnerable areas around these rivers. ii) **Cost-Effectiveness**. Focusing solely on DEM preparation allows efficient allocation of resources, maximizing the cost effectiveness within the available budget. iii) **Feasibility:** The scope of the project aligns with the available resources and technical capabilities, ensuring that the mitigation measures can be implemented effectively within the project timeline. **Achievement of Objectives and Outcomes:** **Objectives:** Enhance flood resilience and protect vulnerable communities and infrastructure. **Outcomes:** Reduced risk of embankment erosion and breaches, resulting in enhanced safety for residents

	Cost Benefit Analysis:	• **Introduction:** This cost-benefit analysis evaluates the social costs and benefits associated with the proposed flood mitigation project, focusing on study of topography of river and adjoining areas. The analysis considers both qualitative and quantitative impacts of the project on the community and environment. • **Social Costs:** The estimated project costs include: 1. Provision of Services for preparation of DEM: ₹ 5,51,25,000/- 2. Publication charges: ₹ 10,000/- 3. Purchase of DGPS: ₹ 15,00,000/- 4. Purchase of High-performance computer: ₹ 5,00,000/- 5. Contingency Charges: ₹ 1,37,812/- 6. Cultural Cess: ₹ 5,51,250/- 7. Third Party Audit Charges: ₹ 5,51,250/- **Total Project Costs: ₹ 5,83,75,312/-** • **Social Benefits:** • **Qualitative Benefits:** • **Risk Reduction:** The project will reduce the risk of Floods as predetermination of floods, its effects will enhance the flood preparation tasks efficiency of the communities/ Departmental agencies during flood events. • **Quantitative Benefits:** • **Economic Savings:** Avoidance of flood-related damage, including property destruction, agricultural losses, and infrastructure damage will be saved over the project's lifespan.

	Planned Activities:	**Project Objective:** Surveying of flood plains of the River Sutlej, Beas, Ghaggar to mitigate the risk of flood-related damages and enhance community resilience. **Planned activity Timeline:** 1. The contract for 'Provision of services for Acquisition, Processing and Delivery of DEM and Digital Orthoimagery data' in the flood plains of Sutlej, Beas and Ghaggar river basins covering the river bed (with or without water) upto its bank and a buffer zone of 5(five) km on either side of the river banks. The total area will be approximately 7350 square kms. For the purpose of this RFB the area of flood plains has been divided into 3 Lots as given below:

Table :1

Sr. no.	Lot	Description	Approx area (in sq km)	Period of completion
1	I	Sutlej River	3060	6 months
2	II	Beas River	1200	6 months
3	III	Ghaggar River	3090	6 months

2) Services are to be provided for generation and delivery of following key-deliverables.

(i) Processed bare earth ground elevation data of 0.4 m accuracy (on ellipsoidal heights) at regular spacing of 1(one) metre – called DEM in GEOTIFF and ASCII format.

(ii) DEM (on MSL heights) after integration with SOI developed the Geoid model.

(iii) Digital Ortho-imagery of 25 cm GSD or better in GEOTIFF format.

In addition, following raw/intermediate products/reports shall also be delivered:

(iv) Raw data captured by various sensors and instruments.

(v) All Ground control points (GCPs) provided/used for Data Acquisition & Processing.

(vi) Processed Digital Surface Model (DSM).

		(vii) Processed bare earth ground elevation data of 0.4 m accuracy (on ellipsoidal heights) at irregular spacing with mass points and break lines – called DTM. (viii) Contours at 1 metre vertical interval (ix) Combined hard copy plot of ortho-imagery with contours at 1 metre vertical interval on 1:10000 scale. (x) All salient reports generated as part of processing, QA/QC . Two copies of all softcopy deliverables will be provided in USB hard-disks/ NAS Boxes 3. Brief Scope of Activities for this contract shall include (i) Provision of Ground controls as per requirements of the project. This shall include planning, observations, computation, monumentation and signaling as necessary. Sub-contracting shall be permitted for this activity. (ii) Raw Data Acquisition & Pre-processing : Acquisition of Raw Digital Data by Aerial Platform for generating Digital Elevation Model(DEM) of 0.4 m accuracy (on ellipsoidal heights) and Digital Orthoimagery of 25 cm GSD. This shall also include Flight Planning, Sensor Calibration, Flight Execution as per plan, QA/QC for review of flight line alignment, raw data validation for completeness, no data voids, strip matching, pre-processing of onboard GNSS/IMU data for trajectory file and other pre-processing steps needed for point cloud extraction/preparing data for post-processing stage. Scope of this activity shall also include performing responsibilities of Non-Scheduled Operator for performing Aerial Work as required for performing the services. Valid Non-Scheduled Operator's Permit (NSOP) should be held by the firm (as single entity or JV) or its subcontractor, granted by the Central Government under sub-rule (2) of rule 134A of Aircraft (2nd Amendment) Rules, 2010, published in the Gazette of India vide Ministry of Civil Aviation Notification No. 423 dated 29th July 2010. The bidder may perform the duties of NSOP by itself or may sub-contract it to a firm which is an NSOP holder. The Contractor shall also obtain necessary clearances from the Ministry of Defence, Government of India, and other agencies as needed, for flying over the survey area and

		to acquire and deliver raw data and processed products. Contractor shall mobilize all necessary equipment, software and hardware at Survey of India Camp/Office required for carrying out this activity. (iii) Post Processing for generation of DSM, DTM, DEM & Digital Ortho-imagery: This activity shall include: • Planning • Setting up of Production: This would include setting up LAN and mobilization of adequate storage systems, servers, workstations, software, peripherals etc to handle/store raw data, intermediate data, data under process and processed data/deliverables. The use-rate of equipment and other costs associated with Preparation of site at the Production Centre shall be deemed to be included as part of post-processing cost. Pl. refer footnote at Form-1(Priced Activity Schedule). • Generation of Digital Surface Model (DSM) from raw/pre-processed data. • Necessary editing/filtering of non-ground points (vegetation, built-up areas, bridges, elevated structures etc) to generate bare-earth DEM of of 0.4 m accuracy (on ellipsoidal heights) • QA/QC at various stages of Project including validating horizontal and vertical accuracy as per specifications laid down in RFB. Proper versioning and management of data in various Production Cycles. This shall include carrying out corrections as per Quality Audit Report and security vetting report provided by SOI • Facilitating quality audit, stage approvals , security vetting and final acceptance tests by SOI • Integration of Geoid model supplied by SOI with the DEM on ellipsoidal heights, generated by contractor, to yield DEM on MSL heights • Generation of Digital Ortho-Imagery • Carrying out corrections after security vetting as pointed out by concerned agencies

Specifications of deliverables are given below: Digital Elevation Model (DEM)

TABLE-2

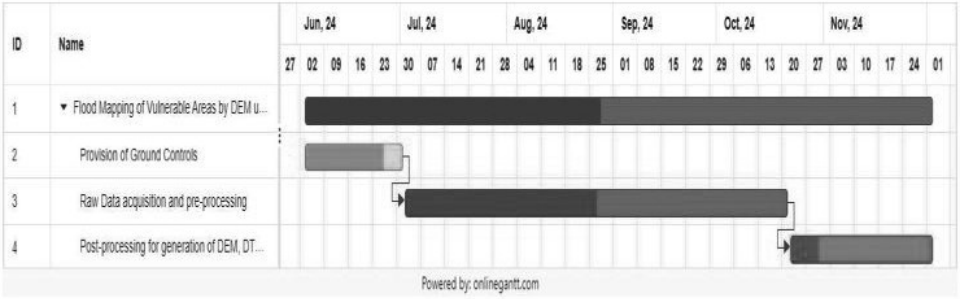
S.No.	Description	Specification
1	Fundamental Spatial Accuracy Requirements	Fundamental spatial accuracy of the survey must conform to the following: a. Fundamental Vertical Accuracy (FVA)* i) <= +/- 40 cm. 95% confidence interval (1.96 x RMSE) for terrain with open vegetation, sparse or dense man-made structures. b. Fundamental Horizontal Accuracy (FHA) i. <= +/- 25 cm. 95% confidence interval (1.96 x RMSE)
2	Supplemental Spatial Accuracy Requirements	Supplemental spatial accuracy of the survey must conform to the following: Supplemental Vertical Accuracy (SVA)* i. <= +/- 50 cm. 95% confidence interval (1.96 x RMSE) for terrain with low crop/low weeds ii. <= +/- 60 cm. 95% confidence interval (1.96 x RMSE) for terrain with tall crop/tall weeds/tall scrub/ dense forest/thick vegetation
3	Supplemental Spatial Accuracy Requirements	On average • there shall be 4(four) or more directly measured points per sq. m in open area • there shall be 1 (one) or

		more directly measured points in forest area.
4	Maximum Data Void in Shadow/Shady Areas**	The maximum size of data void in bare-earth DTM shall not exceed 1(one) sq metre
5	Projection	UTM
6	Datum	Vertical: (i)WGS-84 (before integration with Geoid Model) (ii) MSL (after integration with Geoid Model)Horizontal: WGS-84

DIGITAL ORTHO- IMAGERY:

- Ortho Imagery of Pan- sharpened, R, G, B
- Spatial Accuracy: 25 cm in Plain Area
- Spatial Resolution: 25 cm GSD .
- Projection: UTM
- Datum: WGS 84
- A Gaussian-like histogram with grey levels spreading at least 85% of (0, 255)

- Seam lines should not run along linear features and should be edited in a manner so as not to introduce visible flaws
- No visible geometric flaws, graphic imperfections and colour unbalancing at viewing scale of 1:2,000
- The imagery closest to the nadir view should be used for ortho mosaic to minimize the effects of relief displacement
- Ortho-image format: GeoTIFF.

	Implementation Plan:	**Project Objective:** Surveying of flood plains of the River Sutlej, Beas, Ghaggar to mitigate the risk of flood-related damages and enhance community resilience. **Implementation Timeline:** **Week 1-4: Provision of Ground Controls.** Planning, Observations, Computation, Monumentation and Signaling. **Week 5-20: Raw Data Acquisition and & Pre-processing.** Acquisition of Raw digital Data by Aerial platform for generating DEM of 0.4m accuracy and Digital Orthoimagery of 25cm GSD. Flight Planning, Sensor Calibration, Flight Execution, QA/QC for review of flight line alignment, raw data validation, Strip Matching, Pre-Processing of onboard GNSS/IMU data for trajectory file. **Week 21-26: Post Processing for generation of DSM, DTM, DEM & Digital Ortho-imagery.** Planning & Setting up a production centre at SOI at Dehradun. Generation of DEM from pre-procesed data. Facilitating quality audit, stage approvals, security vetting. Integration of Geoid model with DEM. Generation of Digital Ortho-Imagery. Carrying out corrections after security vetting. **GANTT CHART:**
		
	Budget for Project Activities:	Rs. 5,83,75,312/-

	Reporting and Monitoring Arrangements:	1. **Objectives:** Surveying in the geographical data of river section and adjoining areas to determine the flood routing in respective rivers and preparation of dashboard for data bank & real time evaluation of topography in rivers. **Monitoring Plan:** • **Objective:** Surveying the geographical data of rivers by means of DEM applications. • **Indicator:** Progress of work in terms of surveying, data processing and compilation.(% completion). • **Timeline:** Weekly progress reports submitted by the firm during work. • **Evaluation:** Compare actual progress against planned milestones to ensure timely completion. 2. **Objective:** Ensure compliance with PWD specifications and engineering standards. • **Indicator:** Adherence to PWD specifications and safety protocols. • **Timeline:** Daily on-site inspections by field staff. • **Evaluation:** Document any deviations from design specifications or safety standards and take corrective actions as necessary. 3. **Objective:** Enhance community resilience and preparedness. • **Indicator:** Community engagement activities conducted. • **Timeline:** Monthly community engagement reports submitted by project coordinator. • **Evaluation:** Assess community participation and feedback to gauge effectiveness of awareness-raising efforts. **Timeline for Evaluation:** • **Daily:** Conduct inspections to ensure compliance with specifications and safety standards. • **Weekly:** Review progress reports of DEM application and address any issues or delays. • **Monthly:** Analyze reports and adjust outreach strategies as needed. **Reporting Arrangements:** 1. **Weekly Progress Reports:** • Firm/Agency submits weekly progress reports on installation of equipment, including photos and updates on milestones achieved. • Executive Engineer reviews reports and addresses any concerns or delays. 2. **Daily Inspection Reports:** • Field staff team submit inspection reports, documenting adherence to PWD specifications. • Any deviations or non-compliance issues are reported immediately for corrective action.

	Conflict of Interest:	Since the work has been proposed by taking into confidence all stakeholder, therefore no chance of conflict will be there for this work.		
	PROJECT BUDGET/COST OVERVIEW			
	Breakdown of costs			
S.No.	**Objective/ activity**			**Amount**
1.	Provision of services for acquisition, processing and Delivery of DTM and digital ortho image @ Rs. 7500 per square kilometre.			
	River Name	**Approx Area in Sq KM**		
I	Sutlej river	3060		2,29,50,000/-
Ii	Beas River	1200		90,00,000/-
ii	Ghaggar River	3090		2,31,75,000/-
2.	Publication Charges.			10,000/-
3.	Purchase of DGPS.			15,00,000/-
4.	Purchase of High-performance computer.			5,00,000/-
5.	Cultural Cess @1%			5,51,250/-
6.	Third Party Audit Charges @1%			5,51,250/-
7.	Contingency Charges @ 0.25%			1,37,812/-
8.	Grand Total (a)			Rs. 5,83,75,312/-
	Ineligible cost (b)			0
	Contribution from other sources (c)			0
	Total eligible project cost (a-b-c)			Rs. 5,83,75,312/-
	Fund requested from Mitigation Fund			Rs. 5,83,75,312/-
20	How have the costs been determined ? (attach cost determination report)			Attached
	Detail cost estimate	**Tender Quotations**	**Benchmark Rates**	**Other**
	Yes			NA

	MONITORING AND EVALUATION (M&E)			
	INDICATOR	**DESCRIPTION**	**OUTPUT**	
	Progress of installation process (%)	Measure the completion status of the installation process activities.	Percentage of completion of installation process.	
	Adherence to Design Specifications	Assess whether construction activities adhere to the PWD and design specifications.	Compliance with design specifications documented through daily inspection reports.	
	ATTACHED DOCUMENTS CHECKLIST			
Section	Document		Attached	
3.1	Hazard Assessment Report		Yes	
3.2	Vulnerability Assessment Report		Yes	
	Community Interaction Report		N/A	
	Sample Questionnaire		N/A	
3.3	Risk Assessment Report		Yes	
	Option Analysis		Yes	
	Cost-Benefit Analysis		Yes	
3.5	Preliminary Design for Infrastructure Projects		N/A	
3.6	Project/River Plan		Yes	
4.2	Cost Determination Report		Yes	
	List of all references used for research data		Yes	

Sub Divisional Officer
Phillaur Bandh Sub Division
Ludhiana

Executive Engineer/Ludhiana
Drainage-cum-Mining & Geology Division
Water Resources Department, Punjab

Hazard Assessment Report:

1. Introduction: This hazard assessment report focuses on evaluating the risks associated with flooding in the Nearby villages of River Sutlej, Beas and Ghaggar , located in State of Punjab. The region surrounding the Sutlej River, Beas River & Ghaggar River has a documented history of recurrent flooding events. Historical records indicate significant flood events in the years 1988, 1993, 1995, 2008, 2019, and 2023. These floods have been attributed to various factors including heavy rainfall, snowmelt, and fluctuations in river discharge. The floods have resulted in erosion, breaches in embankments, inundation of agricultural lands and communities, displacement of residents, and economic losses.

2. Methodology: The hazard assessment was conducted using a combination of historical data analysis, hydrological modeling, and risk mapping techniques. Historical flood records were analyzed to identify patterns, trends, and magnitudes of past flood events.

3. Hazard Identification: Analysis of historical data revealed a pattern of recurrent flood events in the region, affecting villages along the Rivers Sutlej, Beas And Ghaggar. These flood events were primarily attributed to heavy rainfall, snowmelt, and fluctuations in river discharge. Hazards associated with flooding include erosion, breaches in embankments, inundation of agricultural lands and communities, displacement of residents, and economic losses.

4. Vulnerability Assessment:

The assessment evaluated vulnerabilities and capacities across four key dimensions: physical, social, economic, and ecological.

Physical Vulnerabilities: Included analysis of infrastructure susceptibility to flood damage, such as embankments, roads, bridges, and utilities.

Social Vulnerabilities: Examined the impact of flooding on communities, considering factors such as demographics, access to resources, social cohesion, and resilience networks.

Economic Vulnerabilities: Assessed the economic consequences of flooding on livelihoods, income sources, agricultural productivity, local industries, and employment opportunities.

Ecological Vulnerabilities: Biodiversity, ecosystems, water quality will not get disturbed due to this work.

5. Summary of Results:

- The hazard assessment identified flooding as a significant and recurring threat to nearby villages of River Sutlej, Beas and Ghaggar, with a history of frequent flood events.
- Vulnerability assessments revealed vulnerabilities across multiple dimensions, including physical, social, economic, and ecological.

6. Conclusion: The hazard assessment underscores the urgent need for comprehensive flood mitigation measures tailored to the specific vulnerabilities and hazards faced by nearby villages of River Sutlej, Beas and Ghaggar. These measures should include infrastructure reinforcement, early warning systems, community preparedness and

response mechanisms, and ecosystem-based approaches to enhance resilience and reduce vulnerability to future flood events.

7. Recommendations: Based on the findings of the hazard assessment, the following recommendations are proposed for nearby villages of River Sutlej, Beas and Ghaggar:

By using applications of DEM we can:

- Implement infrastructure upgrades to reinforce critical assets such as embankments and bridges.
- Develop and implement early warning systems tailored to the local context to alert communities to impending flood risks.
- Enhance community preparedness and response mechanisms through education, training, and capacity-building initiatives tailored to the specific needs of nearby villages of River Sutlej, Beas and Ghaggar· Promote ecosystem-based approaches to flood mitigation, including wetland restoration and floodplain management, to enhance resilience and reduce vulnerability to future flood events

8. Acknowledgement: We acknowledge the contributions of all stakeholders involved in the hazard assessment process, including community members, local authorities, and subject matter experts from nearby villages of River Sutlej, Beas and Ghaggar.

This hazard assessment report provides valuable insights into the risks associated with flooding in nearby villages of River Sutlej, Beas and Ghaggar and serves as a foundation for developing strategies to enhance resilience and reduce vulnerability to future flood events in the region.

Sub Divisional Officer
Phillaur Bandh Sub Division
Ludhiana

Executive Engineer/Ludhiana
Drainage-cum-Mining & Geology Division
Water Resources Department, Punjab

Vulnerability Assessment Report:

1. Introduction: This Vulnerability and Capacities Assessment (VCA) report aims to assess the vulnerabilities and capacities of nearby villages of River Sutlej, Beas and Ghaggar in State of Punjab, particularly in relation to flood events. The assessment seeks to identify key vulnerabilities across physical, social, economic, and ecological dimensions, as well as to evaluate the existing capacities that contribute to resilience in the face of flood hazards.

2. Methodology: The VCA utilized a participatory approach, combining quantitative and qualitative methods:

- **Household Surveys:** Conducted structured surveys with randomly selected households to gather demographic data, assess vulnerability levels, and identify specific needs and concerns related to flooding.
- **Focus Group Discussions:** Organized focus group discussions with community members, local authorities, and experts to explore social, economic, and ecological vulnerabilities and capacities, and to solicit inputs for resilience-building strategies.
- **Key Informant Interviews:** Held key informant interviews with community leaders, government officials, and subject matter experts to gather insights into flood-related issues and potential mitigation strategies.
- **Field Assessments:** Conducted on-site inspections and field observations to assess the physical vulnerability of infrastructure and ecological zones to flooding.
- **Data Analysis:** Utilized both qualitative and quantitative data analysis techniques to identify patterns, trends, and relationships, and to derive actionable recommendations.

3. Vulnerabilities and Capacities Assessment: The assessment focused on four key dimensions:

- **Physical Vulnerabilities:** Identified critical infrastructure, such as embankments, roads, and utilities, as highly susceptible to flood damage.
- **Social Vulnerabilities:** Highlighted concerns regarding vulnerable populations, limited access to resources, inadequate evacuation routes, and insufficient community preparedness and response mechanisms.
- **Economic Vulnerabilities:** Identified significant economic losses in the agricultural sector, impacting livelihoods, income sources, and local industries.
- **Ecological Vulnerabilities:** Assessed the impact of flooding on biodiversity, water quality, and ecosystem services, identifying vulnerable ecological zones and habitats.

4. Summary of Findings:

- The VCA revealed vulnerabilities across multiple dimensions, including physical, social, economic, and ecological, in nearby villages of River Sutlej, Beas and Ghaggar.
- Critical infrastructure, vulnerable populations, agricultural livelihoods, and ecological systems were identified as at risk from flooding.
- Existing capacities, such as community networks, local knowledge, and informal coping mechanisms, were found to contribute to resilience in the face of flood hazards.

5. Recommendations: Based on the findings of the VCA, the following recommendations are proposed:

- Implement infrastructure upgrades to reinforce critical assets and improve flood resilience.

- Enhance community preparedness and response mechanisms through education, training, and capacity-building initiatives.
- Promote ecosystem-based approaches to flood mitigation, including floodplain management, to enhance resilience and reduce vulnerability to future flood events.

6. Conclusion: The VCA underscores the urgent need for comprehensive flood mitigation measures tailored to the specific vulnerabilities and capacities of nearby villages of River Sutlej, Beas and Ghaggar. These measures should be informed by the findings of the assessment and developed in collaboration with local stakeholders to ensure effectiveness and sustainability.

Sub Divisional Officer
Phillaur Bandh Sub Division
Ludhiana

Executive Engineer/Ludhiana
Drainage-cum-Mining & Geology Division
Water Resources Department, Punjab

Risk Assessment for Flood Protection Project

Project Rationale: The proposed flood protection project aims to establish a dashboard to analyse, building capacities for flood remedial tasks by creating a DEM of Rivers Sutlej, Beas and Ghaggar to observe the topography and ortho imagery for analysing flood routing regarding the discharge in rivers of Punjab State and to monitor the flow in rivers and prediction of evacuation situations in different zones of Flood-Plain-Zone of these rivers. Without immediate intervention, the potential loss of life, property, and infrastructure would have been catastrophic. Therefore, preparing a DEM, such as the proposed, is essential to safeguard the embankments and adjoining villages of rivers and protecting the community from future flood events.

Options Analysis

Several options were considered for flood mitigation/protection measures in vicinity of the rivers, including:

i. Stereo Photogrammetry.
ii. GIS Mapping.
iii. Contour Surveying.

After careful evaluation, the preparation of DEM was selected as the most viable option due to its effectiveness in evaluating and plotting a complete topographical representation of the surrounding areas of rivers, minimizing the risk of embankment breaches.

Cost and Benefit Analysis: The cost and benefit analysis of the proposed flood mitigation measure project are outlined below:

Costs:

The estimated cost of preparation of DEM including advertisement, and contingency charges, is approximately 583.75 lacs.

Benefits:

1. Risk Reduction: The primary benefit of the project is the reduction of flood risk.
2. Economic Savings: The avoidance of flood-related damages, including property destruction, agricultural losses, and infrastructure damage, will result in significant economic savings for the community and government.
3. Environmental Protection: The project will help preserve the natural environment by protecting riparian habitats, and maintaining water quality in the Rivers.

Sub Divisional Officer
Phillaur Bandh Sub Division
Ludhiana

Executive Engineer/Ludhiana
Drainage-cum-Mining & Geology Division
Water Resources Department, Punjab

Cost Benefit Analysis

Computation of Annual cost of the Project:

A. Total PROJECTED cost of this Project= Rs. 583.75 Lacs

B. Total Benefited Area = 16,34,602 Acre (Approx.)

Assuming cultivated area @ 70% of 1634602 Acre = 11,44,221 Acre (Approx.)

Assuming DEM benefits @ 10% of this 1144221 Acre = 1,14,422 Acre (Approx.)

Assuming the flood occurs 1 times in 10 years, then benefited area = 114422 acres

Value of Crop (Rice) Area x Yield x Rate

114422 x 28 x 2180

= Rs 698.4 Crore

Hence, Benefit Cost Ratio (B.C. Ratio) = 698.4 : 5.83

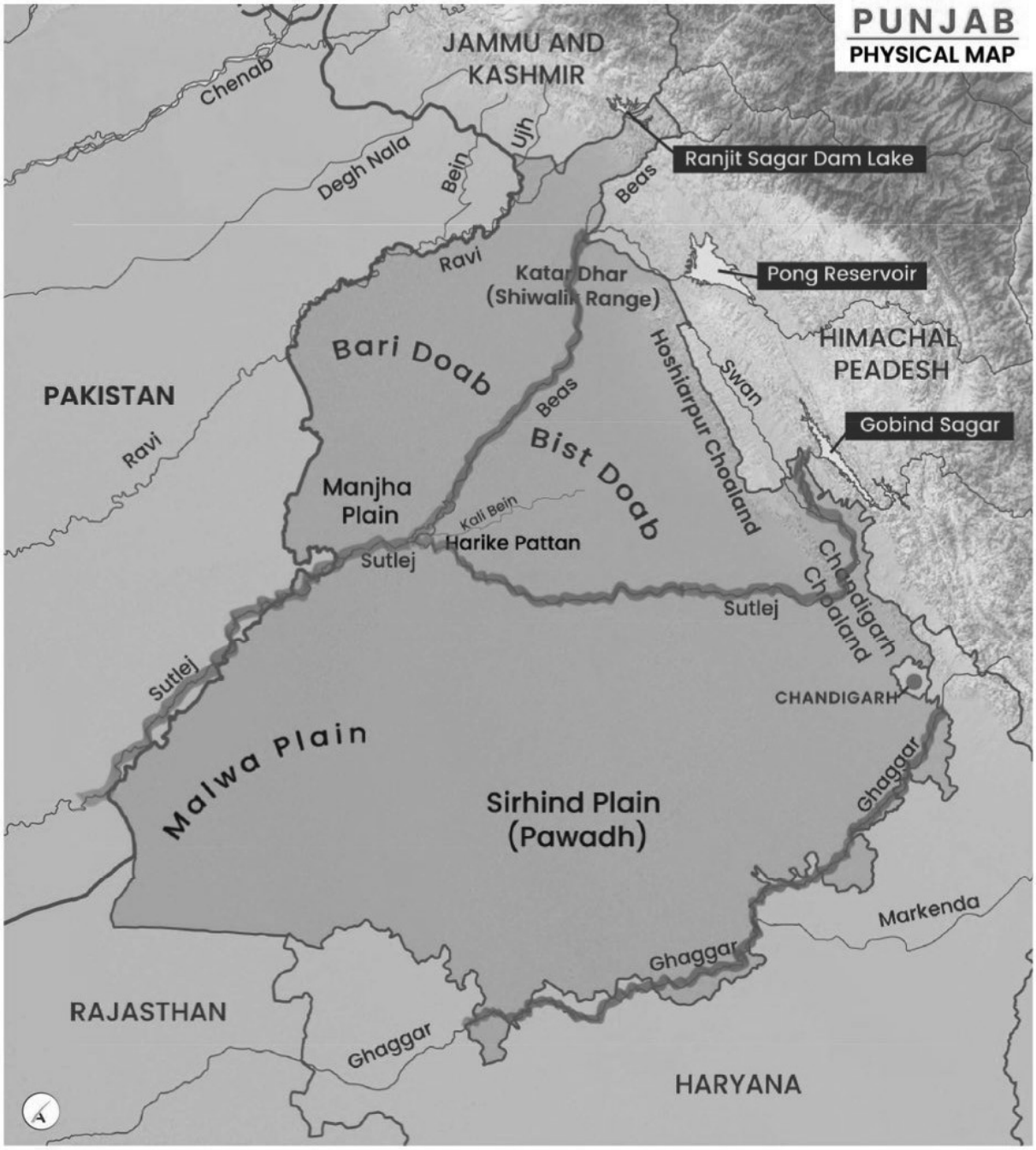
= 119.8 : 1

- The Paddy crop has been taken because the paddy crop is sown during the flood period (01.07 to 30.09) in Punjab.
- Rate of Rice crop taken from F.C.I. Department
- Average yield of crop in year 2023 also taken from F.C.I. Department 28 qtl/acre and (28 x 2.47)= 69.16 qtl/hectare

Sub Divisional Officer
Phillaur Bandh Sub Division
Ludhiana

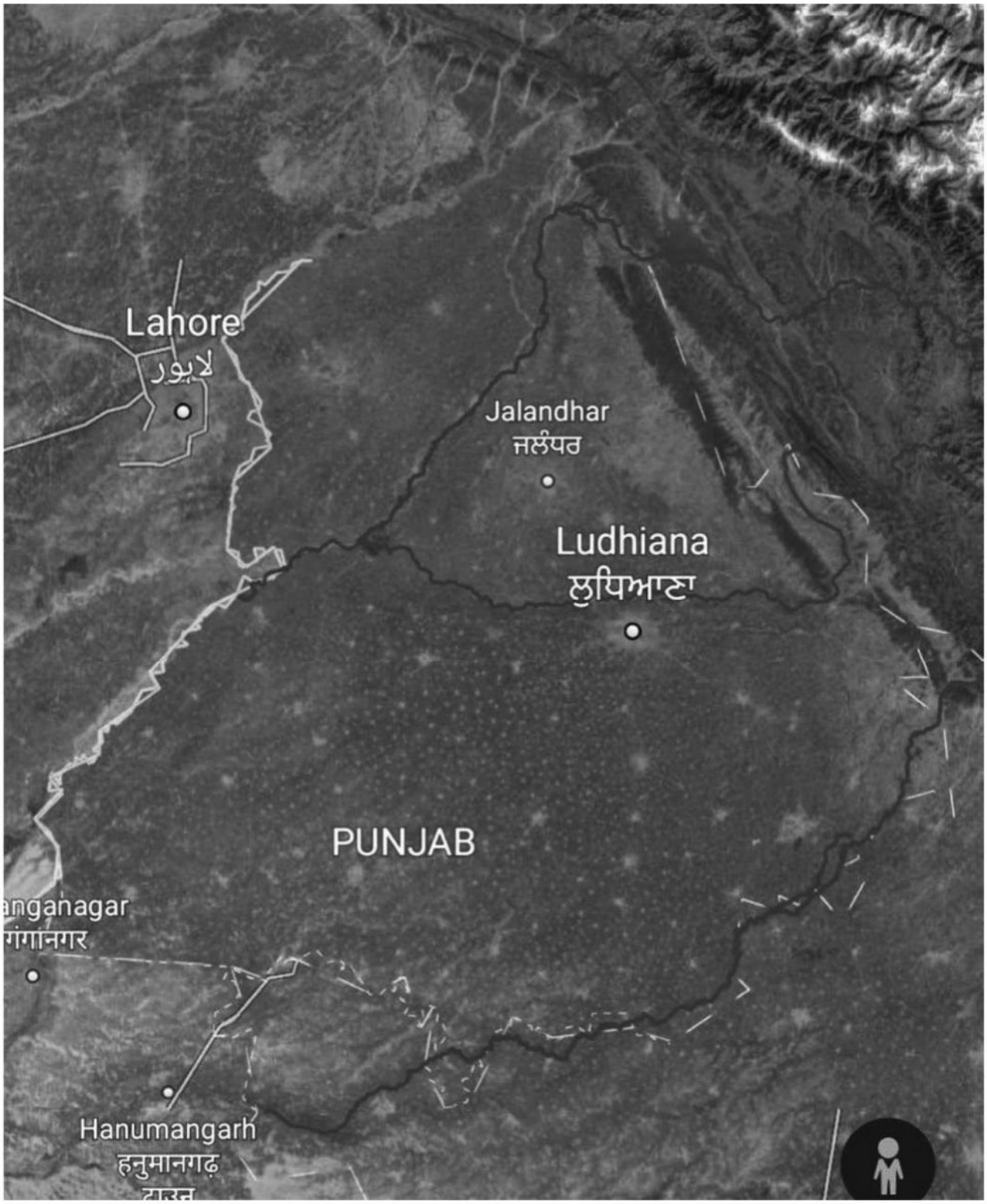
Executive Engineer/Ludhiana
Drainage-cum-Mining & Geology Division
Water Resources Department, Punjab

River Plan Map



→ Rivers in project

KML Plan of Rivers



COST DETERMINATION REPORT

S. No.	Item	Name of River	Length of River (km)	Width to be analysed (km)	Unit	Rate	Cost
1.	Provision of services for data acquisition, processing and Delivery of DTM and digital ortho image.	Sutlej	306	10	Per sq. km.	7500	2,29,50,000
		Beas	120	10	Per sq. km.	7500	90,00,000
		Ghaggar	309	10	Per sq. km.	7500	2,31,75,000
2.	Purchase of DGPS						15,00,000
3.	Purchase of High-performance computer						5,00,000
4.	Publication Charges						10,000
5.	Third Party Audit Charges @1%						5,51,250
6.	Culture Cess @ 1%						5,51,250
7.	Contingency @ 0.25%						1,37,812
						TOTAL	5,83,75,312/-

Sub Divisional Officer
Phillaur Bandh Sub Division
Ludhiana

Executive Engineer/Ludhiana
Drainage-cum-Mining & Geology Division
Water Resources Department, Punjab

Annexure R-4

GOVERNMENT OF PUNJAB
Department of Water Resources

To

Special Chief Secretary-
Cum-Financial Commissioner, Revenue,
Department of Revenue, Rehabilitation & Disaster Management,
Govt. of Punjab.

Memo No.: - 1666/CE/DRG/2024
Date: - 09/10/2024

Subject: Submission of Revised Pre-Feasibility Report (PFR) and Detailed Project Report (DPR) for Approval under State Disaster Mitigation Fund FY 2024-25.

1.0 Please refer to the subject cited above and your office Memo No. 2/1/2022-2 DM-1/ 16404 dated 26.09.2024.

2.0 As per the instructions vide the referenced letter above, the Revised PFR and DPR for the project *"Provision of services for acquisition, processing, and delivery of Digital Elevation Model (DEM) and Digital Ortho-Image for Flood Risk Mitigation/ Mapping of areas along the Sutlej, Beas, and Ghaggar rivers* " amounting to Rs. 582.62 lakhs are submitted herewith.

3.0 It is requested that the enclosed Pre-feasibility Report (PFR) and Detailed Project Report (DPR) may be forwarded to the Appraisal Committee for due consideration and approval so that the Department of Water Resources can carry out the further necessary action regarding tendering/execution of the work.

Encl/As Above

Principal Secretary,
Water Resources Department

Endst No. 1667/CE/DRG/2024 Dated: 09/10/2024

Chief Engineer/Drainage-cum-Mining and Geology, Water Resources Department, Punjab, Chandigarh to coordinate with the concerned Department and provide all relevant information.

Principal Secretary,
Water Resources Department

Government of Punjab
Revenue, Rehabilitation, and Disaster Management Department
(Disaster Management – 1 Branch)

To

1. The Director, Indian Meteorological Department,
   Meteorological Centre, Sector 39, Chandigarh, 160036
2. The Head of the Department,
   Earthquake Engineering Division, Department of Civil Engineering
   Indian Institute of Technology Ropar,
   Nangal Road, Rupnagar – 140001.
3. The Director (Research),
   Punjab Agriculture University, Ludhiana.
4. The Director, Punjab Remote Sensing Center,
   PAU Campus, Near Kitchlu Nagar block 'F' end,
   Ludhiana 141004
5. Officer In charge, Punjab Climate Change Knowledge Centre (PSCCKC)
   Punjab State Council for Science & Technology
   MGSIPA Complex, Sector-26, Chandigarh-160001
6. The Director, Department of Local Government
   Municipal Bhawan, Plot No. 3, Dakshin Marg,
   Sector 35-A, Chandigarh-160022
7. The Chief Administrator,
   Punjab Urban Development Authority,
   Room No. 101, 1st Floor PUDA Bhawan,
   Sector-62, SAS Nagar (Mohali)
8. The Chief Conservator of Soils,
   Department of Soil & Water Conservation,
   First Floor SCO 50-51, Sector 17-E Chandigarh
9. The Chief Engineer (Drainage),
   Department of Water Resources,
   Sector 18, Chandigarh.

Memo No. 2/1/2022-2 DM-1/ 18848-57
Chandigarh, Dated: 12/11/2024

Subject: **Proceedings of the 5th Meeting of the Technical Advisory Committee of the State Disaster Mitigation Fund (SDMF)**

Sir,

Kindly refer to the subject cited above.

2. This is with reference to the fifth meeting of the Technical Advisory Committee of SDMF held under the Chairmanship of Sh. Harpreet Singh Sudan IAS, Special Secretary (Revenue) and Director (Disaster Management), Department of Revenue, Rehabilitation and Disaster Management, Government of Punjab on 06.11.2024. The proceedings of the meeting are enclosed for your information and necessary action.

Deputy Secretary Revenue

Proceedings of the 5th Meeting of the Technical Advisory Committee (TAC) held on 06.11.2024 at 10:30 a.m. under the chairmanship of Sh. Harpreet Singh Sudan IAS, Special Secretary Revenue -cum- Director (Disaster Management) for the appraisal of project proposals under the State Disaster Mitigation Fund (SDMF).

The list of participants has been attached in Annexure 'A'

1.0 At the outset of the meeting, the Chairman welcomed all the committee members for attending the 5th meeting of the Technical Advisory Committee.

2.0 **Agenda 1**: The committee was informed that the Disaster Management Department had sought clarification from the Ministry of Home Affairs (MHA), Government of India, regarding the application of the 50% limitation on funds for single-hazard mitigation as the MHA's guidelines for SDMF. Specifically, the query concerned whether this 50 % limitation should be calculated based on the entire opening balance (including accumulated funds) or only the annual allocation for the corresponding financial year. The clarification was necessary to prevent the potential underutilization of accumulated funds for mitigation activities if the limitation was applied solely to the annual allocation. In response, the MHA clarified, in a letter dated September 17, 2024, that the opening unspent balance should be included when calculating the 50% limitation for single-hazard mitigation within a given year. The Technical Advisory Committee (TAC) was informed of this clarification, and committee members took note of the clarification issued by MHA.

3.0 **Agenda 2**: A project from the Water Resource Department was originally approved & sanctioned during the 2nd State Executive Committee (SEC) meeting held on 26.06.2024 for a total cost of Rs. 583.75 lakhs under the State Disaster Mitigation Fund (SDMF) which was originally the total project cost for all three rivers in the previously approved plan. The duration of the project was 6 months as per the DPR. Now vide the revised proposal, the Department of Water Resources has requested approval for the revision of the project, with a change in scope to execute the DEM for the Sutlej River from Nangal to Machiwara-Rahon Bridge (98 km) & Harike D/S to up to Sutlej enters International Border (47km) i.e. Total length of 145 km as Phase-1 in the current FY 2024-25 at an estimated cost of Rs. 5.82 Crores. This change has been proposed to comply with the Hon'ble NGT's directives for flood zonation based on Survey of India standards. The adoption of advanced technologies, such as LiDAR, has increased the overall project cost.

4.0 **Agenda 3**: A project proposal was presented by Regional Research Station (PAU), Ballowal Saunkhri, SBS Nagar titled "To study the Impact of Land Use and Land Cover Changes on Soil Erosion under Changing Climatic Scenarios in Kandi Region of Punjab" amounting Rs. 109.16 lakhs.

5.0 The technical members of the committee deliberated upon the submitted projects from the Water Resources Department & PAU, and after detailed discussions following decisions were taken:

S.No.	Title	Amount	Decision by TAC
1	Provision of services for acquisition, processing and delivery of Digital Elevation Model and Digital Ortho-Image for Flood Risk Mitigation/Mapping of area along River Sutlej" from Nangal to Machiwara- Rahon Bridge (98 km) & Harike D/S to up to Sutlej enters International Border (47km) i.e. Total length of 145 km as Phase-1 **Submitted by: Water Resources Department**	Rs.582.62 Lakhs	Given the project's importance for flood risk assessment and the inclusion of additional technological interventions, the revised proposal submitted by the Water Resources Department under Agenda No. 2 was recommended for further appraisal by the Project Appraisal Committee.
2	To study the Impact of Land Use and Land Cover Changes on Soil Erosion under Changing Climatic Scenarios in Kandi Region of Punjab **Submitted by: Regional Research Station (PAU)**	Rs.109.16 Lakhs	It has been recommended that this project by PAU be incorporated as a non-structural component with increased scope including the water, mining, and geomorphological studies for the *Kandi* area into a similar project submitted by the Soil & Water Conservation Department, valued at Rs. 88.92 crores (as the activities proposed are linked to the structural activities). The Soil & Water Conservation project has already been endorsed by the TAC and PAC to the State Executive Committee for submission to the NDMA for funding under the National Disaster Mitigation Fund (NDMF).

6.0 **Agenda 4:** With the Chair's permission, some additional agenda items were also discussed during the meeting, and after due deliberations following decisions were made:

a. The Committee members recommended organizing exposure visits to states that are recognized leaders in disaster response, operations, research and development, early warning systems, and mitigation efforts. States such as Odisha, Bihar, Haryana, and Himachal Pradesh etc have developed robust frameworks and innovative practices in these areas. By

visiting these regions, Punjab's teams could observe successful models, learn about cutting-edge technologies, and gain insights into efficient operational strategies. The knowledge gathered from these visits would serve as valuable input for designing and establishing the proposed Center for Excellence in Punjab, ensuring that it incorporates best practices and aligns with national standards for disaster management and resilience. This initiative aims to equip Punjab's disaster management efforts with proven strategies and tailored solutions that address the state's specific challenges. The Chair approved the agenda in principle and directed that the DM Department should form teams of officers who volunteer from PRSC, IIT Ropar, Water Resources Department, other member departments and districts to be nominated for these peer learning visits subject to approval by the competent authority.

b. The Water Resources Department requested training on digital modeling software and capacity building for their engineers. In response, IIT Ropar and the Punjab Remote Sensing Center, Ludhiana, have expressed their willingness to support this initiative. It was decided that proposals from both institutions, through the WRD, for two batches of 25 engineers each, should be submitted to the committee for consideration.

c. The Chair directed the Disaster Management Department to request relevant departments to share the challenges they are facing related to various hazards in the state such as industrial & chemical fires in Industrial areas, and fires in crowded areas where the movement of fire tenders becomes restricted. These issues will be considered for the design and implementation of mitigation activities under the State Disaster Mitigation Fund.

The meeting ended with a vote of thanks.

Harpreet Singh Sudan, IAS
Director (DM)-cum-Chairperson,
Technical Advisory Committee

List of Participants:

1. Sh. Surender Paul, Director India Meteorological Department (IMD) Chandigarh
2. Dr. Manmohan Singh, Deen & Director RRS PAU
3. Dr. Abrar Yousf, Scientist Soil & Water Engg, RRS PAU
4. Dr. A. S. Brar, Principal Agronomist, PAU Ludhiana
5. Dr. Sukhpreet Singh, Agronomist, PAU Ludhiana
6. Er. Maganbir Singh, Principal Scientific Office, Punjab State Council for Science & Technology
7. Er. Anuj Sehgal, SEC (HQ), PUDA
8. Smt. Avneet Kaur, Xen Local Government
9. Dr. R. K. Setia, Scientist-SE, PRSC Ludhiana
10. Sh. Gurbinder Singh Dhillon, DSCO(H.Q), Soil Water Conservation, Punjab
11. Sh. Rajat Grover, XEN/DRAINAGE WRD
12. Dr. Putul Haldar, Assistant Professor, Civil Engg. IIT Ropar
13. Dr. Rupali Bal, Scientist-C, Punjab State Council for Science & Technology
14. Sh. Sashikanta Sahoo, Scientist SD, PRSC Ludhiana
15. Smt. Manjeet Kaur Sahotra, Deputy Secretary Deptt. of Revenue, Rehabilitation and Disaster Management.
16. Smt. Prabhjot Kaur, ACFA, Deptt. of Revenue, Rehabilitation and Disaster Management.
17. Sh. Vivek Sharma, Senior Consultant (DM), Deptt. of Revenue, Rehabilitation and Disaster Management.
18. Sh. Vipin Kakkar, Superintendent -I, DM-1 Branch
19. Sh. Swarn Singh, Senior Assistant, DM-1 Branch

Annexure PP6

Government of Punjab

Department of Water Resources, Punjab,

To

Additional Chief Secretary-
Cum-Financial Commissioner, Revenue,
Department of Revenue, Rehabilitation & Disaster Management,
Govt. of Punjab.

Memo No.: 3137-40 /CE/ DRG/ 2024 /E-754256
Date: 23/12/2024

Subject: Scheduling of Project Appraisal Committee (PAC) meeting for revised Digital Elevation Modelling (DEM) Project.

1.0 Please refer to your office Memo No. 2/1/2022-2 DM-1/ 16404 dated 26.09.2024

2.0 As per the instructions vide the referenced letter above, the Revised PFR and DPR for the project *"Provision of services for acquisition, processing, and delivery of Digital Elevation Model (DEM) and Digital Ortho-Image for Flood Risk Mitigation/ Mapping of areas along the Sutlej, Beas, and Ghaggar rivers* " amounting to Rs. 582.62 lakh was submitted vide this office Memo No. 1666/CE/DRG/2024 dated 09-10-2024.

3.0 It is submitted that PFR of the said project was apprised by the Technical Advisory Committee (TAC) vide Minutes of Meeting dated 06-11-2024 (copy enclosed).

4.0 You are requested to kindly schedule the Project Appraisal Committee (PAC) Meeting for appraisal of (PFR) and Detailed Project Report (DPR) so that the Department of Water Resources can carry out the further necessary action regarding tendering/execution of the work.

Encl/As Above

Principal Secretary
Water Resources Department

C.C

1. Chief Engineer/Drainage cum Mining and Geology Water Resources Department, Punjab.
2. Superintending Engineer/Jalandhar, Drainage cum Mining & Geology Circle, WRD, Punjab.
3. Executive Engineer/Ludhiana, Drainage cum Mining & Geology Circle, WRD, Punjab.

Annexure R-7

Proceedings of the 4th Meeting of the Project Appraisal Committee (PAC) held on 31st January 2025 under the chairmanship of Sh. Anurag Verma, IAS, Additional Chief Secretary-cum-Financial Commissioner, Department of Revenue & Rehabilitation for proposals under the State Disaster Mitigation Fund (SDMF).

Following members were present in the meeting: -

1. Sh. Krishan Kumar, Principal Secretary, Water Resources
2. Sh. Arun Sekhri, Commissioner Ferozepur Division (Online)
3. Smt. Gurpreet Kaur Sapra, Commissioner Rupnagar Division (Online)
4. Dr. Satbir Singh Gosal, Vice-Chancellor, PAU Ludhiana
5. Sh. Harpreet Singh Sudan, Director (DM) & Special Secretary Revenue-cum-Member Secretary PAC
6. Sh. Amarbir Singh, Joint Secretary, PWD (B&R)
7. Sh. Jaswinder Singh, Deputy Secretary Finance, Govt of Punjab
8. Sh. H.S. Mendiratta, Chief Engineer, Water Resources Department
9. Sh. Anil Gupta, Chief Engineer, PWD (B&R)
10. Sh. Dilbag Singh, Joint Director, Agriculture (E&T)
11. Dr. R. K. Setia, Scientist-SE, PRSC Ludhiana
12. Sh. Sashikant Sahoo, Scientist SD, PRSC Ludhiana
13. Officers from the Divisional Commissioner, Ferozepur, Jalandhar & Faridkot were connected online.

1.0 At the outset of the meeting, the Chairman welcomed all the committee members for attending the 4th Project Appraisal Committee (PAC) meeting.

2.0 The Committee then reviewed the proposals submitted by the Water Resources Department and Punjab Remote Sensing Centre in line with the mandate of the Project Appraisal Committee. After detailed discussions, the following concept notes, Preliminary Feasibility Reports (PFRs), and their corresponding Detailed Project Reports (DPRs) were appraised and selected for recommendation to the State Executive Committee (SEC) for further approval: -

S.No.	Title	Amount	Remarks
Department of Water Resources			
1	Provision of services for acquisition, processing and delivery of digital elevation model and digital ortho-image for flood risk mitigation/mapping area along river Sutlej.	**Rs. 584 Lakhs**	Recommended for approval of SEC.
Punjab Remote Sensing Centre			
2	Flood Risk Assessment Based on Hydrodynamic Modelling Using Remote Sensing Datasets and Ground Observations – Study of Major Rivers and Canals in Punjab, India	**Rs. 202 Lakhs**	Recommended for approval of SEC.

3	Integrating Climate, Social, and Economic Variables for Delineating Flooding Hotspots in Punjab Using Geospatial Technology	Rs. 26 Lakhs	Recommended for approval of SEC.

3.0 A discussion was also held on the establishment of a Centre of Excellence (CoE) for Disaster Management by the Punjab Remote Sensing Centre (PRSC) in collaboration with the Water Resources Department. It was conveyed to the Chair that the Department of Land Resources (DoLR), Ministry of Rural Development, Government of India, has already designated the Mahatma Gandhi State Institute of Public Administration (MGSIPA) for setting up a Centre of Excellence (CoE) in Land Administration and Management under its project i.e. DILRMP, with the grant for its establishment finalised. The key stakeholder for this CoE is the Revenue Department of the Government of Punjab. Since Disaster Management also falls under the purview of the Revenue Department in the State, it was proposed that the planned components of the CoE for Disaster Management be integrated within this existing CoE under DILRMP, subject to MGSIPA's consent. This integration would enable a holistic approach by leveraging expertise in land administration, disaster risk reduction, and resilience-building through capacity development, policy support, and technology-driven solutions. MGSIPA may seek additional funding from the Department of Revenue, Rehabilitation, and Disaster Management for incorporating disaster management components and enhancing remote sensing and GIS-based research. The CoE can also have MoUs with eminent research and expert organisations and institutions such as PRSC, PAU, Panjab University, GNDU, Thapar Institute, and IIT Ropar etc for leveraging resources & knowledge sharing. The CoE shall provide guidance, expertise & services to all departments of the government of Punjab involved in Disaster Risk Reduction & Management. The Principal Secretary, Department of Water Resources further stated that the CoE can also be housed in the building/office space of the Department of Water Resources if MGSIPA has any space constraints subject to the terms already agreed with PRSC.

The meeting ended with a vote of thanks.

Principal Secretary
Water Resources Department
Member, PAC

Special Secretary Revenue-cum-
Member Secretary, PAC

Additional Chief Secretary-cum-Financial
Commissioner Revenue
Chairman, PAC

Minutes of the 42nd Meeting of the State Executive Committee (SEC) held on 4th June 2025 under the chairmanship of Sh. KAP Sinha IAS, Chief Secretary-cum-Chairman, SEC.

Following Officers were present in the meeting: -

1. Sh. Anurag Verma IAS, Additional Chief Secretary-cum-Financial Commissioner.
2. Sh. Alok Sekhar IAS, Additional Chief Secretary, Home Affairs.
3. Sh. Tejveer Singh IAS, Additional Chief Secretary, Local Government.
4. Sh. Krishan Kumar IAS, Principal Secretary, Finance.
5. Sh. Harpreet Singh Sudan IAS, Director DM & Special Secretary Revenue

1.0 At the outset, the Director, Disaster Management, warmly welcomed the worthy Chairperson and all esteemed Members of the State Executive Committee (SEC) to the 42nd meeting. With the permission of the Chair, the agenda items were placed before the Committee for deliberation & approval.

2.0 **Agenda No.1: Implementation of MHA's Guidelines on Constitution & Administration of Recovery & Reconstruction Funding Window of SDRF/NDRF dated 14.08.2024:**

Approved. The implementation of the Recovery & Reconstruction Guidelines to be done w.e.f. from 04.06.2025.

3.0 **Agenda No.2 – Approval of the Mitigation Projects for funding from the State Disaster Mitigation Fund**:

SEC approved the projects at Sr. No. 1, 2, 3, 4 & 6. For Sr. No. 5, the Department of Water Resources is directed to coordinate to send a DO letter by the Hon'ble Chief Minister, Punjab, to the Hon'ble Union Home Minister, requesting 100% central assistance for the project.

4.0 **Agenda No.3 – Ex-post facto approval of Rs. 48,99,048/- for Emergency Response Support System (ERSS) Project**:

Approved.

5.0 **Agenda No.4 – Declaration of State-Specific Disasters (Heat Waves, Excessive or Unseasonal Rains, Cattle Disease Outbreaks, and Industrial Chemical Disasters:**

Deferred.

6.0 **Supplementary Agenda No.1 – Provisions of the Disaster Management Act 2005 as amended by the Disaster Management (Amendment) Act 2025:**

After reviewing the provisions of the DM (Amendment) Act 2025, the SEC issued the following subsequent directions:

Clause/Section	Action Taken	Directions
Sec 18(2)(p): Disaster database	Noted.	DM Department to coordinate with MGSIPA for the Centre of Excellence
Sec 20(2)(c): DGP as SEC member	Noted.	SEC Notification to be processed as per Govt. procedure
Sec 25(2)(f): Appoint 2 expert members in DDMA	Noted.	DM Department to propose action
Sec 38(2)(ia): State-wise hazard nodal depts	Noted.	-

Sec 41A(1): Urban DM Authorities **Sec 78(2)(fa) & 41A(6):** Urban Authority functions	Noted.	Notification for Urban Disaster Management Authorities for 13 Municipal Corporations to be processed as per procedure. Brief functions of the Urban Authority shall be mentioned in the Notification.
Sec 44A(1): State Disaster Response Force Constitution **Sec 78(2)(fb) & 44A(2):** SDRF rules	Noted.	Home Dept to finalize in 3–4 months

7.0 **Supplementary Agenda No.2 – Proposal for extension of the NDMA Scheme Implementation of Sendai Framework for Disaster Risk Reduction:**

Approved.

8.0 **Supplementary Agenda No.3 – Funds to District Fazilka for relief during floods 2023 and recovery & reconstruction of roads culverts:**

Approved.

9.0 **Supplementary Agenda No.4 – Ex-post facto approval of the funds approved at the level of the worthy Chief Secretary and Financial Commissioner, Revenue:**

Ex-post facto approval is granted by the SEC.

The meeting ended with a vote of thanks.

Additional Chief Secretary Home Affairs

Additional Chief Secretary Local Government

Principal Secretary Finance

Additional Chief Secretary-cum-Financial Commissioner Revenue

Chief Secretary-cum-Chairman, SEC

S.No.	Title	Amount	Remarks
	Punjab Remote Sensing Centre		
1	Mapping of Paleo channels and delineation of suitable sites for groundwater recharge and flood management in Punjab using Geospatial technologies.	Rs. 233.45 Lakhs	Recommended for approval by the SEC
2	Flood Risk Assessment Based on Hydrodynamic Modelling using Remote Sensing Datasets and Ground Observations – Study of Major Rivers and Canals in Punjab, India	Rs.202 Lakhs	Recommended for approval by the SEC
3	Integrating Climate, Social, and Economic Variables for Delineating Flooding Hotspots in Punjab Using Geospatial Technology	Rs.26 Lakhs	Recommended for approval by the SEC
	Department of Soil & Water Conservation		
4	Project for Strengthening Flood Resilience and Disaster Preparedness through Structural Mitigation Measures in Kandi Region of Punjab	Rs. 88.92 Crores	Recommended for approval of SEC for submission to NDMA for funding under NDMF
	Department of Water Resources		
5	Flood Protection Works in Border Areas to Protect BOP, International Boundary Fencing, and Other Defence Infrastructure Established in terms of National Security Submitted to NDMA for funding under National Disaster Risk Mitigation (NDMF) **Total Project Cost – Rs.204.50 Crores**	Initial proposal for 10% of total cost Rs. 20.45 Crores to be contributed from SDMF	Previously recommended by the PAC for approval by the SEC, however the Hon'ble Chief Minister has directed the Water Resources Department to seek 100% funding from the Central Government since the BoPs are installation under the purview of the Government of India.
6	Revised Projects Provision of services for acquisition, processing and delivery of Digital Elevation Model (DEM) and Otho-image for flood risk mitigation/mapping area along river Sutlej.	Rs.582.62 Lakhs already sanctioned	Recommended by the Project Appraisal Committee after appraisal for revision of the scope of work due to incorporation of Survey of India's directions.

WATER RESOURCE DEPARTMENT (WR)

Government of Punjab

Technical Sanction Order

Memo No : WRD/25-26/DO/Div Drainag LDH/Drainage/0023 Date : 30/06/2025

To : Amrinder Singh Pandher-Superintending Engineer - Jalandhar Drainage-cum-Mining & Geology Circle

Work Id : WRD/25-26/Div Drainag LDH/00023

Name Of Work : ESTIMATE FOR PROVISION OF SERVICES FOR ACQUISITION, PROCESSING AND DELIVERY OF DIGITAL ELEVATION MODEL AND DIGITAL ORTHO-IMAGE FOR FLOOD RISK MITIGATION/MAPPING OF AREA ALONG RIVER SUTLEJ.

ਆਪ ਜੀ ਸਿਫਾਰਿਸ ਅਨੁਸਾਰ Hardeep Singh Mendiratta-Chief Engineer - Chief Engineer Drainage cum Mining and Geology ਉਪਰੋਕਤ ਕੰਮ ਦੇ ਸਬੰਧੀ ਅਨੁਮਾਨ ਬਾਬਤ ? 5,82,62,750.00/- (Indian Rupee Five Crore Eighty Two Lacs Sixty Two Thousand Seven Hundred Fifty Only) ਦੀ ਵਿਭਾਗੀ ਵਿੱਤੀ ਨਿਯਮਾਂਵਲੀ ਦੇ ਨਿਯਮ 10.5 ਦੇ ਲੜੀ ਨੰਬਰ 1 ਤਹਿਤ ਪ੍ਰਵਾਨ ਕੀਤਾ ਜਾਂਦਾ ਹੈ। ਇਸ ਅਨੁਮਾਨ ਦਾ ਖਰਚਾ ਮੱਦ - ਨੂੰ ਚਾਰਜ ਹੋਵੇਗਾ।

ਸ਼ਰਤਾਂ :-

1. ਇਹ ਕੰਮ ਮੌਕੇ ਤੇ ਤਾਂ ਹੀ ਸ਼ੁਰੂ ਕੀਤਾ ਜਾਵੇ ਜੇਕਰ ਇਹ ਉਸਾਰੀ ਦੌਰਾਨ ਬਿਨ੍ਹਾਂ ਕਿਸੇ ਨੁਕਸਾਨ ਤੋਂ ਪੂਰਾ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੋਵੇ।
2. ਕੌਂਡਲ ਰੂਲਾਂ ਮੁਤਾਬਿਕ ਕਾਰਜਕਾਰੀ ਇੰਜੀਨੀਅਰ/ਉਪ ਮੰਡਲ ਅਫਸਰ ਵੱਲੋਂ ਲੋੜੀਂਦੀ ਮਾਤਰਾ ਵਿੱਚ ਕੰਮ ਚੈਕ ਕੀਤਾ ਜਾਵੇ।
3. ਮੁੱਖ ਇੰਜੀਨੀਅਰ/ਚੌਕਸੀ ਅਤੇ ਇਸ ਦਫਤਰ ਵੱਲੋਂ ਸਮੇਂ-ਸਮੇਂ ਤੇ ਜਾਰੀ ਹਦਾਇਤਾਂ ਦੀ ਪੂਰਨ ਰੂਪ ਵਿੱਚ ਪਾਲਣਾ ਕੀਤੀ ਜਾਵੇ।
4. ਇਸ ਕੰਮ ਤੇ ਇਹ ਯਕੀਨੀ ਬਣਾਇਆ ਜਾਵੇ ਕਿ ਮੱਦ ਐਸ.ਡੀ.ਐਮ.ਐਫ 2245-08-101-01-99-50 ਵਿੱਤੀ ਸਾਲ 2025-26 ਅਧੀਨ ਰਲੀਜ਼ ਬਜਟ ਪ੍ਰੋਵੀਜ਼ਨ ਤੋਂ ਇਸ ਅਨੁਮਾਨ ਦੀ ਮੰਨਜੂਰੀ ਸਮੇਤ ਟੈਂਡਰ ਰੇਟਾਂ ਦਾ ਖਰਚਾ ਕਿਸੇ ਹਾਲਤ ਵਿੱਚ ਨਾ ਵਧੇ ਅਤੇ ਵਿਭਾਗ ਵਿਰੁੱਧ ਕਿਸੇ ਪ੍ਰਕਾਰ ਦੀ ਦੇਣਦਾਰੀ ਜਿਸ ਵਿੱਚ ਹਰ ਪ੍ਰਕਾਰ ਦਾ ਮੁਆਵਜ਼ਾ ਵੀ ਸ਼ਾਮਿਲ ਹੈ, ਖੜੀ ਨਾ ਕੀਤੀ ਜਾਵੇ।
5. ਮੌਕੇ ਤੇ ਕੰਮ ਸ਼ੁਰੂ ਕਰਨ ਤੋਂ ਪਹਿਲਾਂ ਫੀਲਡ ਡੈਟੇ ਨੂੰ ਤਕਨੀਕੀ ਪ੍ਰੀਖਿਅਕ/ਚੌਕਸੀ ਕੋਲੋਂ ਚੈਕ ਕਰਵਾ ਲਿਆ ਜਾਵੇ ਅਤੇ ਤਕਨੀਕੀ ਪ੍ਰੀਖਿਅਕ/ਚੌਕਸੀ ਵੱਲੋਂ ਜਾਰੀ ਕੀਤੇ ਗਏ ਮੀਮੋ ਅਨੁਸਾਰ ਹੀ ਏਜੰਸੀ ਨੂੰ ਅਦਾਇਗੀ ਕੀਤੀ ਜਾਵੇ।
6. ਜ਼ਲ ਸਰੋਤ ਵਿਭਾਗ ਦੀ ਮੁੱਖ ਇੰਜੀਨੀਅਰਜ਼ ਦੀ ਟੈਕਨੀਕਲ ਕਮੇਟੀ ਵੱਲੋਂ ਜਾਰੀ ਕੀਤੀਆਂ ਹਦਾਇਤਾਂ ਦੀ ਇੰਨ ਬਿੰਨ ਪਾਲਣਾਂ ਕੀਤੀ ਜਾਵੇ।
7. ਇਸ ਕੰਮ ਨੂੰ ਸ਼ੁਰੂ ਕਰਨ ਤੋਂ ਪਹਿਲਾਂ ਕਿਸੇ ਹੋਰ ਮਹਿਕਮੇ ਦੀ ਮੰਨਜੂਰੀ/ਸਹਿਮਤੀ ਦੀ ਜਰੂਰਤ ਹੋਵੇ ਤਾਂ ਉਸ ਨੂੰ ਆਪਣੇ ਪੱਧਰ ਤੇ ਪ੍ਰਾਪਤ ਕਰਨਾ ਯਕੀਨੀ ਬਣਾਇਆ ਜਾਵੇ।
8. ਇਸ ਕੰਮ ਦੀ ਉਸਾਰੀ ਸਟੈਂਡਰਡ ਡਿਜਾਇੰਨ ਮੁਤਾਬਿਕ ਅਤੇ ਸਪੈਸੀਫਿਕੇਸ਼ਨ ਅਨੁਸਾਰ ਹੀ ਕਰਵਾਈ ਜਾਵੇ।
9. ਇਸ ਕੰਮ ਦੀ ਕੀਮਤ ਤੇ ਜਨਰਲ ਐਬਸਟ੍ਰੈਕਟ ਦੀਆਂ ਤਸਦੀਕਸੁਦਾ ਕਾਪੀਆਂ ਸਿੱਧੇ ਹੀ ਮਹਾਂਲੇਖਾਕਾਰ, ਪੰਜਾਬ, ਚੰਡੀਗੜ੍ਹ ਨੂੰ ਭੇਜ ਦਿੱਤੀਆਂ ਜਾਣ।
10. ਇਸ ਕੰਮ ਨੂੰ ਮੌਕੇ ਤੇ ਕਰਵਾਉਂਦੇ ਸਮੇਂ ਸਰਕਾਰ ਦੀਆਂ ਹਦਾਇਤਾਂ ਅਨੁਸਾਰ ਕੰਮ ਦੀਆਂ ਫੋਟੋਗਰਾਫਸ ਈ.ਪੀ.ਐਮ.ਐਸ ਦੀ ਵੈਬਸਾਈਟ ਤੇ ਅਪਲੋਡ ਕੀਤੀਆਂ ਜਾਣ ਅਤੇ ਨਾਲ ਹੀ ਸਾਈਟ ਤੇ ਕੰਮ ਸ਼ੁਰੂ ਕਰਨ ਤੋਂ ਪਹਿਲਾਂ ਅਤੇ ਕੰਮ ਖਤਮ ਹੋਣ ਉਪਰੰਤ ਕੰਮ ਦੀਆਂ ਫੋਟੋਗਰਾਫ, ਮੰਡਲ ਦਫਤਰ ਵਿੱਚ ਵੀ ਰਿਕਾਰਡ ਹਿੱਤ ਰੱਖੀਆ ਜਾਣ।
11. ਇਹ ਯਕੀਨੀ ਬਣਾਇਆ ਜਾਵੇ ਕਿ ਮੌਕੇ ਉੱਤੇ ਕੰਮ ਕਰਦੇ ਸਮੇਂ ਵਰਤੀ ਗਈ ਮਸ਼ੀਨਰੀ ਅਤੇ ਅਸਲ ਦੇ ਅਧਾਰ ਤੇ ਕੀਤੇ

ਗਏ ਕੰਮ ਦੇ ਅਨੁਸਾਰ ਹੀ ਅਦਾਇਗੀ ਘੱਟ ਤੋਂ ਘੱਟ ਕੀਤੀ ਜਾਵੇ।

12. ਸਬੰਧਤ ਕਾਰਜਕਾਰੀ ਇੰਜੀਨੀਅਰ ਵੱਲੋਂ ਵਿਸ਼ੇ ਅਧੀਨ ਕੰਮ ਦੀ ਪ੍ਰਗਤੀ ਰਿਪੋਰਟ ਸਮੇਂ-ਸਮੇਂ ਤੇ ਇਸ ਦਫਤਰ ਅਤੇ ਸਰਕਾਰ ਨੂੰ ਭੇਜਣੀ ਯਕੀਨੀ ਬਣਾਈ ਜਾਵੇ।
13. ਇਸ ਕੰਮ ਨੂੰ ਕਰਵਾਉਣ ਲਈ ਸਰਕਾਰੀ ਮਸ਼ੀਨਰੀ ਦੀ ਵਰਤੋਂ ਨੂੰ ਪਹਿਲ ਦਿੱਤੀ ਜਾਵੇ
14. ਇਸ ਕੰਮ ਨੂੰ ਕਰਵਾਉਣ ਉਪਰੰਤ ਜੇਕਰ ਕੋਈ ਬਚਤ ਹੁੰਦੀ ਹੈ ਤਾਂ ਉਸ ਦੀ ਵਰਤੋਂ ਆਪਣੇ ਪੱਧਰ ਤੇ ਨਾ ਕੀਤੀ ਜਾਵੇ।
15. ਇਸ ਕੰਮ ਦੇ ਟੈਂਡਰ ਲਗਾਉਣ ਸਮੇਂ ਸਰਕਾਰ ਵੱਲੋਂ ਪ੍ਰਵਾਨਿਤ ਐਸ.ਬੀ.ਡੀ/ਡੀ.ਐਨ.ਆਈ.ਟੀ. ਦੀ ਇੰਨ ਪਾਲਣਾਂ ਕੀਤੀ ਜਾਵੇ।
16. ਕੰਮ ਸ਼ੁਰੂ ਕਰਨ ਤੋਂ ਪਹਿਲਾਂ ਵਿਭਾਗੀ ਕੋਡਲ ਨਿਯਮ/ਸੀ.ਐਸ.ਆਰ/ਪੀ.ਡਬਲਯੂ.ਡੀ ਸਪੈਸੀਫਿਕੇਸ਼ਨ/ਪੀ.ਐ ਫ.ਆਰ/ਸੀ.ਬੀ.ਸੀ ਗਾਈਡਲਾਈਨਜ ਅਤੇ ਸਾਰੇ ਸਬੰਧਤ ਨਿਯਮਾਂ/ਹਦਾਇਤਾਂ ਦੀ ਪਾਲਣਾਂ ਕਰਨੀ ਯਕੀਨੀ ਬਣਾਈ ਜਾਵੇ।
17. ਸਰਕਾਰ ਦੀਆਂ ਹਦਾਇਤਾਂ ਅਨੁਸਾਰ ਇਨ੍ਹਾਂ ਕੰਮਾਂ ਦੀ ਅਦਾਇਗੀ ਸਬੰਧਤ ਡਿਪਟੀ ਕਮਿਸ਼ਨਰ ਤੋਂ ਬਣਦੀ ਸਹਿਮਤੀ ਲੈਣ ਉਪਰੰਤ ਹੀ ਕੀਤੀ ਜਾਵੇ।
18. ਮੰਨਜੂਰ ਸੂਦਾ ਅਨੁਮਾਨ ਨੂੰ ਲੜੀ ਨੰਬਰ 1362/ਟੈਂਡਰਿੰਗ ਅਤੇ ਆਕਸ਼ਨ ਮੈਨੇਜਮੈਂਟ ਤੇ ਦਰਜ਼ ਕੀਤਾ ਗਿਆ ਹੈ।
19. ਇਸ ਤੋਂ ਇਲਾਵਾ ਟੈਕਨੀਕਲ ਐਡਵਾਈਜਰ ਵੱਲੋਂ ਲਗਾਈਆਂ ਹੇਠ ਦਰਸਾਈਆਂ ਸ਼ਰਤਾਂ ਦੀ ਇੰਨ ਬਿੰਨ ਪਾਲਣਾਂ ਕੀਤੀ ਜਾਵੇ :-

(i) As per the report, estimate has been prepared to comply with the Hon'ble National Green Tribunal (NGT) directive for flood plain zoning, the project involves the acquisition, processing, and delivery of Digital Elevation Model (DEM) and Ortho-Image for flood risk mapping of the Sutlej River. The proposal is submitted under the State Disaster Mitigation Fund (SDMF) – Non-Structural Measures scheme and includes Phase-I of the work, covering the stretch from Nangal to Machiwara-Rahon Bridge (98 km) and from Harike downstream to the international border (47 km), encompassing a total length of 145 km and an area of approximately 1450 sq.km.

As per the report, the work shall be done by the Survey of India as a deposit work.

(ii) It must be ensured that the final deliverables are meeting up with the requirement of WRD, as advised by CWC in the meeting of flood management and also as per Hon'ble NGT, so that the the optimum utilization of the work is obtained.

Further, all the data captured and final deliverables should be the property of WRD so that these are available with WRD as and when available to carry out any further study. Needful decision in this regard be taken.

(iii) As per the report, it has been noticed that 5km stretch on either side of the river has been considered for DEM. It must be ensured that the guidelines issued by the GoI for flood plain zoning are followed so that utilization of the proposal is obtained.

(iv) It must be ensured that the MoU is signed between the SoI and Govt. of Punjab, WRD.

(v) Since the last reaches proposed in the works falls near the Indo-Pak international border, therefore, it must be ensured that needful permission if required be obtained from BSF/Army as applicable.

(vi) Since the water flows throughout the year in River Sutlej, therefore, it must be ensured that the data through the flowing water be captured to the maximum accuracy to provide the requisite

the data through the flowing water be captured to the maximum accuracy to provide the requisite results.

(vii) All the norms for the flying of the aircraft, zonewise, be followed.

(viii) As per the report, it has been observed that only the Survey of India has been contacted, and the estimate includes a quotation solely from them. It is advised to explore the possibility of checking prevailing market rates for the various items and provisions included in the estimate. This will help ensure that there is no undue financial burden on the state exchequer.

(ix) As per the quotation of SoI, it has been observed that a robust storage will be provisioned by the SoI. Given the scenario, that this is the part of their quote, the separate provision in the estimate be rechecked.

(x) The area considered throughout the estimate is 1450 sq.km. It must be ensured that this is based on actual mapping requirements and is validated with GIS boundary assessment. Any deviation in area will proportionally affect costs.

(xi) As per the information of this office, since WRD has its own GIS wing and also the training has been departed to the department officers; therefore, it is advised that the capacity building of all level officers of the department be done so that in future department may take up such initiatives in -house, if possible.

(xii) It is advised to attach the necessary supporting documents with the estimate, including rate analysis or reference documents for each major item, technical specifications of the storage hardware, quality control protocols and processing methodology, along with the delivery schedule.

(xiii) All Quality Assurance/Quality Control, contouring, DEM processing, and all deliverables should strictly follow SOI/NRSC/hydrology norms and formats as per the directives of Hon'ble NGT and CWC for flood zone mapping.

3. The comments are based as per the estimate report considering the information provided in the report as correct. SE concerned to ensure the adequacy of the provisions made in the estimate.

4. It should be ensured that the above observations and earlier observations for similar works have been addressed, and thereafter the estimate should be corrected accordingly.

5. H form be ensured before starting of work

Stamp Of Approving Authority

Hardeep Singh Mendiratta-Chief Engineer - Chief Engineer Drainage cum Mining and Geology

Ref.No : WRD/25-26/DO/Div Drainag LDH/Drainage/0023 Date : 30/06/2025

Copy of the above is forwarded to the following for information and necessary action :-

1. Accountant General (A & E), Punjab, Chandigarh.
2. Accountant General (Audit), Punjab, Chandigarh.
3. Chief Engineer/ Vigilence & Quailty Assurances, Water Resources Department, Punjab, Sector-18, Chandigarh.

Stamp Of Approving Authority

Hardeep Singh Mendiratta-Chief Engineer - Chief Engineer Drainage cum Mining and Geology

MEMORANDUM OF UNDERSTANDING

BETWEEN

WATER RESOURCES DEPARTMENT, GOVERNMENT OF PUNJAB

AND

SURVEY OF INDIA, DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVERNMENT OF INDIA

This Memorandum of Understanding (MoU) is made on this 28th day of August 2025 between:

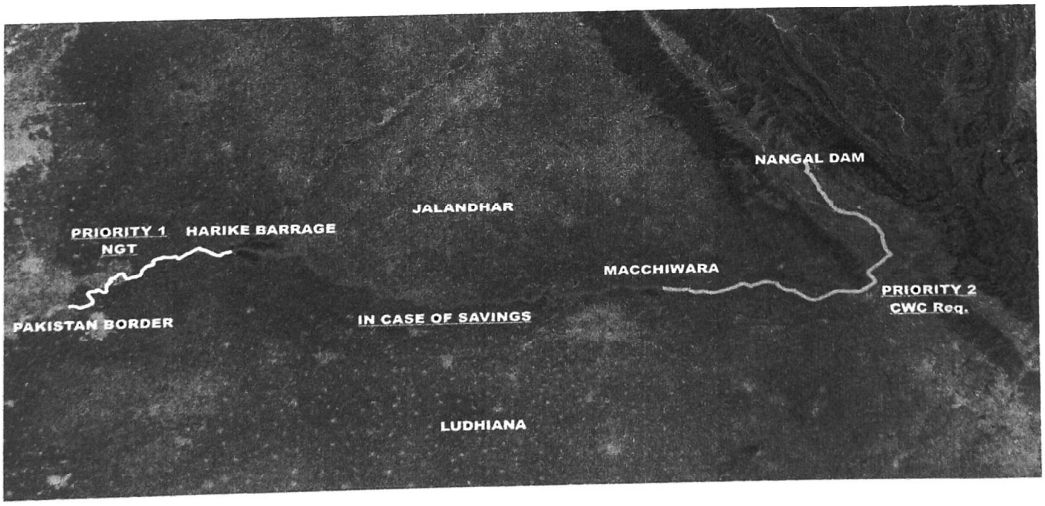
The Water Resources Department, Government of Punjab, located at Chandigarh, hereinafter referred to as "WRD" or the FIRST PARTY, which expression shall, unless excluded by or repugnant to the context, be deemed to include its successors, administrators, assigns and nominees;

AND

Survey of India, under the Department of Science & Technology, Government of India, having its office at Hathibarkala Estate, Dehradun-248001, hereinafter referred to as "SoI" or the SECOND PARTY, which expression shall, unless excluded by or repugnant to the context, be deemed to include its successors, administrators, assigns and nominees.

1.0 INTRODUCTION

The Water Resources Department (WRD), Government of Punjab, is undertaking a project to map and model flood risks of Sutlej river by acquiring high-resolution Digital Elevation Models (DEMs) and Ortho Rectified Imagery (ORI). For this purpose, WRD has approached the Survey of India (SoI) to acquire, process, and deliver DEMs and ORIs acquired using Aerialand space based techniques in Satlej river basin distance **169.3 Km. (Area about 1693 sq km)**



SOI has agreed to undertake this work as per its technical capacity and mandate, and has submitted a proposal dated 05-07-2025, which has been accepted by WRD

1.0 The extensive flooding in the state of Himachal Pradesh, Punjab and Uttarakhand in 2023 necessitated a review of issues related to flood management in these States. A Committee was thus constituted by Department of Water Resources, RD&GR (Flood Management Wing), under the Chairmanship of the Chairman of Central Water Commission (CWC), through their order no. 1/87733/2023 dated 04-09-2023. The mandate of the committee is to conduct a joint flood management study in wake of the extensive floods in the state of Himachal Pradesh, Punjab and Uttarakhand. In its 2nd meeting dated 29-02-2024, the committee decided that the State Governments of these three states shall prepare DEM of area covering Sutlej river, in their own territorial extent, as per the standards & specifications of SoI.

2.0 Consequently, O/o Chief Engineer/ Drainage-Cum-Mining & Geology, Water Resources Department, Chandigarh, Punjab has requested Survey of India to get this work done for the state of Punjab. A detailed proposal for preparing Orthometric Height (~MSL) based Digital Elevation Model and Digital Ortho Rectified Image of river basins up to 5km from each bank for flood risk mitigation/mapping of area along river Sutlej. The Project is prepared with following advantages in mind

(a) The generation of a digital elevation model plays a major role in Modernization of flood.

(b) The project has been prepared for flood mitigation measures by means of Digital Elevation Model (DEM) [i.e. both Digital Surface Model (DSM) and Digital Terrain Model (DTM)] using Remote sensing techniques i.e both LiDAR and Optical Sensors for area covering River Sutlej. By using DEM, flood routing and topography of river basins up to 5km from each bank of the rivers can be determined and used for better preparedness of Department of Water Resources and local administration, so that they can conduct flood preparation works effectively.

(c) The Digital computational data gathered by DEM project will be easily accessible and usable to the administrative agency or the Stake holder on local scale.

(d) Project will modernized and enhance the ability of the concerned department and institution to understand the terrain significantly and topography of rivers, to take preventive measure by the data accumulated by the DEM.

(e) Digital Ortho rectified Imagery [ORI] will also be generated for understanding the topographical features in the project area. This will aid in better understanding of the project area and in turn will result in more efficient decision making. Also, it will be used as reference with future surveys for change detection in the river basin area.

(f) The project will enable the authorities to assess the impact of both natural and man-made features upon flood risk by identify the topography of river basin up to 5km from each bank.

2.0 PURPOSE OF MoU

The purpose of this MoU is to establish a formal understanding between WRD and SoI regarding the implementation of the above-mentioned project, and to define the roles, responsibilities, deliverables, and payment terms under which the project will be executed.

3.0 SCOPE OF WORK

1) Provision of Ground control/Check Points:
   a. This part includes planning, creation, observation, computation, of Ground Control/Check Points.

   b. Existing CORS (Continuously Operating Reference Station) of Survey of India and Control points established under various mapping work shall be utilized for provisioning the Horizontal Control/Check points for the project.

   c. Provision of Vertical Control/Check Points will be based on the Geoid Model developed by Sol based on Indian Vertical Datum.

   d. High Precision levelling/ DT Levelling would be carried out if necessary for achieving the objectives of the Project.

2) Aerial Data Acquisition [LiDAR+ RGB]/ {including planning and other preparatory works}:

   a. Flight planning, sensor calibration, Flight execution as per plan, QA/QC for review of flight line alignment, raw data validation for completeness, avoiding data voids, strip matching, pre-processing of on-board GNSS/IMU data for trajectory file and other pre-processing steps needed for point cloud extraction/ preparing data for post-

   b. Obtaining necessary clearances from relevant ministries as per the extant rules of Gol and other agencies for flying over the survey area and to acquire data.

   c. Mobilization of all necessary equipment, software and hardware for carrying out the activity.

   d. Assistance from Govt. of Punjab will be required wherever necessary for getting necessary administrative approvals and smooth execution of survey and mapping related activities such as data acquisition, field validation, etc.

   e. Acquisition of Raw Digital data by Aerial Platform for generating Digital Elevation Model (DEM) of 0.25mvertical accuracy (RMSE) and Digital Ortho Rectified Imagery of 10cm GSD (Ground Sampling Distance) with 0.20m Horizontal Accuracy. LiDAR survey and Digital photogrammetry of the area shall be carried out by the SOI through outsourcing using Aerial platform with onboard LiDAR and Optical Sensors integrated with on-board GNSS and IMU to generate Digital Elevation model (DEM) of 0.25m accuracy (RMSE) and Ortho rectified image of 10cm GSD with 0.20m Horizontal Accuracy.

   f. If the case arises in which Aircraft flying is not permissible in any particular area pocket as per the extant rules, UAVs with RGB & LiDAR Sensors will be the platform for data acquisition in such area pockets. This will ensure continuity of Data (DEM/ORI, Contours) in such area pockets.

3) Post Processing for generation of DEM [DSM & DTM] and Digital Ortho Rectified Imagery:

   a. This part includes generating Digital Surface Model (DSM) from raw/ pre-processed data and performing necessary editing/ filtering of non-ground points (vegetation, built-up

areas, bridges, elevated structures etc.) for generating bare-earth DEM [DTM] of 0.25m accuracy (RMSE).

b. Conversion of Ellipsoidal Height Based DEMs to Orthometric height DEMs usingGeoid model developed by SoI.

c. Generation of Ortho-imagery of 10 cm GSD with 0.20m Horizontal Accuracy (RMSE).

d. QA/QC at various stages of project including horizontal and vertical accuracy validation as per specifications.

e. Proper Cataloguing of all data.

4) Feature Extraction: Topographical features shall be derived from Ortho-rectified image using suitable GIS software. The base map shall comprise of various layers in GIS format as per the requirements of the project. Geospatial Data Model used in NHP project by SOI will be deployed for better consistency of data.

5) Generation of Final Deliverables: Map template on 1:25k scale in pdf and Geo package(open source) or equivalent. Contour at 0.5 m interval in vector format (.shp). Geospatial Data Model used in NHP project by SOI will be deployed for better consistency of data.

6) Final Deliverables: QA/QC of the final deliverables and proper cataloguing of raw data, project files and documents, map templates, etc. before delivery.

7) Storage and Management of Data acquired/Generated:

a. Several Terra Bytes (TB) of Data will be acquired and generated during the course of the project. Hence, to store and maintain a copy of all the data generated in the project, a robust storage will be provisioned compatible with Geo-ICT Infrastructure of SOI.

b. A similar storage will required to be provisioned in Government of Punjab also for maintaining a copy of all the data for records and further utilization by Govt of Punjab.

8) Training: Training of Govt of Punjab Officers and Staff as per the requirement at National Institute of Geo-informatics Science and Technology (NIGST), Hyderabad, the training institute of SOI. The Training related costs will be borne by Govt of Punjab.

4.0 ROLES AND RESPONSIBILITIES

4.1

i. Additional Surveyor General, North Zone will be responsible for Monitoring of the MOU.
ii. On behalf of Survey of India, Director, Punjab, Haryana, Himachal Pradesh and Chandigarh Geospatial Directorate shall plan, execute and deliver as per the Scope of this MoU.
iii. Procurement of goods and services will be done as per the extant Public Procurement Rules and Guidelines of Government of India.
iv. SOI will hand hold and provide training as per the requirement of Govt of Punjabat NIGST, Hyderabad for geospatial skill development of its officers and staffs .Retain a copy of the datasets as part of the National Digital Spatial Framework, in line with National Geospatial Policy 2022

4.2 WRD shall:

- Facilitate administrative and field-level support for Aerial surveys
- Provide funding through approved government channels
- Coordinate permissions and clearances wherever applicable

5.0 DELIVERABLES

1.0 Ellipsoidal height (WGS-84) based Digital Elevation Model (DSM & DTM) with 0.15 m vertical accuracy (RMSE).

2.0 Digital Elevation Models (DSM and DTM) referenced to Indian Vertical Datum with 0.25m accuracy (RMSE)

3.0 Ortho Rectified Imagery with 0.1m GSD and 0.20m horizontal accuracy in Geo-TIFF Format.Contours at 0.5 m interval (as the scale permits) in vector (.shp) format

4.0 QA/QC reports, trajectory data, metadata and control point information.

5.0 Topographical maps on 1:25k scale in '.pdf' and 'Geo-package' or equivalent. GeospatialData Model will be as per NHP project.

6.0 Time Frame'

Ten (10) Months from the date of receipt of funds, subject to natural and administrative constraints.

7.0 PAYMENT TERMS

1) Funds for the project will be provisioned by Govt of Punjab.
2) Cost Estimate for Total Area of 1693 sq km:

Sl No.	Activity	Cost (in Rs per sq km)	Amount (Rs)
1	Provision of GCP and vertical control	1700	28,78,100
2	Data Acquisition	16,000	2,70,88,000
3	Data processing	1,250	21,16,250
4	ORI & DEM Generation	1,450	24,54,850
5	Post processing (DEM editing, DTM & contour generation, etc.)	2750	46,55,750
6	QA/QC of ORI/DEM	1000	16,93,000
7	**Total (1 to 6)**	**24,150**	4,08,85,950
8	Feature Extraction including QA/QC	4000	67,72,000
9	**Total (7+8)**	**28,150**	4,76,57,950
10	Storage with Smart Rack	@500TB [usable]	75,00,000
11	**Total(9+10)**		**5,51,57,950**
12	@10% of Sl.No. 11, for unforeseen expenses.		**55,15,795**
13	@20% of Sl.No. 11, to cover expenses incurred towards usage of SOI equipments and other expense on travel etc. of SOI personnel - For control provisioning, Levelling, Workstations etc. to be used for QA/QC/Audit of Deliverables etc.		**1,10,31,590**
14	**Grand Total (11 to 13)**	Area of about 1693 sq km	**7,17,05,335 /- 7,17,00,000 /- say (Rs Seven Crore Seventeen Lakh Only)**

- These are estimates only. The final cost of the project will be discovered after open tendering and subsequent the price discovery.

The amount to be deposited in the following account.

PAO Name& Code	Name of Bank	Account Number	IFSC Code
RPAO, SOI, Jaipur-058743	Union Bank of India	369202840903000	UBIN0536920

8.0 CONFIDENTIALITY

All data, maps, and information shared or generatedunder this MOU shall be treated as public good and may be used by any Department of Government of India or Government of Punjab for their mandated work

9.0 AMENDMENT

This MoU may be amended or extended only through mutual written consent of both parties.

10. VALIDITY AND TERMINATION

1.0 This MoU will remain in force for a period of one year from the date of signing of MOU.

2.0 The MoU shall be deemed to expire on completion of the period as in clause 10.1 unless extended by both the parties upon mutual consent.

3.0 MoU may be terminated at any time by mutual agreement on one month's notice at any time by either party.

4.0 Any notice request or other communication required or permitted to be given under this MoU shall be in writing and shall be delivered by e-mail/ in-person/ By India-post.

11. COMMUNICATION & NOTICES

All notices under this MoU shall be sent in writing by post or email to the following addresses:

If to WRD:

Chief Engineer (Drainage),

Water Resources Department, Government of Punjab, Chandigarh

Email ID: cedrg.dwr.chd@punjab.gov.in

If to SoI:

Addl. Surveyor General, Northern Zone.

Palam ,Delhi Cant New Delhi.

12. COORDINATORS

Each party shall nominate a coordinator for smooth execution of the project. Day-to-day matters shall be resolved by mutual discussion between the coordinators.

13.DISPUTE RESOLUTION

In case of any differences / disputes in respect of the obligation of the parties or in the meaning or any interpretation of any of the clauses set out hereto or any other matters arising out of the MoU the matter in dispute shall be resolved through mutual discussions between the parties and in the event of any failure in reaching an amicable settlement, the dispute shall be referred to the nominees to be appointed by the Head of the Organization of the respective parties, whose decision shall be final and binding.

IN WITNESS WHEREOF

The parties hereto have signed this Memorandum of Understanding on the date, month and year first written above.

For and on behalf of
WATER RESOURCES DEPARTMENT, GOVT. OF PUNJAB

Name: Hardeep Singh Mendiratta
Designation: Chief Engineer/Drainage cum Mines & Geology, Punjab.
Date: 28/8/25
Place: Chandigarh

For and on behalf of
SURVEY OF INDIA

Name: M.C Gaur
Designation: Addl. Surveyor General, NZ.
Date: 28/08/25
Place: Chandigarh.