TRIDIMENSIONAL MODELING OF HYDRODYNAMIC SEDIMENTS

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Abstract. *Sediments of the sand particle dimension or bigger will deposit in a shorten time after the entry of the flow in the lake. Delta deposits are formed when the flow enters the lake and coarse materials are deposited and the speed and carrying capacity diminishes. . Amount of sediment in a reservoir should be evaluated periodically, in this sense developing in the INCDMecatronica & Measurement Technique, a family of intelligent high-tech equipment used to monitor sediment, including the purchase of specific software, storage, processing and transmitting data*

Keywords: *sediments intelligent measurement, silt, lakes, reservoirs*

1. INTRODUCTION

Hydrodynamic phenomena related to the dam sediments in lakes, canals and waterways , port basins, is an objective reality, both in Romania and European and international. Accumulation of sediment in lakes artificial or natural barrier reduces their storage capacity by over 1% each year which will result in the next 3-5 decades lower water storage capacity by about 50%.. These consequences are especially important today when climate change is a fact universally known and accepted, some of these influences are visible in different regions of our country. Amount of sediment in a reservoir should be evaluated periodically, in this sense developing in the INCDMecatronica & Measurement Technique, a family of intelligent high-tech equipment used to monitor sediment, including the purchase of specific software, storage, processing and transmitting data

1.1 ASPECTS OF MOVEMENT AND TRANSPORT OF THE SEDIMENTS

Silt are small solid particles transported by water in suspension or tare the bottom bed. Alluvial particle characteristics are: grain size (d), grain shape ($k_{\gamma;}$ k_s), specific gravity (γ_s) fall speed (w). Materials from the bed sediments, which make up the coarse particle bed sediments are transported usually near the riverbed. There are several numerical formulas for assessing predicting sediment transport, of which we mention: Van Rijn (1984) ; Meyer-Peter-Mueller (1948); Graaf (1983), etc.

1.2 DISPOSAL OF SEDIMENT DEPOSITS IN LAKE

If the flow of streams is just above the entrance hole in the lake, the flow velocity immediately begins to decline, and transported coarse sediments begin to settle.

Sediments of mud and clay will be transported a greater distance in the pool location and manner of storage depends on the longitudinal slope, as lake sediment mineral characteristics and chemical composition of water.
Thus the lake deposits are made in three ways:
1. Deposits in the area of influence.
2. Deposits of sand and gravel.
3. Delta deposits of mud and clay on the bottom.
Deposits in the area of influence. Are deposits that form in the area above the lake and increase both the lake and upstream.

2.DELTA TYPE DEPOSITS

Sediments of the sand particle dimension or bigger will deposid in a shorten time afetr the entry of the flow in the lake. Delta deposits are formed when the flow enters the lake and coarse materials are deposited and the speed and carrying capacity diminishes(Yonas 2005).
Location and shape of the Delta depend on slope deposits, longitudinal length of the lake, and size distribution of particles, volume and shape of the lake deposits. Delta deposits increase in upstream and downstream directions(Sloff 1991).
According to Zangh and Qian (1985), we can distinguish two forms of delta:

deltaic deposits $\frac{V}{S_{\Delta t}} > 2$ and $\frac{\Delta h}{h} < 0{,}15$ (1)

Wedge-shaped deposits $\frac{V}{S_{\Delta t}} < 2$ and $\frac{\Delta h}{h} > 0{,}15$ (2)

2.1. DELTA FORMATIONS CHARACTERISTICS

Mainly, coarse sediment fractions are stored at the end of the lake in the area of influence taking birth formations

Delta. Delta formation is the basic unit of the lake deposit. It consists of "part of the tail", "the top" and "front of the dam".
Deposits concept for deep reservoirs (Dr.CJSloff 2006) Type delta deposits at the bottom of the lake. Is the most upstream part beeing a transition between natural flow and Delta. Flow, after entering the rear starts to become smoother along the watercourse. As a result of growth at the top in the immediate vicinity, it will extend upstream a slow (Zangh and Qian 1985).
Deposits above the Delta. almost all cargo entering moves reaching the front of the Delta deposit making it to move forward. For this reason, water from the back rises and disrupt the natural balance who is maintained in the previous phase bringing other particles that are deposited (Zangh and Qian 1985). According Yonas (2005) the most important characteristics of delta deposits are:
1. There is a sudden change in slope between the top and at the end. This change in slope usually corresponds to current density at the point of immersion.
2. Particles sedimented at the top are larger in diameter as that of the extremities.
3. Elevation of the transition zone and the front end of transfer depends on the exploitation of the lake

3.DEPOSITS DUE TO DENSITY CURRENTS

Materials transported to the front of the dam are made by the current density. Turbidity currents or underground currents occur because of gravitational forces due to sediment present in large rivers in the environment. Low-speed currents are able to carry heavy loads of fine particles in the less accessible parts of the lake (Sloff 1991). A turbidity current, current density difference coming from the surrounding water that eventually diminishes to disappear completely (Duquennois, 1956). When current density reaches the dam stores it transport suspended particles forming a "mud pond". They are deposited to form a very gentle slope considered to be horizontal for easy calculations (Sloff 1991).

3.1DEPOSITS ON THE BOTTOM OF THE LAKE

Much of the fine sediments are transported in suspension as a load of washing being stored by Delta deposits forming the bottom bed. Submission is more uniform than in coarse deposits but their distribution depends on the circulation and stratification of the lake. Discrete particles of mud and clay have low deposition rates. Even in the absence of turbulence the particles can travel considerable distances up to sit the lake bottom

4. CASE STUDY ON INTELLIGENT DEVICES USED ON THE CLOGGING DEVELOPED BY INCDMTM

Pitesti reservoir is located on the middle course of the Arges river, land code GL-1009-X1, at 3 km downstream of confluence with River Lady, respectively at 8 km downstream of dam Bascov, in the middle of Pitesti area located on the middle course of the Arges in an area subject to erosion. accumulation suffered during the operating period since 1971 a strong clogging process that led to raising the lake bottom over 3 meters with repercussions on the volume of storage conditions of transit and worsening flood insurance riverside residents water supply.

Fig.1. Initial plan of Pitesti arrangement

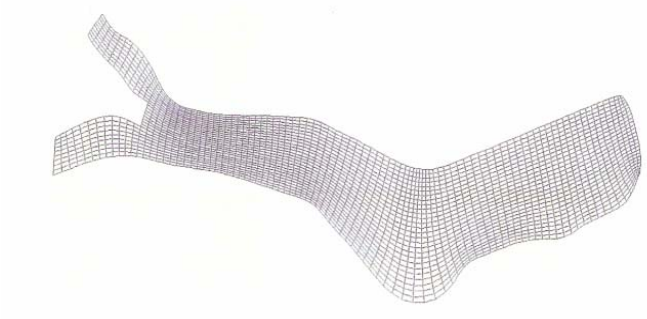

Fig.2. Morphological graphic at initial state (2D)

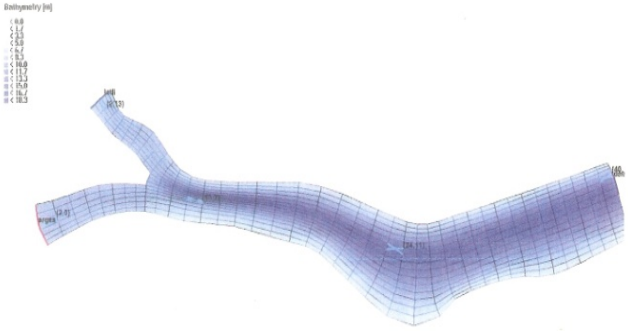

Fig.3. Pitesti reservoir examined in order to determine the morphological level mesh refinement

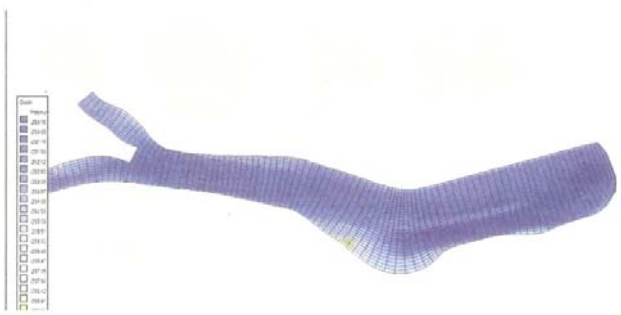

Fig.4. Final Morphological graphic

At last Bathymetry conducted in 2008 by ISPH Bucharest, it was found that water volume is 1.06 cm from 4.47 million cubic meters initially, so a clogging of about 76%. For a more accurate determination of the situation by monitoring lake point with intelligence equipment developed INCDMTM modeling can increase accuracy by over 15%. New entries in Delft 3D modeling software allowed to establish precisely the degree of clogging zone. Mathematical modeling was based on a discretization of the analyzed domain. There have been 30 determinations on grid line to obtain optimal mesh. Mesh was made with elements "linear curve" and after discretization domain, data entry of depth and edge condition is achieved "morphological level "

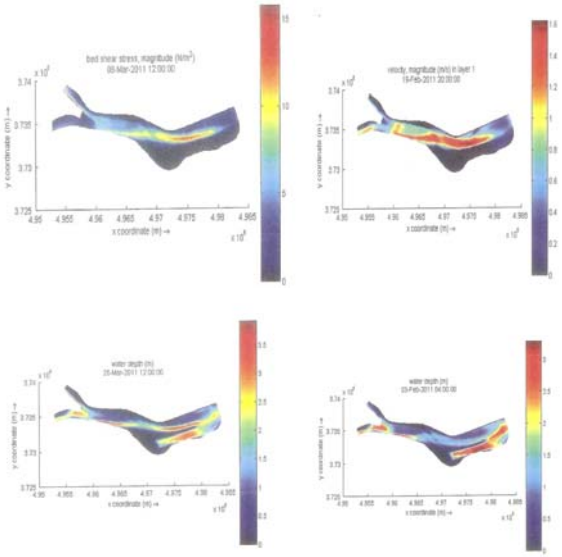

Fig.5. The graphic result of simulations

5. REFFERENCES

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