

Surge in the Lower Genesee River
and its Significance for Riverfront Development

by

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SUMMARY

As part of the proposed Waterfront Revitalization Plan for the old Port of Rochester, a new marina is to be dredged into the existing parking lot between the Port Authority buildings and Ontario Beach Park. However, a wave surge is generated in the lower Genesee River (from the Conrail Bridge downstream to the lake) during northeasterly storms on Lake Ontario. Because this surge makes facilities dangerous and even unusable during the periodic northeast storms, marine development in the lower Genesee is very difficult, if not impossible. Consequently, the surge has a negative affect on the existing boating and support facilities and threatens further economic development of the Rochester Harbor and riverfront area. Changes in the existing piers at the mouth of the river or construction of an offshore breakwater could control the surge.

BACKGROUND

Rochester Harbor encompasses the Lake Ontario shoreline between Braddock Point and Nine Mile Point and the Genesee River mouth south to the Federal turning basin (see Fig. 1) (1). The region of the river from the Stutson Street highway bridge in Rochester north to its discharge into Lake Ontario historically has been devoted to both

commercial and recreational activities. Over the years there have been shipyards, foundries, railroad terminals, yacht clubs, the Rochester-Monroe County Port Authority, and a resort and amusement park. Currently, this portion of the river is bordered largely by marinas, yacht clubs, and city-owned land, which comprises the Genesee River Fishing Access Site on the east side and the combined Port Authority-Ontario Beach Park on the west side. The Fishing Access Site is administered by the New York State Department of Environmental Conservation (NYS-DEC) and the Port Authority and Ontario Beach Park are administered by Monroe County. The County also has a boat launch ramp at the southern boundary of the Port Authority property adjacent to the Conrail bridge.

Two concrete and steel piers extend the river northeasterly into the lake for one half mile. (Technically, these are jetties, since they are designed to protect the harbor (2); however, the common local usage of "pier" will be retained here.) Upstream from the Lake Ontario shoreline, the riverbanks have been lined with steel piling backed by concrete almost continuously to the Conrail bridge. From the Conrail bridge south to the Stutson Street bridge, the banks are lined with piers, some fronting steel and concrete and others built to the natural bank. South of the Stutson Street bridge, the banks are largely natural, although pier-lined.

THE PROPOSAL

In order to promote growth and economic development, the City of Rochester's \$100 million Waterfront Revitalization Plan (3) calls for:

- 1) Improvement in access to the river harbor area.
- 2) Construction of a visitor marina and supporting parking. The proposal calls for construction of the marina between the existing southern grassed area of Ontario Beach Park and the Port Authority buildings to the south. The area is currently parking lot for the park and is located directly across the river from the NYS-DEC Genesee River Fishing Access Site, which is on the site of the old Naval Militia base.

- 3) Development of wave surge protection for the river harbor area. The City has asked the United States Army Corps of Engineers to build a \$4 million extension of the existing west pier at the mouth of the river (3), and the U.S. Senate recently authorized a \$200,000 Army Corps of Engineers study to evaluate storm surge conditions at the Rochester Harbor. However, the fate of this study depends upon the outcome of federal budget negotiations for fiscal year 1990-1991 (4, 5, 6).

THE PROBLEM

Whenever winds from the northeast blow across Lake Ontario, waves are created on the lake which sweep up the Genesee River. Since the Rochester Harbor piers extend northeasterly into the lake, they produce no sheltering effect and, in fact, may help channel the wave energy upriver. When this phenomenon occurs, structures in the path of the waves must withstand large forces, both at the surface and underwater.

While northeasterly winds are not the prevailing winds in the region, when they occur they produce some of the largest waves (up to 8 feet) in this portion of Lake Ontario and the largest that affect the river mouth. The size of wind-generated waves is determined predominantly by four factors: water depth, wind speed, wind duration, and fetch, or the distance which the wind blows across the water surface. Since the water depth at the harbor is the same for all wind directions, it is not a variable here. A typical northeast wind in this region has speeds as high as those from any other direction and often may blow for three days. Since it takes only a matter of hours for waves on Lake Ontario to reach their maximum sustainable height, the speed and duration factors produce waves equal to those from any other direction. The location of the Rochester Harbor presents the longest fetch possible (about 70 miles) to waves from the northeast. (Rochester is on the south shore of Lake Ontario and in an embayment formed by Braddock Point on the west and Nine Mile Point on the east, so the longest stretch of open water lies to the northeast.) The combination of these factors results in the largest waves having unhindered access to the harbor (including the lower Genesee). The piers provide protection from the prevailing wind directions, but the harbor still must periodically withstand maximum force waves generated by atypical northeast storms (7, 8).

Wind-generated waves are not only surface phenomena; they have associated underwater pressure waves which extend in all directions from their centers. These underwater waves are as dangerous as the surface waves (7, 8). The combined effect of the surface and underwater waves is the surge in Rochester Harbor.

In order to stop or dissipate a wave, it is necessary to remove its energy. The natural shoreline of a body of water does this either by absorbing the energy or by scattering it in many directions. The relatively straight, smooth, and hard surfaces of the piers and lined riverbanks in the Rochester Harbor, aligned parallel to the direction of travel of the incoming waves, do little to dissipate wave energy; as a result, the incoming waves continue almost undiminished to the Conrail bridge. In fact, wave conditions in the Federal turning basin opposite the Port Authority can be equivalent to or worse than those outside the harbor (9). From the Conrail bridge upstream to the

Stutson Street bridge, the irregular banks of the river begin to dissipate the wave energy, so that by the time the waves reach the Stutson Street bridge, they have subsided enough to be of no further concern.

THE RESULT

The City of Rochester categorizes the surge impact on the harbor area in three ways: 1) physical damage to harbor structures and boats, 2) safety issues, and 3) loss of boating opportunity days (3).

Physical damage

Ontario Beach Park, the Monroe County Water Quality Monitoring Station, the County Boat Launch, the NYS-DEC Fishing Access Site, Shumway Marine, Rochester Yacht Club, and O'Loughlin's Restaurant all have reported significant physical damage resulting from surge conditions. Damage to piers, docks, breakwalls, underwater slabs, and warehouses, as well as general flooding damage, have been reported (3).

For example, several years ago when the NYS-DEC built a boathouse at the basin in the Genesee River Fishing Access Area, both the boathouse and the boat it contained were destroyed by the wave action during a northeaster. This site is directly across the river from the proposed marina.

In addition, the Monroe County launch ramp at the southern border of the Port Authority and directly west of the Conrail bridge is unusable during a northeaster. It recently had to be reconstructed, because the underwater pressures of the waves lifted and displaced several of the concrete slabs forming its foundation.

The severe wave action in the harbor during a northeasterly blow makes mooring small boats untenable. Only the ocean-going ships which once utilized the harbor safely withstood the surge, and even their moorings were uneasy. Smaller vessels (perhaps up to 100 feet) are pounded against the walls, or their moorings are broken and they are swept aground or against the walls elsewhere. The U.S. Coast Guard normally moors its 44 foot motor life boat in its river slip, which is located on the river just lakeward of the proposed marina location. During wave surge conditions, the Coast Guard must move the boat upriver to a more sheltered foul weather mooring site. This leads to safety concerns.

Safety

The safety of individual boaters is severely jeopardized during surge conditions, which may arise suddenly; boats may become disabled or may have to "ride-out" the storm in the lake, because surge conditions

may not allow them to reenter the river (3). This becomes doubly hazardous, since Coast Guard emergency response time is greatly increased due to use of the foul weather slip and treacherous boating conditions in the harbor.

Loss of Boating Opportunity Days

In addition to boat and dock repair costs for surge-induced damage, Rochester's commercial boating ventures (charter boats, sight-seeing tours) lose thousands of dollars each year due to loss of boating opportunity days (9, 3). There are an estimated ten days each season when no boats can be launched. Because recreational boaters do not utilize support facilities (hotels, motels, restaurants, boat dealerships, equipment rentals, bait and tackle shops, etc.) during these days, it can be argued that the surge has a detrimental affect on the economy of the Rochester Harbor area and puts the entire Waterfront Revitalization Plan in jeopardy (3).

THE AFFECT OF THE SURGE ON THE PROPOSED DEVELOPMENT

It has been suggested that projections built from the western wall of the proposed marina area into the river would mitigate the affects of the surge on the marina. Similar proposals have been made for the launch ramp. These proposals have several drawbacks. First, Rochester Harbor is a Federal harbor. Consequently, permits for construction of such deflectors most likely would be difficult to obtain, since the deflectors would be hazardous to river navigation. Second, it is likely that the projections would not work, because, even if they deflected surface wave action, they would have little dissipating affect on the underwater wave energy. As a result, the waves essentially could "turn the corner" and propagate into the enclosed space, where they would reflect from the walls back and forth across the space. Previous experience on coastlines around the world suggests that such wave action could be worse than in the river itself (8). Even if the marina experienced wave levels somewhat less than in the river, the strain on boats and moorings would be extreme. The cross waves and currents generated by the protective barriers would make navigation in and out of the area hazardous, and the water motion would make occupation of the boats impossible.

The existence of the Rochester Yacht Club basin across from the County launch ramp should not be taken as proof that the marina location at the Port Authority is feasible. The entrance to this basin is across from the southernmost boundary of the Port Authority and, therefore, is farther upstream than the proposed marina entrance. Also, the cove to the north of the Yacht Club peninsula tends to deflect wave energy across the river from the

entrance to the basin. Consequently, the Yacht Club basin is significantly more protected than the proposed marina would be. Notwithstanding, wave action in the Yacht Club basin sometimes is extreme during a northeaster.

Shumway Marine, even farther upstream, reports recurring boat damage during northeasters. Pelican Marine, across the river from Shumway's, has had to hoist boats out of their assigned slips to prevent damage during northeasters.

It also has been suggested that a properly protected marina could be constructed by cutting a mooring basin into the riverbank. This plan would require careful study to determine its feasibility (9).

CONCLUSIONS AND RECOMMENDATIONS

Wave surge action in the Genesee River during a northeasterly blow makes the development of permanent small boat mooring facilities contiguous to or in the river north of the Conrail bridge very difficult at best. On a broader scope, all revitalization plans and possibility of economic development of the river harbor area are called into question, unless the surge is mitigated. To date, three possible solutions have received the most attention.

In 1987 the Buffalo District of the U.S. Army Corps of Engineers studied the surge problem in Rochester Harbor and developed two possible plans. The first suggested that the channel side of the existing piers be lined with 1350 feet of rubblemound (dolomite rip rap) facing; this action was expected to reduce the wave surge by only 40%. The second plan, which was expected to nearly eliminate the surge, called for a 800 foot rubblemound extension of the west pier. The extension would project easterly in a "dogleg" (9, 2). However, there is a concern that this west pier extension might cause a shallow dead water area immediately to the east of the east pier. In fact, at the Irondequoit Bay outlet, a dogleg extension of the west pier has created such a dead water area. This aspect would require further study. At March 1987 price levels, the two Army Corps of Engineers plans were expected to cost \$1.5 million and \$3.5 million, respectively (9). The City of Rochester favors the pier extension plan and estimates its cost (as of late 1989) to be \$4 million (3). At the time of the original study, the Corps determined the corrective measures were not economically justified (9).

A third possible solution might be the construction of a breakwater perpendicular to the piers in Lake Ontario at the mouth of the river. According to the Corps of Engineers, the closest similar structure, constructed west of Rochester off the mouth of Oak Orchard Creek at Point Breeze, N.Y., apparently has provided excellent protection for the harbor. No such plans exist for Rochester Harbor because the structure would block access to the harbor by

large ships and, therefore, would be in violation of the current Federal harbor status. (The only large ships that now use the harbor are the Steven B. Roman, which delivers cement for the Lake Ontario Cement Corporation and the dredge contracted by the Corps of Engineers to keep the river deep enough for the Roman.) Flow studies would be required to determine whether construction of a breakwater would cause silting problems in the river or lake due to disruption of existing flow patterns. A first estimate suggests that the normal flow of the river water, which usually turns sharply east immediately upon leaving the piers, would be little affected by such a structure. As is now the case, some maintenance dredging would be necessary to maintain water depths in marina basins along the river, but dredging of the main channel for the use of small boats probably would not be required. Since this third alternative has not been specifically studied for Rochester Harbor, the estimated cost is unknown. However, the project is expected to be the most costly of the three.

As mentioned earlier, the City of Rochester has requested that the Army Corps of Engineers correct the surge problem in the Genesee (3), and in 1990 the U.S. Senate approved a \$200,000 study for fiscal year 1991 for the Corps to evaluate the situation. The fate of the study will be determined by the outcome of federal budget negotiations (6).

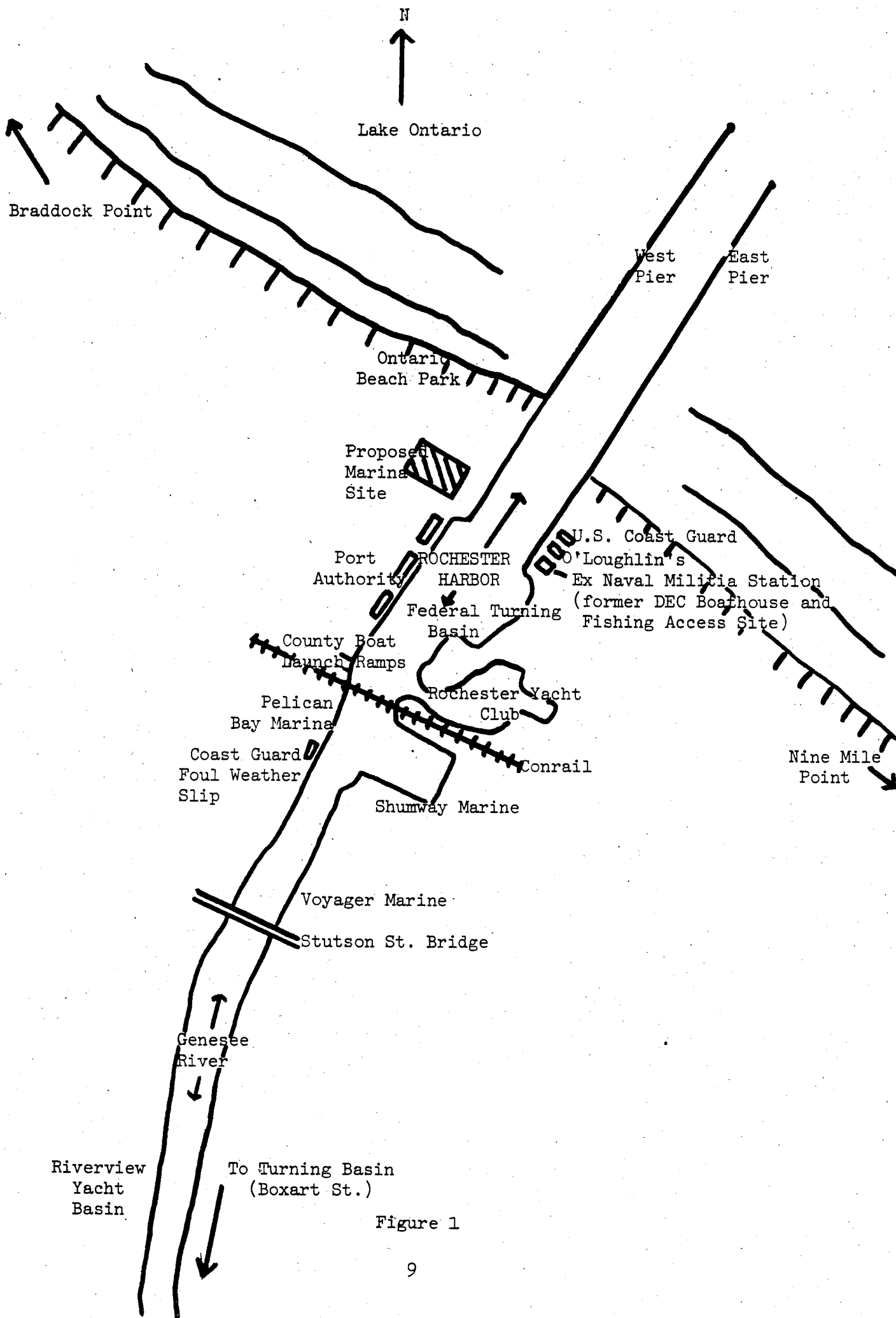
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Lake Ontario

Braddock Point

West Pier

East Pier

Ontario Beach Park

Proposed Marina Site

Port Authority ROCHESTER HARBOR

U.S. Coast Guard O'Loughlin's Ex Naval Militia Station (former DEC Boat House and Fishing Access Site)

Federal Turning Basin

County Boat Launch Ramps

Rochester Yacht Club

Pelican Bay Marina

Coast Guard Foul Weather Slip

Conrail

Shumway Marine

Nine Mile Point

Voyager Marine

Stutson St. Bridge

Genesee River

Riverview Yacht Basin

To Turning Basin (Boxart St.)

Figure 1

