



राष्ट्रीय स्वच्छ गंगा मिशन National Mission for Clean Ganga

फ़ा. स.: TE-27/5/2026-GIS NMCG (Comp. No.:302569)

दिनांक: 18 मार्च, 2026

कार्यालय ज्ञापन

Subject: Adoption of Standard Operating Procedure (SoP) for Drone-Based Survey for Drainage Mapping and Annotation under Namami Gange Programme.

A project titled "Aerial Survey and Development of GIS-Based Visualization Dashboard with Analytical Module and Geotagged Videography of Drainage System (Natural & Manmade) of River Ganga for the State of Uttar Pradesh" was taken under Namami Gange Programme.

2. The objective of the project is to develop a GIS-based web application for the identification and geotagging of large, medium, and small drains discharging into rivers, ensuring source-to-sink coverage wherever possible. The application will also facilitate visualization and analytics of 2D/3D photogrammetry data and videos, providing a comprehensive spatial understanding of drainage networks. The total coverage area of the project is approximately 2,200 sq. km, extending 200 meters on either side of the Ganga River within the administrative boundary of Uttar Pradesh.
3. The outcome is the development of a Drain Decision Support System (Drain DSS) to effectively analyse and monitor river pollution sources.
4. In this regard, a Standard Operating Procedure (SoP) for Drone-Based Survey for Drainage Mapping and Annotation has been finalized and is enclosed for reference. The SoP prescribes standardized technical parameters for drone-based aerial surveys including flight altitude, camera orientation, image overlap, speed, data capture specifications and processing workflow to generate high-resolution geospatial datasets such as ortho mosaic imagery, Digital Terrain Models (DTM) and GIS-based drainage layers.
5. State Missions for Clean Ganga (SMCG/SPMG) in Ganga Basin States are requested to adopt the enclosed SoP while undertaking any drone-based mapping and videography of rivers and drainage systems. After completion of the aerial survey, the acquired datasets including high-resolution orthophotos, GIS layers and video documentation of the surveyed stretches may kindly be shared with National Mission for Clean Ganga (NMCG) for integration with the Drain Dashboard and the national database.

This issues with the approval of the competent authority.

Enclosure: Annexure (SoP)

नलिन श्रीवास्तव

(नलिन कुमार श्रीवास्तव)

उपमहानिदेशक

To:

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Standard Operating Procedure (SOP)

Drone-Based Survey for Drainage Mapping and Annotation

1. Objective

The objective of this Standard Operating Procedure (SOP) is to define the methodology and technical parameters for conducting drone-based aerial surveys for drainage mapping. The survey will generate high-resolution geospatial datasets including orthomosaic imagery, Digital Terrain Models (DTM), and GIS-based drainage networks with annotation to support planning, monitoring, and decision-making.

2. Drone Flight Planning Parameters

2.1 Mapping Flight Parameters

Parameter	Specification
Flying Height	80 meters Above Ground Level (AGL)
Camera Angle	-90° (Nadir Orientation)
Forward Overlap	90%
Side Overlap	90%
Drone Speed	25–30 km/hr
Image Capture Rate	1 image per second
Ground Sampling Distance (GSD)	Approximately 5 cm
Flight Pattern	Double grid flight pattern

The mission shall be planned using standard mission planning software where the Area of Interest (AOI) is defined and automated flight paths are generated to maintain constant altitude and required image overlap. Ground Control Points (GCPs) shall be established using high-accuracy GNSS equipment to ensure positional accuracy of the outputs.

3. Videography Flight Parameters

Parameter	Specification
Flying Height	70–80 meters AGL

Camera Angle	-45° to -55° (Oblique)
Video Resolution	4K
Frame Rate	30 fps
Video Format	MP4 / H.264

The drone flight path shall follow the drainage corridor with multiple passes along both sides of the drainage channel to ensure full visual coverage.

4. Data Processing Workflow

- Image alignment and aerotriangulation
- Dense point cloud generation
- Digital Surface Model generation
- Digital Terrain Model extraction
- Orthomosaic generation
- Drainage feature extraction and GIS mapping

5. Deliverables

5.1 Orthomosaic

Parameter	Specification
Ground Sampling Distance	~5 cm
Horizontal Accuracy	≤ 10 cm (with GCPs)
Projection	WGS84 / UTM
Format	GeoTIFF

The orthomosaic shall be a seamless, distortion-free aerial image suitable for GIS analysis, feature extraction, and drainage mapping.

5.2 Digital Terrain Model (DTM)

Parameter	Specification
Resolution	10 cm
Vertical Accuracy	≤ 15 cm
Format	GeoTIFF / DEM

The Digital Terrain Model represents the bare-earth terrain after removing vegetation and structures from the point cloud. It is used for terrain analysis, watershed generation, and drainage delineation.

5.3 Drainage Mapping Deliverables

- Drainage centerline shapefile
- Drainage polygon layer
- Attribute table containing drainage annotations

Drainage shall be classified based on width as follows:

Category	Width
Small Drainage	Less than 1 meter
Medium Drainage	1 – 3 meters
Large Drainage	More than 3 meters

6. Video Annotation for Drainage

Parameter	Specification
Resolution	4K
Frame Rate	30 fps
Format	MP4
Geotagging	Enabled
Annotation	Timestamp based

Annotations shall include:

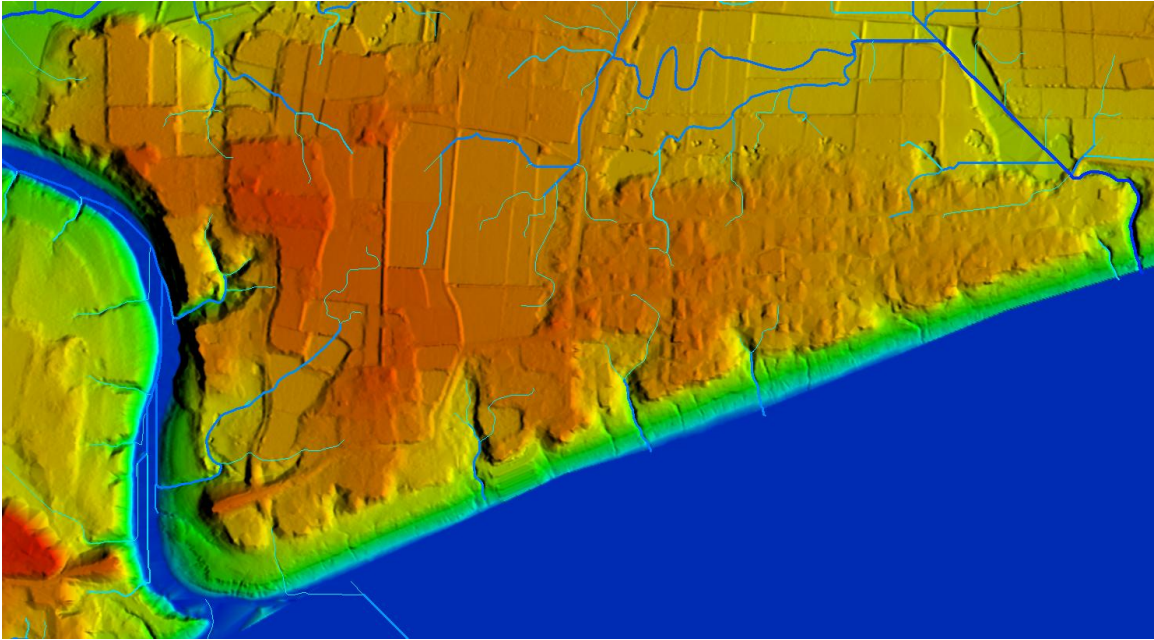
- Drainage path and connectivity
- River name first letter_District name 3 letters_Chainage_Right or left (R/L) side_drain type(S/M/L) e.g. G_ALI_323+340_RL

7. Final GIS Deliverables

- Orthomosaic imagery (GeoTIFF)
- Digital Terrain Model (DTM)
- Drainage network shapefile
- Drainage classification layer
- Annotated drone video
- Survey methodology and accuracy report

Watershed Generation:

DTM data is used to automatically generate streamlines. The mainstream is then used as a reference to delineate the drainage line.



Capture drainage line from DTM:



Drainage Classification by Width:

Classification of drainage channels should be done into three categories based on their measured width:

1. Small Drainage:
Width: Less than 1 meter
2. Medium Drainage
Width: 1 meter to 3 meters
3. Large Drainage

Width: More than 3 meters

Small Drainage:



Medium Drainage:



Large Drainage:

