Chicago Fish Barrier – Abstract

The United States of America – and more specific the state of Illinois – are dealing with a problem of Asian carps spreading from inward waterways to the Great Lakes. The Asian carp was originally brought to America to be used in study’s on agricultural pounds, but escaped after series of flooding. The Asian carp has no natural enemies in the waters of the United States and are heading via the Mississippi River to the Great Lakes. The threat of the Asian carp lies in the ‘special’ property that these fish have a large appetite and tend to eat everything in their way which is smaller than them. They reproduce rapidly which means that in relatively short periods entire areas can be cleared from plankton and aquatic plants. Their presence can ruin entire vegetation’s and especially when the would enter the Great Lakes, huge economic and environmental problems could arise.

Due to these imminent problems multiple studies have been made to stop these fish, but yet so far no actual solution has come up. Even an electrical curtain wasn’t able to stop them. The only connection between the Mississippi River and the Great Lakes – the Chicago Sanitary and Ship Canal – is a perfect location for a structure that can stop these fish, but still allowing the inland water vessels to gain access to Chicago and the Great Lakes. This canal is designed as part of the sewage system of the Chicago Area Waterway System and is needed to remain a proper water quality – closing this canal off will lead to large investments in multiple wastewater treatment plants. A proper solution is therefore desired which lead to a passage for vessels without providing a passage for fish heading upstream towards the Great Lakes.

A surroundings and stakeholders analysis showed that the best location for such a solution will be in the Chicago Sanitary and Ship Canal near the place Lockport. Meeting the requirements the best solution for this problem is the design of a ‘water-free vertical boat lift’. This design can be combined with the renovation/renewing of the current Lockport lock in the canal. The water-free vertical boat lift has similarities with a regular vertical boat lift, but has the special property that it lifts the vessels to the upstream water level without the help of water.

A vessels will enter the lock chamber via two vertical lifting doors whereafter the water is drained out of it. The vessel will the lower until it rests on inflatable rubber bags on the floor. Hereby all the water and fish will be caught in a water storage area underneath the lock chamber from where the water and fish will be released downstream again. Afterwards the empty lock chamber with the vessel will be lifted to the upstream water level from where water can be pumped back in and the vessel can continue.

The lock chamber is made out of steel walls of 7,5 meters high in combination with a steel/concrete combined floor of 18,5 meters width and 100 meters length. The concrete slab will be inclined to gain a 1:20 slope for a proper outflow of the water and fish. The inflatable bags are placed over the width every 10 meters and the 2x2 meter gaps are placed in pairs of two in-between. The lock chamber is closed-off by two vertical lifting gates and is supported by 42 steel cables with a diameter of 103 mm distributed over the length. The cables will go up over large pulleys, which will be mounted on the total construction for support. The counter weights have to be adjustable due to the difference in weight of the lock chamber when filled and emptied. By using variable weights the mass can be regulated, which leads to better handling of the lifting/lowering equipment.

This report shows that a decent solution to stop Asian carp from invading the Great Lakes lies in the form of a vertical boat lift that lifts the vessels without the help of water. Further researches will lead to a better conclusion regarding the feasibility of this design and the applicability to the Chicago Sanitary and Shipping Canal regarding the main objective: stopping fish from invading Lake Michigan!