

Buffalo's Hamburg Drain CSO and the Revitalization of the Erie Canal

by Franklin DiMascio, Christopher Martin and Daniel Bentivogli

Buffalo is called the Queen City of the Great Lakes. Its waterfront was once the busiest port on the Lakes. Today, however, Buffalo's waterfront is largely underutilized, undeveloped and post-industrial in appearance. What development there is has been spasmodic, endlessly marred by funding difficulties and intra-mural turf wars by competing government agencies.

All of that appears to be changing. There are now ambitious plans to redevelop the waterfront, with an emphasis on highlighting the history of the Erie Canal, and the original location of the central wharf and commercial slip, which were located at the terminus of the canal (see Fig. 1). The new facilities are being constructed around the original stones of the Erie Canal's terminus (see Fig. 2), an area known as the Commercial Slip.

The waterfront promenade and shore features along the Commercial Slip will enhance the integration of water and land use facilities. These facilities will serve several functions including the landing of recreational boats, a meeting and gathering place, a trail system and a system to connect nearby parks and adjacent development. Overall, the Erie Canal Harbor Project will result in an attractive and inviting environment incorporating historic features on the waterfront (Fig 3).

However, a significant roadblock is that the terminus of the Canal is also the terminus of the Hamburg Drain, a combined sewer overflow (CSO) owned and operated by the Buffalo Sewer Authority (BSA). It's not just any CSO. It is the fourth largest and third most active in the BSA system (more on this later). A key challenge to making the Erie Canal Harbor Project a success in promoting tourism and allowing the Commercial Slip to be rewatered is the remediation of this CSO.

History of Erie Canal and Buffalo

When it opened in 1825, the Erie Canal was considered the engineering marvel of the 19th Century. With project costs of \$7 million, it was also one of the biggest of its

time. The idea by Governor Dewitt Clinton to build the Canal was famously but disparagingly referred to as "Clinton's Folly" and "Clinton's Ditch." However, the Governor was soon proved right as the Canal unleashed enormous economic and social changes on the still young nation. Buffalo became the focal point for the first great westward migration.

At the beginning of the 19th Century, the Allegheny Mountains were the western boundary of the US. In fact, since George Washington, the government discouraged expansion west of the Alleghenies. The Erie Canal changed all of that. It allowed travelers, settlers and businesses to move supplies relatively quickly. Because of the Canal, the Northwest Territories (later to become Illinois, Indiana, Michigan and Ohio) were accessible. These resource rich territories became a migration magnet. For example, in 1829, 3,640 bushels of wheat were transported from Albany to Buffalo. By 1837, this amount increased to 500,000 bushels transported; and by 1841, more than one million bushels were moved.

The Canal was subsequently enlarged twice. Lateral canals were added to the system. However, by the latter part of the 19th Century, the Canal had declined in significance due to competition from the railroads.

Between 1847 and 1879, seven combined sewers were constructed flowing to the Hamburg Canal, draining the south Buffalo area to accommodate Buffalo's rapidly expanding population. The Swan Trunk was added to the mix in 1882, and 1884 and 1897 saw the addition of the Hamburg Street and Alabama Street sewers, respectively. The Hamburg Canal essentially functioned as an open sewer.

Between 1901 and 1907, the Hamburg Canal and associated relief sewers were covered over from Main Street to Hamburg Street. A dry weather flow sewer constructed in the south wall of the Hamburg Drain conveyed dry weather flow to the Buffalo River and ultimately the Niagara River. Finally, the remainder of the Hamburg Drain was covered—the structure that currently runs



Figure 1. Erie Canal terminus in the past – Commercial Slip

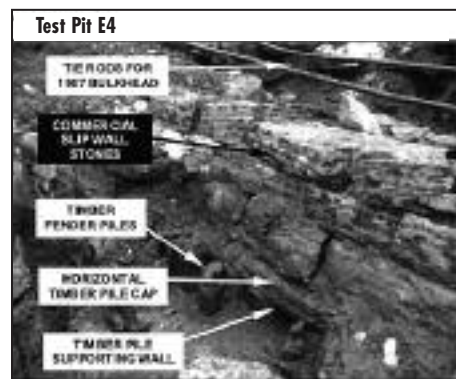


Figure 2. Commercial Slip today

down the center of the old Erie Canal, including the original terminus at the Commercial Slip.

In 1935, the Buffalo Sewer Authority (BSA) was formed and it constructed a primary wastewater treatment plant that drained to the Niagara River. At the time, the plant's disinfection facility was the biggest chlorine project in the world and gained worldwide recognition for its innovative design. In 1972, construction began on a secondary wastewater treatment plant. The plant, designed for an average daily flow of 180 million gallons per day (mgd), hydraulically is capable of greater than 500 mgd. The dry weather flows running along the Hamburg Drain sewer were rerouted to the new plant via the South Interceptor. Although this interceptor can convey two-and-one-half times the dry weather flow to the treatment plant, remaining wet weather overflows are still conveyed to the Hamburg Drain.

The Hamburg Drain discharges into the Buffalo River, a Class C water body. The river generally flows from east to west and its watershed drains an area of approximately 445 square miles. The Erie Canal Harbor Project is located along the lower portion of

continued on page 30

The presence of floatables also would be a concern whether the Hamburg Drain discharged directly into the Commercial Slip or if the discharge were relocated. It became apparent that the need to preserve the historic aspects of the site, as well as provide real estate for waterfront activity and development, would be seriously impacted by the relocation option. While truncating the Hamburg Drain would require little real estate, an offsite floatables treatment facility would be required. Relocating the Hamburg Drain also would be significantly more costly than truncating the CSO and treating the discharge.

Therefore, truncation of the Hamburg Drain at the Commercial Slip was determined to be the preferred alternative. Facilities were recommended to provide the ability to maintain an adequate DO concentration (5 mg/L) in the slip to minimize odor generation potential; to maintain adequate flushing after a CSO event to provide turn-over for stagnant water; and to maximize the removal of floatables.

In order to address the first two issues – increasing DO levels and slip water turnover – the flow from the Hamburg Drain will be supplemented by river water pumped to the new terminus of the conduit to promote flushing of the Commercial Slip after CSO events. A new below-grade pumping station that uses an axial-flow impeller pump drawing from a rotating-screen intake structure built on the Buffalo River bulkhead upstream of the Commercial Slip will provide 38 cfs (17,000 gallons per minute) of recycled water to the head end of the slip. The discharge from the pumping system will be distributed through a weir structure constructed along the head end of the slip and over the Hamburg Drain outlet. It will then pass over a steel cascade step-aeration structure to supplement the Commercial Slip with DO. These facilities are currently in the final stages of construction, and should be placed in operation in the summer of 2007.

What about the Floatables?

The challenge facing the BSA and its consultant, Conestoga-Rovers and Associates (CRA), is to remediate floatables from this CSO to help make the area attractive and increase the water quality. Options considered included:

- An underflow baffle with manual bar rack
- Netting systems
- Automated mechanical bar screens
- Vortex separators
- Chemically-enhanced high rate sedimentation

It was determined that although vortex separators and chemically enhanced high rate sedimentation would provide superior solids removal, these systems are very costly and complex to operate, given the extreme variability of flow from the Drain. An underflow baffle with manual bar rack would have lower complexity and cost. However, with an expected floatables removal efficacy of between 25 percent and 60 percent, this alternative would not meet the treatment objectives. In addition, the baffle would have intensive cleaning requirements after every CSO event. While successfully used in other cities, space limitations in and around the commercial slip would prevent the use of a netting system. Netting also would be labor intensive, and there is a potential for the net to break free with a resulting large discharge of floatables into the commercial slip.

After much investigation, the project team concluded that the installation of automatically cleaned bar screens upstream of the Erie Canal terminus was the preferred alternative. Automatic bar screens are expected to remove 90 to 95 percent of the floatables. Moreover, this capture efficiency is not reliant on continuous maintenance involvement. The screenings would be conveyed to a grinder and pumped to a sanitary sewer once the CSO event has ended. BSA staff have successfully used automated bar screens at their wastewater treatment plant, and thus are familiar with their operations and maintenance requirements. The facility can be monitored remotely as well.

However, implementing this recommendation has been complex due to the limited availability of land, aesthetic concerns with the facility and the need to fit in with development planning (which has changed periodically) for the area. Ideally, the screening facility needs to be as close to the Hamburg Drain terminus to capture as much as the

floatable-containing flow as possible. However, the superstructure for the screening facility will require approximately 8,000 square feet and needs to be about 30-feet high, plus there are potential odor issues. Adding to the difficulty of locating the screening facility is the alignment of the Hamburg Drain (Fig. 4). It passes under the Niagara Section of the NYS Thruway, the Buffalo News building, Memorial Auditorium and the Skyway Bridge before entering the Commercial Slip.

The Screening Facility Location

Obviously, design of the screening facility cannot begin until a location is selected and preliminary layout accepted. Three locations were examined over the past two years. Two sites were at preferred (from a floatables removal perspective) locations near the terminus of the Hamburg Drain. However, after extensive review, it was ultimately determined that the proposed screening facility would not fit into the context of the planned development in those areas.

A third location, known as the Donovan site, looked promising for a while. The existing office building at the Donovan site was planned for demolition and replacement with a parking garage. This type of primary property use would not preclude installation of the screening facility if potential for odors is addressed. This site, located between the Auditorium and the Buffalo News, would allow capture of all of the CSO flows in the Hamburg Drain. Construction would also be facilitated, because the parallel facility could be constructed and tested before final connection to the adjacent Hamburg Drain. However, the development plans for this site were changed in late summer 2006 when the Donovan site was redesignated for commercial/tourism use. This



Figure 4. Location options for Hamburg Drain screening facility



Courtesy of CRA Infrastructure & Engineering, Inc.

Current construction at the Commercial Slip

again rendered the screening facility inappropriate to construction in this area. Therefore, a new location had to be found.

The next best location was found to be at the Oak and Elm Street ramps of the NYS Thruway, immediately East of the Buffalo News building. At this point, the Oak/Swan CSO intersects the Hamburg Drain. If the screening facility was located upstream of this point, up to 20 percent of sewer overflows would not be treated. Bounded by the Thruway to the south, expressway ramps to the east and west, and an intermittently used rail spur and adjacent Conrail/CSX

high-speed rail line to the north, the available area for the site was limited. However, it was determined sufficient space was available to locate the screening facility. At this location, the Hamburg Drain and Oak/Swan CSO would be diverted to flow through the screenings facility. Two 10-foot-11-inch climber screens will remove floatable materials from the flow stream. A bypass channel also would be provided. The screenings would be conveyed to a com-

minutor where they would be ground up and pumped through a force main to an exiting sanitary sewer running parallel to the Hamburg Drain.

The current challenge is obtaining an Occupancy Permit from the NYS Thruway Authority and a license from CSX Corporation, which has an easement through the property. The BSA and CRA, with assistance from the Erie County Industrial Development Agency, are working with these entities to develop a mutually acceptable site plan. Current plans anticipate facility design

being completed in early to mid 2007, with facility construction to take place in 2008.

The challenges of restoring the historic terminus, contributing to industrial tourism and coordinating these efforts with the BSA's long term control plan are both daunting and exciting. We anticipate meeting these engineering challenges with the same creative effort that created the Canal in the first place.

Come to Buffalo in 2008 and enjoy our industrial and cultural history!

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