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A Study on the |Unauthorized Removal of Sand in the Longitude Profile of Lisar River

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Abstract: *Lisar watershed is one of the main areas at the east of Gilan which is a component of Gorganrood of Talesh province in terms of political divisions of this area. This study has done by the aim of study the morphologic changes of the river due to river material removals in Lisar River. For this purpose, by studying and identifying physical and hydrological features of the basin, the rate of annual sediment load was calculated which is including load floor, suspended load using sediment rating curves. And the rate of authorized removal of river materials was obtained according to calculations of total sediment 42/22 thousand tones in a year in the average flow rate and when syllabic is 140/25 thousand tones in a year. The amount of authorized removal of materials during a year is 2.85 thousand tones in a year or is equal to 7.8 tones in a day. However, the rate of material removal from Lisar River is calculated more than authorized amount. Fall of the river and consequently increasing slope and in results increasing speed and power of flow is cause to being active floor action and wall corrosion especially in the end point of the road.*

Keywords*: material removal, changes in the river bed, geomorphology, corrosion, Lisar River.*

INTRODUCTION

End of the problem: one of the malicious activities which are forced on rivers is sand removal from their bed for civil projects. However, materials removal from rivers is essential and unavoidable, but this is cause to reduce internal sediment feed to river and so river attack to his bed and sides to complete capacity of sediment shipment that is cause to change river's morphology between upstream and downstream and changes is cause to destruct natural condition of river and change in hydraulic and hydrology condition of flow and is cause to some problems including diversion of flow path and development of floodwater range, bed and beach corrosion and reduce the level of the river bed and risk structures sustainable with low foundation like bridges and or slope adjustment structures. Therefore, the study of consequences resulted from materials removal of the river and its monitoring is an essential work to these usages doesn't lead to destruction and erosion of sides and river bed, aquatic habitat, violation of rivers and around lands. Lisar River is one of the western main rivers of Gilan that according to being flood and side erosion and flood in the river bed, being a steep dock and finally being up to the runoff coefficient, the high potential in the changes of river's morphology and increase side erosion. Sand mine in the end part of Lisar River increase the importance of studying the changes of river's morphology for river materials. And the aim of this study is following to provide proposes for fixing problems and difficulties, in addition to answer to this question that: Do sand and gravel from the bed river has an effect on longitude profile of Lisar River/. How much is the amount of effect of sand and gravel removal on the change of longitude profile of Lisar River? Where are the points of longitude profile change of Lisar River?

Erosion: erosion of soil is as one of the dilemmas of this era that is a cause to high disadvantages to agriculture part and is a factor of filling reservoirs and reduce their useful life. In order to run soil protection programs and determine ways to combat erosion and reduce sediments and so on, it is necessary that evaluate and estimate the volume of all amount of annual sediment production in a watershed and if there are adequate statistics and information related to water flow and sediment in a watershed, calculation of total volume of annual sedimentary made necessary experimental methods to estimate erosion intensity and sedimentary using statistics methods of soil erosion and sediment production at many our country watersheds (Refahi, 1996). Erosion is materials replacement from a point to another point. Materials resulted are carried due to loss cohesion and comprehension by different factors like water, wind, and snow after soil or stone destruction and transmit and sediment dependent on the power of deporting factor (Ahmadi, 1999). Erosion is a phenomenon to tabulate or grade land level, so, soil and cobblestones through being grade, wallow and being washed move due to exertion power from high points to earthborn places (Hadson, translated by Ghadiri, 1993).

Erosion of river side: this type of erosion is done in walls of creeks and rivers. In this erosion, some regions that wear out strongly are external parts of bends, because water shear force is high there. The act of this type of erosion is different from other types of erosions. Erosion along the sides and bed permanent stream is always active, while other erosions are active just during rainfall and or a little after its beginning.

Some factors that help this type of erosion is: high speed of water flow, being wet and dry soil of walls alternatively that is cause to relent soil of walls, made them sensitive to erosion. This erosion is affected by the rate of sediment load, it means that if it diminishes by soil protection methods or dam reservoir upstream, enter the materials especially coarse materials to river and or don't enter any material, it is possible that sides and bed of creek doesn't outwear, especially its soil doesn't be erodible (Refahi, 1996).

River morphology: recognizing the form and building of river is called river morphology. In one hand, we can obtain information from the geometry of the channels, bed form, and longitude profile of river by helping river morphology. Morphology of a river is affected by different factors like erosion flow speed and method of sedimentary. Geology and the type of path are divided in terms of river morphology in two ways:

In terms of geology: in this division, we are face to young, coherent, old rivers.

Young rivers: it is called a part of the river that depth – to – width and speed ratio is high due to river steep slope. It is beginning from resource and is continued to the beginning of the middle area and most destruction is in the floor and river form (v) form.

Middle rivers or comprehend: these types of rivers are flow in the wider valley and have ane easier slope. The depth – to – width ratio is lesser than primary mood and also, the flow speed is reduced and flow segment is (u) form and destruction in sides and bed is tangible. Wall erosion in this type of rivers is the replacement of bed erosoin because the bed is reached to a relative equilibrium mood.

Terminal or old rivers: in this part of river width is high and speed of flow is low and bed destruction is done in sides. This part creates delta in river Beal.

In is mentioned that a river can change from old to young mood and or from young to the old position during its path according to existing imposition (natural or false) and positions that river pass on the natural bed.

Sanctum of the river: neighbor lands of river bed with width 1 to 20 meters that are necessary as height right for انتفاع sophistication and protection from the river bed. The exact rate of this sanctum is determined based on the river bed in spate with 25 years period according to power administration destruction. And on one hand, flood way is called a part of the river that flow passes from it during spate and a part of flood width with return duration of 100 years that its occupation is a cause to increase spate level more than 32 cm.

How to determine the appropriate location of sand and gravel from river: in the course of the river, after the middle stage was left behind (or in middle stage), path is becoming as twisted that resulted arcs from twisted in the external arc regions is erosion and depth bed due to screw movement and Thalweg flow and in the internal arc, sediments are permeate, so, the best location to remove sand and gravel in twisted parts and in the internal arc that creates screw movement.

Causes of river rupture: increase side slope due to erosion and scour and consequently its slip is established due to satiate for term flooding in the river; from saturated soil of sides of a permeated flow towards river that internal shear strength of soil particles is reduced intensively and risk side slope stability and will lead to slip. Seepage conduit from underlay knows as direct erosion due to underground water movement into the river that carries fine-grained material in the soil. Rupture based on some cases like reducing resistant into side soil and rupture after side foundation. Totally, the stability of a ramp affected by water is dependent on two factors. Firstly, water static height that is a cause to satiate soil and create water leakage. Secondly, water destruction power in flow that creates changes in forms, slope and its stability.

Geographical location of Lisar watershed: Lisar watershed is one of the main western watersheds of Gilan during Talesh and has geographical coordination between lengths 13" 55' 37° and 42" 2' 38° eastern and width

48° 35' 29" and 48° 56' 2" northern. Space of this region is 206.5-kilometer square. The main operation of this region is forest and tore operation cover the most level of the region.

Stratigraphy of the studied region: the oldest baits is related to before the first period that is including igneous granite unit and granodiorite that has been Alborz basement and shows as g. stratum related to the second period – Jurassic and Upper Cretaceous – Triassic: deposits of sandstone conglomerate and are in the condition of fenny and waterlogging along with coal works (Js), limestone, calcareous sandstone, and slit, lithologic units related to Jurassic area is observable in the most study units and subunits. Cretaceous: Upper Cretaceous deposits in the study area are visible in three ways: A) Gross limestone with layers of Chile, silt and sand bedding preceded by K2ls these units has been modest and good alternation of limestone, siltstone and shale stake. Anticline and Syncline works of folding as can be seen easily in this stratigraphic unit. B) Pyroclastic deposits and deposits with the abbreviation K2vs with basalt and Andesite.

Rock units: Lithologic units constituting the study area is divided into three groups: Sedimentary rocks include: Clastic sedimentary rocks such as conglomerate, shale, siltstone and sandstone that all remaining deposits of the Jurassic period (particularly Shemshak) and alternately Cretaceous stratigraphic units (K2ls). Clastic sedimentary rocks such as tuff and sediments Tofdar the dominant December lithologic units (K2v), which has a significant development in the basin. Chemical sedimentary rocks are such as limestone, particularly Permian limestones and calcareous rocks of the Jurassic (Js) and Cretaceous (K2ls). Igneous rocks include: Such as granite and basalt and Cretaceous intrusive igneous Andesite (K2v) can be seen.

Table 1: rock units and the inherent susceptibility to erosion units and their relative permeability

Age	Sign in map	Substance of lithologic unit	Present operation	Sensitive rate to erosion	Relative permeability
Quaternary	Q	Disjoint sedimentary of present era	Agriculture and water	High	High
Paulsen	Pgkl	Andesite echo with Lava, Agglomerate, and conglomerate	Forest and tore	Low to average	Average
	Pgv	Andesite Lava	Forest and tore	Low	Low
Upper Cartas	K2Vs	Pyroclastic stones and echo sediments along with basalt and Andesite	Forest	Low to average	Low to average
	K2LS	Gross limestone with Chili, silt and sand layer	Forest and tore	Average	Average
Infra-Cambrian	G	Granite and granodiorite	Tore	Low	Low

Topography and elevation basin: Lisar of Highland watershed basin in Guilan province has a maximum altitude of 3168 m and a minimum height of basin area is 21 km coastline. Most of the basin is on the floor height of 3000-2700 meters. Class elevation and area of each floor is provided in Table (2).

Table 2: elevation and area, and the percentage of the area of each floor

Space present	Space with kilometer square	Height stages with meter unit
8.8	18.2	-21-300
9.6	19.8	300-600
11.1	22.9	600-900
11.8	24.4	900-1200
9.5	19.6	1200-1500
8.6	17.8	1500-1800
7.9	16.3	1800-2100
6.6	13.5	2100-2400
9.8	20.3	2400-2700
14.1	29.2	2700-3000
2.1	4.4	3000-3168
100.0	206.5	

Slope Basin: Most area located on slopes greater than 40 percent and the lowest area belongs to the class of the steep slope of 2-0%, which is indicative of the basin. This is the high rate of runoff and erosion potential, production, and transport in the basin. Watershed slope map is provided in Figure 3.

Table 3: Area and percentage of slope of the watershed area

Slope percent	Space of every stage	Slope stage
0.7	1.4	0-2
2.4	4.9	2-5
2.4	4.9	5-8
4.5	9.2	8-12
12.0	24.8	12-20
17.6	36.3	20-30
17.5	36.1	30-40
43.1	89.0	40 >
100.0	206.5	Total

Climatic characteristics of the study area: The study area is in a period of 30 years with a mean temperature of 15.8 degrees Celsius that the rate fluctuating between 6.0 degrees in February to 2.9 degrees in August. The absolute minimum temperature for the month of January (-12 degrees Celsius) and the absolute maximum in August (38.8 degrees Celsius), respectively. Based on the seasonal temperature regime, the region has an average temperature of 7.5 degrees Celsius in winter, 18.5 ° C in spring, 24 degrees Celsius in summer and 13.4 degrees Celsius in autumn. The average monthly temperature in the region Lisar is summarized in Table (3-4). The minimum monthly rainfall is not less than 42.5 mm (August) and its maximum monthly rainfall arrives in 127.9 mm (November). Annual rainfall according to statistics, at least 653 mm of precipitation 30 meters in height and 1229.6 mm of annual precipitation in plain areas in the region.

Average monthly rainfall in the basin Lisar is in Table 5.

Table 4: Average monthly and annual temperature field Lisar

October	Novemb er	Decembe rs	Janua ry	Februa ry	Marc h	Apr il	Ma y	Ju n	Jul y	Augu st	Septemb er	Annu al
12.3	7.9	3.7	0.9	0.6	3.7	9.6	13. 3	17. 4	19. 9	20.9	17.2	10.6

Table 5: Average monthly and annual rainfall catchment Lisar

Octob er	Novemb er	Decembe rs	Janua ry	Februa ry	Marc h	Apr il	Ma y	Ju n	Jul y	Augu st	Septemb er	annu al
95.4	127.9	83.4	79.8	72.9	86.1	93.4	105	52. 1	43. 8	42.5	74	1130

Soil watershed: The watershed due to moisture and heat maps of soils, climate and weather data Study Group has xeric soil moisture regime and Youdick that Xeric soil moisture regime can be seen to a height of 1,200 meters and moisture regimes Youdick to the top height.

In addition, the study area has a thermal regime mesic the thermal regime Fryjyd altitude of 1,500 meters and is higher from 1,500 square meters.

In this area soil taxonomic classification based on three categories as found below:

A: Entisols at an altitude higher than 2,100 meters on gentle slopes on sandstone bedrock, which also does not have much change and soil processes of formation is not well established and it can be seen at an altitude of about 650 meters higher precipitation and warmer temperatures and forest vegetation.

B: Category insepty Sol which can be seen at an altitude of 650 to 2100 meters with forest vegetation on the rocks.

C: Category Alfie Sol at an altitude of about 1650 meters and on igneous rock of the game and thermal regime Frijid irrigation iodic with forest vegetation can be seen on gentle slopes.

Vegetation and land use: Overall, the study area was forested vegetation zone which is depending on access conditions, topography and population density of different tree, so that the conditions of access to the forest cover is less dense trees and severity of damage and the severity of damage is not the same everywhere The fusion of form and structure, density, types Mkhtls has emerged that some of the main types have dramatic differences. For example, in the northwest area of the main species is beech, which is of very good quality. However, in areas close to towns and palatable leaves of oak and hornbeam and use the wood for the trees and houses is cause to be mostly young stands lopping forks and bad form and low and become as forests become dilapidated and half dilapidated. Figure 6 shows a map of the vegetation.

Drainage network: The study area is the main channel of the river upstream of the 3 branches Lisar long and was filled with water. This 3 sub-branch of height about 2000, 2600 and 3050-meter zone is split and then join together and form Lisar River at an altitude of 1000 meters. The river has a length of 22 km and in the West to the East, crossing the plains of the land Lisar and liquor pour into the Caspian Sea. Basin have gauging stations in the name of J. is black. Basin drainage density is 8.1 km per square kilometer. Map drainage basin Lisar has become in the form below.

Lisar river morphology: Lisar which is the longest river along the main stream equal to 6/36 km which originated from the highlands and flows into the Caspian Sea. But the river Lisar together the three branches at a height of 1100 meters is sure to have a length of about 23.3 km. The river is one of the old rivers that over the course have its own three youth, maturity and old age.

The main stream and river longitudinal profile Lisar: As mentioned, the longest path, the waterway has been km 36.6 that the longitudinal profile is drawn and the average slope of 10.7 percent, respectively.

Lisar longitudinal profile part of the river has drawn also based on the elevation. This river has an average slope of 5.1%. The longest river Lisar is to the 7057 m elevation on the floor 100-21- meters. This section of the river that has a slope of about 1.7 percent over the river Main harvested materials that are directly affected by the impact of the morphology of the river is harvested materials.

Flood frequency analysis: It was used in order to flood frequency analysis of the statistics recorded maximum flood discharge at gauging stations. The Goodness of fit test to determine the statistical distribution of the maximum discharge was performed using the software SMADA. The test log-pearson type III distribution is determined to be most appropriate. Using this test, the rates of up flood was calculated for return periods of 5, 10, 25, 50, 100, 200, 500 and 1000 years, respectively. Table (6) Results of flood frequency analysis shows Lisar basin.

Basin flood peak discharge at different return periods Lisar (cubic meters per second)

	Return period (year)							
	5	10	25	50	100	200	500	1000
Shallow period	2.95	4.46	6.67	8.85	11.92	15.82	25.7	37.11
Full of water period	114.9	142.6	173.9	195.3	216.1	233.5	253.8	268.7

The sediment

Monthly and annual sediment basin: To check the sedimentation basin, they were used from sediment rating curve Lisar hydrometric stations. As mentioned, the curve is a sediment rating curve between water flow and sediment discharge parameters plotted and are one way to estimate suspended sediment. Sediment rating curve equation method (USBR) Black J. River Station Lisar in both dehydration and overhydration is in Table 2.

Hydrometric Station sediment rating curve equation Lisar

Curve equation of sediment	Flow
$Q_s=4Q_w^{1.199}$	$Q_w \leq 1$
$Q_s=4Q_w^{2.199}$	$Q_w >1$

Where Qs deposition flows in milligrams per liter or tons per day; Qb is the flow rate in terms of cubic meters per second. After analysis of monthly and annual discharge data using the rating curve equation, suspended sediment Lisar annual monthly average in both Dubai and Dubai over hydration, respectively.

Bed load: Total deposits are the sum of suspended sediment and bed load. Since the measuring and calculating the bed hard and complex process entails, researchers generally consider suspending the bed percent of the time. Coefficient taken into account for the calculation of bed load sediment grain size is depends on the situation and the type of flow. Depending on the type of Lisar river bed which is relatively coarse, the bed load was account into about 30 percent of the load suspended. On this basis, bed load and all deposition of the river were calculated and provided in Table 3.

Table (7): the suspended load, bed load sediment basin annual total Lisar

Total load	Bed load	Suspended load	Sediment flow

Meter cube	Thousand tones	Meter cube	Thousand tones	Meter cube	Thousand tone	
3030.9	41.22	699.3	9.51	2330.9	31.70	**Average**
10312.5	140.25	2380.1	32.37	7933.1	107.89	**Maximum**

The amount of allowable harvest of river materials: Harvest materials are done from the riverbed for the river. According to Prince, picked up about 25 to 30 percent of annual bed load bed and prevents the loss of water in the upstream and downstream changes will be more adverse. The Rainoff et al stated extraction rate equal to the long-term average annual bed load. So to calculate the amount of allowable harvest of the river, the two theories used and the amount of withdrawals permitted under tons and tons per day, respectively.

Assessment of changes in river morphology Lisar: The effect of sand and gravel in river morphology, field visits and taken to cross river sand mining in the upstream and downstream. The results offered by the separation of the harvest.

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Table (7): The results of the calculation of the allowable harvest materials

Sediment flow	Bed load	Withdrawal Penalty riverbed							
		Princes theories				Rainoff et al theories			
		Tone in year	Meter cube in year	Tone in a day	Meter cube in a year	Tone in a year	Meter cube in a year	Tone in a day	Meter cube in a day
Average	9.5	2853	2097.8	7.8	5.7	9510	6992.4	26.1	19.2
Maximum	32.4	9711	7140.4	26.7	19.6	32370	23801.5	88.7	65.2

Assessment of changes in river morphology Lisar: The effect of sand and gravel in river morphology, field visits and taken to cross river sand mining in the upstream and downstream. The results offered from the separation of the harvest. Figure (8) the location of sampling as well as mine sand and position harvest sites show materials.

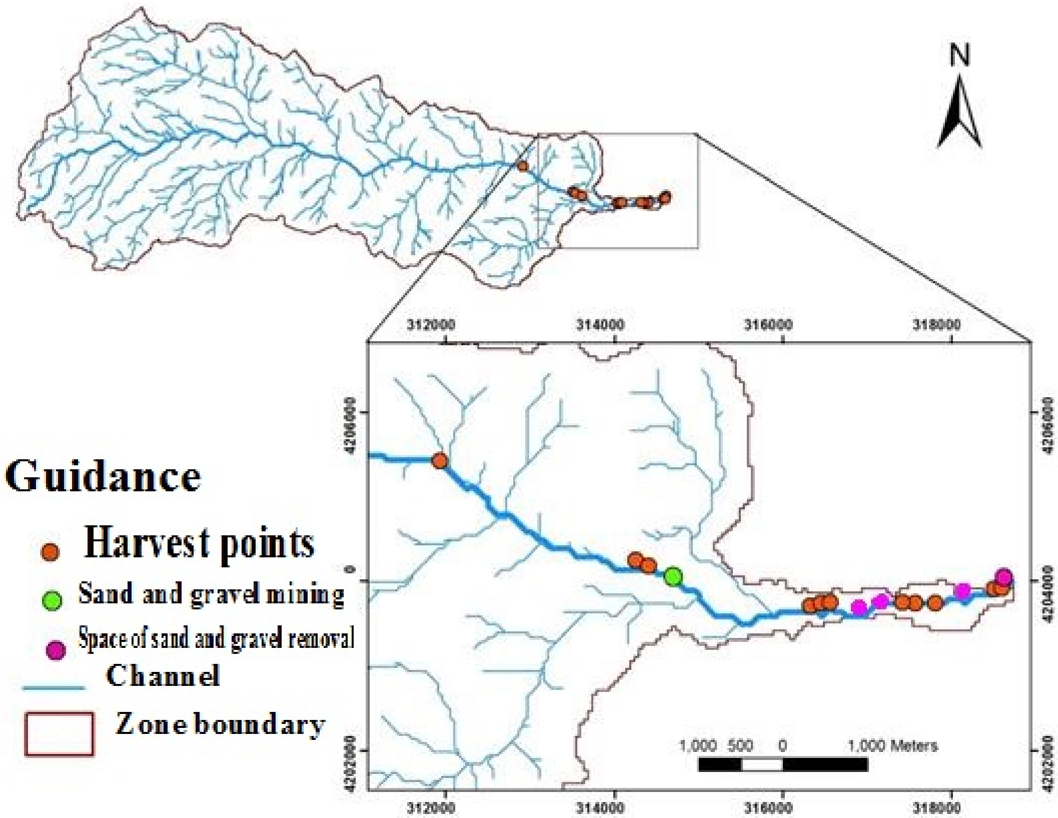

Figure 8: Positions of points obtained during field visits

Conclusion

Generally, unfavorable impression materials can be done in two ways: Building more transmission capacity to harvest the river sediment removal and surface drill holes below the river bed and river harvested materials. In the first case, if the sides of the river are well protected, corrosion and foam materials picked up from bed just realized that this phenomenon may be extended to span downstream and in the second case, the harvest will happen with holes in the riverbed, severe erosion in upstream and downstream of the harvest. On the other hand, removal of materials from rivers and ponds generally cause large holes in the direction of the river. Despite the ponds to increase the depth of the inlet flow and the rapid decline that leads quickly. By reducing speed, current-carrying part of the sediments is drawn in these ponds. The outflow from the pond sediment drilled far below the sediment-carrying capacity of the river. This causes the balance and the balance of the river became public and hydraulic parameters such as depth, slope and bed load sediment will be changed. Increased sediment transport downstream reservoirs drilled a factor that will leads to erosion of the riverbed downstream products and the extent of this erosion to continue or complete cessation materials harvested from ponds depends drilling are as follows: If it continues impression materials, the river slope from the initial slope will be less new and usually long-term bed elevation and water levels will decrease this will create problems for the dehydration of the river.

And if certain materials are picked up after a while, over time, stream sedimentation in the basin filling the pond will be excavated under the initial balance is achieved in the long term.

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