Coastal and ecocoastal engineering

Water Quality Protection: Grand-marina, Sochi

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It's presented the method based on the numerical modeling of the processes for the forecasting and protecting of the sea water quality at the stage of design of the coastal constructions like the ports, recreation and shore protection. The enclosed coastal water bodies are the areas of the intensive pollution and in the same time have the limited water exchange with the main basin. The objective of the study is the development of the method of forecasting of the port water quality and recommendations on the required water quality supply. The protection of the water quality in the yachting ports is very actual problem because the water quality is not only environmental but also the consuming property of the marinas. The study has been carried out for the conditions of the yachting port "Grand-Marina Sochi", which is designed for placing in the sea port Sochi, Russian Black Sea coast. The capacity of marina is 300 yachts; the water area of marina is bounded by construction of the additional breakwater in the main sea port. The discharges of the oil, as well as the accidence at the sewage system are considered like the sources of the pollution. The numerical modeling of current patent has been applied to forecast the spreading of the pollution under the determined hydro-meteorological scenarios. 3D circulation of the currents inside and in the gate of the marina is modeled by application of the SELFE-code – the numerical solution of the hydrodynamic equations on the unstructured grids. To simulate the dynamics and evolution of the oil spill the 3D OILTOX-code is used. The both codes have been developed in Ukrainian Center of Ecological and Water Projects. The system dynamic model of the water quality evolution has been designed on the base of PowerSim program, and applied to simulate the changes of the water quality parameters after sewage system damage. Three meteorological scenarios with the wind velocity, 5, 10, and 15 m/s have been considered. It was shown that the currents have the 3D structure with the surface velocities following wind direction, and near-bottom velocities having the opposite direction. The oil spill dynamics simulated using the Lagrange approach, the total volume of the discharged oil is taking as 500 liters, the time of discharge is 10 minutes, the number of model Lagrange tracers is 6200. As the result, the time of reaching by the oil the coastline (breakwater or port mole) has been obtained. That should be included to the planned measures of the water quality protection system. The analysis of the sources of pollution of the Sochi sea port resulted that the main source is the surface rain water discharge.

That gives the main input of the organic matters to the sea water. The main mechanism of the cleaning of the water body is the water exchange between marina and the Black sea. It’s shown the evolution of the water quality as the result of the chemical reactions and the flushing by water exchange. The results of the study apply for development the recommendation for program of the environmental monitoring of the sea water quality in the port basin at the stage of port operation.