

# **Application of groundwaters and its effect on environment: a case river in Iran**

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**Abstract.** There are some water basins in Iran. The Persian Gulf and the Caspian Sea are the best examples. Also there are some rivers in Iran that are originated from them, for example: The Karoon river and Kore river. The The Karoon river is the biggest one in Iran. It passes from Khuzestan state cities. In Shushtar an ancient city in Khuzestan, this river has a meander through itself and so a setting dam was built in its route. The setting dam named "Bande Mizzan" divides the The Karoon water flowing to another artificial crevasse named "Gar-Gar". The shape and area of the windows on the dam for controlling water currents follow hydraulic and civil engineering concepts. By this, it would be possible to prevent destruction of the coastal zone in Shushtar and coastal erosion has been decreased notably. In fact there are 9 gates as controlling windows on the face of the The Band-e-Mizzan with a scientific engineering view. The hydraulic pattern used in building the dam is followed for other setting dams in Iran. It has been useful to protect coastal zone in cities near rivers and use river water in life and agricultural well. Deby of water flowing through the gates in the dam is calculated and sedimentation has a very small value. Following civil engineering regulations would be useful in building coastal cities and ports like Shushtar. In this paper, we model dominant current deby in the meander in rout of the The Karoon river, Shushtar domain.

**Keywords:** Shotteit, Karoon, Band-e-Mizzan, Groundwater

## **Introduction**

Floodplain zone could be seen when water body flowing in a river basin was more than volume of the basin. In these areas, bank erosion takes place and river supply and path management won't be applicable for long time (Werner, 1993). Building coastal walls and setting dam on river gates will be useful to preservation of river basin deformation and long time management (Shames, 1999). Number and position of gates appointed on dam is very important hydraulically and hydro dynamically. Existence of setting dam will lead to water storage and flood prevention. The Karoon River, the biggest river in Iran, in Shoushtar domain, is divided into two branches, "GarGar" and "The Shotteit" and water bodies in the ratio of 2 to 4 are cleaved between them. The number of gates and their position in a special area called "BandEMizzan" in front of water flowing in The Karoon were well appointed at hundreds years ago. As could be seen in Fig. 1, there are nine gates on "BandEMizzan". "BandEMizzan", is a setting and water divider dam. Its position is on top of meander of The Karoon, that coast erosion and sedimentation happen so much. Its front wall is set in 90° angle due to river current, so a main part of water body of The Karoon would conducted to "GarGar" canal and then erosion and sedimentation in "The Shotteit" will be decreased very much in Shoushtar domain. Of course reconstruction of "BandEMizzan" and its gates is necessary to conserving this valuable hydraulic structure in canal of The Karoon on mouth of "GarGar". Sedimentation rate around "BandEMizzan" has been little because it is exactly on top of the The Karoon meander; less depth of the river in this area helps to reduce bank erosion too. Material used to building dam is

important to fasten it and raise (magnify) dam resistance against water penetration and water destroy. Shape and distance between the gates cross section and area of gate mouth of setting dam is a main factor for efficiency of dam operation. Water body flowing in river route and entering to canal should be enough to decrease water in the first canal and supply necessary water for the second canal after gates mouth in dam face. The shape of gates mouth and windows on the front wall in "BandEMizzan" dam is rectangular. Maybe it would be circle or ellipsoidal or others but after considering all factors about hydro dynamical studies on dam efficiency must be exact and scientific. Fig 2 shows windows and gates (9 gates) of "BandEMizzan" built in "Sassani" ages that need reconstruction. Eddies and non laminar currents can be detected by Reynolds number that turbulent flow, on the other hand, occurs at high Reynolds numbers and is dominated by inertial forces, which tend to produce random eddies, vortices and other flow fluctuations.

## **Materials and Method**

### **Sinusoidal parallel wall of the dam**

Particularly in bending of river route (meander) and on surface of river water, eddies and secondary flows in bank and coastlines of river would be shaped and happen always. Sinusoidal face wall helps to decrease rate of these currents and then coastal destruction by a main drift (Mosaddad and Akhyani, 2007). From top of "BandEMizzan" dam a sinusoidal shape with two successive waves in the water surface could be seen. Fig 3 presents the above point. The wave length of this sinusoidal shape should be appointed efficient and exactly to weaken eddies to be swept. In fact, eddies happening on surface of river or secondary flows in banks of river, specially in river meander, will be weaker much more if the wavelength of sinusoidal shape of the front face of dam comparable with their own. Length scale of surface eddies on "The Shotteit" is about 1 to 5 meters of domain while two wavelengths of "BandEMizzan" wall behind of the river are about 30 and 20 meters from dam top to down stream . We could watch eddies weakening after striking the dam face. Of course intensity of water currents flowing in the river after dam is decreased and enough as a result of number and position of them rather to water currents (with 90° angle).



Fig. 1 An aeropicture of the Karoon river, Shoushtar **Laminar currents and little destruction for Gar Gar**

Due to existence of the setting dam "BandEMizzan' and position of dam gates, GarGar water body after this dam has been deformed to good zone of currents direction. Furthermore enough water body provided to be flowing in the river canal after the setting dam, in existence of bending in river path has been applied and useful to prevent from bank erosion and sedimentation (Mosaddad and Akhyani, 2007). We don't have any floodplain for "GarGar" but it happens around "The Shotteit" because reconstruction of "The Band-e-Mizzan" that is necessary to optimize the application of the dam hasn't been finished yet. Laminar and calm currents happening in "GarGar" are results of no bending and no much water body flowing in "GarGar" canal (Figure6). So building of setting dams in correct position with suitable gates and windows in size and number is very applicable to conduct water currents in river that should be performed due to too much consideration. Sometimes known as streamline flow, occurs when a fluid flows in parallel layers, with no disruption between the layers. In fluid dynamics, laminar flow is a flow regime characterized by high momentum diffusion, low momentum convection, pressure and velocity independent from time. It is the opposite of turbulent flow. In nonscientific terms laminar flow is "smooth," while turbulent flow is "rough" (Urick, 1991). The dimensionless Reynolds number is an important parameter in the equations that describe whether flow conditions lead to laminar or turbulent flow (Blishev, 1997). Reynolds numbers of less than 2100 are generally considered to be of a laminar type. When the Reynolds number is much less than 1, Creeping motion or Stokes flow occurs. This is an extreme case of laminar flow where viscous (friction) effects are much greater than inertial forces (Tamara, 2005).

## **Result and Discussion**



Fig. 2 A picture of the Gar-Gar canal (a mankind one)

We could see a calmly laminar profile of current on the surface water in such a direct canal with no meander

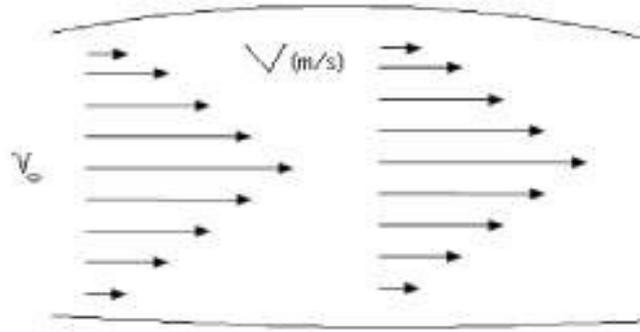


Fig.3 Laminar and calmly current profile of the surface water in a straight canal

Overall, the picture of surface pattern of currents would be as the following photos on the surface. That is, we could see ripples on it even when wind blowing on.



Fig. 4 Some photos of the surface calm pattern of current for the gargar water canal

## **Conclusion**

We could get useful and applied results from researches like this article such followed notes:

1. Direction of setting dam should be straight in ratio to water currents of river for entrance after dam to optimize the efficiency that related to their structure.
2. Numbers of windows and gates on setting dam must be appointed correctly to apply exact control water body flowing in river or canal after setting dam.
3. Building of setting dam and establishing of the second canal in place of maximum curvature of river is an applied task to decrease the rate of sedimentation and bank erosion.
4. Fastening bank lines of river, building of river coastal walls and deepening of the river basin would be useful to avoid happening of flood around river.
5. Materials for building of coastal structures must be appointed resistant rather than water.
6. Flood currents and sedimentation in the river with high current velocity could be controlled by setting dam creation.
7. Superposition of surface waves and secondary flows with dam structure mouths can lead to decrease erosion and make a calm river.

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