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Estimation of water storage capacity of Jhilli Chaur area, Pusa farm, RPCAU, Samastipur Bihar

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Abstract
In India most of the rainfall is concentrated in a period of 3 months of monsoon season which causes waterlogging problem in chaur area. Relationship between stage and related storage capacity had been developed to find out the maximum storage capacity of the area. Contour map was obtained with the help of software that are; Google Earth, TCX Converter, Arc GIS and Goble Mapper. The highest elevation of Jhilli A was 52.5 m and for Jhilli B was 52 m. Total area under Jhilli chaur A was 4.90 ha and its maximum storage capacity was 2.305 ha-m. The total area under Jhilli chaur B was 8.409 ha and the maximum storage capacity was 4.205 ha-m.

Keywords: Stage, contour elevation, waterlogging

Introduction
The national commission on floods assessed that a total area of about 40 million ha is liable to floods and drainage congestion. Out of this, it was estimated that only about 80% or 32 million ha could be afforded reasonable protection. The problem of water logging in chaur land is attributed to inadequate provision of outlet. The natural drainage channel has become sluggish owning to mild slope, and lack of due care and maintenance. All these factors associated with mammoth deluge in various river are responsible for wide spread submergence in chaur land. In Jhilli chaur water stagnation takes place for 2 to 3 months. Most of the time during monsoon, the level of water in the river is higher than the field elevation. Hence sluice gate became necessary to control flood in the area. A stage storage relationship has been developed for knowing the capacity of watershed to store water when the sluice gate is closed and when there is no outlet for water to drain out from the field. Optimized schedule of pump operation for irrigation or drainage was needed for accumulated water for pusa Deopar chaur (Jha and Islam, 1995) [3]. Contour map was prepared with use of GIS technique. Modern tools such as satellite Remote Sensing, Global Positioning System (GPS) and Geographical Information System (GIS) provides newer dimensions to monitor and manage soil resources for their effective utilization. Soil boundaries are more precisely delineated than in conventional methods. Changing Pattern of Land could be monitored by GIS system (Islam and Sarker, 2016) [2]. GPS technique could be used instead of spirit levelling in producing a topographic contour map with an accuracy of about 20 cm in orthometric height (Shouny *et al.*, 2017) [7].

Objective
1. To prepare contour map of Jhilli chaur area.
2. To develop stage-storage relationship.

Material and Methods
Description of study area
Jhilli chaur, pusa farm, RPCAU was selected for the study. It has its geographical expansion from latitude $25^0$58’25” N to $25^0$58’35” N and longitude from $85^0$39’55”E to $85^0$39’56.52” E. The river “Burhi Gandak” passes near by the selected area in the east. The area of Jhilli chuar was divided as Jhilli-A and Jhilli –B. The soil of Jhilli chaur is medium texture sandy loam. The average annual rainfall of Pusa is 1142.2 mm.

Contour Map
The contour map of the study area has been created by using four software namely Google Earth, TCX converter, Arc GIS and Global Mapper.

Final map was prepared in Global mapper and the area between two contour intervals was obtained. Graph between waterlogged areas between two corresponding contours and contour elevations had been developed for Jhilli-A and Jhilli-B Multiplying the area between two contours with corresponding contour elevation difference, the storage volume was obtained for the study area. This storage volume shows the maximum storage capacity of the chaur area to store water when sluice gate is close during rainy season.

Result and Discussions

Owning the methods discussed for the completion of the objective of the experiment the contour map was prepared and the maximum storage for the Jhilli chaur area was obtained. The contour maps had been presented in fig.-1 and fig.-2 for Jhilli chaur-A and Jhilli chaur-B respectively. The maximum elevation obtained from the map was 52.5 m and the minimum elevation was 47.5 m and the contour elevation difference was taken as 0.5 m. Stage for the lowest contour elevation i.e. 47.5 m was counted as zero so the maximum value of stage was 5m up to the maximum elevation of 52.5 m. The relation between area between two contours of the watershed and the contour elevation showed that the maximum area for storage was 4.90 ha for Jhilii-A (Fig.-3) and 8.40 for Jhilli-B (Fig.-4). For lower contour elevation range 47.5-48 (stage of 0.5 m), the storage volume was 0.026 ha-m and 0.260 ha-m for Jhilli –A and Jhilli-B respectively and for the contour elevation range 52.0-52.5 (stage of 5 m) the storage capacity of was 2.305 ha-m and 4.204 ha-m for Jhilli –A and Jhilli-B respectively (table-1). The maximum storage volume in Jhilli Chaur-A was 2.39 ha-m (fig.-5) and Jhilli Chaur-B 4.204 ha-m (fig.-6) which can be stored in Jhilli chaur when sluice gate is closed.

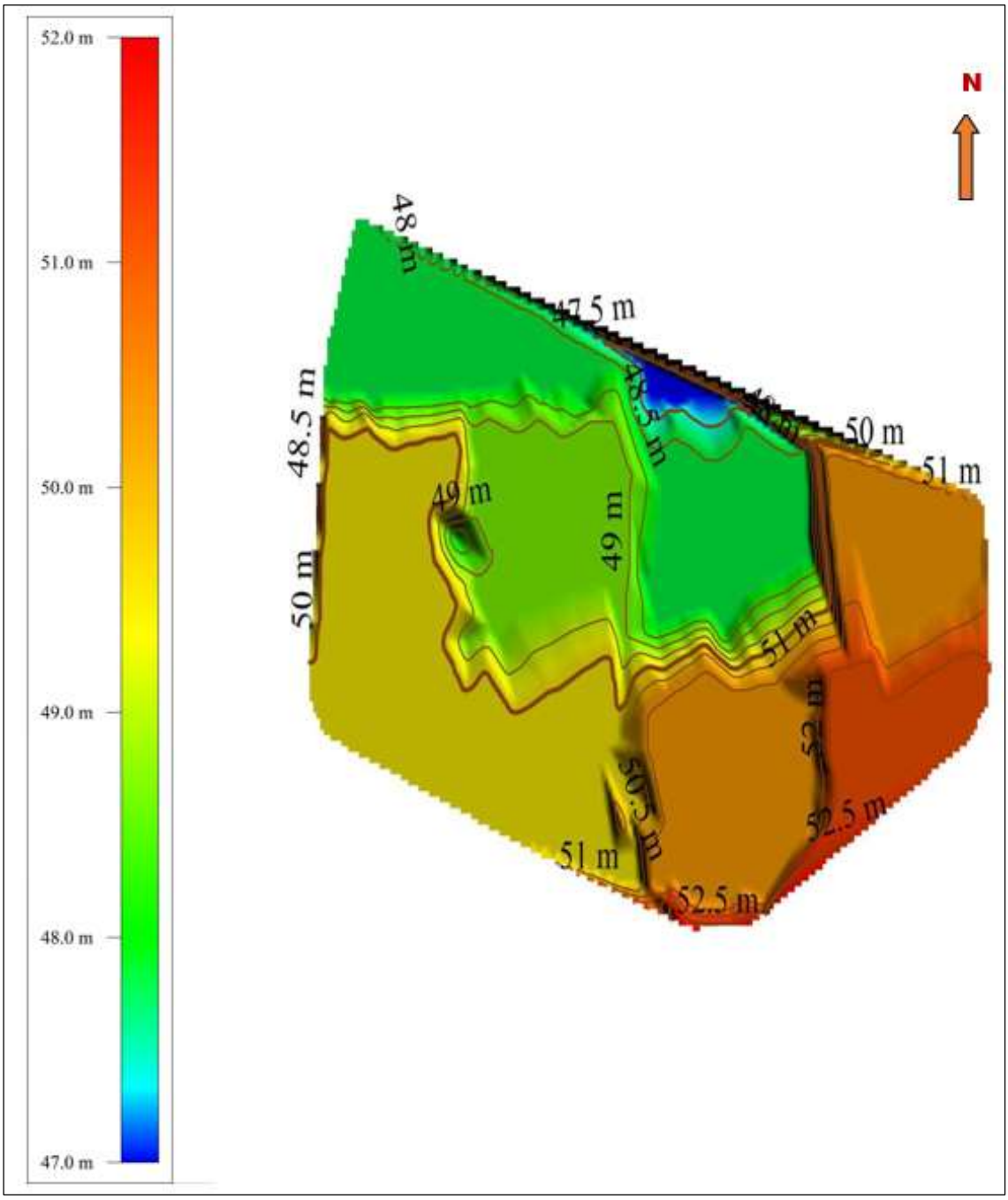

Fig 1: Contour Map of Harpur Jhilli Chaur area - A

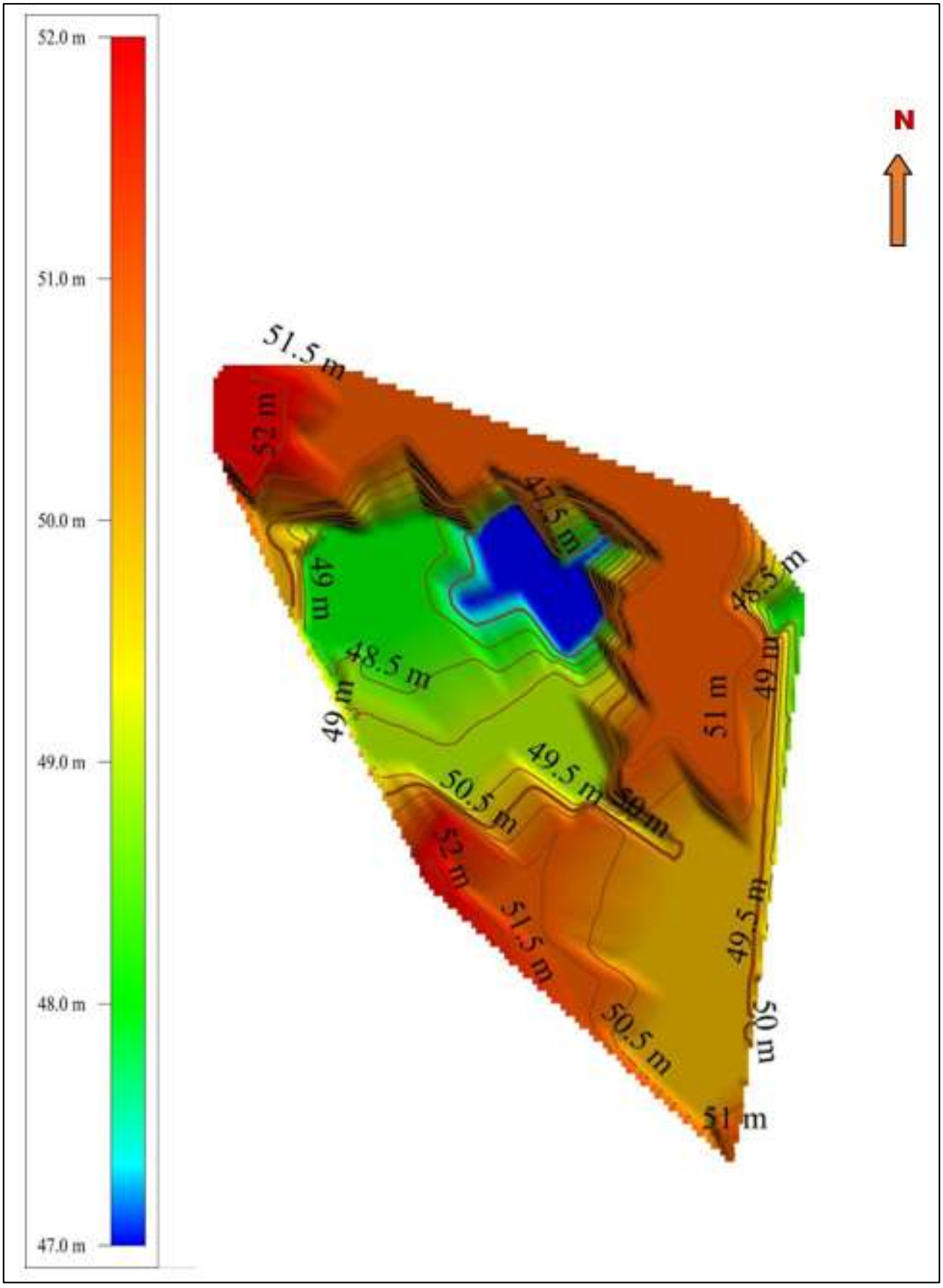

Fig 2: Contour Map of Harpur Jhilli Chaur area - B

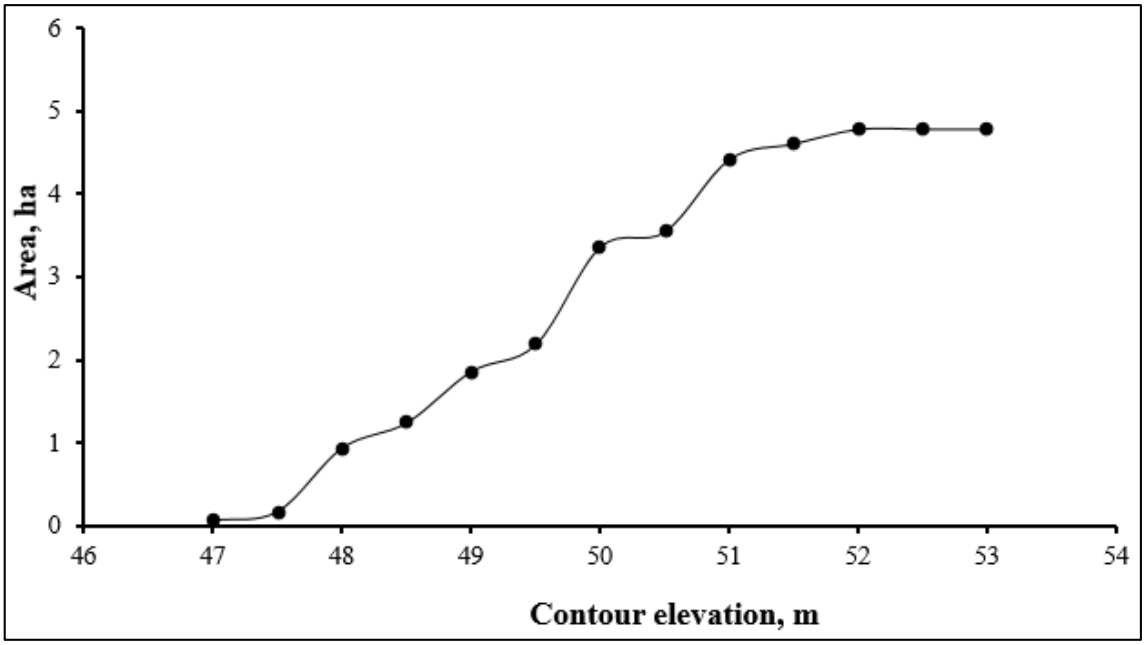

Fig 3: Relationship between contour elevation and waterlogged area for Jhilli -A

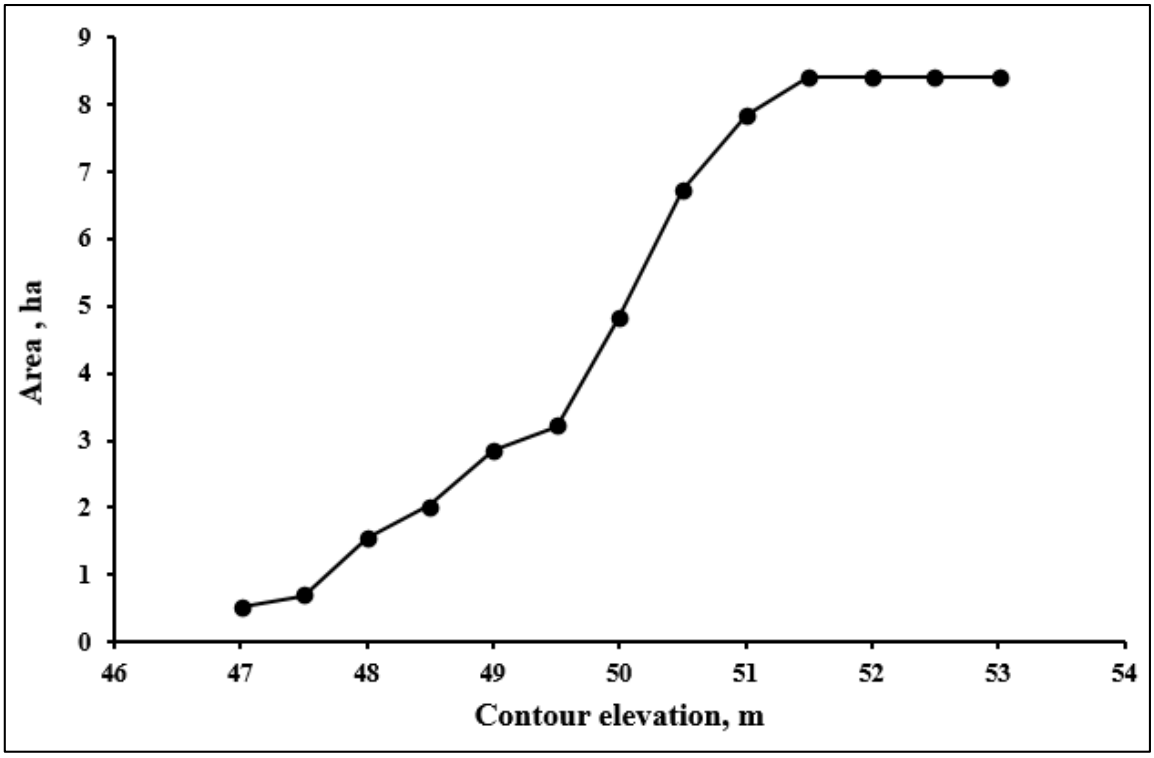

Fig 4: Relationship between contour elevation and waterlogged area for Jhilli-B

Table 1: Relationship between stage and storage for study area

Contour elevation range	Stage (m)	Storage volume (ha-m)	
		Jhilli -A	Jhilli- B
47.5-48.0	0.50	0.026	0.260
48.0-48.5	1.00	0.081	0.348
48.5-49.0	1.50	0.465	0.777
49.0-49.5	2.00	0.617	1.017
49.5-50.0	2.50	0.927	1.431
50.0-50.5	3.00	1.091	1.609
50.5-51.0	3.50	1.681	2.415
51.0-51.5	4.00	1.773	3.369
51.5-52.0	4.50	2.212	3.923
52.0-52.5	5.00	2.305	4.205

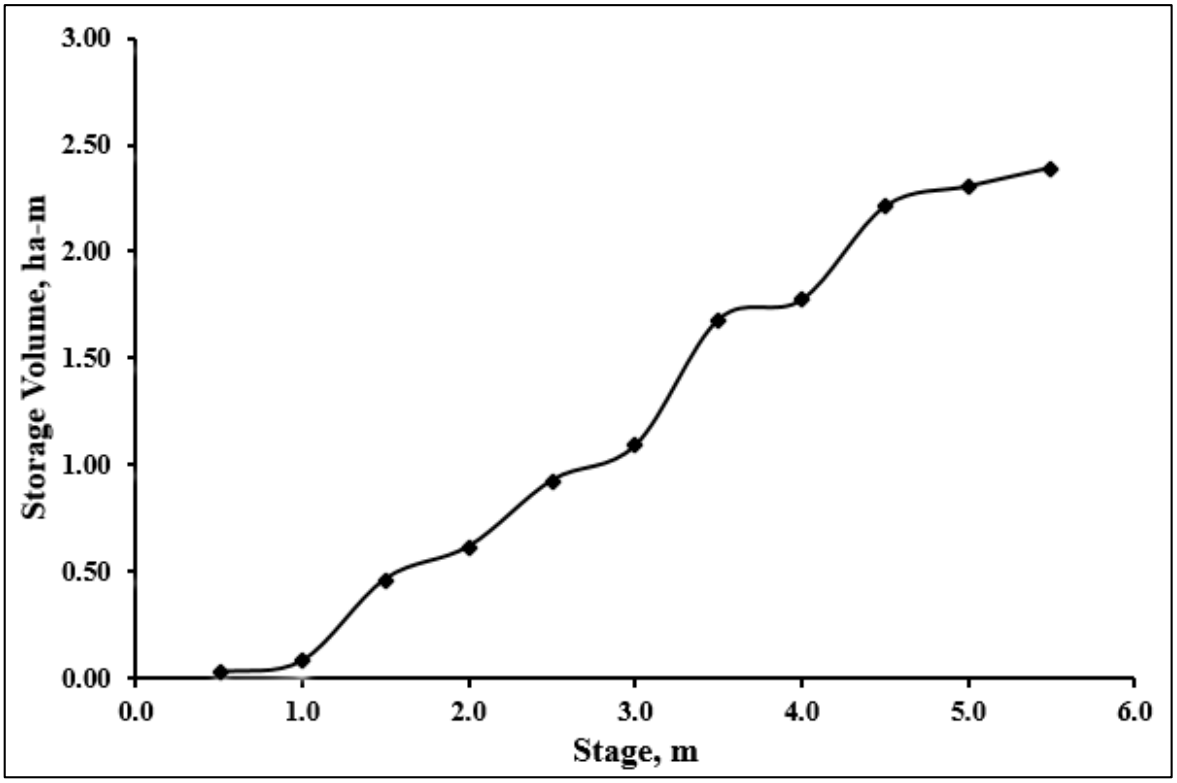

Fig 5: Relationship between Stage and storage volume for Jhilli chaur- A

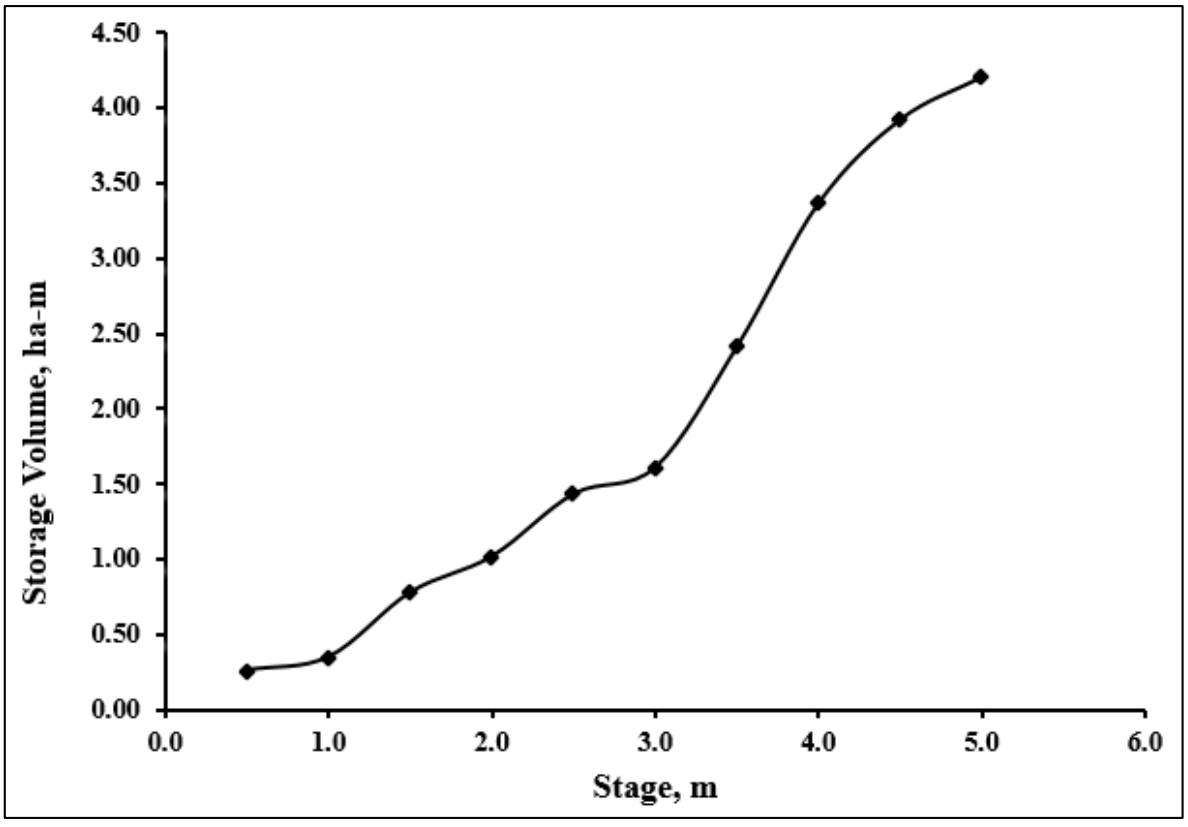

Fig 6: Relationship between Stage and storage volume for Jhilli Chaur- B

Conclusions

A stage storage relationship has been developed for knowing the capacity of watershed to store water when the sluice gate is closed and when there is no outlet for water to be drained out from the field. For this contour map was prepared which had given the contour elevation and the area between the two corresponding contours. The relation between total area under different contour interval and the contour elevation had been developed. Relationship between stage and storage was developed which gives the maximum storage capacity of the area when sluice gate is closed. The highest elevation of Jhilli A was 52.5 m and for Jhilli B was 52 m. Total area under

Jhilli chaur A was 4.90 ha and its maximum storage capacity was 2.305 ha-m. The total area under Jhilli chaur B was 8.409 ha and the maximum storage capacity was 4.205 ha-m.

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