

## The Svärtsjö project: environmental dredging and dewatering of pulp- and-paper sludges.

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The two Svärtsjö lakes near the city of Hultsfred (Sweden) have been contaminated in the past by pulp originating from a paper mill upstream the Pauliström. The pulp, which is highly organic and polluted with mercury, has settled down in both lakes, where it causes a serious threat to the marine fauna and flora. For this reason the Swedish EPA decided to remove about 300000 m<sup>3</sup> of sediments in the course of 2006. The sediments have to be dewatered, and stored in a final HDPE lined landfill area in the vicinity of the lakes.

The remote location of the lakes, combined with the environmental aspect of the dredging imposes quite some boundary conditions on the dredging operations:

- The dredge has to be completely dismountable and transportable over road as the nearest port is located at 200 km distance.
- In order to guarantee very accurate and low turbidity dredging, the positioning of the dredge has to be done based on an anchoring system at the shore of the lakes.



Fig. 1: View on the dredge "Pixie"

For this particular project, a new dredge was designed and constructed, as shown in the picture above. It is based on 7 connectable and transportable pontoons. Positioning of the dredge in the lakes is based on four anchoring points along the shore, and a set of four GPS controlled winches with which a desired area can be dredged automatically.

At a rate of about 300 m<sup>3</sup> per hour, the dredger pumped the sediments via a 2 km long floating pipe system to the final storage area, as shown on the principle drawing in figure 2. Onshore, organic flocculant was injected controlled by continuous measurement of dry matter content flow in the pipe. Then the sediments were dewatered in geotubes, and the filtrate treated in a biological water treatment unit. The process flow diagram is shown in figure 3.

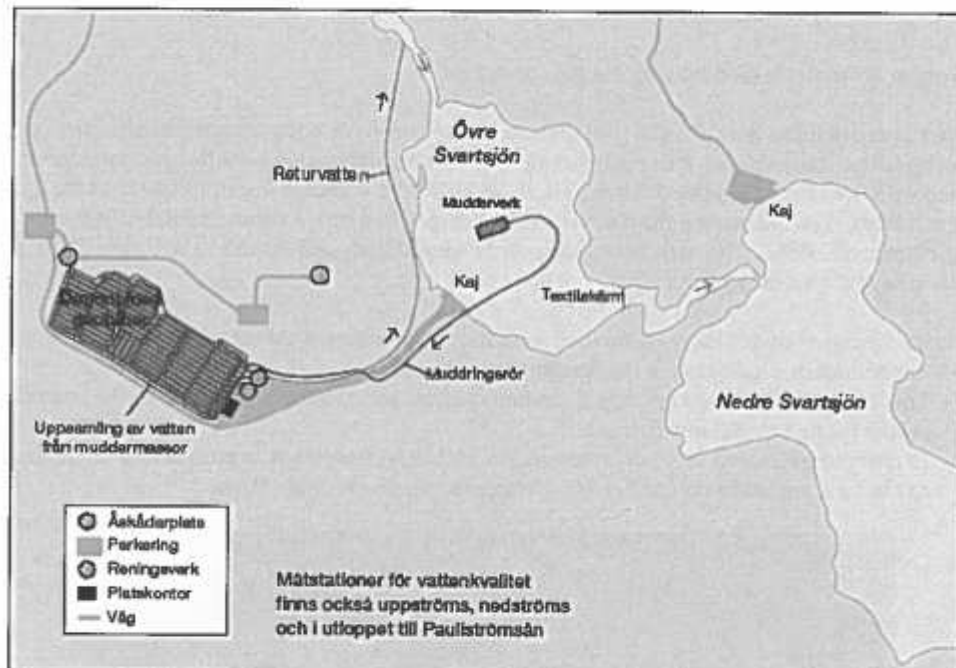


Fig. 2: Principle drawing of the dredging and dewatering works.

The geotubes were installed directly in the final landfill. First they served as dewatering media, later, during the future storage of the sediments they will reinforce the sediments in order to maintain stability and control differential settlements. In addition, they allowed to stack the dewatered sediments upwards and in a sloped area.

The water released from the geotubes was pumped into a high capacity water treatment plant, shown in figure 4. The plant basically consisted of an aerobic bioreactor of the SBR type, with a capacity of 150 m<sup>3</sup>/h. The main contaminants to be removed from the water were BOD, COD, suspended solids and mercury. The treated water was discharged in the lake.

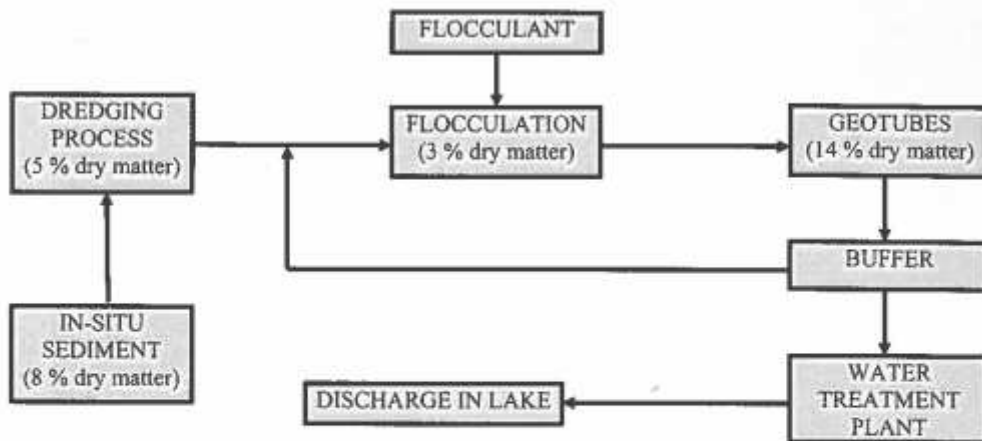


Fig. 3: Process flow diagram

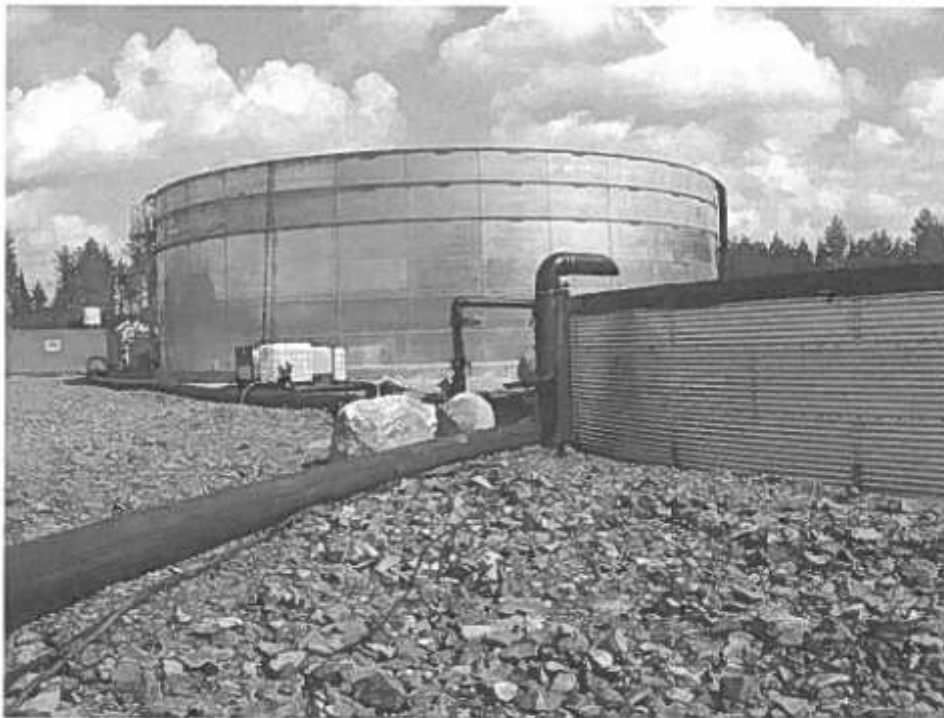


Fig. 4: View on the biological water treatment plant.



**Fig. 5:** Aerial view on the landfill site with the filled geotubes. The water treatment plant can be seen in the back.

During winter and spring 2007 a half year period was allowed to achieve further consolidation of the sediments in the geotubes. In the summer of 2007 the disposal area will be capped and the topsoil cover will be revegetated. The contaminated sediments will be stored in a geotechnically and chemically stable environment for the future.

### **Conclusions**

- The Svartsjö project proves that environmental dredging, dewatering and water treatment can be carried out by a synchronised process.
- The process allows high throughput and ensures short execution periods.
- Dewatering in geotubes has a double advantage: high throughput capacity and long-term reinforcement of the dewatered sediments in the disposal area.