



## Quarrying Activities along the Lower Balason River in Darjeeling District, West Bengal

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### Abstract

*Quite recently, quarrying of materials from the river bed has become an important source of livelihood along the foot hills of the Darjeeling Hills. Rivers, originating from the uplands bring down huge quantities of bed materials of different grades. Larger materials (boulders) are mostly used for road sloping and wall construction, while medium and smaller grades (gravels and sands) are used for construction activities. Although it has been an important income source for the locals, its environmental impact has been really serious to reckon with: the most obvious one is the recent damages to bridges (rail and road) and river bank erosion. Hence, an attempt has been made here to explore the possibilities of a sustainable approach for the quarrying activities. Essentially, it needs a proper understanding of scientific knowledge (channel dynamics and neotectonics) and management of the channel sediments at the basin level.*

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### Introduction

The 20<sup>th</sup> century development pattern in the Darjeeling hills has produced the following depletion of forest cover, increased export of medicinal plants, construction of water resource works, exploration and mining of minerals, enhanced tourism, introduction of commercial farming, and urban industrial growth in the foothills. The rapid growth of population since 1901 has steadily changed the land use pattern of the region as well as its pattern of utilization of available natural resources. The British established the Tea plantations and provided an opportunity for the local inhabitants to harness its natural resources. In the process, the water resources from Teesta, Mahananda, Balason, etc supported the basic needs of the region (Tamang and Mandal, 2011).

Since the later half of the 20<sup>th</sup> century, forest

cover declined rapidly, tea plantations stagnated due mainly to management issues; hence quarrying of materials from the river bed has become an important alternative source of livelihood particularly along the foot hills of the Darjeeling Himalayas. Due to sudden and sharp changes in slope near the foot hill region, rivers naturally deposit huge quantities of bed materials (of different grades). Due to its hardness, mostly larger materials (boulders) are used for road sloping and wall construction, and medium and smaller grades (gravels and sands) are quarried for construction purpose. With the gradual expansion of Siliguri town, the demand for construction materials increased manifold. This triggered the quarrying of construction materials directly from the bed of the Lower Balason river, and also from its adjoining terraces and floodplains. Although quarrying is rampant in almost all the rivers of this region,

its scale and extent far exceeds those of the rivers like Rakthi, Rohini, Mahananda, etc.

Quarrying has been largely responsible for changing the fluvial characteristics of the rivers. Some of the impacts identified by the author in course of study are bridges being undermined and damaged, changes in the channel planform, irregular sediment sorting, bank erosion and loss of agricultural lands (Plates a to f). Hence, the author has attempted to assess the sustainable approach for the quarrying along the Lower Balason river through an extensive field survey along the entire lower course (24.13 km). In order to estimate the actual amount of bed materials quarried, the number of trucks carrying quarried materials from the river has been recorded from different sites along with the official records of check posts and Land & Land Reform Offices.

### The Study Area

Being the major right bank tributary of the Mahananda river, Balason originates from Lepchajagat ( $88^{\circ}14'12''\text{E}$ ,  $27^{\circ}3'55''\text{N}$ , 2361 m) located on the Ghum-Simana ridge. It is a perennial river with a basin area of  $367.42\text{ km}^2$  and a length of 48.40 km (of which 24.27 km lies in the hills/mountains and 24.13 km in the plains). It joins the Mahananda near Siliguri town at ( $88^{\circ}18'30''\text{E}$ ,  $26^{\circ}48'37''\text{N}$ ). At an altitude of 305 m, it starts its lower course (Fig. 1) whence mostly transportation and deposition are dominant fluvial processes. Further down in its lower course, the river is joined by Rakthi khola, Rohini khola, Panighata khola, Chenga, and Manjha.

Within the course of Balason river, there exists a portion of the Darjeeling Himalayas, covering almost the upper and middle course of it and the remaining portion is occupied by piedmont plains called "Terai". The elevation increases from 121 m at Matigara to 2361 m at Lepchajagat with the relative height ranging between 1000 - 2000 m (Lama, 2003). In the hilly portion, there exist narrow ridges with steep slopes inclined at  $30^{\circ}$  -  $40^{\circ}$ . The gradient of the headwater is steeper and controlled by subsurface lithology and mass movement, but from the piedmont plain, the valley floor has widened and aggraded due to havoc sedimentation / deposition.

The whole basin covers a forested area of nearly  $96.18\text{ km}^2$ , located mainly in the northern and north-eastern portions with some natural patches at Singbulli, Selim hills, Manjwa and between the Pankhabari and Longview Tea Estates. The temperate forest occurs in the northern portions between 1600 - 2400 m, the Sub-tropical forest occurs mostly in the central foothills between 800-1600 m, and the tropical forests (mainly, Sal) occurs in the lower southern plains.

The hydrological characteristics of the Balason river is primarily controlled by the discharge, bed load and the abrupt changes in the gradient in which the channel adjusts itself (Jana and Dutta, 1997). In its piedmont zone, the landforms are mostly fluvial in origin and as such are dynamic in the sense that modification is still active due to fluvial and anthropogenic processes. The fluctuating discharge, excessive bed load supply from its upper catchments and highly erodible banks results in the braided nature with sandy filled bars in the lower plain.

### History of Bed Materials Quarrying

The quarrying of bed materials along the lower Balason river began only after the river shifted its course into the present position, which previously used to be fertile agricultural land with forest cover (as per the old records in S. O. I. topographical maps, cadastral maps, literatures, etc). The loss of agriculture lands forced the local inhabitants to take up quarrying of the bed materials as an alternative source of livelihood. Initially, only the large sized gravels and boulders were quarried, but as demands increased with time, quarrying of other grades of bed materials began. It was 1980 onward, when the quarrying permits and leases were distributed to the landholders.

### Quarrying Permissions and Land Ownership

Any quarrying from the river bed requires a mining permit and land lease on the condition that a minimum annual royalty be paid to the State Government, even if no actual quarrying has taken place in that year. Quarrying without a licence is liable to penal action. The process of permits and leases are looked after by the Land & Land Reform Department at each Block and the concerned

authority functions under the jurisdiction of Sub-division and District mining authority. Illegal mining is punishable by imprisonment for a brief term or a fine or both. This is provided by Rule 21 (Penalties) of the Mines and Mineral (Development & Regulation) Act 1957 (Act 67 of the Indian Parliament) and its amendment up to 2000; and Rule 33 (Penalty) of The West Bengal Minor Minerals Rules, 2002 (Banerjee, 2007). There is also legal provision for the recovery of the mineral and associated royalty.

Initially, the lease to land for quarrying was given for a period of 5 years that could subsequently be renewed to a maximum of 20 years. The period of quarrying extends from a few days to a maximum of three months in a year. The Mining Department is authorised to grant these permits as well as more elaborate, long-term mining leases. During 2008-2009, as per the official records of District Land and Land Reform Office, Darjeeling, a total of 37 Quarry Permits had been issued. Of these, about 21 were operational in the lower course of Balason river covering mainly the Kurseong and Siliguri sub-division of Darjeeling district (Tamang and Mandal, 2010).

### Extent of Bed Materials Quarrying

The entire stretch (24.13 km) of the Lower Balason river falls under four CD Blocks of Darjeeling district (Fig. 2), namely Mirik, Kurseong, Naxalbari and Matigara. Quarrying in the channel bed is remarkably selective in location; it primarily depends on the size, amount and quality of materials available. Based on the official records of the District Land & Land Reform Office, Darjeeling and field information collected about size and quantity of material quarried, the author has divided the whole stretch of the Balason river channel into three important segments as (Fig. 3) -

**A. Segment I:** Lying in the upper piedmont area, it extends up to 8 km downstream. Here, large boulders (upto 1m diameter) and larger sized gravels and boulders are predominantly quarried. Such boulders are manually broken into pieces of different sizes to be used for road, embankment and bridge construction. Some important sites are Dudhia, Panighata, M. M. Terai, Bauni

Bhitar Chhat, Dhemaal, Tarabari and Gouri.

**B. Segment II:** With a length of about 9 km, it extends up to the Matigara Bridge. Due to gradual decline in sediment size, boulders ranging from 30 mm - 50 mm diameter are mainly quarried. Huge amount of medium to small sized gravels along with sand grains (coarse and fine) are quarried. The quarried materials are commonly manually processed at the quarrying sites; however, there are mechanical processing centres, e.g., *Kasari*, where mechanical sieves are used. Due to the greater transport accessibility (NH 31 and well connected local roads), this segment has the largest number of quarrying sites producing highest volume of quarried materials in the whole stretch of the Balason river. Some important sites are Lalsara Chhat, Dumriguri Chhat, Bataliguri, Rangia, Nimai, Nengtichara, Pataner Chhat and Tari.

**C. Segment III:** Downstream of the Matigara bridge, quarrying of smaller sized gravels, pebbles and sands predominates. Mostly sand quarrying is done on an extensive scale, particularly at Jitu, Mathapari, Kalam and Kauakhali.

### Nature of Quarrying

Construction of efficient transportation networks connecting the rapidly developing trading town like Siliguri primarily accelerated the demand for construction materials. Due to the nearness and availability of raw materials in the form of bed materials in Balason river, it became the major source. The activity attracted a huge influx of labourer from different parts of North Bengal, South Bengal, Bihar, Assam, Rajasthan, Uttar Pradesh, and Bangladesh. Most of them are 1971 migrants from Bangladesh. They had settled along the river banks in temporary huts and till today, often all the members of a certain family, even the small children, are engaged in this activity. Their labours are in huge demand since comparatively, their wage demands and rates are the lowest. The average rates for quarrying accurate (gravel sized) materials is Rs. 350/100 cft, while for crushing into smaller sizes

(*Bajiri*) is Rs. 750/100 cft.

Normally, bed materials are quarried up to a depth of 2 m during dry season and the larger boulders are collected at some selected places, which are then crushed into smaller sizes (75 mm – 90 mm diameters). Other grades supplied are *accurate, misali, metal, grid, bajri, 3/4<sup>th</sup>, 1/4<sup>th</sup> and chips* from large boulders, coarse and fine sands. During monsoon, quarrying is restricted near the banks for mostly larger boulders and gravels brought down by the high velocity flow.

### Processing of the Quarried Bed Materials

Along the Lower course of Balason river there are at least three processing centers (locally called, *kasari*) where the quarried materials are brought in by trucks @ Rs.120/-/ton and then mechanically processed with the help of sieves of various sizes. At Basbari (near Khaprail), sieves of 40 mm, 20 mm, 10 mm, 6 mm and 0.75 mm are used. The wage rate of the unskilled labour is Rs.90/day while that of a skilled worker is Rs.166/ day.

### Transportation of Quarried Bed Materials

After the finished products are ready, they are loaded in trucks of different capacities. These are then transported not only to the adjacent local places but also to the distant markets. Usually, small to medium sized trucks (125 – 250 cft) are used for transportation to surrounding areas, majority of which are supplied to Siliguri, Jalpaiguri, Islampur, Dalkhola and Raiganj. Larger trucks (400 – 1200 cft) are used to supply to the distant places like, South Bengal, Bihar, Assam, Jharkhand, etc. The final price is based on the cost of production, processing, loading, unloading and transport. For example, a full truck of 250 cft gravel costs around Rs. 1200 – 1500 in the local market, whereas the same quantity of gravel in Darjeeling costs about Rs.5000 – 6000.

### West Bengal Minor Minerals Rules, 2002, Schedule V) -

- 1 No quarrying of minerals shall be allowed within 200 m of both sides of any river bridge or culvert over any waterway or from any embankment and structural works of the irrigation and waterways Department.
- 2 No quarrying operation shall be allowed

within a distance of 200 m from any hydraulic structure, reservoir, bridge, canal, road and other public works or buildings.

- 3 No quarrying operation shall be done within a distance of 5 km of a barrage axis or dam of a river. The distance is to be reckoned across an imaginary line parallel to the barrage or dam axis as the case may be.
- 4 In the districts of Darjeeling and Jalpaiguri, the quarrying of boulders and sand shall only be made from the central one-third of the river-bed, provided that where the width of the river is 30 m or less, the quarrying of the said minerals shall not be made except with the permission in writing from the Irrigation and Waterways Department.
- 5 No tree shall be felled and removed and no public easement shall be interfered with except with the written consent of the issuing Authority in this respect and he may attach such conditions to his consent as he thinks fit, and the conditions shall be binding on the permit-holders.

### Sustainable Approaches for Bed Material Quarrying

An integrated environmental assessment, management, and monitoring programme is certainly a part of any quarrying operation, and to be encouraged at national, regional, district, and local levels. The concerned government officials, permit holders, landowners and other key persons related to quarrying directly or indirectly should be involved as they only can compel the permit holders and labourers to follow the agreed guidelines when given the powers to do so within the framework. Precautions essential for undertaking the quarrying in a sustainable way are:

1. Quarrying of gravelly sand from the riverbed should be restricted to a maximum depth of 3 m from the surface for safety and sustainability. For surface quarrying beyond a depth of 3 m, it is imperative to adopt quarrying in a systematic bench like fashion, usually not feasible in a riverbed.



2. Quarrying of riverbed material should also take into account the location of the active channel bank. It should be located sufficiently away, preferably more than 3m away from the banks to minimize bank erosion and to avoid consequent channel migration,
3. Continued quarrying in a given segment often induces seasonal scouring and intensifies the erosion within the channel, thereby adversely affecting not only the quarrying site but also areas adjacent towards its upstream and downstream. Such hazardous effects should be properly monitored to formulate further strategies for sustainable quarrying.
4. Identification and demarcation of quarrying sites must be completed prior to actual quarrying under the supervision of Govt. authorities for sustainable development.

### Conclusion

The Lower Balason river has become an important source of *bed material quarrying* mostly due to its monsoon regime characterized by very high rainfall, and quick flow that together facilitate rapid transport of bed load from the upper course. High intensity rainfall often induces landslides and huge quantities of weathered materials of different grades are washed directly into the channel bed in its lower course. Currently, the scale and intensity of quarrying have taken such a dimension that it needs immediate check to reduce the associated environmental impact. For this the district authorities have issued several prohibitory orders/circulars but these have not been properly implemented /executed. People dependent upon such activities seem to be least concerned about its environmental impact; illegal quarrying is a common practice and rampant; even quarrying near the bridges and embankments is prohibited by law but in reality, the location of the quarrying sites are chosen on the basis of degree of convenience and minimum cost of transportation of quarried materials to the markets and thus are inevitably situated near bridges. Channel bed quarrying affects the fluvial dynamics of the channel segment by

altering its form, roughness, and cross section that together influences the velocity, load, transport and deposition. The huge influx of migrants now occupying the adjacent floodplains exerts an additional burden over the available natural resources of the region. Therefore, devising and executing a sustainable approach is essential for quarrying of bed materials along with the local subsistence economy.

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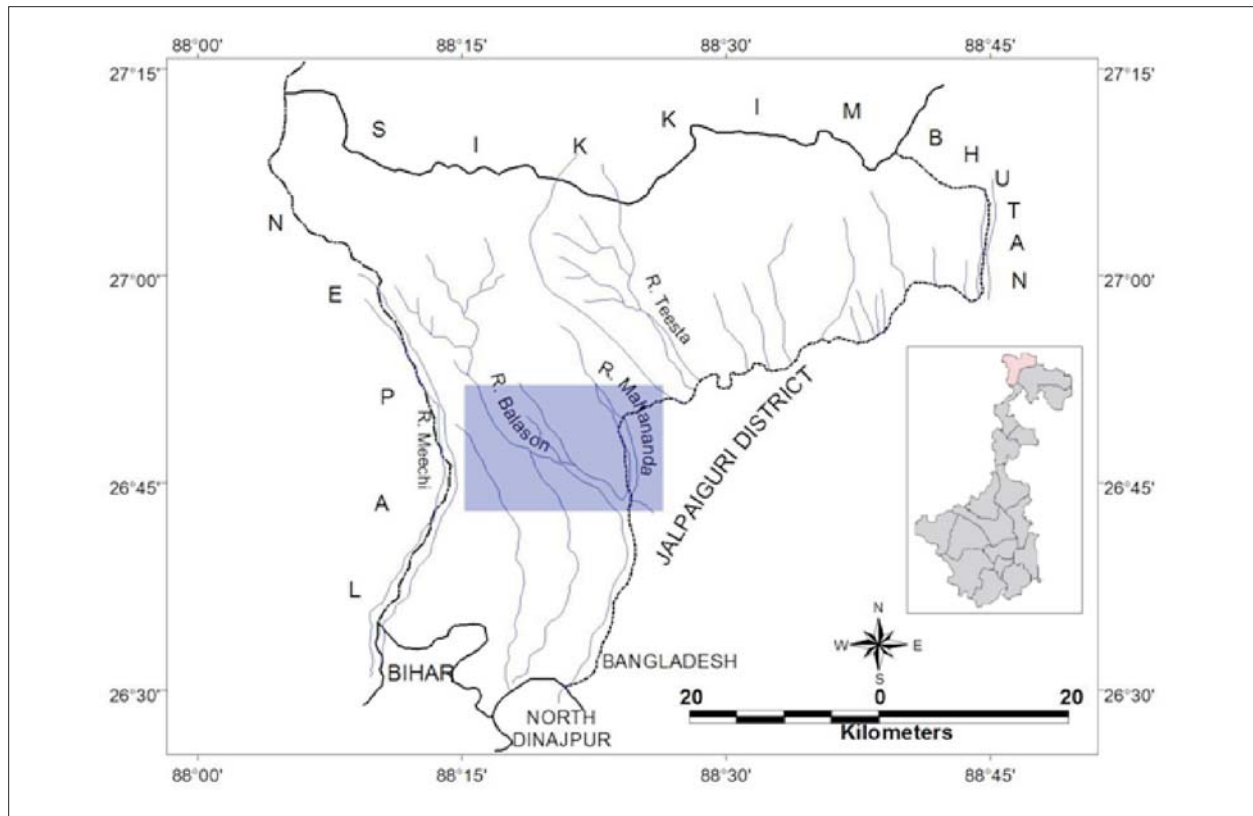


Fig.1: Location of the Study Area

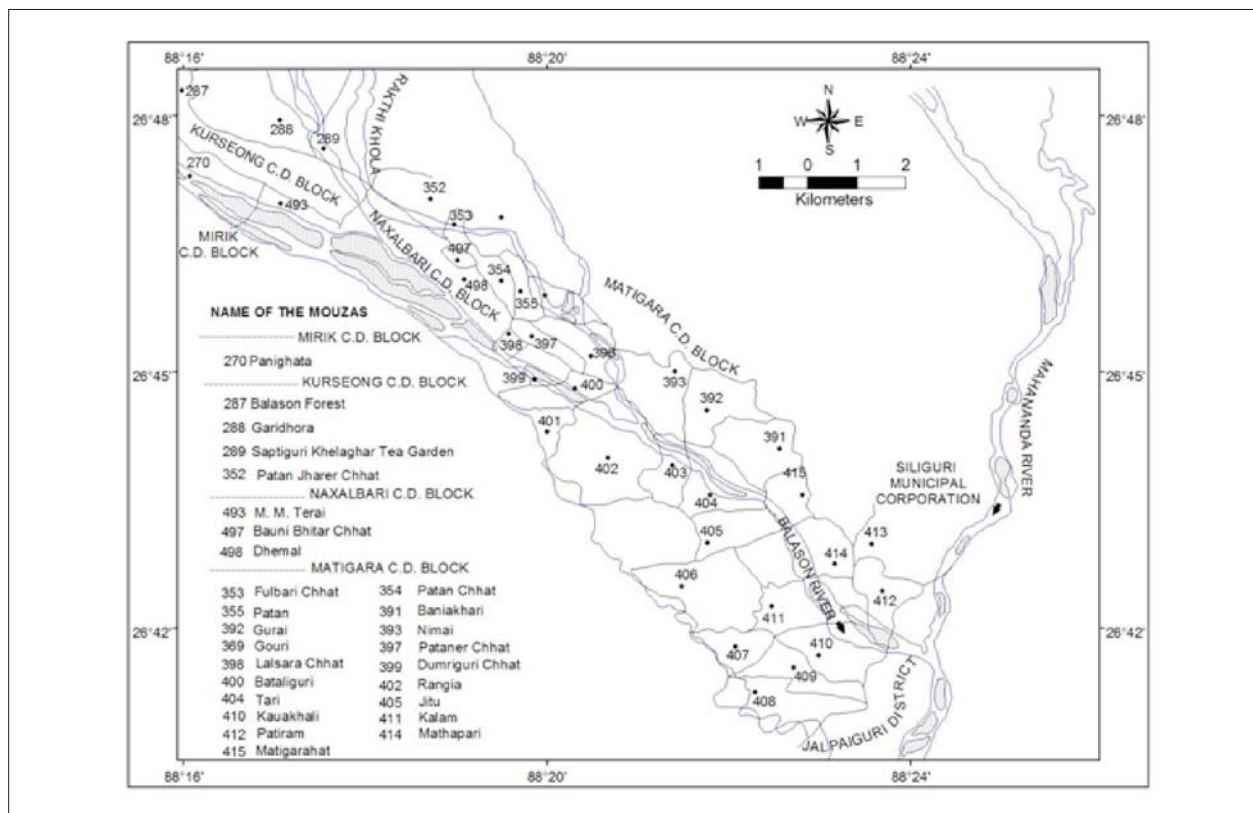


Fig.2: Mouzas along the Lower Balason River

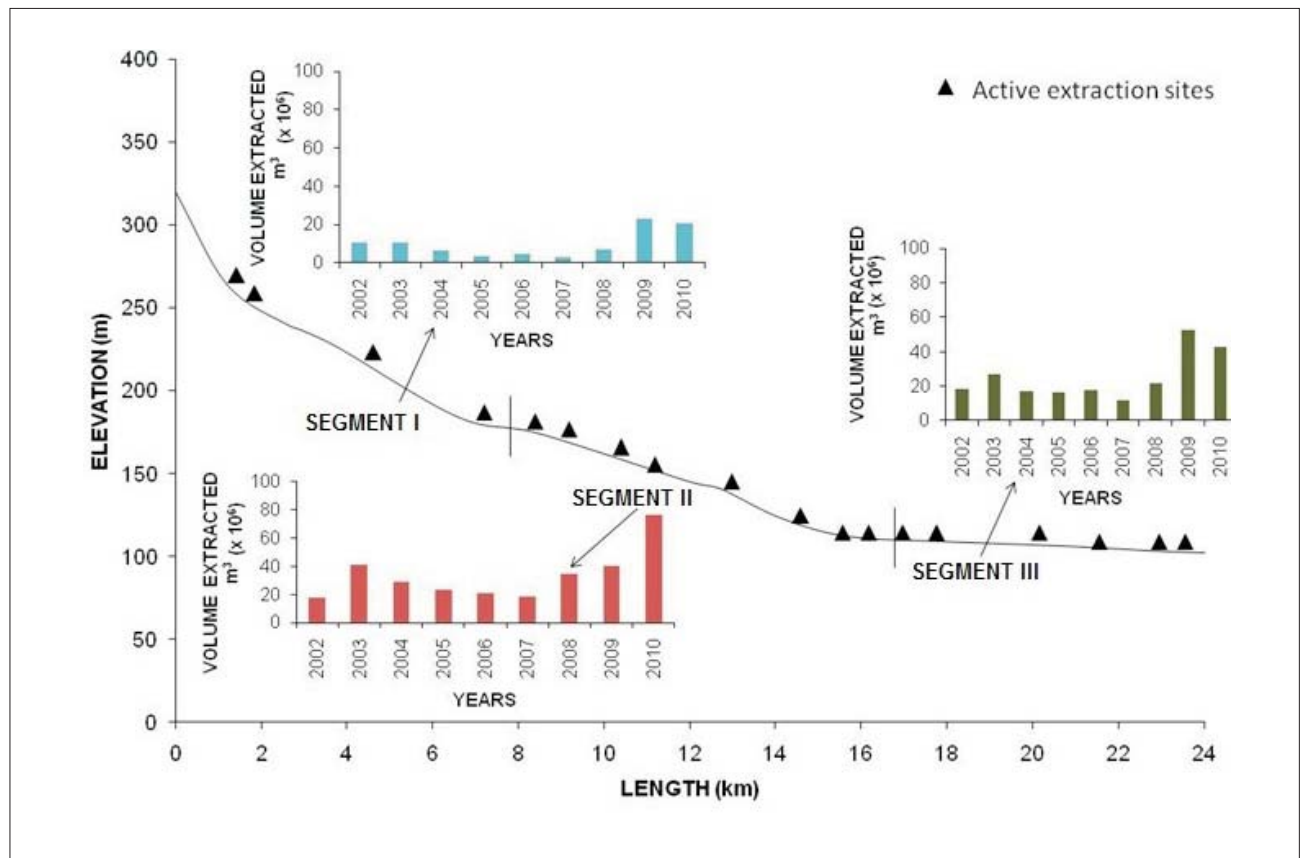


Fig.3: Volume of Bed Materials (extracted from different sites, 2002 - 2010)



(A)



(B)

Plates showing -

(A) Quarrying of Bed Materials from the Lower Balason river during Dry Season

(B) Inchannel Quarrying of Gravels during Monsoon



(C)



(D)



(E)



(F)

Plates showing -

(C) The Railway Bridge damaged on 18<sup>th</sup> August, 2009 due to extensive Quarrying

(D) Undermining of a Bridge Pier

(E) Quarrying near Retreating Banks

(F) Diversion of Main Channel flow inducing Bank Erosion.