

***Morphologic Change Assessment of Riverbed Before and after Dam  
Construction Using HEC RAS Model and GIS  
(Case Study: Downstream of Satarkhan Dam)***

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Received: 07/08/2012      Accepted: 21/04/2013

**Extended Abstract**

**Introduction**

Rivers are important sources of water supply in the world. So reduction of their water can impact on human life. This water supply is facilitated by dams as huge structures that save water and make big reservoirs behind. Dams are well known for influencing channel and vegetation dynamics downstream, but little work has focused on distinguishing effects of land use and channel responses to the impoundment. The impact of construction of dams and reservoirs on alluvial rivers extends both upstream and downstream of the dam. Downstream of dams, both the water and sediment supplies can be altered leading to adjustments in the river channel geometry and ensuing changes in riparian and aquatic habitats. Construction of large water structures such as dams across rivers may lead to considerable decrease in the flood discharge proportionate to structure size which will in turn result in lower flood probability. Assessment of the vulnerability of river boundary is of great importance due to their rich soil and easy access to irrigation water which makes such riverbank farms economically valuable especially in dry areas. The results of such assessment can be used in land use planning. In this paper, we examined the interacting effects of Satarkhan dam on downstream changes in channel morphology of Aharchai River. Satarkhan dam was constructed on the main stem of the

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Aharchai in 1998 for water supply, flood control and sediment retention. This dam is located between Ahar and Varzaghan city, eastern Azarbaijan, northwest of Iran.

### Methodology

Base line data including mean annual sediment, mean daily discharge and cross sections data located downstream were collected from several sources. Dams influence the two primary factors—water and sediment—that settle the shape, size, and overall morphology of a river and represent fundamental interventions in the fluvial system. These data were calculated and estimated for two periods as before (1989-1997) and after (2003-2009) dam construction. To measure the cross sections changes, HEC RAS model and two hydrometric station's data (Oshdologh and Tazekand) were used to estimate mean discharge of the river and annual sediment transportation. Also satellite images SPOT 2006, aerial photos 1995 (scale, 1:40000) and 1:25000 map were used to study the changes in river path. These data were calculated in Arc map and the results represented as maps.

### Results and Discussion

Prior to the construction of the Satarkhan, the total mean flow discharge measured at Tazekand and Oshdologh stations varied along the whole year, and ranged between 2.3 m<sup>3</sup>/s to 9.3 m<sup>3</sup>/s and 1.8 m<sup>3</sup>/s to 7.3 m<sup>3</sup>/s. The total annual sediment for these stations varied between 287000 to 100000 t/y and 275000 to 51000 t/y. As Satarkhan was completed, a complete control of the Aharchai River discharges was achieved and the channel has no longer been subjected to high floods. The flow rate of water also became under full control. Accordingly, the average annual discharge has been reduced by 63% and 61% at Tazekand and Oshdologh stations. Moreover, a substantial change in the sediment regime of the river downstream of the dam occurred, which in turn disturbed the stability of the hydraulic geometry of the river.

### Conclusion

Changes in the release schedule for Satarkhan dam have led to a decline in the frequency and greatness of peak flows that trigger channel changes. The river is more stable some distance downstream from the sediment sources because of the decline in channel avulsion. But far from the dam, this influence is weak. On the other hand, a great change in the flow regime of the Aharchai River occurs downstream of the Dam, with it captured all upstream flows early in the rainy season, most low flows, many larger flows and the reduction in magnitude of some floods that are released downstream. The change in flow regime is also likely to have caused a change in sediment load. Changes in the water and sediment regimes of the river resulted in channel adjustments in both the vertical and lateral dimensions. The channel pattern has shifted from a wide, braided shape with mid channel bars, to a single-thread straight and meandering planform. The channel pattern change was studied by comparing the SPOT satellite image and the aerial pictures for prior and after dam construction.

**Keywords:** *Catchment Area, River Morphology, HEC RAS, Cross Section, Satarkhan Dam.*