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**SEDIMENT TRANSPORT ANALYSIS FOR  
SECURING WATER  
(CASE STUDY : UPPER JENEBERANG RIVER)**

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**Abstract** - The Jeneberang River Basin, upstream of Bili-Bili Dam Reservoir is divided into five (5) major sub-basins, named upper and middle main Jeneberang (Bili-Bili Dam Basin : 384.40 km<sup>2</sup>) , Salo Malino (85.89 km<sup>2</sup>), Salo Kausisi (37.50 km<sup>2</sup>), Jene Rakikang (42.2 km<sup>2</sup>) and Binanga Jajang (22.7 km<sup>2</sup>). Salo Malino is divided into more two (2) tributaries, named Salo Bulang (23.8km<sup>2</sup>) and Salo Ahuwa (37.1 km<sup>2</sup>). Bili-Bili dam is a multipurpose dam for irrigation, electricity, flood mitigation, and raw water. Bili-Bili Irrigation system covering 23,660 Ha of paddy field (Bissua system and Kampili system) of 270 bil.m<sup>3</sup>, Capacity for flood control 41 bil.m<sup>3</sup>, capacity for water supply 35 bil.m<sup>3</sup>, and the total storage capacity is 375 bill. M<sup>3</sup>, of which the effective storage capacity is 346 bi.m<sup>3</sup>.

Bili-Bili dam has been operated since 1999 year, serious sediment issues have been occurred in the Jeneberang river basin. Especially, after gigantic caldera collapse at March,2004, the sediment inflow volume in the reservoir have been reaches totally 49 million m<sup>3</sup> as of May 2007. The objective of this study is to analyse the sediment transport at Upper Jeneberang river using HEC-RAS. Which can be used to perform mobile bed computation. This study covering 32814.80 m length, consist of 80 reach (cross section). Large amount of sediment flowing to the dam could be reduce the capacity of the dam. Consequently the amount of water will reduced.

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The result is a continuous simulation of the change in cross section as sedimentation processes adjust to the hydraulic condition imposed by the water-sediment hydrograph and the base level control boundary conditions. Based on the analysis which show the erosion area and the sediment accumulated area, the decision maker can make the right choice to construct specific river structures at certain places to prevent sediment flowing to the dam for securing water.

**Keywords:** Sedimentation, Sediment Transport, Securing Water

### 1. Introduction

The Jeneberang River Basin upstream of Bili-Bili Dam Reservoir is divided into five (5) major sub-basins, named upper and middle main Jeneberang (Bili-Bili Dam Basin : 384.40 km<sup>2</sup>) , Salo Malino (85.89 km<sup>2</sup>), Salo Kausisi (37.50 km<sup>2</sup>), Jene Rakikang (42.2 km<sup>2</sup>) and Binanga Jajang (22.7 km<sup>2</sup>). Salo Malino is divided into more two (2) tributaries, named Salo Bulang (23.8km<sup>2</sup>) and Salo Ahuwa (37.1 km<sup>2</sup>).

Bili-Bili dam has been operated since 1999 year, serious sediment issues have been occurred in the Jeneberang river basin. Especially, after gigantic caldera collapse at March,2004, the sediment inflow volume in the reservoir have been reaches totally 49 million m<sup>3</sup> as of May 2007. Total storage capacity of the dam is 376 bil. M<sup>3</sup>, and the effective storage capacity is 346 bil.m<sup>3</sup>. Due to the sedimentation, the design life of the

dam would be shortened, and the water quality of water supply for municipal water would be deteriorated.

## 2. Methodology of Study

This study using Sediment Impact Analysis Methods (SIAM) in HEC RAS version 4.1, which can calculate sediment budget to compare in a reach of a river, if in that reach occur surplus or deficit. SIAM calculate the sediment transport capacity to decide ,if the reach of a river has the imbalance potential and instability. The procedure to run this study are as follows :

- Topography data input : Survey data cross section of the river

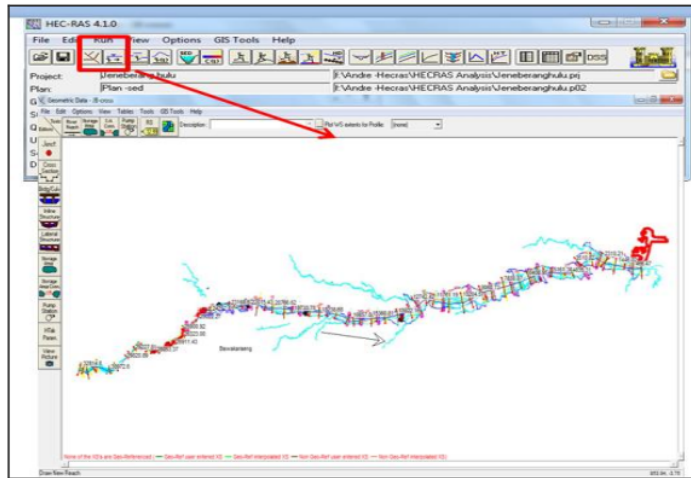


Figure 1. Upper Jeneberang River Plan Drawing

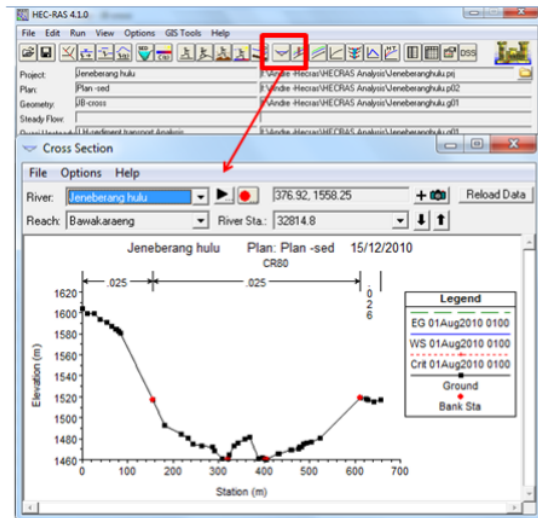
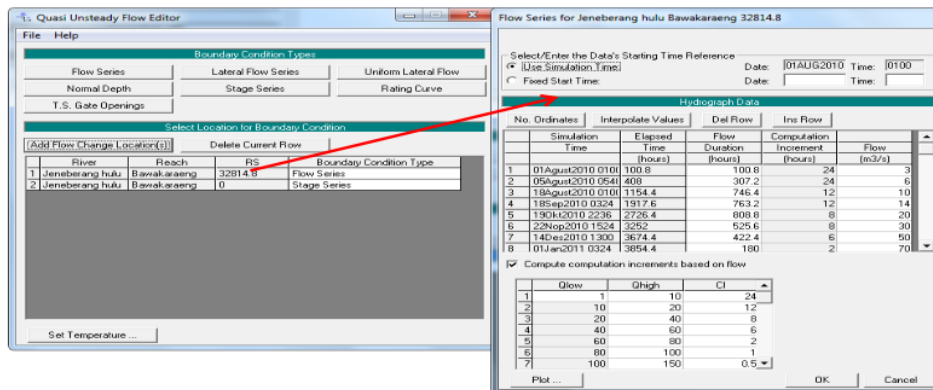


Figure 2. Cross Section Data Editor

Quasi unsteady flow data : as boundaries condition at upstream

Table 1. Discharge Hydrograph as upstream boundary condition

Time Ratio (t/tp)	TP hours	T hours	Discharge Ratio (q/qp)	Qp m <sup>3</sup> /s	Q m <sup>3</sup> /s	Stage /EL
0.00	1.40	0.00	0.000	800	0.00	
0.10	1.40	0.14	0.030	800	24.00	103.105
0.20	1.40	0.28	0.100	800	80.00	103.535
0.30	1.40	0.42	0.190	800	152.00	103.823
0.40	1.40	0.56	0.310	800	248.00	104.083
0.50	1.40	0.70	0.470	800	376.00	104.288
0.60	1.40	0.84	0.660	800	528.00	104.516
0.70	1.40	0.98	0.820	800	656.00	104.621
0.80	1.40	1.12	0.930	800	744.00	104.693
0.90	1.40	1.26	0.990	800	792.00	104.733
1.00	1.40	1.40	1.000	800	800.00	104.739
1.10	1.40	1.54	0.990	800	792.00	104.733
1.20	1.40	1.68	0.930	800	744.00	104.693
1.30	1.40	1.82	0.860	800	688.00	104.647
1.40	1.40	1.96	0.780	800	624.00	104.595
1.50	1.40	2.10	0.680	800	544.00	104.529
1.60	1.40	2.24	0.560	800	448.00	104.403
1.70	1.40	2.38	0.460	800	368.00	104.275
1.80	1.40	2.52	0.390	800	312.00	104.185
1.90	1.40	2.66	0.330	800	264.00	104.108
2.00	1.40	2.80	0.280	800	224.00	104.044
2.20	1.40	3.08	0.207	800	165.60	103.877
2.40	1.40	3.36	0.147	800	117.60	103.685
2.60	1.40	3.64	0.107	800	85.60	103.557
2.80	1.40	3.92	0.077	800	61.60	103.419
3.00	1.40	4.20	0.055	800	44.00	103.272
3.20	1.40	4.48	0.040	800	32.00	103.172
3.40	1.40	4.76	0.029	800	23.20	103.098
3.60	1.40	5.04	0.021	800	16.80	103.045
3.80	1.40	5.32	0.015	800	12.00	103.004
4.00	1.40	5.60	0.011	800	8.80	102.978
4.50	1.40	6.30	0.005	800	4.00	102.937
5.00	1.40	7.00	0.000	800	0.00	



Upstream Boundary Condition

Figure 3. Quasi Unsteady Flow -Upstream Boundary Condition Editor

5 Table 2. Discharge calculation for Rating Curve

No.	Elevation (m)	Area	Wetted Perimeter	Hydraulic Radius	n manning	Slope (S)	Velocity (m/s)	Discharge Q (m <sup>3</sup> /s)
		A (m <sup>2</sup> )	P(m)	R (m)				
1	103.000	10.126	39.893	0.254	0.025	0.005	1.134	11.482
2	103.500	40.632	83.289	0.488	0.025	0.005	1.753	71.220
3	104.000	101.167	177.902	0.569	0.025	0.005	1.941	196.407
4	104.500	220.466	299.545	0.736	0.025	0.005	2.306	508.323
5	105.000	392.606	388.826	1.010	0.025	0.005	2.847	1117.643
6	106.000	869.898	558.888	1.556	0.025	0.005	3.799	3304.525
7	107.000	1448.628	599.326	2.417	0.025	0.005	5.094	7379.570
8	108.000	2066.678	632.371	3.268	0.025	0.005	6.229	12873.157
9	109.000	2705.586	646.772	4.183	0.025	0.005	7.343	19867.647
10	110.000	3357.097	661.173	5.077	0.025	0.005	8.356	28050.551
11	111.000	4306.527	798.786	5.391	0.025	0.005	8.696	37451.566

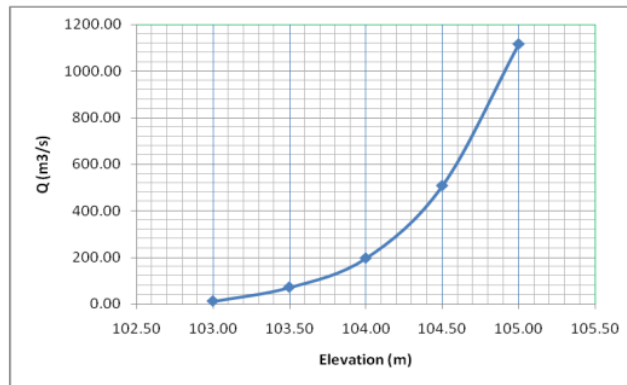
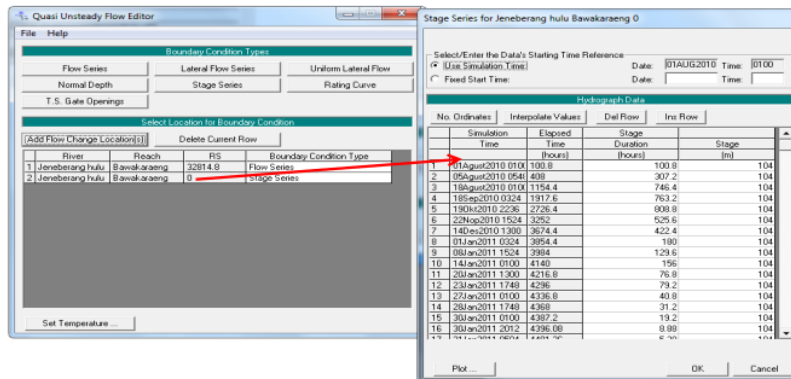


Figure 4. Rating Curve as downstream boundary Condition



6 Downstream Boundary Condition

Figure 5. Boundary Condition Editor

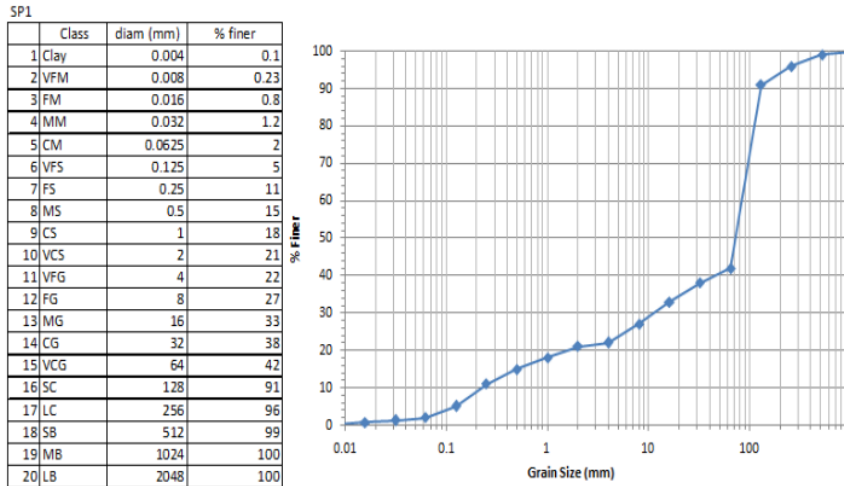


Figure 6. Grainsize of River Bed Material

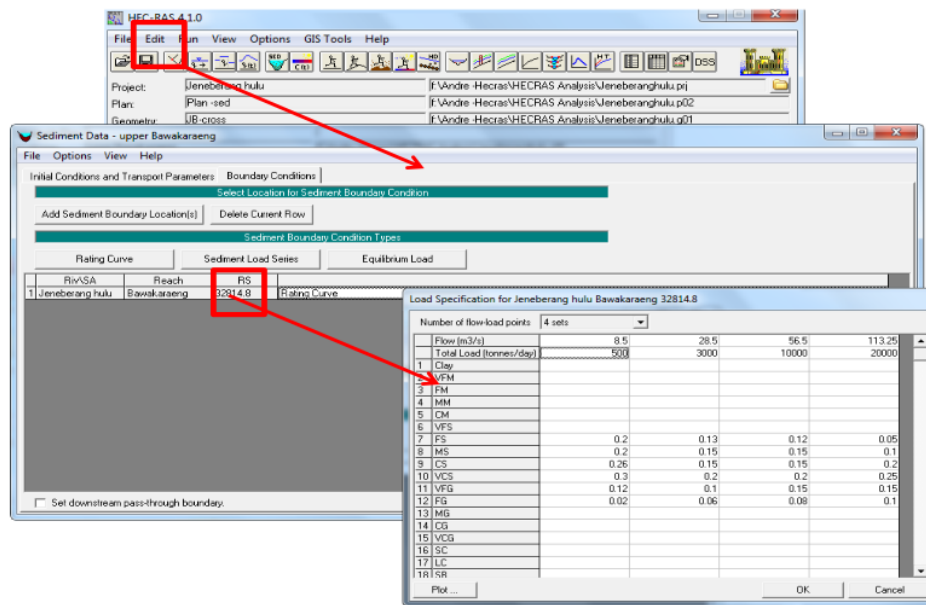


Figure 7. Sediment Data Editor

- Run simulation

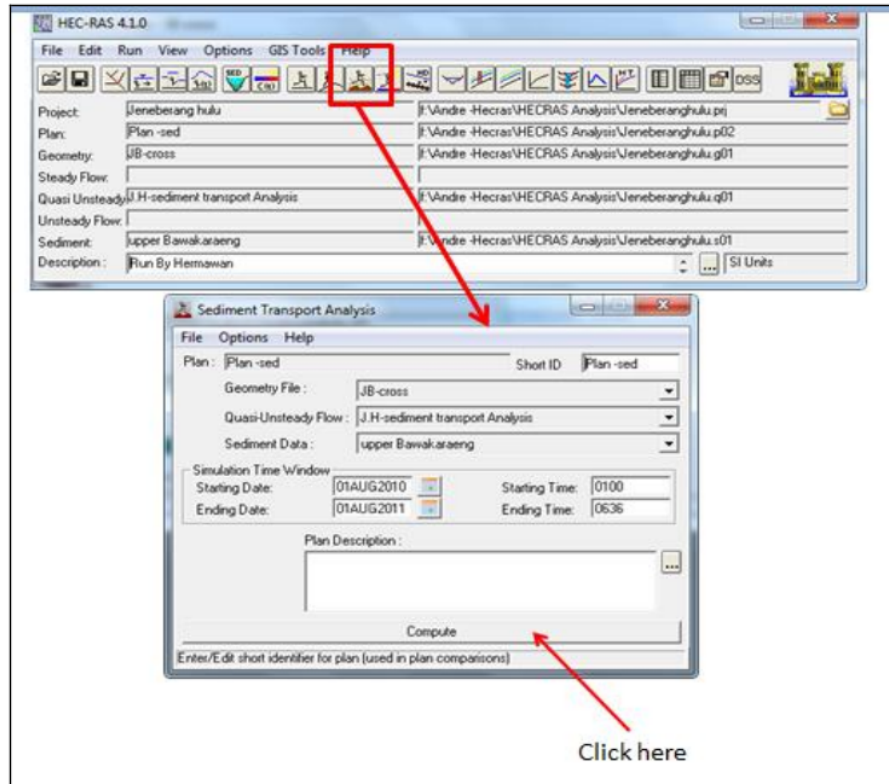


Figure 8. Run Editor

### 3. The result of simulation<sup>1</sup>

The result of the study is a continuous simulation of the change in cross section, as sedimentation processes adjust to the hydraulic condition imposed by the water-sediment hydrograph and the base level control boundary conditions.

In figure 9, showing the longitudinal profile of riverbed, and in Figure 10. Showing that the solid line is the original profile, and the dot line is the profile after simulation.

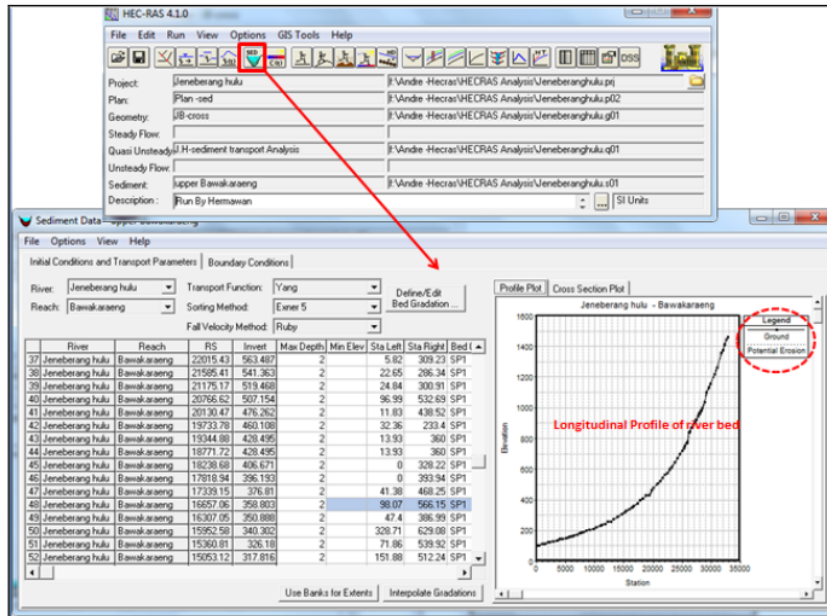


Figure 9. Longitudinal Profile of Riverbed after Simulation

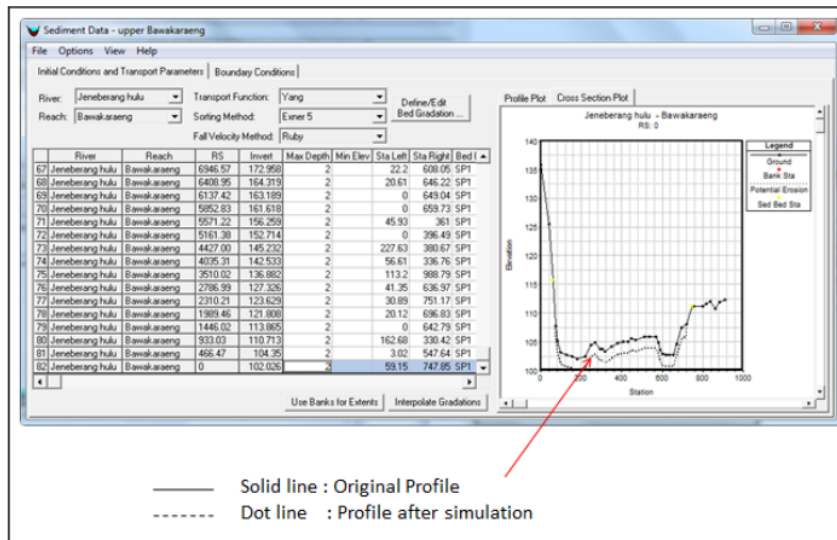


Figure 10. Cross Section Profile after Simulation

The result of the simulation (Figure 10) shows the river bed profile after simulation, if the new profile were below than the original ones, then the degradation were occurred, and if the new profile were above than that original ones, it means, the aggradation were occurred.

#### **4. Conclusion And Recommendation**

Based on the analysis which show the erosion area and the sediment accumulated area, the decision maker can make the right choice to construct specific sediment control structures , at specific location to prevent sediment flowing to the dam. With the right type and the right place of these river structures constructed for securing water.

#### **Acknowledgements**

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#### **References**

- Simon C. Reid , Stuart N. Lane , David R. Montgomery , Christopher J. Brookes. (2007). "Does hydrological connectivity improve modelling of coarsesediment delivery in upland environments?".
- Sohn, Young Kwan, Rhee,Chue Woo & Kim Bok Chueh. (1999). "Debris Flow and Hyperconcentrated Flood-flows Deposits in an Alluvial Fan, Northwestern Part of the Cretaceous YongDong asin, Central Korea ". The journal of Geology, Vol. 107, pp.111-132.
- Chi Ted Yang. (1996). "Sediment Transport". Theory and Practice.McGraw-Hill, Inc.
- Hydrologoc Engineering Centre. (2008). "River Analysis System-Sediment Transport Computation" . CPD-70, version 4.0, March, 2008.
- Hydrologoc Engineering Centre. (2010). "River Analysis System" User's manual, CPD-68, version 4.1, January, 2010.
- Yachiyo Engineering Co.,Ltd and Associates. (2008). " Comprehensive Sediment Management Study" Supporting Report. Annex No.2-1 Watershed and Sediment Disaster Management. PPK Pengendalian Sedimen Bawakaraeng.
- Yachiyo Engineering Co.,Ltd and Associates. (2008). " Comprehensive Sediment Management Study" Supporting Report. Annex No.10. Sustainable Sand Mining Management Watershed and Sediment.. PPK Pengendalian Sedimen Bawakaraeng.

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