NPS Form 10-900 OMB No. 1024-0018
(Oct. 1990)

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials and areas of significance, enter only categories and subcategories listed in the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name New York State Barge Canal

other names/site number

2. Location

street & number NYS Barge Canal, Waterford to Tonawanda, Whitehall, Oswego & Waterloo [ ] not for publication

city or town See continuation sheet, item 2 [ ] vicinity

state New York code NY county multiple code mul. zip code multiple

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I certify that this [x] nomination [ ] request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property [x] meets [ ] does not meet the National Register criteria. I recommend that this property be considered significant [x] nationally [ ] statewide [ ] locally. [ ] See continuation sheet for additional comments.

Signature of certifying official/Title Date

State or Federal agency and bureau

In my opinion, the property [ ] meets [ ] does not meet the National Register criteria. [ ] See continuation sheet for additional comments.

Signature of certifying official/Title Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that this property is: Signature of the Keeper Date of Action

- [ ] entered in the National Register.
  - [ ] See continuation sheet.
- [ ] determined eligible for the National Register.
  - [ ] See continuation sheet.
- [ ] determined not eligible for the National Register.
- [ ] removed from the National Register.
- [ ] other, (explain:)

5. Classification

Ownership of Property
(Check as many boxes as apply)

- [x] private
- [x] public-local
- [x] public-State
- [ ] public-Federal

Category of Property
(Check only one box)

- [ ] building(s)
- [x] district
- [ ] site
- [ ] structure
- [ ] object

Number of Resources within Property
(Do not include previously listed resources in the count.)

Contributing	Noncontributing	
155	59	buildings
0	0	sites
397	169	structures
0	0	objects
563	228	Total

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing.)

Number of contributing resources previously listed in the National Register

See item 7

6. Function or Use

Historic Functions
(Enter categories from instructions)

TRANSPORTATION/water-related, canal-related, canal,
canal terminal, canal shop, drydock, dam
TRANSPORTATION/road-related, bridge,
TRANSPORTATION/railroad-related, bridge
GOVERNMENT/public works
INDUSTRY/PROCESSING/EXTRACTION/manufacturing

Current Functions
(Enter categories from instructions)

TRANSPORTATION/water-related, canal-related, canal,
canal terminal, canal shop, drydock, dam
TRANSPORTATION/road-related, bridge
TRANSPORTATION/railroad-related, bridge
GOVERNMENT/public works
RECREATION AND CULTURE/outdoor recreation, trail
LANDSCAPE/park

7. Description

Architectural Classification
(Enter categories from instructions)

NA

Materials
(Enter categories from instructions) NA

foundation
walls
roof
other

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets.)

New York State Barge Canal — Name of Property

Multiple Counties, New York — County and State

8 Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- [x] **A** Property is associated with events that have made a significant contribution to the broad patterns of our history.
- [ ] **B** Property is associated with the lives of persons significant in our past.
- [x] **C** Property embodies the distinctive characteristics of a type, period or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- [ ] **D** Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria considerations
(mark "x" in all the boxes that apply.)

Property is:

- [ ] **A** owned by a religious institution or used for religious purposes.
- [ ] **B** removed from its original location.
- [ ] **C** a birthplace or grave.
- [ ] **D** a cemetery.
- [ ] **E** a reconstructed building, object or structure.
- [ ] **F** a commemorative property.
- [ ] **G** less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance
(Enter categories from instructions)

engineering
transportation
maritime history
commerce

Period of Significance
1905-1963

Significant Dates
1905, 1909, 1915, 1916, 1918, 1951, 1959

Significant Person
(Complete if Criterion B is marked above)
na

Cultural Affiliation
na

Architect/Builder
New York State Engineer's and Surveyor's Office: Edward Bond Austin, Frank Martin Williams, David Alexander Watt, A.A. Conger, William R. Davis (see item 8)

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

9. Major Bibliographical References

Bibliography
(cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS):

- [ ] preliminary determination of individual listing (36 CFR 67) has been requested
- [x] previously listed in the National Register (see item 7)
- [ ] previously determined eligible by the National Register
- [ ] designated a National Historic Landmark
- [ ] recorded by Historic American Buildings Survey #

Primary location of additional data

- [x] State Historic Preservation Office
- [ ] Other State agency
- [ ] Federal agency
- [ ] Local government
- [ ] University
- [ ] Other

Name of repository:

[x] recorded by Historic American Engineering Record # See item 9

New York State Barge Canal
Name of Property

Multiple Counties, New York
County and State

10. Geographical Data

Acreage of property 23,486.28 acres

UTM References
(Place additional UTM references on a continuation sheet.) **SEE CONTINUATION SHEET**

	Zone	Easting	Northing		Zone	Easting	Northing
1	18			3			
2				4			

[ ] See continuation sheet

Verbal Boundary Description
(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification
(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title Duncan Hay, Historian; see cont. sheet Contact: Kathleen LaFrank, National Register Coordinator, NYSHPO

organization National Park Service: Erie Canalway National Heritage Corridor date April 2014

street & number PO Box 219 telephone 518.237.7000

city or town Waterford state New York zip code 12188

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7.5 or 15 minute series) indicating the property's location.

A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs

Representative **black and white photographs** of the property.

Additional items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of the SHPO or FPO.)

name New York State Canal Corporation

street & number ______ telephone ______

city or town ______ state ______ zip code ______

Locations

Albany County (001)
- Cohoes (C)
- Colonie

Cayuga County (011)
- Aurelius
- Brutus
- Cato
- Conquest
- Mentz
- Montezuma

Erie County (029)
- Tonawanda (C)
- Amherst *
- Tonawanda

Herkimer County (043)
- Little Falls (C)
- Danube
- Frankfort
- German Flatts
- Herkimer
- Little Falls
- Manheim
- Ohio
- Russia
- Schuyler
- Frankfort (V)
- Herkimer (V)
- Ilion (V)
- Mohawk (V)

☐ See continuation sheet

Madison County (053)
- Lenox
- Sullivan

Monroe County (055)
- Rochester (C)*
- Brighton
- Chili
- Clarkson
- Gates
- Greece
- Henrietta
- Ogden
- Perinton
- Pittsford
- Sweden
- Brockport (V)*
- Fairport (V)*
- Pittsford (V)*
- Spencerport (V)

Montgomery County (057)
- Amsterdam (C)
- Amsterdam
- Canajoharie
- Florida
- Glen
- Minden
- Mohawk
- Palatine
- Root
- St. Johnsville
- Canajoharie (V)
- Fonda (V)

☐ See continuation sheet

Fort Johnson (V)
Fort Plain (V)
Fultonville (V)
Nelliston (V)
Palatine Bridge (V)
St. Johnsville (V)

Niagara County (063)

Lockport (C)*
North Tonawanda (C)*
Lockport
Pendleton
Royalton
Wheatfield
Middleport (V)

Oneida County (065)

Rome (C)
Utica (C)*
Floyd
Lee
Marcy
Remsen
Trenton
Verona
Vienna
Western
Sylvan Beach (V)

Onondaga County (067)

Syracuse (C)*
Cicero
Clay
Elbridge
Geddes

☐ See continuation sheet

Lysander
Salina
Van Buren
Baldwinsville (V)
Liverpool (V)

Orleans County (073)
Albion
Gaines
Murray
Ridgeway
Shelby
Albion (V)*
Holley (V)
Medina (V)

Oswego County (075)
Fulton (C)
Oswego (C)
Constantia
Granby
Hastings
Minetto
Schroeppel*
Scriba
Volney
West Monroe
Cleveland (V)
Phoenix (V)

Rensselaer County (083)
Troy (C)
Schaghticoke

Saratoga County (091)
Mechanicville (C)

☐ See continuation sheet

Clifton Park
Halfmoon
Moreau
Northumberland
Saratoga
Stillwater
Waterford
Schuylerville (V)
Stillwater (V)
Waterford (V)

Schenectady County (093)
Schenectady (C)*
Glenville
Niskayuna
Rotterdam
Scotia (V)

Seneca County (099)
Seneca Falls
Tyre
Waterloo
Waterloo (V)

Washington County (115)
Easton
Fort Ann
Fort Edward
Greenwich
Hartford
Kingsbury
Whitehall
Fort Ann (V)
Fort Edward (V)
Whitehall (V)

☐ See continuation sheet

Wayne County (117)

- Arcadia
- Galen
- Lyons
- Macedon
- Palmyra
- Savannah
- Clyde (V)
- Lyons (V)
- Macedon (V)
- Newark (V)
- Palmyra (V)*

*** = Certified Local Government**

County Codes

001, 011, 029, 043, 053, 055, 057, 063, 065, 067, 073, 075, 083, 091, 093, 099, 115, 117

Zip Codes

12008, 12010, 12047, 12065, 12068, 12070, 12072, 12110, 12118, 12121, 12137, 12148, 12150, 12154, 12166, 12170, 12182, 12188, 12302, 12305, 12306, 12308, 12309, 12821, 12827, 12828, 12831, 12834, 12839, 12871, 12871, 12887, 13027, 13029, 13034, 13036, 13041, 13054, 13069, 13080, 13088, 13090, 13112, 13126, 13132, 13135, 13140, 13146, 13148, 13165, 13166, 13204, 13209, 13308, 13317, 13339, 13340, 13350, 13357, 13365, 13403, 13407, 13428, 13440, 13452, 13492, 13502, 14067, 14094, 14103, 14105, 14120, 14150, 14228, 14411, 14420, 14433, 14450, 14456, 14470, 14489, 14502, 14513, 14522, 14534, 14559, 14604, 14606, 14608, 14611, 14614, 14618, 14619, 14620, 14623, 14624, 14626, 14627

☐ See continuation sheet

Summary
The **New York State Barge Canal** is a twentieth-century network of canals, canalized rivers, and lakes that allows commercial and pleasure vessels to pass from the Atlantic Ocean to the Great Lakes. It is composed of four branches: the **Erie Canal**, 340 miles from the tidal Hudson River near Waterford to the Niagara River at Tonawanda; the **Champlain Canal**, 60 miles from the Hudson River at Waterford to Whitehall on Lake Champlain; the **Oswego Canal**, 24 miles connecting the Erie Canal to Lake Ontario at Oswego; and the **Cayuga-Seneca Canal,** 17 miles connecting the Erie Canal to Cayuga and Seneca Lakes. Constructed between 1905-1918, these waterways are direct successors to the canals that New York State first built during the 1820s. The Barge Canal was designed for self-propelled vessels; that is, generally barges towed by tugboats or motorized canal boats, and, thus, did not require the towpaths of earlier canals. Its 57 locks have lifts ranging from 6' to 40' that can pass vessels 300' long, 44.5' beam, with 12' draft. The system remains in operation with almost all of its original early twentieth century structures and machinery in service. The four canal branches are owned and operated by the State of New York, as they have been since the 1820s, now under the aegis of the New York State Canal Corporation, a subsidiary of the New York State Thruway Authority.

Narrative Description
The New York State Barge Canal is a state-owned system of canals, canalized rivers, and lakes across upstate New York, built 1905-1918 to allow passage of large commercial vessels from the Atlantic Ocean and tidal Hudson River to the upper Great Lakes and American Midwest and to Lake Ontario and the St. Lawrence River, Lake Champlain, and Cayuga and Seneca Lakes. It is a direct, albeit much enlarged, successor to the original Erie Canal and three connecting canals, all completed during the 1820s, that opened the interior of North America to commercial agriculture, settlement and industrialization, established New York's role as the Empire State, and confirmed New York City's status as America's principal seaport and commercial center.

Now operated by the New York State Canal Corporation, a subsidiary of the New York State Thruway Authority, the Barge Canal system is officially 524 miles long.[1] There are four principal branches: Erie Canal, 340 miles with 35 lift locks from Waterford on the Hudson River to Tonawanda on the Niagara River; Champlain Canal, 60 miles with 11 locks connecting the Hudson at Waterford to the southern end of Lake Champlain at Whitehall; Oswego Canal, 24 miles with 7 locks connecting the Erie Canal at Three Rivers with

[1] The official length includes Cayuga and Seneca Lakes, which are not included in the nomination because the state does not maintain a marked channel on those lakes and canal facilities at their southern ends no longer retain historic integrity.

☐ See continuation sheet

Lake Ontario at Oswego, and the Cayuga-Seneca Canal, 17 miles with 4 locks connecting the Erie Canal near Montezuma with New York's two largest Finger Lakes.

The early twentieth century Barge Canal system parallels, and in many areas was constructed directly on top of, earlier versions of the Erie, Champlain, Oswego, and Cayuga-Seneca canals. This is due, in large part, to the geography of New York State. The Hudson River flows through the only gap in the Appalachian mountain chain between Georgia and Labrador at the Hudson Highlands. The original Erie Canal utilized that opening and a secondary gap between the Appalachians at the Laurentian (Adirondack) mountains at a spot known as "The Noses" near Canajoharie. The Champlain Canal runs through a deep valley between the Adirondack and Green Mountains, over a short and relatively low drainage divide that separates the Hudson River from Lake Champlain and the lower St. Lawrence River in Quebec. These lowland corridors between the Atlantic seaboard and the interior had been used for millennia by native peoples for communication, trade, and warfare and similarly by colonists and new Americans during the colonial and early national periods. They also formed the major settlement corridors New York, and most of the state's major cities were developed along them.

The original Erie Canal and connecting canals throughout upstate New York had channels that were 40' wide at the surface, 28' wide at the bottom, and 4' deep, with stone lock chambers 90' long by 15' wide with timber gates that could pass boats of 70 gross tons. Choked by its own success, the Erie was enlarged during the nineteenth century to reduce congestion and allow passage of larger boats. The first enlargement, pursued off and on from 1836 through 1862, provided larger lock chambers and deeper channels on the main branches of the system and side-by-side chambers on the Erie to ease traffic. The enlarged prism was at least 70' wide on the surface by 7' deep, with locks 110' long by 18' wide capable of passing 240-ton vessels. A second enlargement was authorized in 1895 with the goal of deepening channels and locks to 9' in order to pass 450-ton vessels, but that project was never completed.

The Barge Canal is far larger than any of its predecessors. Land-cut channels were a minimum of 123' wide at the surface, 75' at the bottom, and 12' deep. Channel bottoms in lakes and canalized river sections are generally 200' wide, while the surface width outside the channel can vary considerably. Concrete locks with electrically powered steel gates and valves could pass vessels 300' long by 44.5' beam drawing 12' of water – nearly three times the length and width and twice the depth of the Enlarged Erie's hand-operated stone locks with timber

☐ See continuation sheet

gates.[2] The twentieth-century waterway was designed for barges towed by tugboats and self-propelled vessels and did not need towpaths, which freed engineers to incorporate lake crossings and "canalized" rivers. In the central part of the state, the route across Oneida Lake, down the Oneida River, and up the Seneca River put the Erie division of the Barge Canal alignment more than a dozen miles north of its nineteenth-century "towpath era" predecessors.

The nominated district includes 450 miles of the Barge Canal system, including 151 miles of land-cut channel and 299 miles of canalized rivers and lake crossings.[3] It also includes two discontiguous features, Delta Dam and Hinckley Dam, and their reservoirs in the southern Adirondacks, built as part of the Barge Canal project to supply water to the summit level where the Erie Canal crosses the drainage divide between the Hudson and Saint Lawrence drainage basins near Rome.

In the land-cut sections, the district boundary was drawn to include the watered section and a narrow strip of land on either bank. The boundary expands to include locks, culverts, bridges, terminals, canal shops and, on the down-hill side of embankments, canal-related features that are essential for canal operations and maintained as part of the system. In canalized river sections (Tonawanda Creek and the Clyde, Seneca, Oswego, Mohawk, and Hudson rivers), the boundary includes that area wetted by the normal navigation pool and flares to include shore lands maintained as part of the system at locks, dams, terminals, canal shops, and bridge crossings. In Oneida, Onondaga, and Cross lakes, the district is confined to the navigation channel marked by buoys, fixed aids to navigation, and lighthouses and does not extend to the shoreline.[4]

<u>ERIE CANAL BRANCH - 340 miles, Waterford to Tonawanda, 35 locks</u>

The Erie Canal branches west from the Hudson River / Champlain Canal at Waterford (elevation 15.3'), climbing 169' in its first 1½ miles through the five closely spaced locks of the Waterford Flight. For the next 112 miles, from Crescent Pool above the Waterford Flight to Rome, the Barge Canal version of the Erie Canal is

[2] Noble E Whitford, *History of the Barge Canal of New York State* (Albany: J.B. Lyon, 1922), pp. 154-5.
[3] This district nomination does not include Cayuga or Seneca Lakes or the canal terminals at Watkins Glen and Ithaca because the state does not maintain a marked channel on those lakes and canal facilities at the southern ends no longer retain historical integrity. Nor does it include Barge Canal terminals that the state constructed on Lake Champlain, the Hudson River, and in New York Harbor that are no longer part of the system.
[4] See boundary justification (Item 10) and methodology for counting features at the beginning of features description (below) for more detailed explanations.

largely in the bed of the canalized Mohawk River.[5] Rome straddles the divide between the Hudson and St. Lawrence drainage basins. The canal crosses that divide at an elevation of 420.4' by way of a fairly straight 18-mile-long land-cut between locks E20 (Town of Marcy) and E21 near Sylvan Beach. The canal steps down through two locks (E21, E22) to the level of Oneida Lake (370.1'). Boats traverse the 23-mile-wide lake between Sylvan Beach and Brewerton along a channel marked by lighthouses and buoys.[6] From Brewerton the Erie Barge Canal follows the canalized Oneida River downstream through lock E23 to its confluence with the eastward flowing Seneca River at Three Rivers Point. (363') The Oswego River and Canal branch north from there, descending to Lake Ontario at Oswego. The Erie continues westward, 51 miles up the canalized Seneca and Clyde Rivers, past the confluence with the Cayuga-Seneca Canal near Montezuma, to the village of Clyde. West of Clyde, the canal is almost entirely in land-cut channel, rising 127' to the level of the Genesee River crossing on the south side of Rochester. Although the original and enlarged Erie Canal ran through the center of downtown, the Barge Canal swings south of the city through a massive rock-cut. Boats can get within two blocks of the old canal bed in downtown Rochester by way of the Genesee Arm of the Erie Canal, a buoyed channel through the Genesee River with 513' pool elevation maintained during the navigation season by a movable dam near Court Street. The Barge Canal rejoins the nineteenth-century Erie Canal alignment west of the deep cut in the town of Greece. From there it follows exactly the same route as its predecessors 54 miles to Lockport. There it climbs the face of the Niagara Escarpment through two deep locks arranged as a staircase (E34 & E35) and runs about five miles through a deep cut in Lockport dolomite, the rock that forms the crest of Niagara Falls. The final 11 miles utilize portions of Tonawanda Creek. The western end of the Erie Barge Canal (and of this nomination) is its confluence with the Niagara River at Tonawanda. From there, boats go upstream on the Niagara, passing through the U.S. Army Corps of Engineers lock at Black Rock and the Black Rock Canal in order to reach Lake Erie. Earlier versions of the Erie Canal had an independent channel hugging the east bank of the Niagara River that led to Buffalo Harbor.

CHAMPLAIN CANAL BRANCH - 60 miles, Waterford to Whitehall, 11 locks

The Champlain Canal largely runs in the canalized bed of the Hudson River from its junction with the Erie Canal at Waterford to lock C7 on the outskirts of Fort Edward, 37 miles to the north. There are short land-cut

[5] 19th century "towpath era" versions of the Erie closely paralleled the Mohawk but were not in the river bed. They ran at a higher elevation, mostly along the south bank, except for a 12¾ mile segment in Saratoga County between Crescent and Rexford.
[6] During the towpath era, the Erie Canal ran slightly north of its current alignment, through downtown Rome, before turning southwest, running well south of Oneida Lake, through downtown Syracuse. The 19th and 20th century alignments of the Erie come together again west of Lyons.

☐ See continuation sheet

sections leading to and/or from locks C1 Waterford, C4 Stillwater, C5 Schuylerville, and C6 Fort Miller.[7] The Champlain Canal leaves the Hudson at Fort Edward, climbing through two closely spaced locks (C7 & C8) to a 140' summit level that extends 5.8 miles from C8 Fort Edward to C9 Kingsbury. From there it runs 15.7 miles, descending through three locks -- C9 Kingsbury, C11 Comstock (there is no C10) and C12 Whitehall, at the southern end of Lake Champlain (elevation 96.8).

OSWEGO CANAL BRANCH - 24 miles, Three Rivers to Oswego, 7 locks

The Oswego Canal utilizes the canalized Oswego River from its head at the confluence of the Oneida and Seneca rivers at Three Rivers Point to its mouth on Lake Ontario at Oswego, descending 118' through 7 locks with short land cuts at Phoenix, Fulton, and Oswego.

CAYUGA-SENECA CANAL BRANCH - 17 miles, Montezuma to Seneca Lake near Geneva, 4 locks

The Cayuga-Seneca climbs 8.8' from its junction with the Erie near Montezuma to Cayuga Lake near the village of Cayuga, 4.2 miles south of the Erie. From there it trends west for another 13 miles, climbing an additional 63.4' through 3 locks to reach the 446.3' level of Seneca Lake on the outskirts of Geneva. The Cayuga-Seneca Canal is entirely within the canalized Seneca River and a small segment of Cayuga Lake.[8]

The Hudson, Mohawk, Oneida, Seneca, and Clyde Rivers were dramatically altered by construction of the Barge Canal, their sinuous meanders cut through by straight navigation channels with excavated material deposited in former oxbows and back channels behind islands. There were subtle changes to existing channels, even where the Barge Canal followed nineteenth-century alignments. The new canal had broad sweeping bends to better accommodate longer and wider vessels. This required construction of deeper cuts and taller embankments.

Authorized by the Canal Improvement Law of 1903 (commonly known as the Barge Canal Law), construction started in 1905. Portions were in operation by 1912, end-to-end navigation started on the Champlain Canal in 1916, and the entire system was open (if not finished) by the beginning of the 1918 navigation season. Portions

[7] The channels of 19th century versions of the Champlain Canal were separate from the river, usually at a higher elevation, about a half-mile from the riverbank. The towpath era Champlain ran on the west side of the Hudson from Waterford to Northumberland where boats were towed across the river on the slackwater pool behind Northumberland Dam. From there the canal ran on the east side of the Hudson to Fort Edward and points north.
[8] Its towpath era predecessors utilized a combination of land-cut sections and towing paths and boardwalks along the stream bank.

of the old system remained open to navigation throughout the construction period with the state providing side cuts, temporary locks, and steam towboats to assist towpath-era boats between old and new segments.[9]

New York State built, owned, operated, and kept its canal system open continuously since 1825. Although individual locks have been repaired and overhauled since the Barge Canal opened in 1918, the early twentieth century system retains a remarkable degree of integrity. The last system-wide modifications occurred between 1935 and 1963, when the federal government subsidized deepening the channel from 12' to 14' and raising bridges to provide at least 20' overhead clearance on the Erie and Oswego canals between the tidal Hudson at Troy and Lake Ontario at Oswego.

Features

Barge Canal channels and structures were far larger than their nineteenth-century predecessors and the project introduced new structure types, building materials, construction techniques, and power supplies to New York's waterways. The canal system includes a number of structures and channel types that are essential to its continued operation. Dams transform rivers from natural sloping watercourses into a series of artificial stair steps. Navigation pools between locks are maintained by 13 movable dams and 21 fixed weirs (some equipped with adjustable Taintor gates to regulate pool elevations under varying flows). Locks lift and lower boats between those steps. Hydroelectric powerhouses that originally generated power to operate lock machinery survive at 26 locks and gasoline-electric powerhouses still stand beside 15 locks, although the generating machinery has been removed at most of these sites. Twenty-two freestanding guard gates stand ready to be lowered into the channel to isolate canal sections and allow repairs. There are six canal "Section Shop" complexes on the system, four of which include dry docks. The canal system is crossed by 245 fixed road bridges, 17 lift bridges, 35 railroad bridges, 5 pedestrian bridges (all in Rochester), and 13 utility pipelines. A reinforced concrete aqueduct carries the Erie Canal over Oak Orchard Creek in Medina. Minor structures include culverts that carry streams under the canal (and one that carries a road), waste weirs, drain gates, and sediment retention dams. A multi-use trail runs on the north bank of the Erie Canal from Lockport to Lyons.

[9] The Oswego canal closed for two seasons to accommodate construction. The Erie, Champlain, and Cayuga-Seneca remained open throughout with some disruptions.

Route and Alignment
New York's nineteenth-century towpath canals, where boats were pulled by horses or mules, were separate from natural water bodies. By contrast, the twentieth-century Barge Canal system was built for self-propelled vessels and utilized canalized rivers and lakes. In the western part of the state, with a few notable exceptions, the Erie division of the Barge Canal was largely built on top of the original Erie and Enlarged Erie alignments. In other parts of the state, nineteenth and twentieth century channels were created parallel to the originals. However, in central New York, the Erie division of the Barge Canal followed rivers and lakes that took it as much as a dozen miles north of its nineteenth-century route.

Channels
Barge Canal channels are at least 12' deep. Portions of the Erie and Oswego canals between Waterford and Oswego were deepened to 14' between 1935 and 1962. Land-cut channels are at least 110' wide at bottom (75' west of Clyde) and 123' at the surface. River and lake channels are at least 200' wide at the bottom. Rubble stone rip-rap protects the banks from boat wake erosion in land-cut and some river sections. The tall embankments that carry the Erie Canal over Irondequoit Creek near Pittsford, Sandy Creek in Holley, and Oak Orchard Creek in Medina are lined with vertical walled concrete troughs. Many sections were excavated by floating dipper dredges and hydraulic dredges that dug or chewed their way up rivers, through marshlands, and across fields, depositing dredged material along the sides to form berms. Rail-mounted steam shovels excavated material in comparatively dry land-cut sections. There are notable rock-cuts at Rochester (7 miles long, up to 65' deep – nicknamed the "Culebra Cut" after another contemporary large excavation on the Panama Canal), Waterford (3/4 mile "deep cut" at the head of the Waterford Flight), Lockport (enlargement of the original Erie Canal's five-mile long cut through Lockport dolomite), Little Falls, and at the northern end of the Champlain Canal between Comstock and Whitehall. The sloped banks of all land-cut sections and many river channels have been reinforced to reduce erosion from boat wakes. In most places this consists of coarse, loosely placed rocks. This rip-rap extends from two or three feet below the waterline to a foot or two above. It tends to slump and in some places needs to be renewed every few seasons by dragging rocks from the bottom of the canal and re-depositing them along the wash line. In other places, they have remained in place and have become so overgrown that the rip-rap almost appears as natural riverbank. A few segments, typically on embankments

☐ See continuation sheet

where wash-outs have been problematic or would be catastrophic, have concrete or sheet pile bank armor or even full concrete trough liners.[10]

Locks

There are 57 lift locks on the Barge Canal system -- 35 on the Erie branch, eleven on the Champlain, seven on the Oswego, and four on the Cayuga-Seneca.[11] For the purposes of this nomination, each lock site is discussed as a complex consisting of the concrete lock chamber with its connected approach walls, steel gates, gate and valve operating machinery, as well as a powerhouse, lock house, storage buildings, and other ancillary structures. (Features that were installed or heavily modified after 1962 are identified as non-contributing in the site descriptions.) At many sites, locks are adjacent to and directly associated with fixed or moveable dams. Several utilize nineteenth-century lock chambers as spillways for bypass flows.

The interior dimensions of a standard Barge Canal lock chamber are 310 feet long by 45 feet wide and it can pass vessels with a maximum length of 300 feet by 44.5 foot beam.[12] Originally, all were designed with twelve-foot depth of water over the sills, but those between Waterford and Oswego on the Erie and Oswego divisions were deepened to 14 feet between 1936 and 1962. Lifts vary from 6 feet to 40.5 feet. Locks have paired steel mitre gates at either end.[13] Chambers are filled and emptied through culverts on either side. Valves and gates are operated by electric motors with manual back-up.

Barge Canal lock chambers were built of unreinforced mass concrete, founded on piles or bedrock where it was available. Side walls are generally 5-7 feet wide at the top. Walls that are exposed to river currents are thicker, usually twelve feet wide at the top. Chamber walls are 28 to 80 feet tall, depending on the lift of the lock and expected fluctuations in river and navigation levels. Walls are vertical on the chamber side and flare to the outside. Base thicknesses range from 13 to 34 feet, depending on the height of the wall. Many locks are

[10] *Book of Plans of the New York State Barge Canal: Issued as a Supplement to the Annual Report of the Department of the State Engineer and Surveyor*, 1920, Frank M. Williams, State Engineer. (henceforth BoP) Published two years after the Barge Canal opened, the BoP has 156 12.5" x 18.5" plates showing both typical and unusual features of canal structures and mechanisms. Plate 2 shows cross-section views of a variety of channel types.

[11] Plus two guard locks at the Genesee River crossing in Rochester and a harbor lock in Utica.

[12] 338' between gate quoins – 310' usable. BoP 5,6 show general arrangement. The 1903 Barge Canal Law called for locks 328 feet long between quoins by 28 feet wide. The law was amended in 1905, to insert the word "minimum." The final dimensions of 338 x 45 were fixed soon thereafter. Whitford, (1922), pp. 154-5.

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supported on piles but a few rest directly on bedrock, where conditions are suitable. Pile supported locks have concrete floors, cast in a longitudinal inverted segmental arch to resist uplift from soil and groundwater below as the chamber cycles through filling and emptying. The outside faces of lock walls are usually buried in earth backfill. Where they are exposed, generally at riverside locations, a concrete deck extension, supported by arches, was cast to provide a walkway for lock operators and line handlers.[14] Concrete stairs were cast into the downstream ends of most lock walls and all but a few have some sort of upstream and downstream approach walls, although the length, height, approach angle, configuration, and presence on one, or both, sides varies.

Longitudinal culverts, used to fill and empty the lock, are cast into the bottom of each chamber wall. Smaller tubes or ports connect the culverts with openings along the length of the chamber wall. In early locks, large cast-iron pipes were embedded in the concrete to form the connection between the culverts and lock chambers but ones built in later construction seasons simply had 7.5 square foot rectangular channels formed in the concrete without metal liners. The size of these conduits varies with lift and the volume of water needed to fill the chamber. Locks with up to 12 feet of lift have longitudinal culverts that are 5 feet wide by 7 tall with 8 ports on each side. Locks with lifts between 12 and 23 feet have 6 by 8 foot culverts and 11 ports on each side. Those with lifts over 23 feet have 7 by 9 foot culverts and 14 ports on each side. Thirty-one locks have an additional high level culvert on one side that delivered water to a hydroelectric plant, which generated power to operate lock machinery and illuminate the facility.

Vertically sliding valves at each end of the chamber control flow in or out of the culverts and ports to fill or empty the lock. Valves resemble small railroad flatcars hung on end with flanged wheels riding on guide rails and a steel deck that closes off the culvert opening when they are lowered. Originally, each valve hung from two chains that passed over notched chain wheels at the top of the valve well and back down to a counterweight. A three-horsepower DC electric motor and train of gears and shafts turn the chain wheels to raise or lower the valves.[15] This original equipment is still in service at most locks, but at some locations stainless steel cables have replaced chains. A few locks have entirely different valve and gate operating mechanisms installed during the 1960s and 70s.

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[13] Lock E17 at Little Falls is an exception. It is a "shaft lock" with mitre gates at the upstream end and a vertical sliding gate at its downstream end.
[14] BoP, p. 7 shows a variety of lock cross-sections.
[15] BoP, p. 22, 23, 24 shows the valves and tracks, 38 shows the hoisting machinery, 40 the cabinet housing that machinery, and 43 the lockstand controller.

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With a couple of notable exceptions, lock gates are steel, double-leaf mitre gates that form an upstream facing "V" when closed.[16] Each leaf is about 26' feet long with heights ranging from 14' for upstream gates in land-cut sections to more than 50' for downstream gates in the Waterford Flight. Mid-gates of the paired "staircase" locks at Lockport (E34-35) and Seneca Falls (CS3-4) are more than 66' tall. Gates have smooth plate steel faces on their upstream sides and exposed steel truss work on their air faces. They were originally assembled with rivets but newer replacement gates are welded.[17] Wood inserts on the vertical edges of each gate (the quoin and the mitre) provide a more leak and shock resistant sealing surface than steel on steel. Quoin (pivot) posts turn on cast-iron pivots embedded in the lock's concrete floor and are held against the quoin pocket by adjustable tie-back anchorages at the top. Quoin pockets are fitted with curved cast-iron liners that provide a sealing and wearing surface for the timber post linings. The downstream faces of most gates are fitted with horizontal timber rub rails near the waterline to protect them from damage by passing boats. Five locks in the central part of the state have vertically sliding guard gates mounted on extended upstream approach walls above the mitre gates. Three of these locks control the levels of major lakes, the others large impoundments.[18]

Mitre gates are opened and closed by forged steel push rods, called spars, attached by pivots to the upstream edge at the top of each gate leaf. Spars are driven by electric motors and a train of gears that engage rack-gear teeth cut in one edge of the rod. In the event of an electrical failure, the motors and gear train can be disengaged via dog clutches and the racks cranked open and closed by large emergency hand cranks called keys. The outboard ends of the spars are supported by rollers that travel on serpentine cast-iron tracks embedded in recesses just below the top surface of the lock walls. During normal operations, those components are hidden by painted diamond plate or galvanized grid covers.[19] The original DC gate operators at a few locks were replaced during the 1960s and 70s by electric servomotors or direct-acting hydraulic cylinders.[20] Those

[16] Lock 17, Little Falls is a "shaft lock" with a vertically sliding gate at its downstream end. Utica Harbor Lock has a vertically sliding gate at its upstream (canal) end and mitre gates below. The guard locks on either side of the Genesee River in Rochester have lift gates at both ends.

[17] BoP, pp. 14-18. Penn Bridge Company fabricated and installed many of the original steel gates under contracts 32 & 33. [Whitford (1922) p. 559]. Locks on the Cayuga-Seneca Canal were initially fitted with reinforced wooden gates but were all refitted with steel gated during the 1930s.

[18] E23 Brewerton, E24 Baldwinsville, CS1 Cayuga, CS3 Seneca Falls, CS4 Waterloo.

[19] BoP, p. 39.

[20] EIM servo-motor actuators replaced DC equipment at C3 (Mechanicville), C-11 (Comstock), and E-19 (Frankfort) in 1968. Hydraulic piston gate operators and butterfly valves were installed at 10 locks during the late 1970s – C6 (Fort Miller), C9 (Kingsbury), C12 (Whitehall), E6 (Waterford), E12 (Tribes Hill), E13 (Randall), O7 & O8 (Oswego), CS2-4 (Seneca Falls), and CS4 (Waterloo).

replacement programs stopped after it became apparent that the new equipment did not stand up to service as well as the original DC machinery.

At most locks, valve and gate motors and gears are enclosed in steel boilerplate boxes with cast-iron caps and bases, doors to allow routine inspection and maintenance and tracks and rollers that allow the covers to be rolled out of the way for large-scale service and component replacement. Typically, two of these boxes stand at each corner of the lock, one each for the valve and gate mechanism.[21] Boxes housing the valve motors and gears are topped by a stack of three clear signal lights that indicate the valve's position: all-off – fully closed, one light – 1/3 open, 2 lights – 2/3 open, 3 lights – fully open. Boxes over the gate operators were fitted with colored lights that showed red when the gates were at any position other than fully open. At many locks these have been replaced by red and green lights that resemble traffic signals, often located some distance from the gate boxes at positions that allow improved visibility to oncoming boaters.

Switchgear to open and close gates and valves is housed in cast-iron pedestals at each corner of the lock. The direct current switches, all built by General Electric, are adaptations of trolley car controllers commonly available in the 1910s and early 20s.[22] Each pedestal has switches to operate both gate leaves and valves at that end of the lock. In other words, the lock operator can control all of the machinery at one end of the lock from either side, but he or she needs to walk to the other end to operate gates and valves there. Some of the locks fitted with servomotor or hydraulic gate and valve operators during the 1970s and '80s were also provided with controls that allowed every gate and valve to be operated from a single point, but this is rare.

Although they were originally all open, small huts have been built around at least one set of pedestals at each lock (generally on the side toward the lock house) to protect the open electrical equipment and operator from precipitation. These control stand shelters are about four feet square with a door on one side and windows on the other three, capped by a hip or gable roof. Most are clad in vinyl or fiber-cement clapboards. These are fairly recent additions. Few control stand shelters are visible in photos taken during the early 1950s. Where

[21] BoP, p. 40. Valve and gate motors and gears were built into the powerhouse at E18 and E20, eliminating the need for one of the four pairs of free-standing iron boxes.
[22] BoP, p. 43.

they did appear, it was generally at the end of the chamber furthest from the powerhouse. Some locks had flat-roofed steel plate control stand shelters, but none of those remain on the system.[23]

Gate and valve operators at locks E8 through E15 in the Mohawk Valley are different from those described above. At these locks, where flooding is a frequent occurrence, electric motors and switchgear are housed in the upper levels of small concrete towers, called cabins, at each corner of the chamber, and power is transmitted via long, heavily greased shafts, to gate and valve machinery below. Control panels are mounted vertically in the walls toward the chamber and connect to the switchgear via pushrods. Fixed steel awnings were added soon after these locks were constructed to protect the controls and operator from precipitation.

D'Olier Engineering Company won the first contract for electrical equipment (Contract 90) and installed machinery at Lock E24 (Brewerton) on the Erie, locks C9 through C12 at the northern end of the Champlain Canal, and four on the Oswego (O-1, O-2, O-7, O-8). Three years later, the consortium of MacArthur Brothers Co. & Lord Electric Company won contracts 92, 93, and 94 to install electrical generating equipment, motors, controls, and gate operating machinery at every Erie lock other than E24, locks at the lower end of the Champlain Canal (C1 through C8), and locks O3, O5, and O6 on the Oswego.[24] The earlier "Contract 90" machinery is noticeably more delicate than that supplied by MacArthur Brothers & Lord. That could explain why the equipment at O-1 and O-2, installed by Lupfer & Remick, may be the only examples that survive. Valve and gate operating machinery at other "Contract 90" locks has been changed to EIM AC motors and/or direct acting hydraulic cylinders.

Locks were originally fitted with buffer beams: riveted steel assemblies installed on pivots in recesses just above the water line outside the lock gates. The beams were about 46' long and could be swung across the chamber, their outboard ends fitting into recesses in the wall on the opposite side. They were intended as safety devices that would keep boats from crashing into the lock gates and as upper supports for temporary needle dams that were installed during the off-season to allow chamber pump-outs for gate and valve maintenance. It is not clear that buffer beams were ever used as safety barriers, opened and closed with each lockage. Although control panels have a switch marked "Buffer Beam," there is no indication that they were ever motorized. Being

[23] A pair from Lock E18 is in the collections of New York State Museum. Similar shelters appear in photos of Lock E2 taken during the late 1930s.
[24] Oswego work under contract 90 was completed by Lupfer & Remick. Whitford (1922), p. 561.

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partially submerged, with little opportunity of access or maintenance, most buffer beams rusted in their pockets. Most have been scrapped; a few remain in place but are inoperable.[25] The Department of Public Works (DPW) installed overhead buffer beams at a few locks during the 1930s. These looked like small guard gates, with beams in place of panels. A few of these survived into the 1950s, but all have been removed. Now, independent beams, placed by portable cranes in pockets in the concrete coping, support the upper ends of temporary dams during pump-out. Most locks have two, resting on concrete saddles nearby, ready to be placed when needed.

Mooring fittings and Chamber Modifications
Every lock was equipped with a DC electric capstan with a vertical shaft rope drum near the center of one side and turning blocks embedded in the top edge of the wall to help move unpowered vessels in and out of the chamber.[26] Concrete-filled cast-iron bollards, spaced about 50' apart, line both sides of every chamber and the approach walls. Cast-iron quarter-rounds were installed at the top edge of lock chambers, between the wall and walkway, during the late 1920s to protect the concrete from wear by mooring lines.[27] High lift locks had one or two rows of recessed cast-iron pins embedded in the walls, directly under each bollard.

Many approach walls, particularly at river locks, were extended and additional bollards installed during the 1920s, after boat operators complained that there was no place to tie up without crowding the lock gates and blocking the channel for oncoming tows. The problem became especially acute when multiple tows had to tie up and wait for high flows to subside. During the 1920s, the DPW purchased concrete barges, which had been built by the federal government during World War I in an effort to conserve strategic materials, scuttled them, filled them with crushed rock, and installed mooring bollards to make approach wall extensions at locks E9, E10 and E13 on the Mohawk. Ice jams in February 1938, followed by hurricane flooding that fall, caused unprecedented scour at Mohawk River movable dams. In response, the DPW installed broad concrete spillways on either end to direct flood waters back into the established channel and protect the banks from erosion.[28] Concrete structures along the canal have seen a variety of patches, repairs, and overhauls during the past century of service. Lock chamber walls, which were built with unreinforced concrete of varying quality, are subjected to frequent cycles of wetting and drying throughout the navigation season and freeze-thaw action during the off-

[25] BoP Plates, pp., 18-21.
[26] BoP Plate, p. 42.
[27] *Annual Report of the Superintendent of Public Works for the Year Ending June 30, 1927* (Albany: J.B. Lyon, 1928) [Henceforth AR-SPW (fiscal year)], p. 16.
[28] AR-SPW 1938, pp. 15-6; 1939, pp. 21-2.

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season; occasionally, they suffer impact damage from boats. Some have been patched with trowel-applied concrete or gunite. A few locks were lined with steel plate during the 1940s and 50s, to cover failing concrete.[29] Some of the busiest and most badly deteriorated underwent major rehabilitation, with old concrete chipped back to sound material and a new reinforced concrete wear surface cast to the original opening. Vertical recesses are often added as part of these large-scale rehabilitations. These slots house tensioned cables or galvanized pipe glide rails that users of small pleasure boats find easier to negotiate than the original system of sturdy bollards and chamber wall pins installed for large commercial vessels.

Lock Powerhouses

Barge Canal construction predated widespread electrification across upstate New York. Therefore, almost every lock in the system was originally equipped with its own direct current (DC) generating station. Thirty-one locks had hydroelectric plants that took advantage of the modest fall of water at the site. Each plant housed a pair of 50-kw, 150-volt DC generators, driven by vertical-shaft Francis turbines in the pit below. Most were direct-connected vertical-shaft units, but five locks had vertical shaft turbines connected to horizontal shaft generators by way of speed increasing bevel gears. At these sites, where low lock lifts (head) kept the turbines from turning fast enough to generate efficiently, the gearing stepped-up rotational speeds to drive the generators.[30] In addition to the turbine-generator sets, each powerhouse was equipped with slate switchboards, a Lombard oil pressure governor for each unit, a pair of motor-driven governor oil pumps, a central lubricating system, electric lights, four 4,000-watt electric resistance heaters, and a hand-operated overhead bridge crane riding on rails set 15' above the floor.[31] In a few places, where locks were close together, one powerhouse served the needs of multiple locks.[32] Fifteen of the 31 hydroelectric plant buildings remain standing; seven have most of their generating equipment in place.

[29] Locks E23, west of Brewerton, and E9, near Rotterdam, were the first to be lined with steel plate during the winter of 1941-42. AR-DPW 1941, pp. 24-5. Lining projects stopped due to wartime steel scarcities but started again in the late 1940s.

[30] BoP, p. 47 shows the vertical shaft generator. BoP, p. 46 shows the horizontal shaft generator and right-angle speed-increasing gearing. Lock E23 near Brewerton is the best preserved example of this form. Other locks equipped with right-angle speed increasing gearing were C8 Fort Edward, C12 Whitehall, and E24 Baldwinsville. Only the empty powerhouse building survives at C12. Nothing remains at C8 or E24.

[31] BoP, p. 44.

[32] Locks E2 through E6 of the Waterford Flight were served be a single AC powerhouse at the end of Crescent Dam. Lock E21-22 near Sylvan Beach were powered by a hydro plant at E21. E30 at Macedon was powered by the hydro plant at E29 above Palmyra by wire strung on a line of concrete poles. E32 and the Pittsford shops were powered by an AC plant at E33. Paired locks E34-35 at Lockport and CS2-3 in Seneca Falls each shared power from a single powerhouse.

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Five closely spaced locks of the Waterford Flight were powered by a single alternating current (AC) hydroelectric plant at the Crescent Dam with substations at every other lock housing motor-generator (M-G) sets that converted AC to DC to operate lock machinery. Substation buildings remain at E3, E5, and at the upper guard gates but their M-G sets have been replaced by solid-state rectifiers. The canal powerhouse at the east end of Crescent Dam was superseded by a far larger hydro station at the opposite end in 1925 and was subsequently demolished.

Locks E8 through E15, next to moveable dams on the Mohawk River, and locks E25 and E26 on the Clyde River had gasoline-driven generators instead of hydroelectric plants. At these sites, where the dams were pulled clear of the river after the navigation season, there would be no head to operate a hydro plant through the winter and therefore no electricity to lower dam sections back into position in the spring. Year-round power was generated at each lock by a pair of 25 kW DC generators, each driven by a four-cylinder gasoline engine.[33] The powerhouses were located on elevated sites to keep the generating equipment above flood waters. Unlike the hydroelectric installations, gasoline-electric powerhouses had basements that contained switches and other electrical equipment.[34] Six of the ten gasoline-electric powerhouses survive; five retain some or all of their original generating equipment.

Powerhouse architecture is similar throughout the system, although building dimensions vary slightly. Powerhouses are rectangular in plan, three bays wide by one deep, generally about 23' x 43,' on concrete substructures with monolithic reinforced concrete walls and hipped roofs with a 6/12 pitch and flared "bell" eaves.[35] The interior is a single room, 22' to the underside of the ridge. They were originally roofed with green glazed semi-circular clay tiles, but many are now covered by asphalt shingles, roll roofing, built-up asphalt, or E.P.D.M. Fenestration included tall 9-over-9 double-hung wood windows and rectangular eyebrow "hopper" windows between the crane rail and the cornice. Access is through large double-leaf frame doors with diagonal bead-board panels. In most instances, the door is in the center of the long three-bay) façade, facing the lock chamber, but at some space-constricted sites it is off-center in one of the two-bay end walls.[36]

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[33] BoP, p. 48.
[34] Those basement electrical vaults remain in service at E8 and E26, even though the rest of the building and generating equipment have been removed.
[35] BoP, p. 45. Gasoline-electric powerhouses were all 22'9" x 32'9" outside.
[36] C2, C5, E7, O5.

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Lockhouses, Oil Houses, Sheds, Lights, Railings, Recreational Facilities

Every lock now has a building that contains an office, workshop, and restroom for the operating staff.[37] Very few lockhouses date to the initial construction period. Photos from the 1920s and 30s show a few wood-frame buildings on piers, possibly left over or salvaged from contractors' construction camps, but it appears that many lock operators worked out of the powerhouse or storage building. A large number of lockhouses were built during the late 1950s when the DPW made a push for sanitary buildings with indoor plumbing. Some have been replaced more than once. Some locks had sentry boxes installed during World War II, but none of those survive. Many locks have windowless concrete storehouses covered by standing-seam metal hipped roofs with triangular ventilation dormers. Sometimes called oil houses or jug houses, they were built during the initial phases of construction to store oil for buoy lamps and other flammable materials. Many locks have recently constructed wooden storage sheds to house lawnmowers and similar equipment. Originally, safety rails were confined to the outboard edge of each lock gate and there was a row of six overhead arc lights, spaced about 200' apart, along each side of the chamber and approach walls. Those have been supplemented by safety railings (most installed since a safety campaign of the 1980s) and lights of varying ages and designs. Some locks have recreational facilities ranging from picnic tables to shelters, restrooms, and viewing platforms. Because of wide variation, these will be described with individual sites.

Guard Gates

Guard Gates allow land-cut sections of the channel to be isolated and drained for repairs, off-season draw-downs, and in the event of emergencies. They have 55' wide guillotine-like steel gates, suspended by cables and counterweights supported by sheaves on latticework steel towers. Most have two side-by-side gates with a mid-channel pier.[38] The east and west guard locks at the Genesee River crossing on the Erie in Rochester have similar 45' wide vertical sliding gates at each end, rather than the more common mitre gates. Locks on the Cayuga-Seneca Canal have 45' wide guard gates at their upstream ends.

Dams

Dams transform rivers from natural sloping watercourses into a series of artificial stair steps. Locks lift and lower boats between those steps. The Barge Canal utilized a variety of fixed and moveable dams. Some fixed dams already existed and were modified by addition or insertion of a lock and bypass channel but most were

[37] Paired staircase locks CS2-3 in Seneca Falls and E34-35 in Lockport share a single lockhouse and operating staff.
[38] BoP, pp. 83-91.

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purpose-built concrete gravity structures. There are more than twenty fixed crest ogee spillway mass concrete dams, including sediment retention dams on tributaries and some structures that look more like overflow spillways than actual dams. Most have straight crests but there are some curved or zig-zag plans, built to take advantage of underlying rock formations.

Movable Dams

The Barge Canal utilized three types of movable dams. The most distinctive were eight bridge dams with Boulé gates on the lower Mohawk, adjacent to locks E8 through E15. They are located in Rotterdam (E8, E9), Cranesville (E10), Amsterdam (E11), Tribes Hill (E12), Yosts (E13), Canajoharie (E14), and Fort Plain (E15). Similar Mohawk River style bridge dams raise pools above E16 near Indian Castle, at Herkimer above E19, and at Mays Point (E25), but they are smaller and located out of sight of the locks.[39] Mohawk River movable dams are distinguished by two or three spans of Pratt trusses with rows of fabricated steel uprights that pivot from heavy steel pins along the downstream edge of the truss. Uprights are connected together in pairs by cross-bracing and catwalk sections. During the navigation season the lower end of each upright rests against a cast-steel shoe embedded in a concrete sill running across the bottom of the river. Once all of the uprights are in position, three rows of horizontal steel gate panels (also called pans) are lowered against their upstream faces to form the dam. Cast-iron rollers, attached to the downstream framework of each gate, facilitate movement up and down along the uprights. Two uprights support each gate with a half-bay overlap at either end. Narrow plates, hinged to one end of each gate, are swung into place, once a full row is in position, to seal the end gaps. At the end of the navigation season the gates are hoisted out of the water and the uprights and gates are swung up against the underside of the trusses by chains hauled by DC electric winches, commonly called “mules,” that run on tracks outboard of the overhead truss.[40] Normally, dams are lowered at the beginning of each season starting at E8 and working upstream to E15 and raised in the opposite sequence in the fall. The pool backed-up by a lower dam diminishes current, making it easier to install lower panels of the next one up. Movable dams 6-11 were first lowered in 1914 to facilitate dredge operations in the pools between. They were turned over to the DPW on March 24, 1915.[41]

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[39] Court Street Dam in Rochester, which maintains the 512.6’ pool elevation in the Genesee Arm of the Erie during the navigation season, was originally fitted with a 240’ Mohawk style Boulé gate bridge dam but that was replaced by two 110’ sector gates in 1926.
[40] BoP, pp. 55, 64-67.
[41] *Annual Report of the State Engineer and Surveyor of the State of New York for the Fiscal Year ended in September 30, 1915, Vol. 1* (Albany: J.B. Lyon Company, 1916)[henceforth AR-SES, (fiscal year)], pp. 102-3.

Fixed dams at Clyde (E26), Lyons (E27), Seneca Falls (CS3-4), Phoenix (O1), Fulton (O2), and on the Hudson River portion of the Champlain Canal (C1, C2, C6) have large Taintor gate sections. Dams at Cayuga (CS1) and Waterloo (CS4) are continuous rows of Taintor gates.[42] The state engineer claimed that the three 50' wide gate sections opposite Champlain Canal Lock C1, north of Waterford, were the largest in the world when they were constructed in 1915. A Taintor gate has a curved upstream face made of steel plate, supported by a triangular framework of structural steel that pivots on a pair of horizontal trunnions. When closed, the bottom edge of the plate rests atop a concrete sill. Taintor gates are raised to release water between the bottom of the gate and the sill. While Taintor gates allow fairly precise control over release volumes, their multiple piers, rather narrow openings, and overhead steelwork can restrict passage of ice and floating debris.

Spillways, Waste Weirs, Drain Gates & Retention Dams
Land-cut sections have fixed-crest spillways and waste weirs that allow excess water from the canal to spill into adjacent creeks rather than overtopping the banks. Most are fitted with screw-operated drain gates (often called sluice gates) and stoplog sections (a segment with a lower sill than the main spillway with slots in the abutments fitted with planks that can be removed to allow more water to spill during high flows). The mouths of most intersecting streams that empty into the canal have concrete retention dams to capture gravel before it enters the channel.[43] Material deposited behind retention dams is removed with earthmoving equipment during the dry season. Managing water and sediment from intersecting streams was a much bigger problem for canalized river segments of the Barge Canal than it had been for its predecessors. The towpath era canals were almost entirely land cut, built on the valley walls of rivers, not in the channel. Intersecting streams and their troublesome flood waters and suspended gravel usually passed harmlessly underneath the channel through culverts or aqueducts that carried the canal across tributary valleys. Canalized rivers of the Barge Canal received all of that water and sediment so retention dams, waste weirs, spillways, guard gates and other seemingly minor structures took on greater importance than they had during the towpath era.

Culverts
Culverts carry streams under the canal bed in land-cut sections. Most are located under the Erie Canal between Rochester and Lockport. One east of Medina allows Culvert Road to pass under the canal bed, as it has since 1823. Several others incorporate Enlarged Erie Canal stonework that was extended with concrete tubes to

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[42] BoP, p. 74-79.
[43] BoP, p. 96.

accommodate the wider Barge Canal. Through culverts were used under high embankments where the bottom of the canal bed is considerably higher than intersecting stream. Dive culverts, which act as inverted siphons with large risers at either end, were used where the surface of an intersecting stream is higher than the bottom of the canal bed.[44] Earlier versions of the Erie Canal used more than twenty stone and timber aqueducts to cross larger intersecting streams and rivers. The Barge Canal has only one – a single reinforced concrete arch carrying the channel over Oak Orchard Creek at Medina.[45]

Reservoirs
Two large reservoirs were constructed in the southern Adirondacks as part of the Barge Canal project to supply water to the Rome summit level and supplement flows in the upper Mohawk River section of the Erie Canal. Delta Dam and Delta Lake are on the upper Mohawk on the northern outskirts of Rome, extending into the towns of Lee and Western, Oneida County. Delta Dam is 1,100' long with a 300' spillway, built of cyclopean masonry. The reservoir covers a little more than four square miles at the base of a 137-square mile drainage basin. Water stored in Delta Lake is released into the natural bed of the Mohawk River below the dam and enters the summit level of the Erie Canal at the western end of the Rome Terminal about six miles downstream.

Hinckley Dam is on West Canada Creek in the towns of Trenton, Oneida County, and Russia, Herkimer County. Hinckley Reservoir extends into the town of Remsen, Oneida County. The dam includes a 3,300' long earthen embankment over a concrete core-wall, rising up to 45' above the valley floor. It is 250' wide at the base tapering to 20' at the top with a 500' long masonry spillway section at the north end of the embankment.[46] The surface area of Hinckley Reservoir is nearly 5 square miles with an average depth of 36.' Water from Hinckley is released into the natural bed of West Canada Creek, passes through Trenton gorge to a low concrete diverting dam below Trenton Falls. From there, water to be used for canal purposes is diverted into a 5.7 mile feeder canal leading to Nine Mile Creek, which empties into the summit level of the Erie in the town of Marcy.

[44] BoP, p. 100-106. Canal Corporation maintenance records identify 118 culverts and dive culverts running under the Erie and 6 under portions of the Oswego. They are invisible from the water and many are small and difficult to find from the banks. Larger culverts and ones that are associated with spillways and other "above grade" structures are identified in the feature list. Minor ones are not.
[45] BoP, p. 4, 97-99.
[46] BoP, p. 51-54.

Use of nineteenth-century structures

Structures and channels from earlier generations of New York's canals remain visible across the state. A few Barge Canal locks utilize towpath-era stone lock chambers as spillway channels.[47] Several nineteenth-century culverts under the Erie Canal in western New York were lengthened to accommodate the wider Barge Canal. The Erie and Champlain segments of the Barge Canal utilize several feeder reservoirs and channels built during the nineteenth century to supply water to "towpath era" segments of the system. Nineteenth-century structures that are utilized in direct service of the operating Barge Canal system are listed as contributing elements. Earlier structures that are within the boundary or visible from the waterway but are not used for Barge Canal operations have been determined eligible for listing as part of New York State's Canal System, and some have been previously listed on the National Register. They are noted, but not counted as contributing features to this nomination because their significance lies in a nineteenth-century context. Although they continue to deliver water to summit levels of the Erie and Champlain canals, upland dams, reservoirs, and feeder canals built to supply earlier versions of the system are not included in the boundary of this nomination because their context and significance is more closely tied to the towpath era canals.[48]

Bridges

Hundreds of road and railroad bridges span New York's operating canal system. Barge Canal Law specified that all fixed and moveable bridges provide at least 15.5' between the lowest part of the structure and the water surface at its highest navigable stage.[49] Steel double-intersection Warren truss road bridges on concrete piers with reinforced concrete approach ramps are the most numerous. They are common over land-cut sections of the Erie Canal from St. Johnsville west to Tonawanda and on the Champlain from Fort Miller north to Whitehall. The largest number were fabricated and installed by Groton Bridge Company of Groton, Tompkins County. Others were supplied by Owego Bridge Company (founded in Tioga County by former Groton Bridge managers), and Penn Bridge of Beaver Falls, PA (which also secured contracts to build & install most of the

[47] Notable examples include the three-lock staircase of the Waterford Side Cut to the old Champlain Canal that spill excess water at lock E2, Enlarged Erie lock 61, which serves as part of the spillway for lock E30 Macedon, and the five-lock staircase at Lockport that spills excess water around Barge Canal locks E34-35.
[48] 19th century water supply features that continue to feed the Barge Canal include Feeder Dam, Glens Falls Feeder Canal, and a portion of the old Champlain Canal that supplies the summit level of the Champlain Canal above Fort Edward; Erie Canal feeders include Lake Moraine, Eaton Brook Reservoir, and Lebanon Reservoir, and portions of the disused Chenango Canal; Jamesville DeRuyter Reservoir, Reservoir, Cazenovia Lake, Tuscarora Reservoir, and portions of the old Erie Canal in Madison and Oneida counties and Forestport Reservoir, Forestport Feeder, and portions of the former Black River Canal in Herkimer and Oneida counties.
[49] Whitford (1921), Ch. 7.

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steel lock gates on Barge Canal locks). Bridge builders were not always identified when contractors bid to excavate a length of canal and provide all related water management structures and crossings, but all of the prime contractors appear to have sub-contracted to specialty bridge fabricators. [50] The state engineer's office developed standard designs for reinforced concrete approach ramps and piers that could be cast in a single pour and used far less concrete and fill than conventional abutments with earth approach embankments.[51] In places where the canal followed a new land-cut alignment, contractors often dug holes at either end of a bridge site, drove piles, and cast the abutments before erecting the truss over dry land and then excavating the channel below. This made assembling steelwork easier and allowed traffic to continue past the site during construction.

Sixteen vertical lift bridges are distinguishing features of the western Erie between Fairport and Lockport.[52] Their Warren pony truss spans are raised by an electrically driven system of cables, counterweights, and sheaves mounted at the four corners. There are concrete pits behind the abutments at either end of the bridge. The pits are slightly wider than the roadway and about 20' deep, extending well below the water level in the canal. One pit, generally the one closest to the operators' tower, contains the motors and gearing used to lift the span. The movable truss is supported by vertical lifting frames at either end. When the bridge is "down" the lifting frames retract into the pits and the weight of the span and road traffic are carried by shoes mounted on the abutments. The bridge is raised by cables that run from fixed anchor points at the top of the pits, down around sheaves at the bottom of the lifting frame, back up to sheaves at the top of the pit, and down to cast concrete counterweights. When the counterweights sink into the pits, driven by motors and gearing to overcome the friction, the cables pull the lifting frames upward by the sheaves at their lower corners. Cross-members between the legs of the lifting frames act as a barrier to prevent vehicles from driving into the canal when the bridge is raised. These have been supplemented by more recent flashing lights and pivoting barriers.

Steel stairways at either end allow pedestrians to cross these bridges when they are in the "up" position. Each bridge originally had a wood or concrete operator's tower at one end. An elevated booth, accessed via one of

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[50] BoP, pp.120-128, Whitford (1922), pp. 558-61.
[51] AR-SES, 1905, plate opposite p. 34.
[52] Main St., Fairport E-128; Union St., Spencerport E-174; Washington St., Adams Basin E-178; Park Ave., Park Avenue, Brockport E-181; Main St., Brockport E-182; East Ave., Holley E-187; Hulberton E-191; Ingersoll St., Albion E-199; Main St., Albion E-200; Eagle Harbor E-203; Knowlesville E-206; Prospect Ave., Medina E-211; Main St., Middleport E-216; Gasport E-222; Adams St., Lockport E-229; Exchange St., Lockport E-230. They were built under contracts 105 by Skene & Richmond and 106 by W.S. Cooper Co. – Whitford (1922), p. 562. There was also a lift bridge with a concrete control tower that carried Ann Street over the canal in Little Falls, but it is no longer extant.

the exterior pedestrian stairways, housed controls and provided views of both canal and road traffic.[53] Concrete towers are rectangular in plan, two bays by three, with flat roofs and wide curved cast-concrete cornices. Wood towers are six sided – a square with clipped corners on the side toward the water. Originally clad in wood clapboards with double-hung windows in the upper control room, they are capped by pyramidal roofs. The towers at Spencerport, Knowlesville, and Gasport were replaced by single-story brick operators' houses during the 1960s. The original electro-mechanical hoist at Gasport was replaced by hydraulic cylinders in the 1960s.

A later group of highway bridges, some constructed during the period of significance, are non-contributing because they have no relationship to the canal era or to maritime transportation. These bridges, some which carry the New York State Thruway, are part of the U.S Interstate Highway System and may be eligible for listing in that context. Others are part of local highway transportation systems. These are noted as "non-contributing highway bridge." Other bridges post-date the period of significance.

Shops & Drydocks

There are "Section Shops" housing canal maintenance operations, machine shops, vessels, and vehicles at Fort Edward, Waterford, Fonda, Utica, New London, Lysander, Lyons, Pittsford, Albion, and Lockport and disused facilities at Syracuse. Most were established during the 1920s, but the Fonda Shops were built in 1954 to replace facilities at Amsterdam that had been prone to flooding; Fort Edward and Lysander facilities were built after the period of significance. The Waterford, Syracuse, Lyons, and Pittsford complexes feature steel-framed machine shop buildings with raised central craneway aisles and clerestory windows. There are large earth-walled dry docks at Waterford and Lyons and smaller concrete-sided dry docks at New London and Lockport.

Terminals

New York State built canal terminals on the system and on connecting waterways to facilitate transfer of freight between land vehicles and canal boats. There are at least forty canal terminal walls on the system, each with a vertical wall over 300' long backed by a row of substantial cast-iron mooring bollards set in concrete.

Dock walls look very similar to terminal walls – a vertical concrete wall with a row of concrete-filled cast-iron bollards a few feet from the edge -- but they never had warehouses or material handling equipment. Unlike terminals, which were constructed for the transfer of cargo from canal vessels to shore, dock walls simply

[53] BoP, pp. 136-141.

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provided a place for boats to tie up, often at locations where there might be a delay before locking. Because they don't have to support heavy trucks or cargo, some dock walls consist of concrete slabs on top of piers or concrete capped steel sheet-pile, usually with a timber rub rail near the waterline.[54]

Terminal walls and dock walls were designed with their top edges four feet above normal pool elevation. This worked well for commercial vessels but in recent years recreational users have complained that it is difficult to scramble from a small boat up a 4' wall. The Canal Corporation and communities have attached floating docks accessed by ramps or stairs to terminal and dock walls throughout the system. A few communities have also added utility pedestals along dock edges to supply water and electricity to visiting boaters.

The state built warehouses at 28 terminals. Eight of those buildings survive. Most were of heavy balloon frame construction, clad in wood novelty siding, supported by concrete piers with their wood floors at loading dock height 4' above grade. Called "timber" warehouses in 1920s canal documents, they have gable roofs with exposed rafter tails, covered by asphalt shingles. Sliding cargo doors provide access to the interiors from both the land and canal sides. They were built in different sizes, in anticipation of varying local cargo demand. Small terminal warehouses at Fort Edward, Holley, Mechanicville, and Spencerport were 16' x 30.' Fonda, Herkimer, and Ilion had 16'x 60' or 16' x 100' buildings. Most of the others were twice as wide – 32' by 50,' 80,' 100' 150' or 200.' Timber terminals were painted gray with white trim. Photos from the 1920s show that some had "New York State Canal Terminal" picked-out in contrasting light colored roof shingles within a dark field but none of that lettering has survived subsequent re-roofing.

The terminal sheds at Herkimer and Syracuse have been moved from their original piers but remain close to the canal. The buildings at Little Falls, Ilion, and North Tonawanda have been modified for use as visitor centers and/or restaurants. Similar adaptive uses have been proposed for the others. The concrete terminal building with steel-framed roof in Whitehall, at the northern end of the Champlain Canal, is much larger and more substantial than the surviving wood-frame terminal sheds. It is a small-scale version, and the last surviving example, of the major canal terminal buildings that New York State built in Buffalo, Rochester, and Manhattan, and it shares structural characteristics with canal shop buildings at Utica and Fonda. Many terminals were originally provided with derricks, conveyors, and other material-handling equipment, but only a few fragments of that hardware survive.

[54] BoP, pp. 147-150.

Discontiguous Terminals (not included in this nomination)
New York State constructed terminal walls, freight sheds, and grain elevators on connecting waterways during the early 1920s to facilitate and promote commercial traffic on the newly completed Barge Canal system. These included terminals at Rouses Point and Port Henry on Lake Champlain, large terminal sheds on Erie Basin in Buffalo Harbor, terminal walls at Watkins Glen and Ithaca on the southern end of Seneca and Cayuga lakes, a terminal and grain elevator on Lake Ontario at Oswego, two terminals on the Hudson River at Troy, one at Albany, and New York harbor terminals at Mott Haven in the Bronx, Flushing and Long Island City in Queens, Piers 5 & 6 on the East River at the lower end of Manhattan, and at Greenpoint and Gowanus Bay in Brooklyn. The Gowanus Bay development included a massive grain elevator. None of these terminals is included in this nomination because they are far from the main stem of the canal system, most are no longer owned or maintained by the Canal Corporation, and they have lost integrity.

Aids to Navigation
Channels in canalized river and lake segments are marked by numbered buoys that are set before the beginning of each navigation season and retrieved in the fall. Wood barrels were soon replaced by steel buoys with angle-iron bows ("harps") that supported kerosene lanterns to permit navigation by commercial vessels around-the-clock and through fog. Black buoys with white lights marked one side of the channel, red buoys with red lamps marked the other. (Black buoys were repainted white, still with white lamps, sometime after World War II.) Although the Erie and Champlain canals went up and down as they crossed summit levels, buoy locations complied with the international "red-right while returning from sea" convention by placing all red channel markers to the right when travelling away from the Atlantic, regardless of current.[55] As commercial shipping and the associated demand for round-the-clock navigation declined during the 1960s, steel buoys with kerosene lamps were replaced by a succession of plastic floats with various shapes, lights, reflectors, and colors. Channels are now marked by foam-filled plastic red "nun" and green "can" buoys with reflective tape. These are supplemented in land-cut and quiet river sections with fixed "beacons" – typically a vertical piece of railroad rail driven into the canal bed. Beacon posts used to support kerosene lanterns but they now carry simple red or green reflective numbered panels facing up and down stream. By the mid-1920s over 2,100 kerosene lanterns marked Barge Canal channels. They were refilled and serviced by a fleet of 27' steel buoy boats; each buoy tender assigned to about a ten-mile segment of canal. Lamp oil, wicks, spare lamps, and other supplies were stored in hip-roofed concrete oil houses (sometimes called jug houses) scattered throughout the system, most at

[55] "Barge Canal Navigation Aids," *Barge Canal Bulletin* VIII:6 (June 1915), pp. 159-61.

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locks but some at freestanding locations. Concrete lighthouses at Verona Beach, Frenchman Island, and Brewerton mark the route across the middle of Oneida Lake, supplemented by buoys.[56] The lighthouses and oil houses are contributing elements to this nomination; buoys and fixed beacon posts are too small to count.

Colors

New York's bright "Royal Blue & Gold" color scheme, one of the signature characteristics of Barge Canal structures, equipment, and vessels, was adopted in 1949. Before that, equipment cabinets and most other metal surfaces at locks were painted black with white lettering. Buildings were white with black trim. Vessels were two-tone gray with red trim and orange bottom paint. Now, equipment cabinets are blue with yellow lettering and trim. Handrails are yellow. Mechanical equipment is bright red. Sand painted walking surfaces are dark red as is the anti-fouling bottom paint on floating plant vessels. Guard gates, lift bridge trusses, movable dam superstructures, and other large structural steel elements are sage green. Motor housings, controllers, and other electrical equipment are a darker green called "Schuyler Jade." Buildings are uniformly white with blue trim.[57]

Vessels

Canal vessels are not included in this nomination, but they are a significant part of the Barge Canal. State-owned maintenance vessels, collectively called "floating plant," include ten tugboats, nine smaller tender tugs (TTs), more than a dozen buoy boats (BBs), six self-propelled scows (SPSs), four hydraulic dredges (HDs), a dipper dredge, six derrick boats (DBs), two Gradall boats, four quarter boats where dredge crews sleep and eat when their rigs are on station, plus a collection of deck barges, hopper barges, and dump scows. Several vessels have been listed on the National Register, including the tug *Urger* (launched 1901, listed 2001), which serves as educational ambassador and flagship for the fleet; the steam-powered Dipper Dredge 3 (DD3) at Lyons Drydock (1929 hull supporting 1909 machinery, listed 2007).[58] NR listed vessels built for commercial service include the canal motorship *Day Peckinpaugh* (launched as *I.L.I 101* in 1921, listed 2009) and the 1938 Bushey built tug *Chancellor* (listed 2000).

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[56] BoP, Plate 152; "Barge Canal Lighthouses," *Barge Canal Bulletin* IX:11 (November 1916), pp 303-7.

[57] NY 27 DOT Chrome Yellow, NY 30 DOT Blue, NY 17 Essex Red, NY 31 Safety Red, NY 11 Schuyler Jade (Many of the state's official colors are named after New York counties.) NYS Canals, "Master Color Template" (March 2014).

[58] State vessels that have been determined NR eligible but are not yet listed include the 1927 tugs *Governor Roosevelt* and *Governor Cleveland* and the 1932 Diesel-electric tug *Seneca*.

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