FOCUS

Climate Change and Great Lakes Shipping/Boating

study conducted by

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The Great Lakes region takes its very identity from the lakes. Fishing, boating, and in particular low cost waterborne cargo transportation have shaped the economic activity of the region for centuries. The Great Lakes-St. Lawrence water transportation system supports more than 30,000 jobs in the US and Canada [F4-1]. Business revenue and personal income resulting from the movement of cargo in the system tops $3 billion/year [F4-1]. Annual shipments (of bulk commodities) average 200 million tons through the 145 ports and terminals. This shipping serves the traditional commodity industries of the upper American Midwest of iron ore/taconite, coal, grain, limestone, salt, and petroleum products [F4-2].

The Great Lakes also teem with recreational boaters – more than 4 million recreational boats are owned within the Great Lakes states. The boating industry consists of boat manufacturers, retailers, marinas, and marine suppliers. Michigan ranks as the top state for boat owners in the United States, with nearly a third of all "boat days" associated with the Great Lakes [F4-2]. Serving these boat owners is a large network of marinas (over 1800 in Minnesota, Wisconsin and Michigan alone).

Impacts from Low Lake Levels

Hydrological processes dictate water levels in the Great Lakes. These levels change on both a seasonal basis as well as a long term basis. Water levels are usually higher in the spring and summer as snowpack water melts and flows to the lakes. Later in the year drier conditions lead to relatively higher evaporation rates and lake levels begin to drop. Fluctuations due to storm events tend to lead to more localized water level changes. Altogether, the Great Lakes Basin represents a complex, interwoven network of waterway resources that are likely to be sensitive to climatic pressures, especially if those pressures result in lowered lake levels.

Current reductions in Great Lakes levels have had a significant effect on both the commercial shipping economy and recreational boating. Starting in the Fall of 1998, lake levels dropped precipitously as a result of the extremely mild 1997-98 winter. With below normal precipitation and above-normal temperatures in 1998-99, lake levels continued to drop below Chart Datum by as much as 6 inches.

Lower lake levels mean ships cannot carry as much. Commercial carriers are very dependent on water depth in channel-ways and harbors. According to the Great Lakes Carrier's Association, a 1,000 foot-long vessel (of the type that is used for intra-lake transportation), loses 270 tons of capacity for each inch of draft loss. Draft is the distance between the water line and the bottom of the vessel. Ocean-going vessels (sized for passageway through the St. Lawrence Seaway), which are approximately 740 feet long, lose 100 tons of capacity for each inch of draft lost. Clearly, in an environment where other modes of transportation (rail and truck) are extremely price-competitive with Great Lakes shipping, the loss of even one-inch of draft can seriously disadvantage Great Lakes carriers and ports.

Low water also makes it more difficult for recreational boaters. There is greater chance of damage when entering or leaving the water. There is greater risk of running aground in harbors, marinas, or while underway in lakes or rivers because of propeller, keel, or hull strikes on lake bottom, boulders or shoals [F4-3]. The most common approach for managing lowered lake level situations in marinas, harbors, and channel-ways is by dredging. Dredging imposes both operational and environmental costs. Much of the material dredged from channels and harbors is contaminated from industrial waste and spills. This must be buried in existing landfills, which are nearing capacity. In the 1970s the Federal Government built 26 Confined Disposal Facilities (CDFs) for dredged sediments of the Great Lakes. The CDFs are viewed as an alternative to the open lake disposal of these sometimes contaminated materials. Currently these 26 CDFs are either full or nearly full, and by 2006 only 2 facilities will have room. Furthermore, ongoing federal support for their continued construction and operation is questionable. In addition, the dredging process releases buried toxins into the lake water. This threatens to reverse the trend towards less contaminated fish in the Great Lakes.

Impacts of Climate Change

The HadCM2 projections are close enough to the status quo to conclude that the socioeconomic impacts of climate change will be minor compared to other pressures that will likely be impacting the regional economy. The CGCM1 scenario suggests an entirely different picture. Namely, significant lake level decreases, ranging from 5 feet for Lake Michigan to 2 feet on Lake Superior. Lake level decreases of this magnitude will clearly have significant effects on the recreation and commercial activities in the region. These effects will be most noticeable in areas like Lake St. Clair, the Detroit River, and The Chicago Diversion as well as numerous smaller harbors, ports and marinas around the lakes (see *Chapter 4: Water Resources* in this report).

The last time that the Great Lakes experienced a significant decline in water levels was during 1962-1964. These declines resulted in dramatic increases in dredging activity and expenditure by the Army Corps of Engineers (the Corps is responsible for 145 harbors and 745 miles of channels in the Great Lakes/St. Lawrence area). Prior to 1963, dredging activity for all of the federal port facilities in the Great Lakes averaged 372,000 cubic yards annually. In the five years after 1963, dredging activity averaged 4,119,000 cubic yards annually. Activity curtailed as lake levels rose in the subsequent 20 years [F4-4].

This tenfold increase in dredging activity is likely to be exceeded in circumstances like those projected by the CGCM1 scenario. During the last five years, average annual dredging activity has removed approximately 752,000 cubic yards. Additionally, costs for dredging have risen significantly since the 1960s. Current prices for dredging are averaging approximately $8.00 per cubic yard with local highs going above $12.00 per cubic yard. This implies, that in a situation with heightened demand for dredging services, it would not be unreasonable to assume prices would be at least $10.00 to $12.00 per cubic yard on average. Therefore in a situation where 7,500,000 to 12,500,000 cubic yards are being removed from federal harbors on an annual basis, it is reasonable to assume that annual expenditures of $75-$125 million could be expected as a minimal investment in Great Lakes shipping infrastructure.

None of these budget figures includes costs to the recreation industry. Already in 1999 dredging frequency has increased for some marinas and small harbors from once every few years to twice per year. In a situation where each harbor needs to be dredged twice per year, the total cost of dredging to the entire industry is significant. For instance, there are 1,883 US marinas on Lakes Superior, Huron, and Michigan. If each of these marinas spends $15,000 twice per year to dredge, then the total cost of this effort is approximately $60 million. Annually this would add $15.00 to the costs of maintaining and operating each of the 4.0 million boats owned in the three state area. Altogether the dollar costs of this type of dredging are significant.

The costs of additional dredging could be partially mitigated by the benefits of additional shipping days on the Lakes caused by less persistent ice cover. Warmer waters would clearly limit ice cover and create opportunities for additional boat movement throughout the whole Great Lakes basin.

Coping Strategies

Because of the environmental costs of handling and disposing of dredge muck, steps should be taken now to site and build a system of new Confined Disposal Facilities (CDFs) for disposing of dredge muck. Regardless of the status of climate change these CDFs are a necessary part of the Great Lakes infrastructure.

One complication to dredging is that some harbors and channels are extemely costly to dredge. The Welland Canal, that allows shipping between Lakes Erie and Ontario, has a rock bottom so deepening it would require a multi-year project including drilling into the rock bottom and blasting away the rock.

Another possible coping mechanism is to transport goods by other means. Waterborne cargo routes are always in competition with rail and truck transportation modes. In recent years water-borne transportation has been losing routes. Railroads that originate traffic inland are reluctant to give up their cargo at the dock. In addition, many destinations are in the interior and require Great Lakes vessels to offload onto rail carriers for the completion of commodity movement. Thus, at one or both ends of many routes, water vessels depend on rail transportation. Railroads can often provide transportation from origination to destination, and have been lowering their prices to capture more market share.

A modal shift from water cargo to rail and truck would have environmental impacts as well. Rail and truck are less fuel-efficient methods and produce more air pollution. For example, wood-and-paper-products used to be transported by rail-ferry on Lake Superior from Thunder Bay, Ontario to Duluth, Minnesota. Now they are transported by rail and truck parallel to the old route. The Minnesota Department of Transportation Ports and Waterways Section estimates the environmental cost from the shift on this single route alone to be $1.1 million.