STUDY ON SEDIMENT LOAD DUE TO RAINFALL

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ABSTRACT

Soil erosion and sediment controls are used to measure the reduce of soil particles that are carried out from a land area and deposited in receiving water. Sediment size distribution greatly affects sediment transport and deposition. The partition of soil loss into these are more meaningful components appears to be essential both for initial data interpretation and for subsequent use of such data for soil loss prediction. A study was undertaken to investigate the characteristics of suspended sediment transport of a canal in KUET due to rainfall. The canal is one kind of artificial and the bed is alluvial. A portion of canal has been made non-alluvial by laying a 30 ft length bricks layer. Four sections of the canal have been considered where two sections are in alluvial portion and others are in non-alluvial portion. It was found from study that the amounts of bed load in alluvial sections are so greater than non-alluvial sections. So, lining is effective to reduce sediment deposition in a canal.

Keywords: *Suspended load, bed load, sediment transport, rainfall, soil erosion*

1. INTRODUCTION

Soil erosion occurs when detachable soils on sufficiently steep slopes are exposed to overland flow and the impact of rainfall. The hydraulics of flow in a natural stream and its sediment transport characteristics are the two basic phenomena that determine it's geometric and plan form shape. There are many variables that affect the hydraulics of flow and the nature of sediment transport. The materials through which a river flows, the characteristics of the watershed, the rainfall-runoff pattern from the basin, the constraints imposed by humans, and the geology of the watershed are some of the factors that determine the hydraulic and sediment transport characteristics of the river (Bhowmik et al., 1980).

In order to render the rate of solid transport independent from the conditions upstream, the usual distinction is introduced between wash load and bed material: "wash load", formed by extremely fine particles, is conveyed (in suspension) along the stream without any interaction with the bottom, thus being irrelevant in regard to aggradations or degradation, "bed-material", composed by the grain sizes present in the bottom, is transported (both in suspension and as bed-load) at a rate which depends only on the local granulometric and hydrodynamic conditions, so that erosion or deposition may take place (Armanini & Di Silvio, 1988).

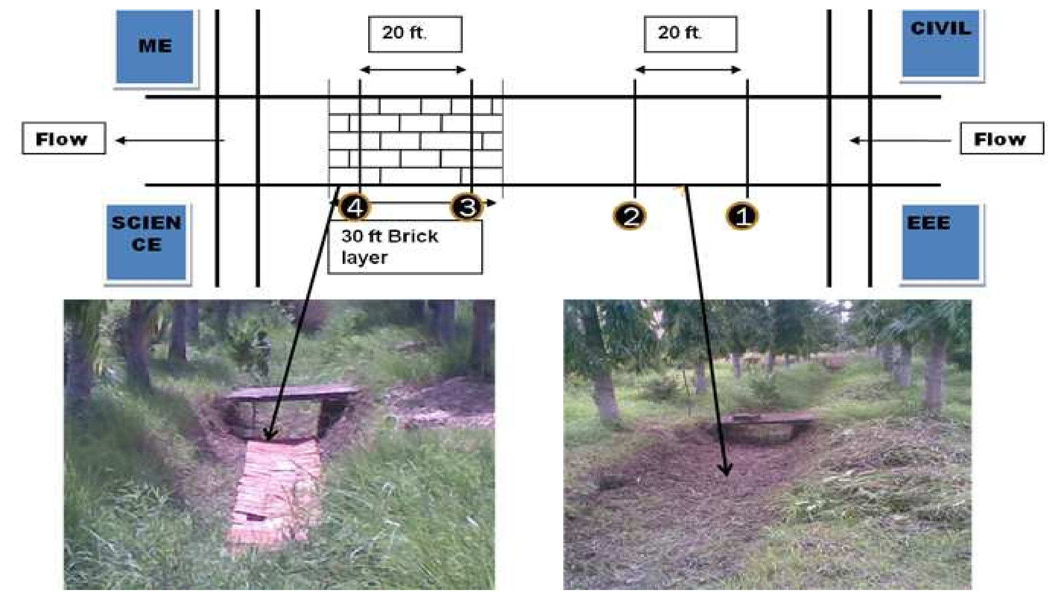
The sediment storage both decreases reservoir capacity and operating efficiency of the dam, and creates a "sediment-shadow" downstream where sediment-starved flows commonly erode channel boundaries and create long-term channel instabilities (Subramanya, 2004). These include channel narrowing, reduction in braiding, and associated loss of habitat complexity (Rathburn & Wohl, 2003). Transport sediment having a tendency to settle down on the river bed due to fall velocity of sediment particles. In the present study the sediment transport characteristics due to rainfall of a canal in KUET campus has been conducted

2. METHODOLOGY

2.1 Experimental Setup

This study was conducted in a canal of KUET campus. The canal has been started from the corner of the playground and end near at the pond. The canal which was performed is one kind of artificial canal and the bed of the canal is alluvial. It has been considered four sections of the canal whose upstream lies between Civil and Electrical building and downstream lie between Science and Mechanical building. The sections 1 and 2 are in alluvial portion and sections 3 and 4 are in non-alluvial portion. The distance between each section is 20 ft. and a 30 ft. long brick layer has been used to develop non-alluvial portion (Figure 1).

All the data are applicable for canal of KUET campus but not for river because the flow of canal is considered as steady and uniform, on the other hand river flow may be turbulence. For this study non recording rain gauge (measuring rainfall) has been installed on the roof of the Civil Engineering Building. The suspended sediment and bed load has been measured by conventional method and the velocity of water in the canal has been measured by floating method.



a) Non-alluvial portion b) Alluvial portion

Figure 1: Experimental set-up (a) Non-alluvial portion and (b) Alluvial portion

2.2 Measurement of Suspended Sediment and Bed Load

Suspended sediment and bed load materials are transported by water during rainy season. Water samples have been collected from four sections of the canal (Figure 1) and heated at 105^0 to 130^0 C on oven, and then has been weight in the balance. Figure 2 shows the collection and procedure for processing of suspended sediment and bed load. The hydrometer analysis has also been conducted to determine the grain size distribution of the sediment particles.

Figure 2: Suspended sediment and bed load

3. RESULTS & DISCUSSION

3.1 BED LOAD

The data of bed load for different bed sections have been shown in the Table 1.

Table 1: Data of bed load in different bed sections

No. of sections	Sec-1	Sec-2	Sec-3	Sec-4
Bed load (gm)	1009	637	318	243

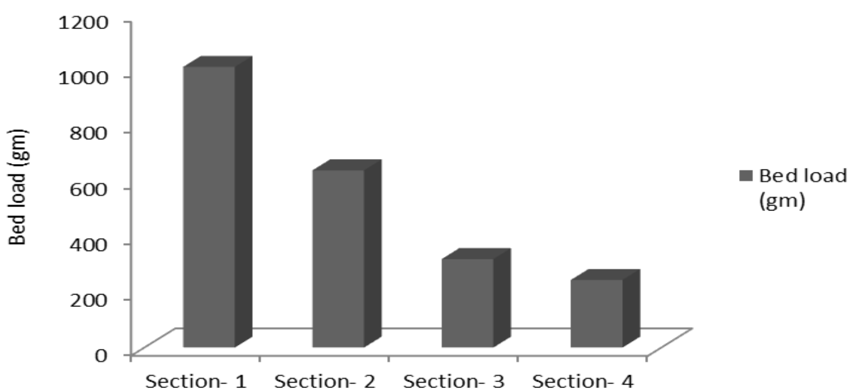


Figure 3: Bed load in different sections

Figure 3 shows the amount of bed load in different sections where sections 1 & 2 are alluvial and sections 3 & 4 are non-alluvial. From the figure it can be seen that the amount of bed load in alluvial sections are so greater than non-alluvial sections. The differences of bed load between two adjacent sections signify the amount of bed load deposited between the next sections. From this figure it can also be visibly said that the rate of sediment depositions in alluvial portion is greater than non-alluvial portion.

3.2 Suspended Load

The data of suspended load for different bed sections have been shown in the Table 2.

Table 2: Data of suspended sediment for different sections

Rainfall (cm)	SL in Sec-1 (gm)	SL in Sec-2 (gm)	SL in Sec-3 (gm)	SL in Sec-4 (gm)
0.64	173	123	117	109
0.75	187	137	121	113
0.9	223	168	143	130
0.94	232	177	148	135
1.03	233	178	153	142
1.17	242	187	157	144
1.24	243	188	159	147
1.31	251	197	167	156
1.33	252	197	171	158
1.54	257	202	177	162
1.54	268	213	187	171
1.58	274	219	192	175
1.61	282	232	207	193
1.67	294	239	209	198
1.8	301	246	219	204
2.03	307	257	228	215
2.18	333	283	254	239
2.61	364	322	295	281
2.61	372	327	297	287
2.66	385	340	310	296
2.78	397	352	323	308
2.96	443	398	368	354
3.21	457	412	382	365
3.47	518	481	451	439
3.64	522	486	456	441
3.98	537	502	472	460

Table 2 shows the amount of suspended sediment loadfor different sections of the canal with respect to the rainfall (cm). The differences between column 2, 3 and column 4, 5 indicates the amount of deposited suspended load between those both sections.

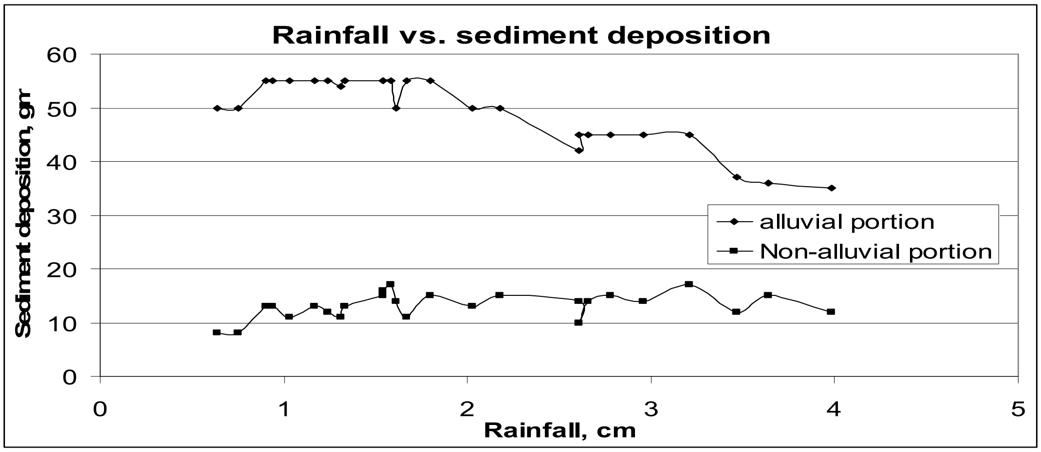


Figure 4: Sediment deposition rate in alluvial and non-alluvial canal

Figure 4 shows the deposited amount of suspended sediment load in the alluvial and non-alluvial portion of the canal. From this figure it can be seen that the rate of sedimentation of suspended load in alluvial portion is greater than non-alluvial portion.

CONCLUSIONS

From this investigation it has been found that the sediment deposition rate is higher in alluvial portion than the non-alluvial portion. So, it can be said that the lining is very effective to reduce sediment deposition in a canal.

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