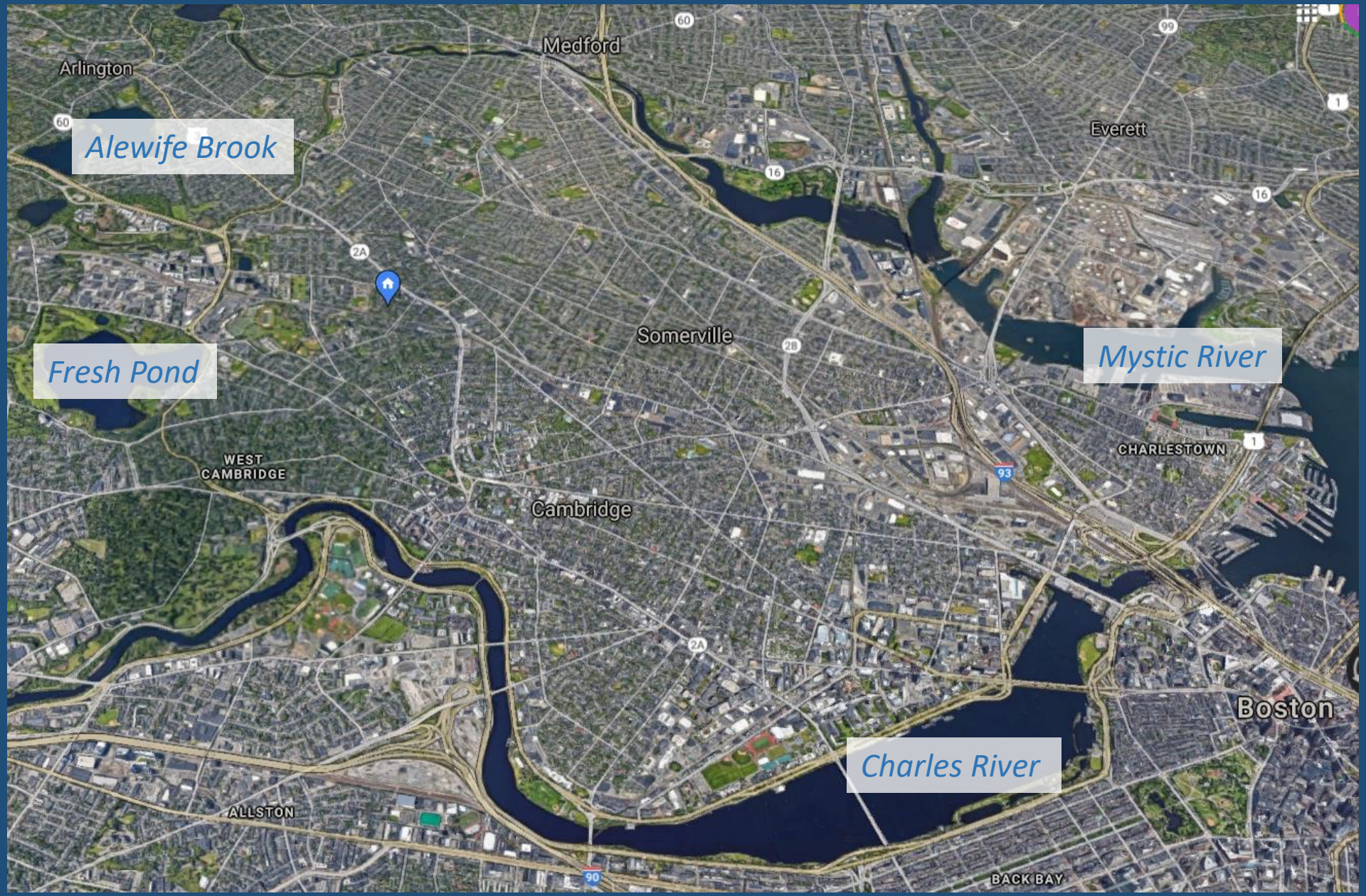
Geology is Destiny

Surface Geology and the Development of Cambridge

Charles Sullivan
Cambridge Historical Commission
October 7, 2024

Keeping History Above Water: The Past as Prologue



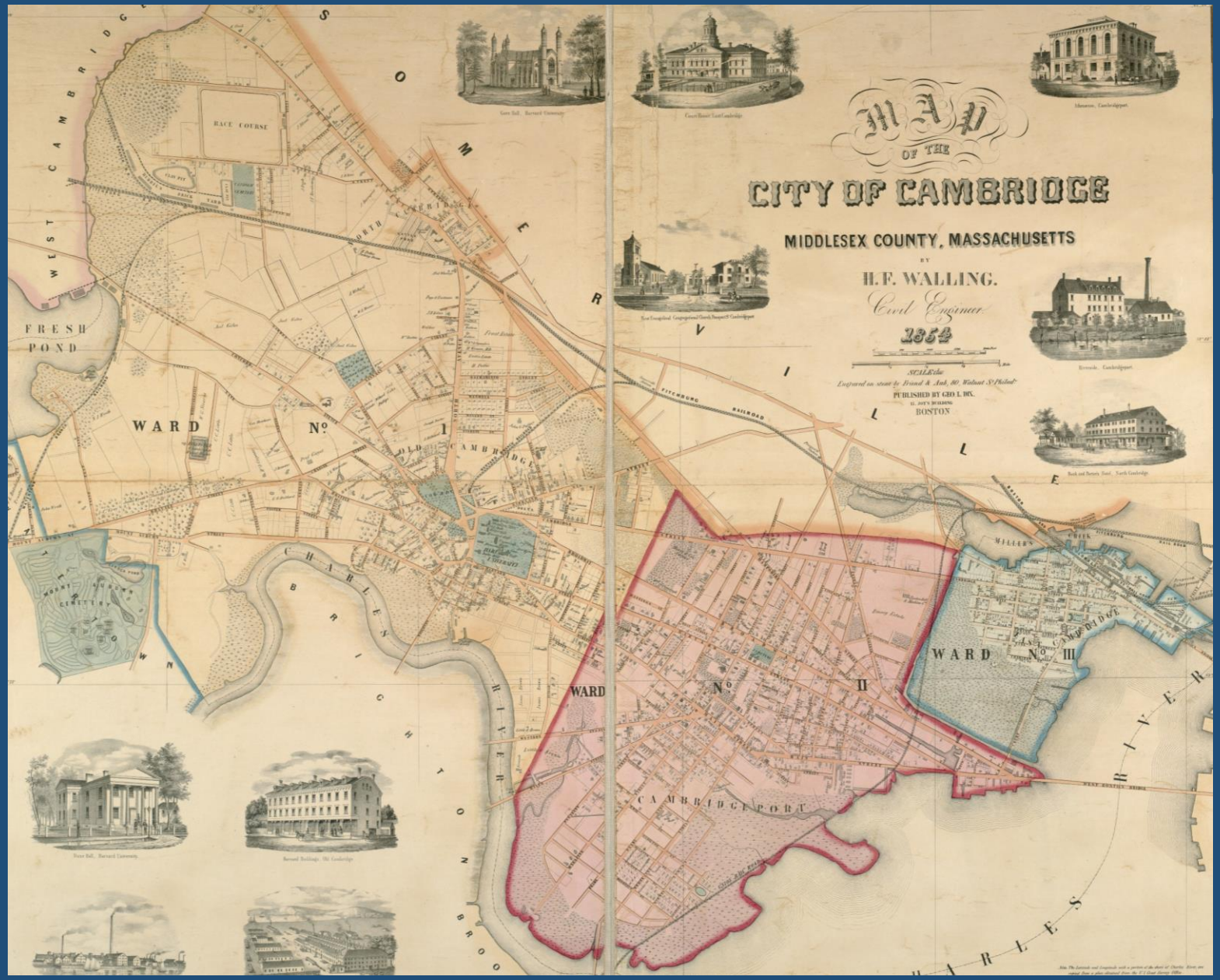
Henry Pelham, *A Plan of Boston in New England …* (London, 1777)

The Watery World of Cambridge, Boston, and Somerville

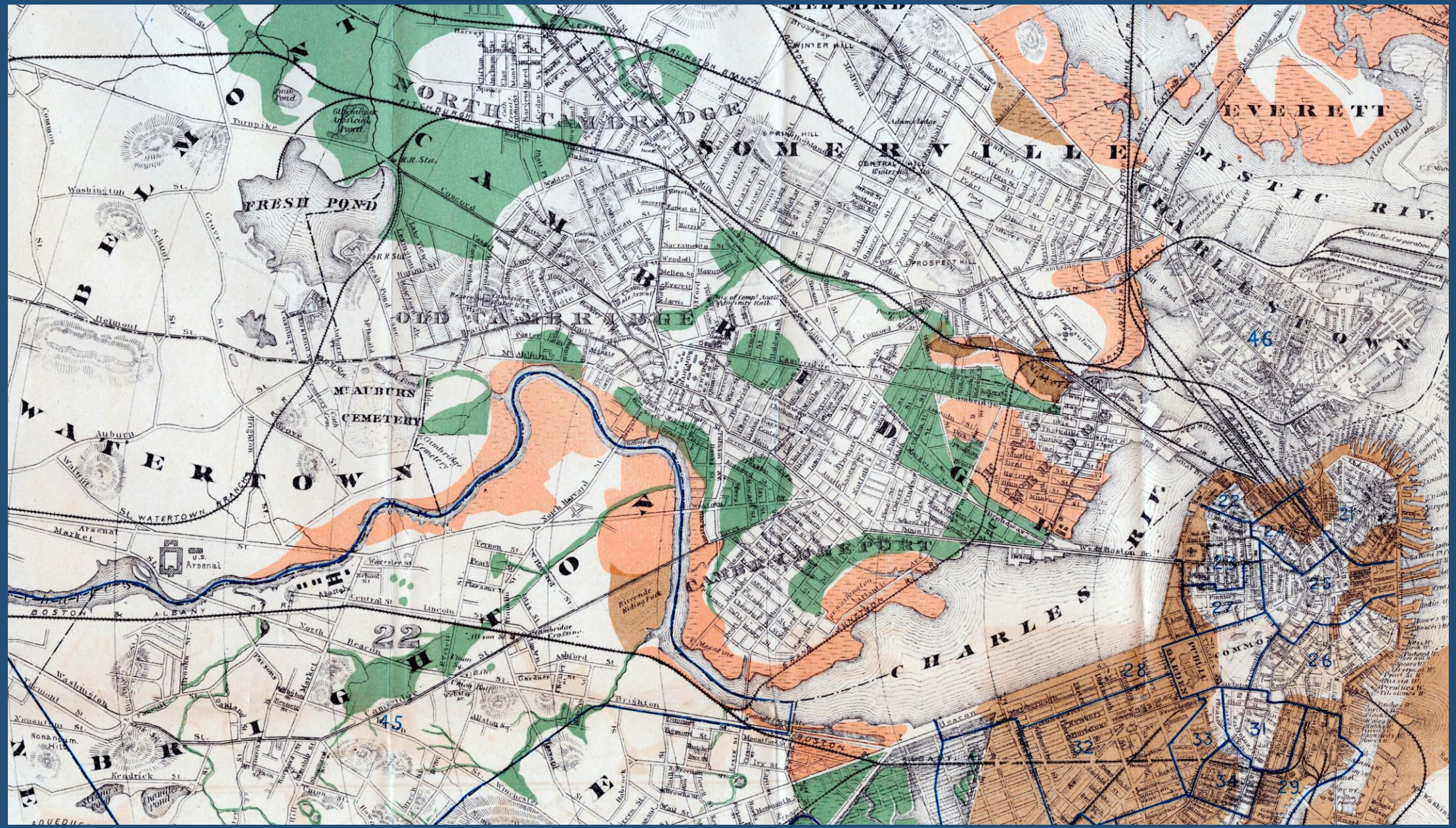
1633

1775

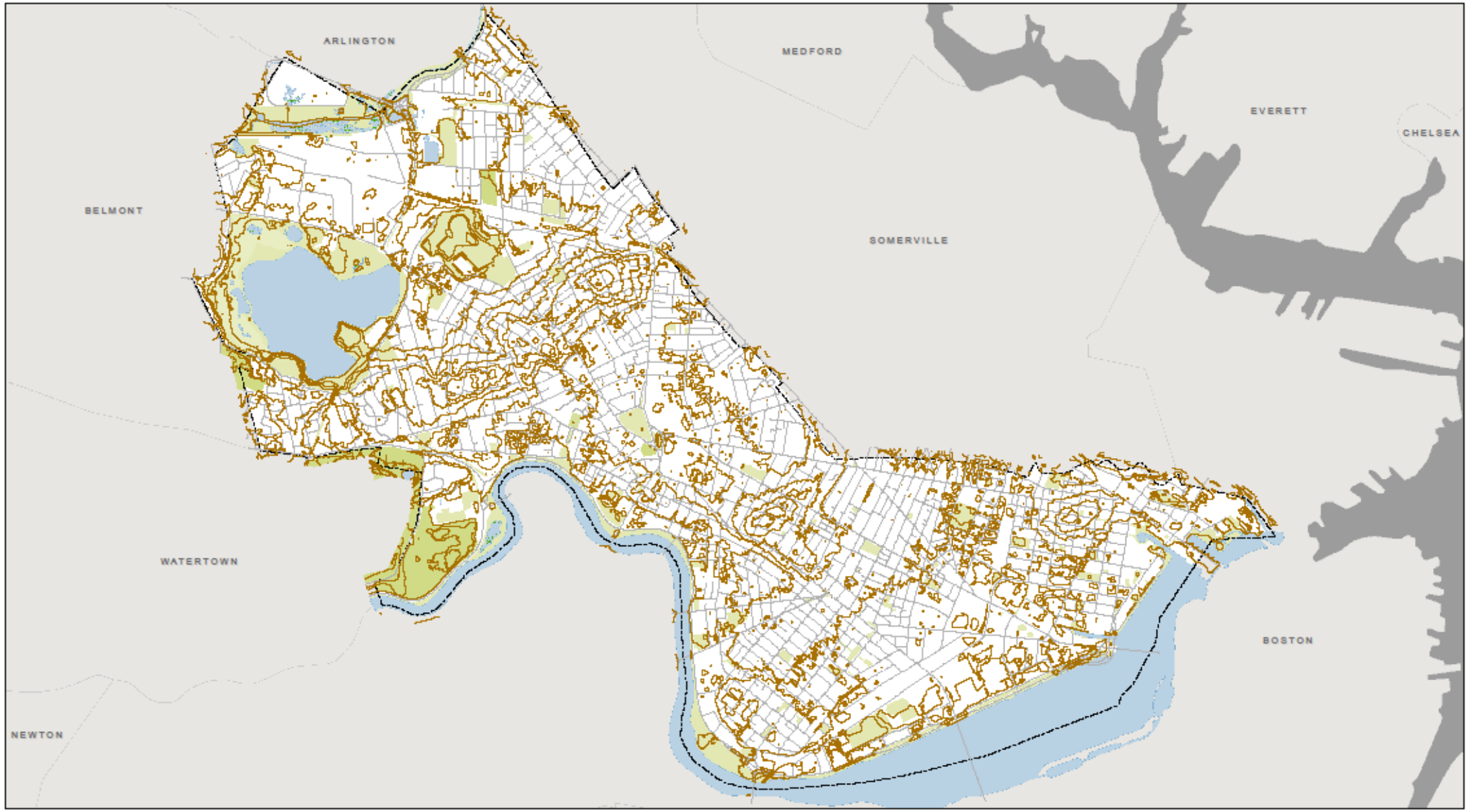
Source (left): British Library. John Winthrop, *A chart of Boston and its vicinity, Massachusetts Bay; drawn on a scale of 2 1/3 Italian miles, by estimation, to an inch,* n.d. [ca. 1633-37]



H.F. Walling, Map of the City of Cambridge, Massachusetts (1854)

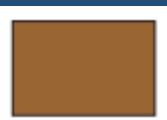


Salt marshes (pink), low-lying land subject to flooding (green) and filled lands (brown), 1877



Current Topography of Cambridge – 10’ contour intervals. Cambridge GIS, 2024.

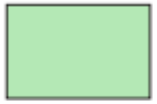
U.S.G.S, *Surficial Materials of Massachusetts— A 1:24,000-Scale Geologic Map Database* (2018)



Artificial fill—Earth materials and manmade materials that have been artificially emplaced, primarily in highway and railroad embankments and in dams; unit may also include landfills, urban-development areas, and filled coastal wetlands

Coarse deposits consist of *gravel deposits*, *sand and gravel deposits*, and *sand deposits*, not differentiated in this report. *Gravel deposits* are composed of at least 50 percent gravel-size clasts; cobbles and boulders predominate; minor amounts of sand occur within gravel beds, and sand comprises a few separate layers. Gravel layers generally are poorly sorted, and bedding commonly is distorted and faulted due to postdepositional collapse related to melting of ice. *Sand and gravel deposits* occur as mixtures of gravel and sand within individual layers and as layers of sand alternating with layers of gravel. Sand and gravel layers generally range between 25 and 50 percent gravel particles and between 50 and 75 percent sand particles. Layers are well sorted to poorly sorted; bedding may be distorted and faulted due to postdepositional collapse. *Sand deposits* are composed mainly of very coarse to fine sand, commonly in well-sorted layers. Coarser layers may contain up to 25 percent gravel particles, generally granules and pebbles; finer layers may contain some very fine sand, silt, and clay

Glaciomarine fine deposits include clay, silty clay, fine sand, and some fine gravel deposited in a higher-level sea in environments of low wave energy along the coast and in river estuaries. Fine to very fine sand, massive and laminated, commonly is present at the surface and grades downward into interbedded very fine sand, silt, silty clay, and clay. The lower silty clay and clay is massive and thinly laminated. Total thickness is generally a few feet to 75 ft



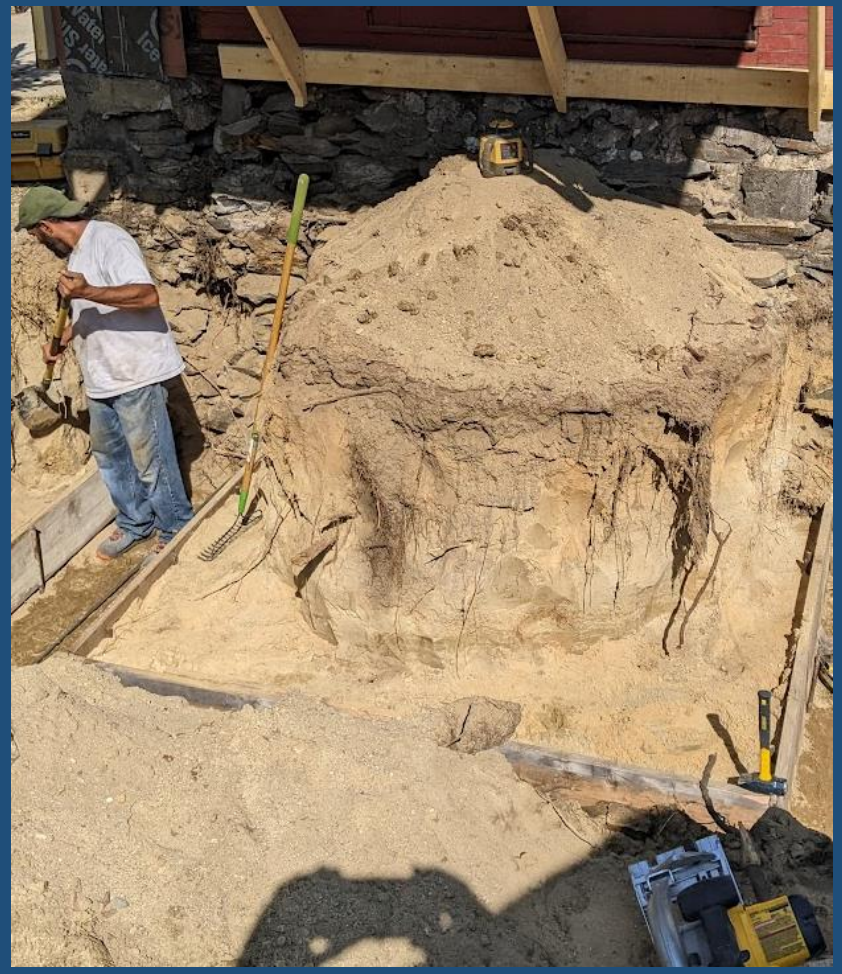
Thick till—Nonsorted, nonstratified matrix of sand, some silt, and little clay containing scattered pebbles, cobbles, and boulders in the shallow subsurface; at greater depths consists of compact, nonsorted matrix of silt, very fine sand, and some clay containing scattered small gravel clasts. Mapped in areas where till is greater than 10 to 15 ft thick, mostly in drumlin landforms in which till thickness commonly exceeds 100 ft (maximum recorded thickness is 230 ft). Although upper till of late Wisconsinan age is the surface deposit, lower till of probable Illinoian age constitutes the bulk of the material in thick-till areas. Lower till is moderately to very compact and is commonly finer grained and less stony than upper till. An oxidized zone, the lower part of a soil profile formed during a period of interglacial weathering, is generally present in the upper part of the lower till. This zone commonly shows closely spaced joints that are stained with iron and manganese oxides

Thrust moraine deposits—In western Martha's Vineyard, thrusted moraine deposits stand as high as 300 ft in altitude and are composed of allochthonous, ice-thrusted Cretaceous, Tertiary, and older Quaternary sediments, locally overlain by thin surface till and boulders. These coastal-plain beds are fossiliferous, semi-consolidated sand, gravel, and silty clay in tilted strata that were thrust up by glacial ice into positions well above the autochthonous coastal-plain surface, which lies below sea level. Numerous northeast-southwest-trending ridges within the thrust moraine unit mark the edges of these tilted and thrusted strata

U.S.G.S, *Surficial Materials of Massachusetts— A 1:24,000-Scale Geologic Map Database* (2018)

Glaciomarine Fine Deposits

99 Brattle Street,
March 27, 2024



137 Allston Street,
July 21, 2022

Moraine Deposits and Clay

Sherman and Walden Streets, April 29, 2017

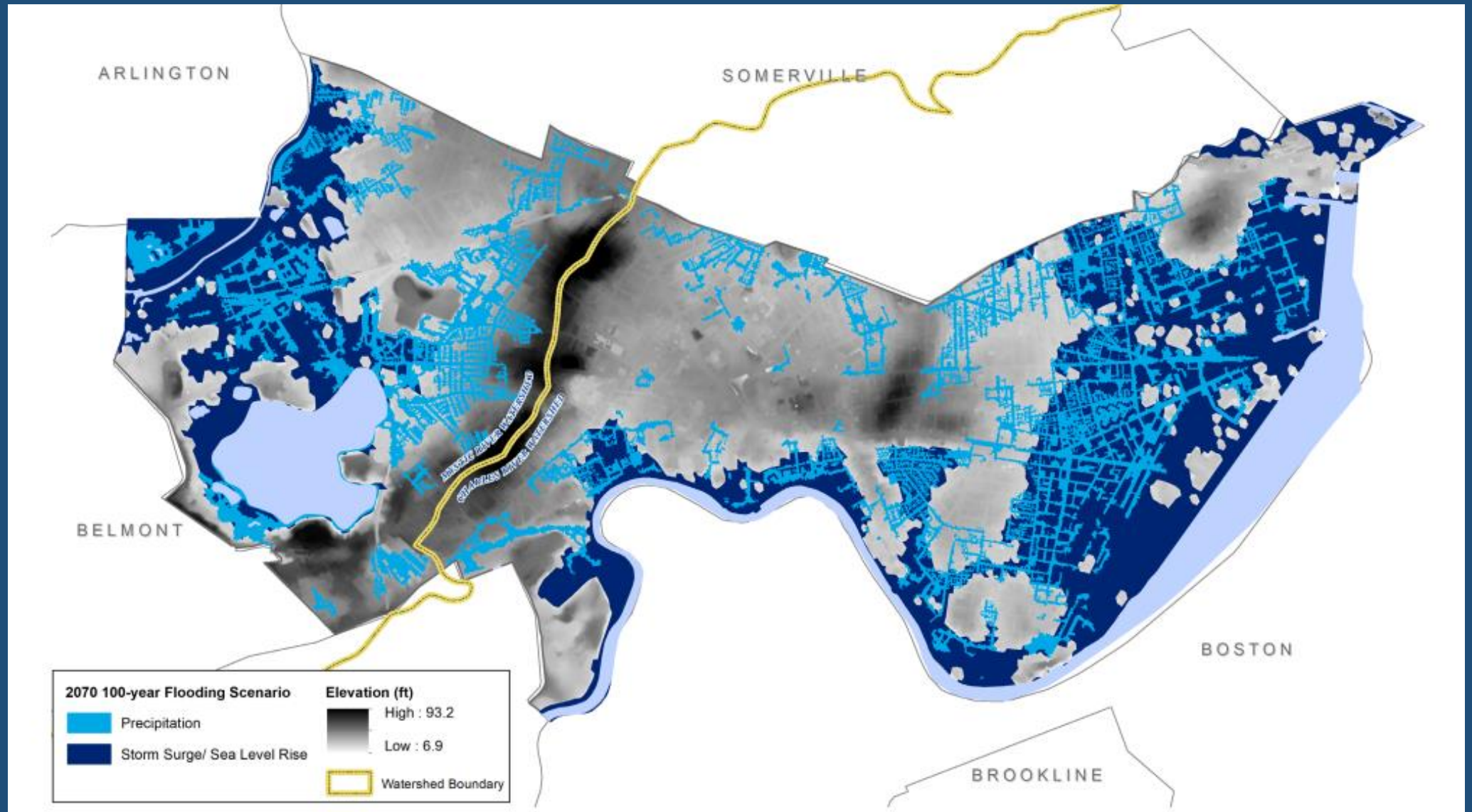


Figure 2. This map illustrates the projected flooding for the 1% Annual Storm in 2070, or the 100-year flood. Source: *City of Cambridge, 2021*

Resilient Cambridge: Climate Change Preparedness and Resiliency Plan, 2021

Millers River Watershed

U.S. Coast Survey, *Boston Harbor* (detail). Published in 1857 from surveys made in 1847.

Millers River Watershed

Mass. Board of Harbor Commissioners, *Map … Showing the Draining Area of the Millers River* (1872)

Millers River Watershed

Oxford Street and Divinity Avenue, 1854

Millers River Watershed

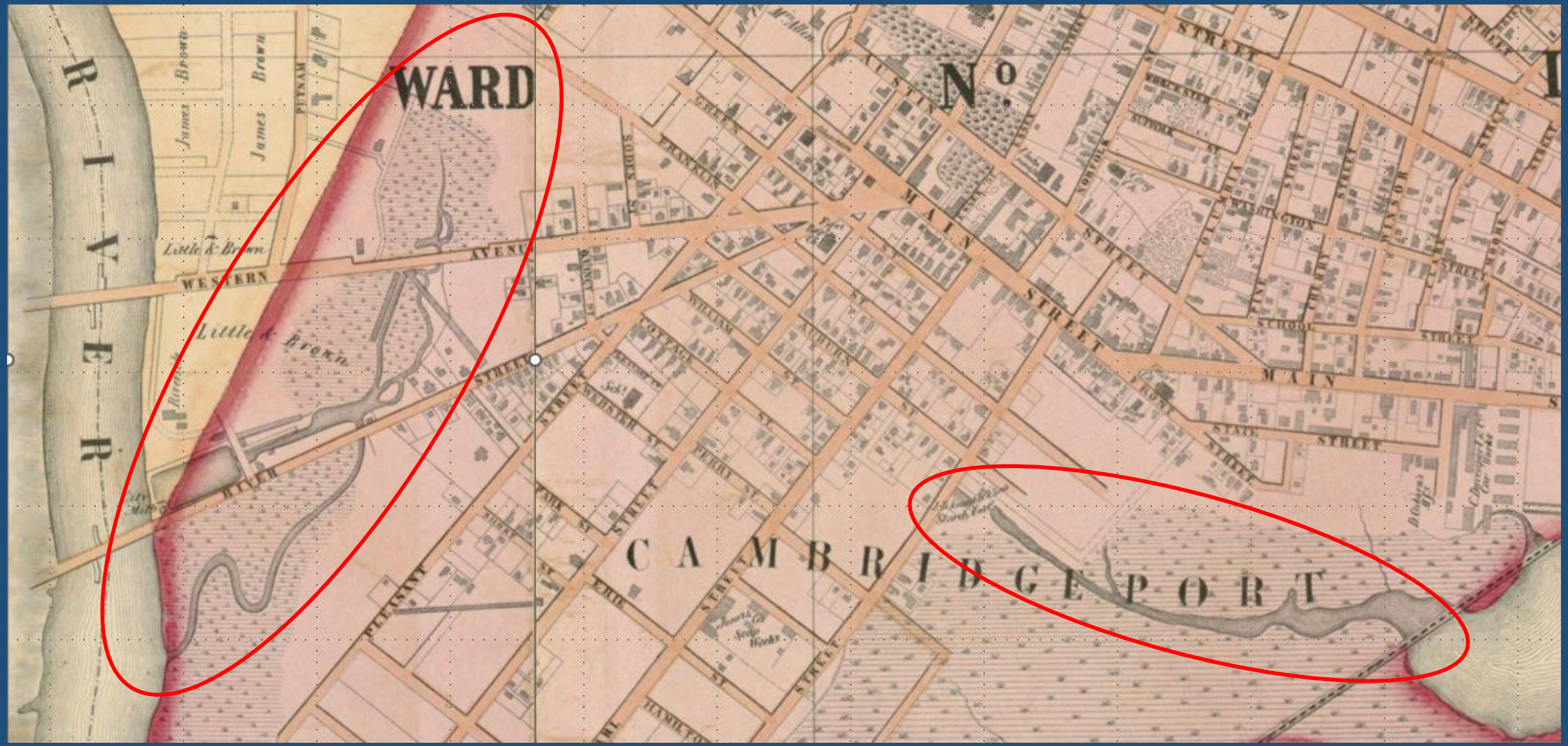
Oxford Street and Divinity Avenue, 1854

Somerville Dyeing & Bleaching Company reservoir, Sacramento Street. Photo 1937

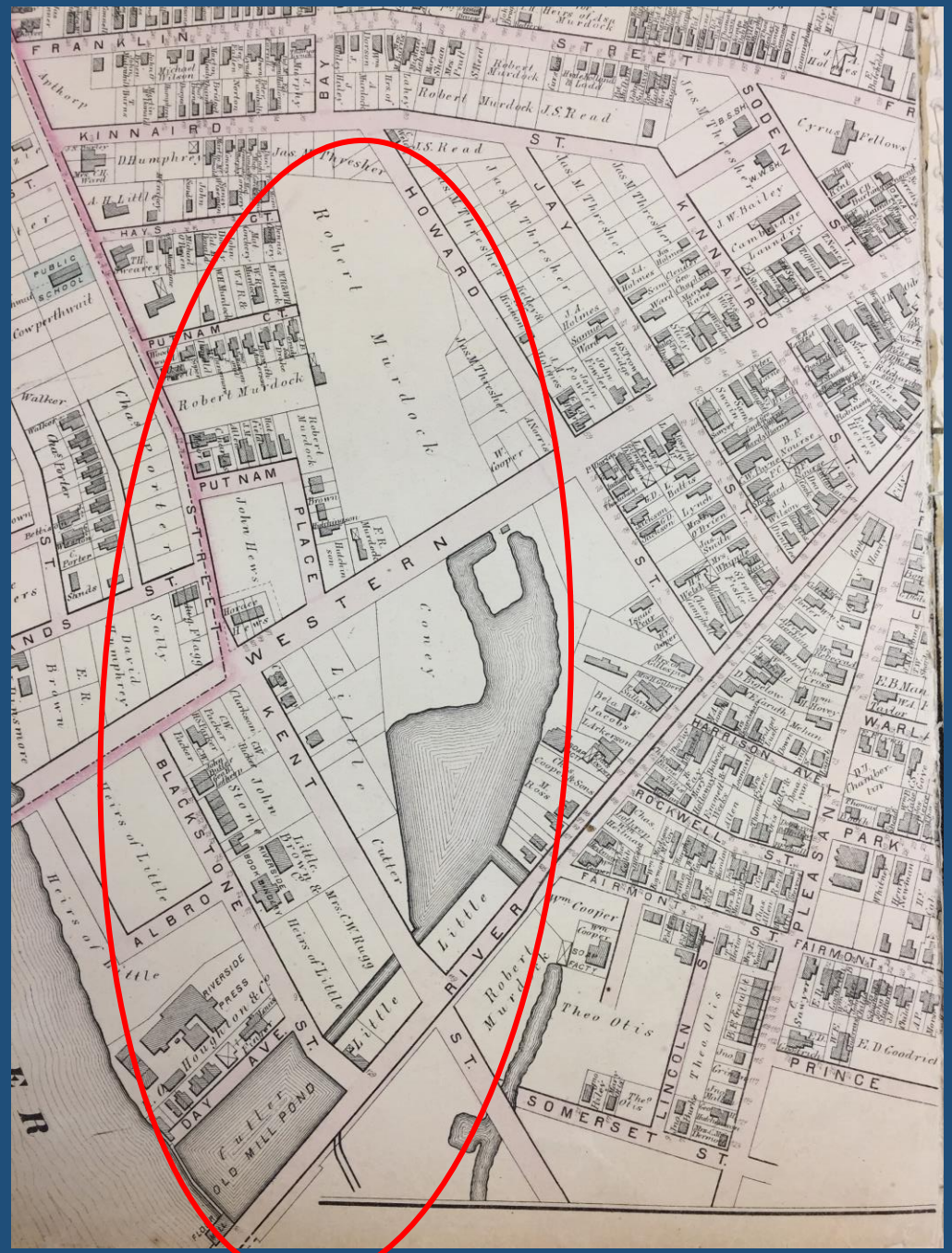
Cambridgeport

1847

Cambridgeport



1854


FRANKLIN
STREET
KINNAIRD
HAYES
PUTNAM
HOWARD
JAY
SUDEN
KINNAIRD
ST.
Robert Murdock
John Hews
PLACE
WESTERN
STREET
Coney
Little
RIVER
Cutter
OLD MILL POND
BLACKSTONE
ALBRO
Heirs of Little
Theo Otis
HARRISON AVE
ROCKWELL ST.
PLEASANT
PARK
FAIRMONT
LINCOLN
PRINCE
SOMERSET ST
DAY AVE
RIVERSIDE PRESS
PUBLIC SCHOOL

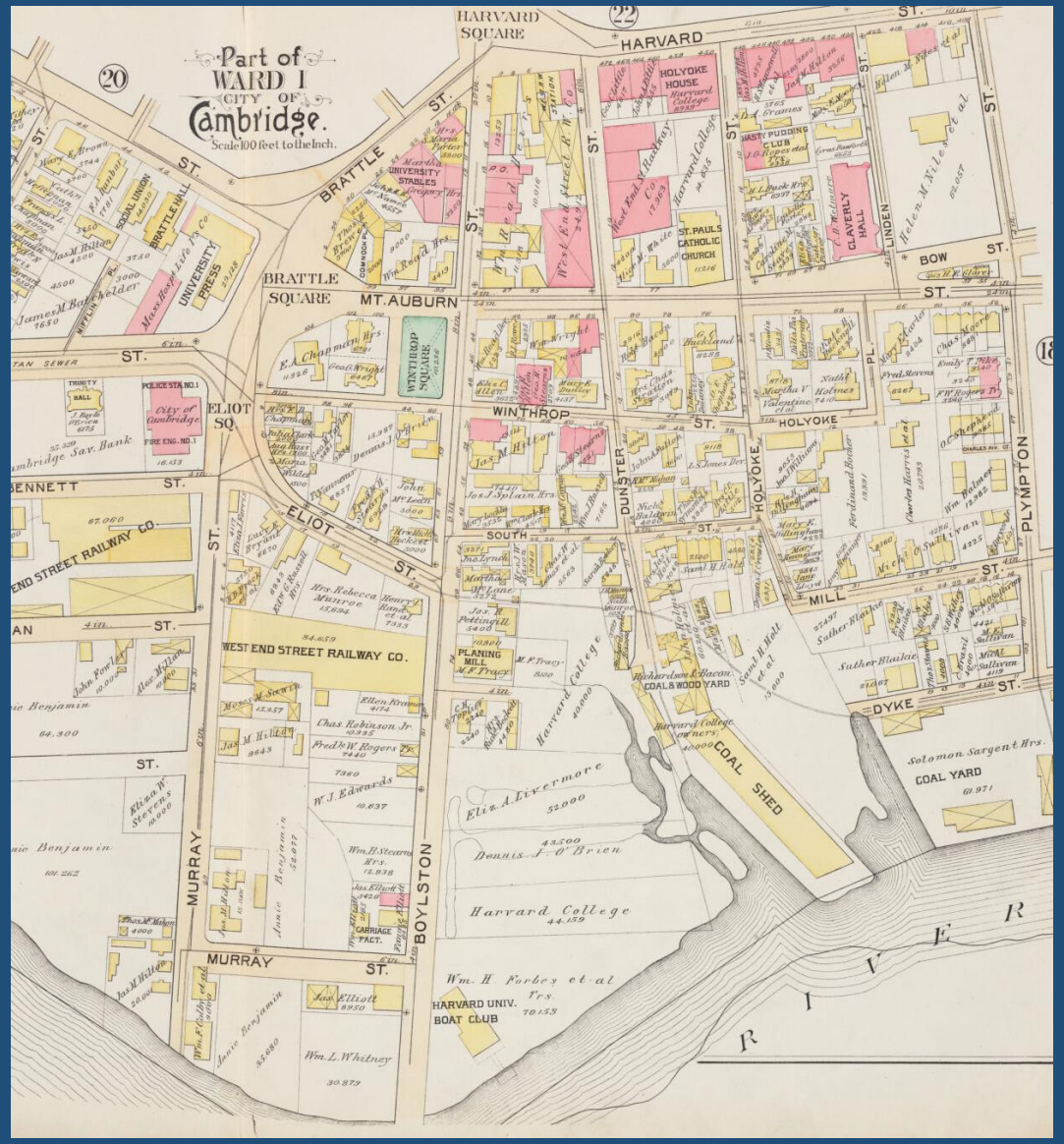
1873

1894


FLAGG
KINNAIRD
HAYES
PUTNAM
BANKS
STILES
AKRON
SANDS
GRIGG
HEWS
MAGEE
HOWARD
AVE
WESTERN
AMPERE
BLACKSTONE
BALLARD
ALBRO
CAMBRIDGE ELECTRIC LIGHT WKS.
The Riverside Press
City of Cambridge
RIVER
CHARLES
Part of WARDS 18 & 14 CITY OF Cambridge

Town Brook

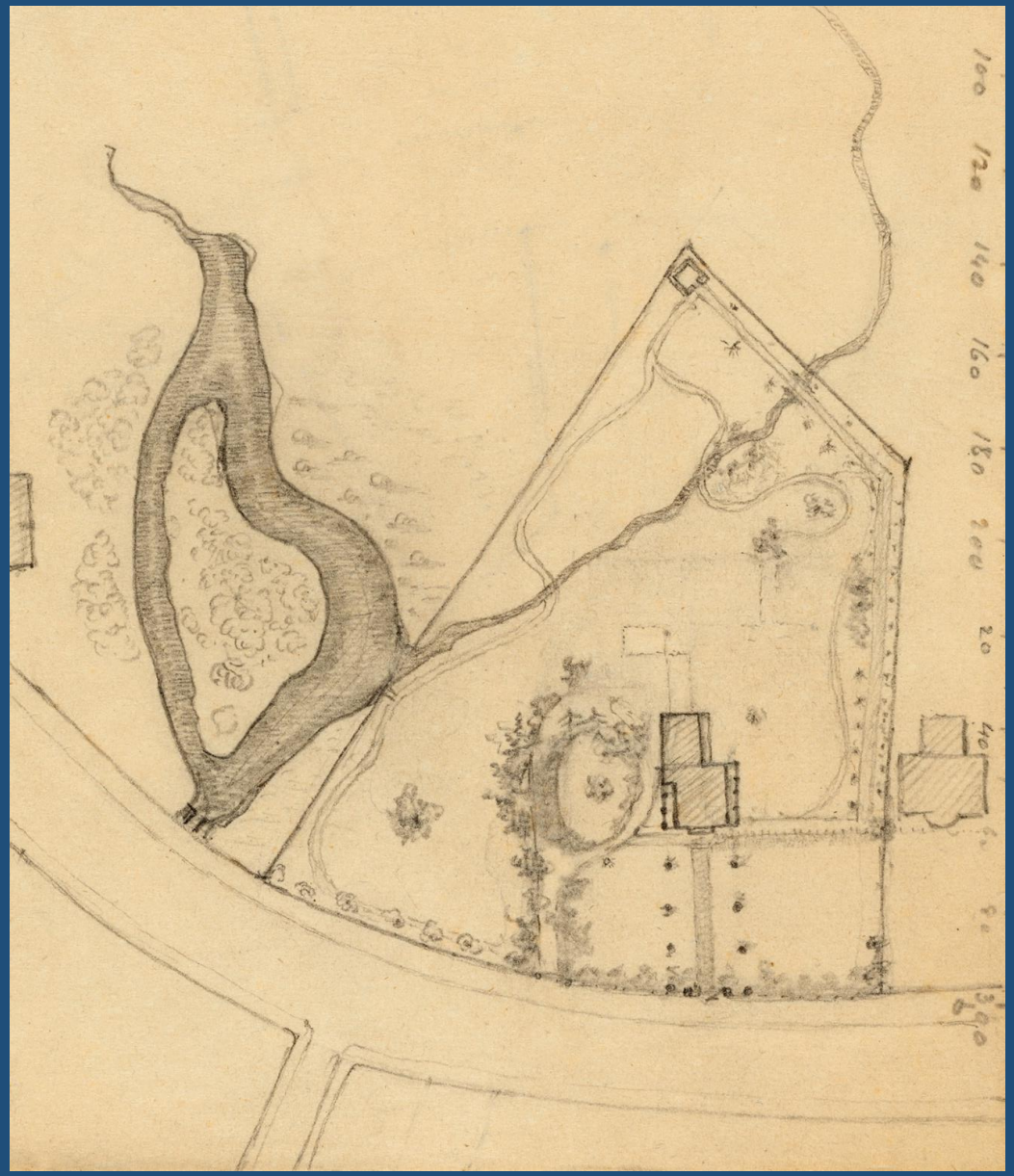
1720



1894

The Lost Brook

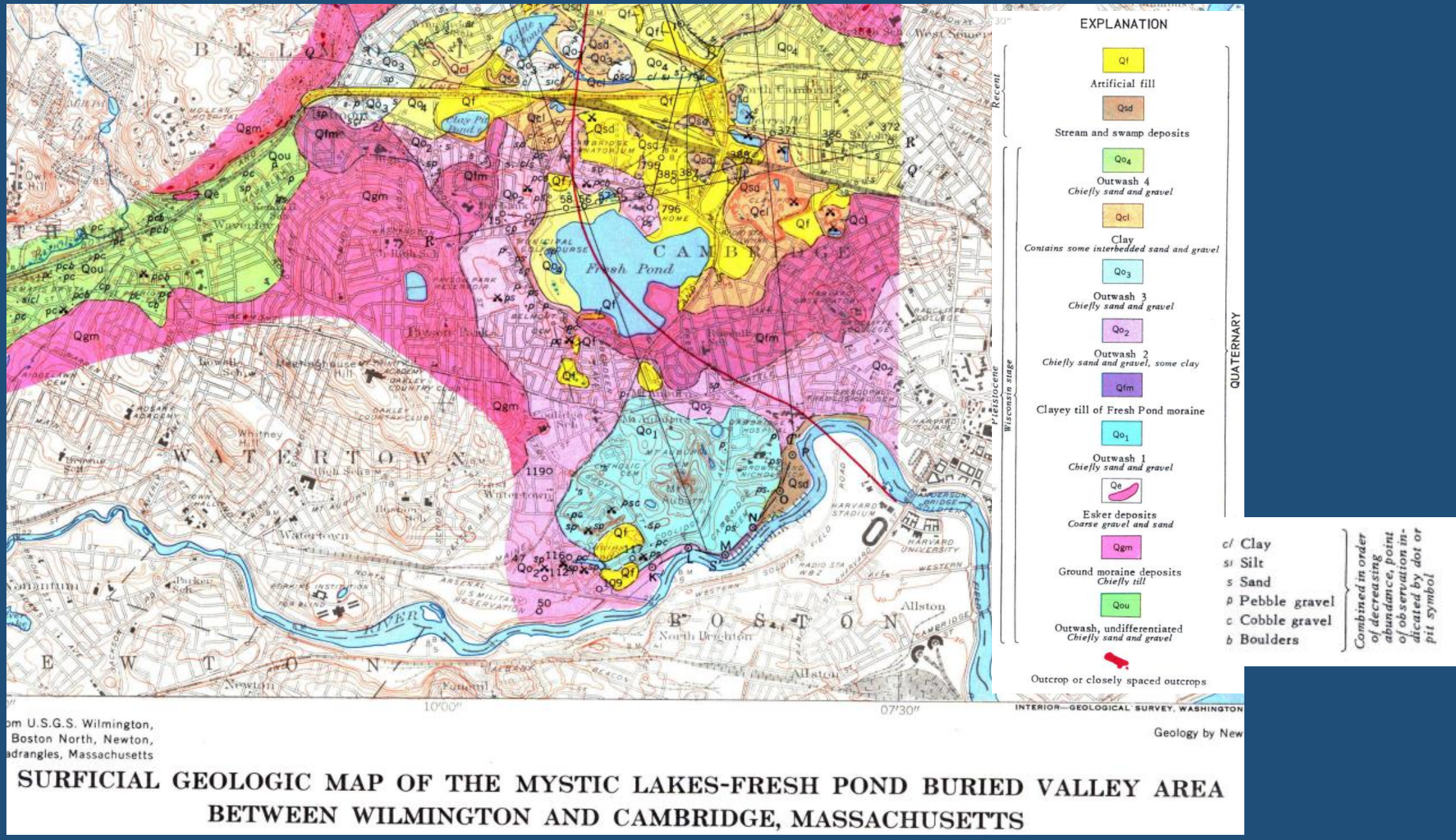
James Hayward, The Streets of Cambridge (1837)



Longfellow house grounds, showing Dictionary Lake, 1844. Sketch by A. W. Longfellow, courtesy National Park Service

Observatory
AVENUE
No.
1
OLD
C A
Jarvis Estate
Willard Phillips
GARDEN
E.S. Dixwell
T. Parsons
D. Treadwell
STREET
AVON
NORTH
Joseph Porter
A. Hilliard
Hadley
Popkin
SPARKS
ST.
Geo. Meacham
Prof. Guyot
J Brewster
CRAIGIE
BERKLEY
J. E. Worcester
Water Course
H. W. Longfellow
Denison
Oliver Hastings
FOLLEN
Mrs Waterhouse
WATERHOUSE ST.
COMMON
GARDEN
CEMETERY
BRATTLE
G. G. Hubbard
C.C. Little
FOSTER
Dr J. Wyman
WILLARD
Sam. Batchelder
Mrs Todd
Rev. W. Newell
MASON
S. Greenleaf
APPIAN WAY
E. Tuckerman
J. Munroe
Chapman
CHURCH

1854

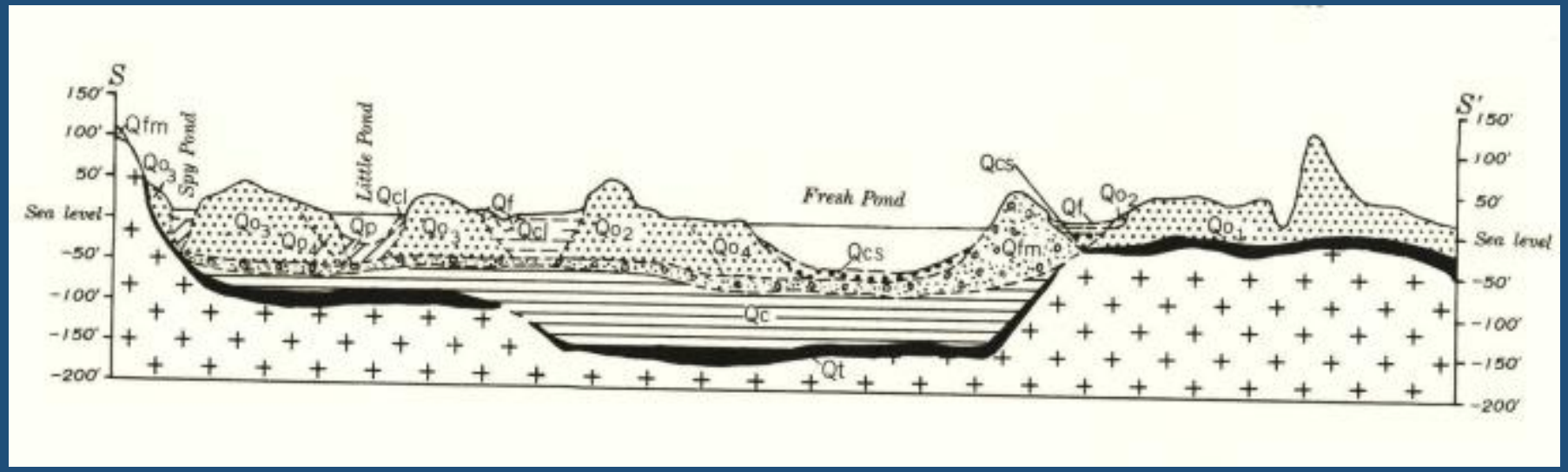


om U.S.G.S. Wilmington,
Boston North, Newton,
adrangles, Massachusetts

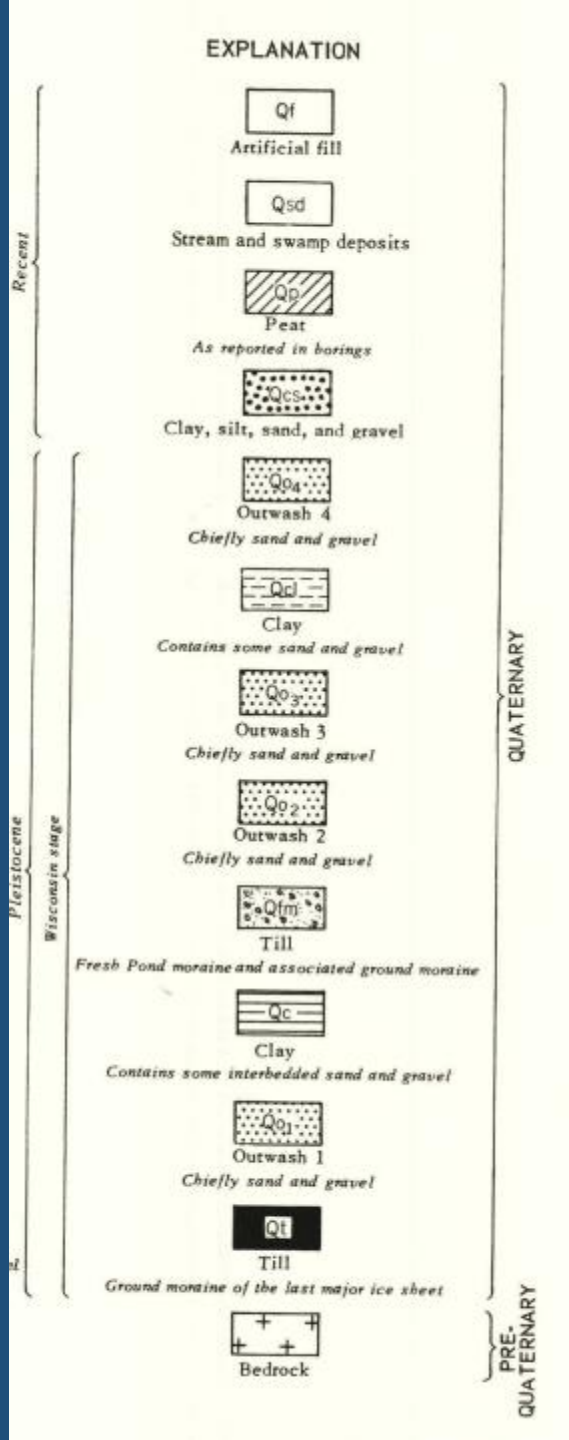
Geology by New

SURFICIAL GEOLOGIC MAP OF THE MYSTIC LAKES-FRESH POND BURIED VALLEY AREA BETWEEN WILMINGTON AND CAMBRIDGE, MASSACHUSETTS

Glacial Geology of the Mystic Lakes-Fresh Pond Area of Massachusetts. Geological Survey Bulletin 1061-F. USGS 1959

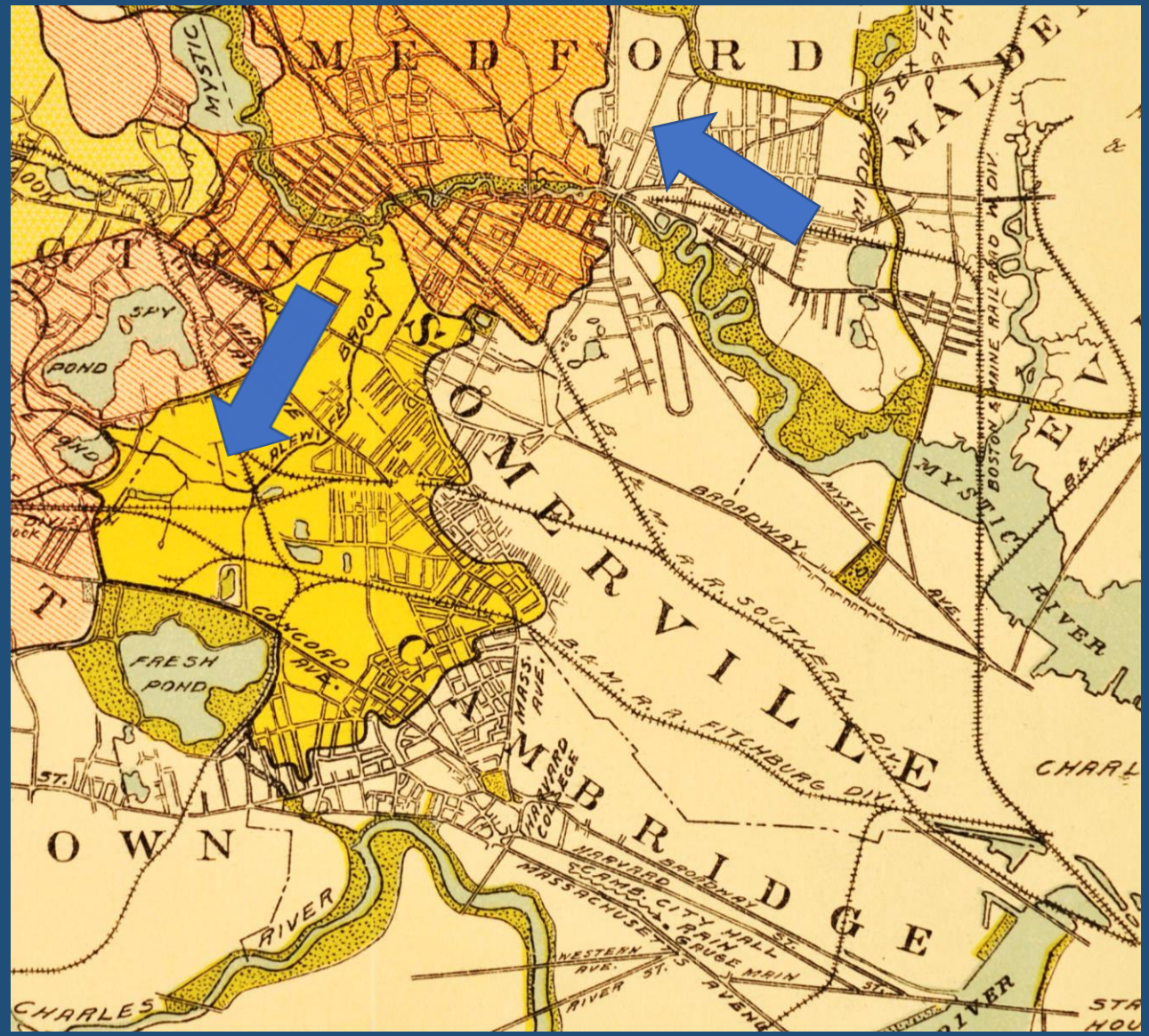


Glacial Geology of the Mystic Lakes-Fresh Pond Area of Massachusetts. Geological Survey Bulletin 1061-F. USGS 1959



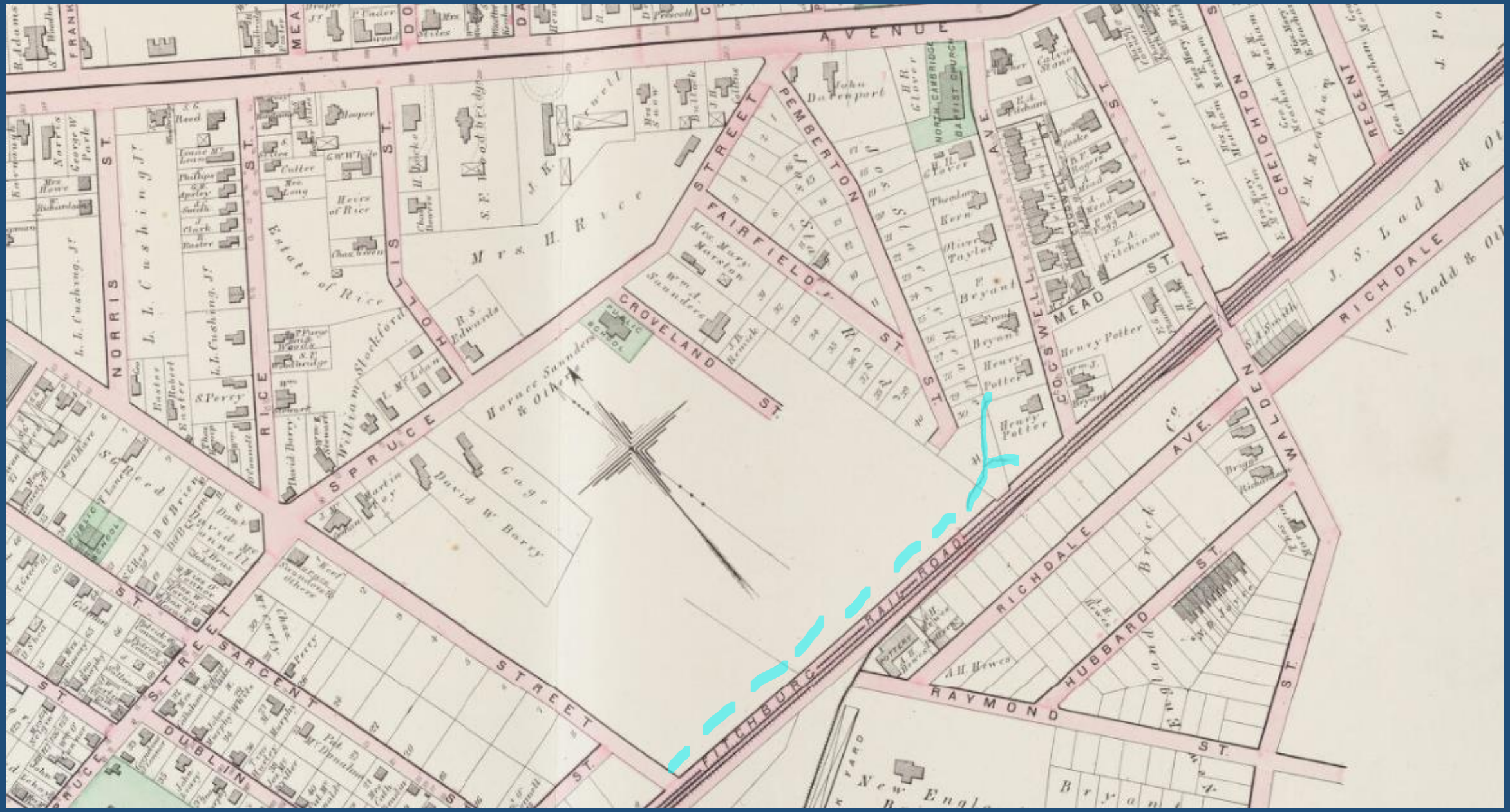
Map of the Water Region of the County of Middlesex … (1836)

Potential Flooding Through the Back Door: The Mystic River and Alewife Brook

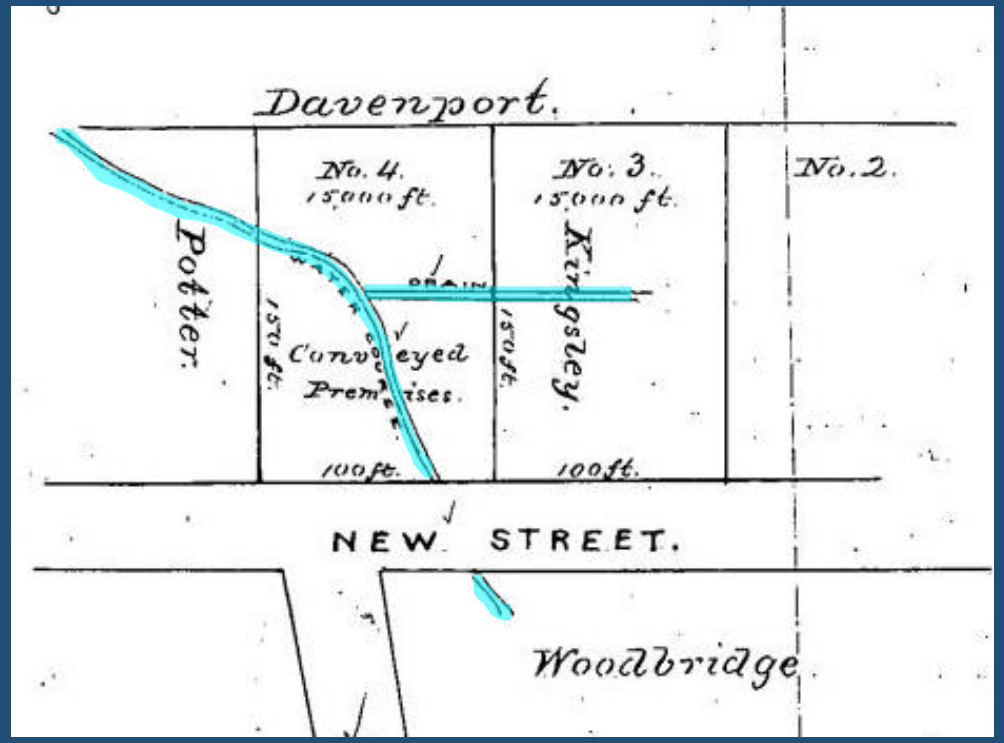


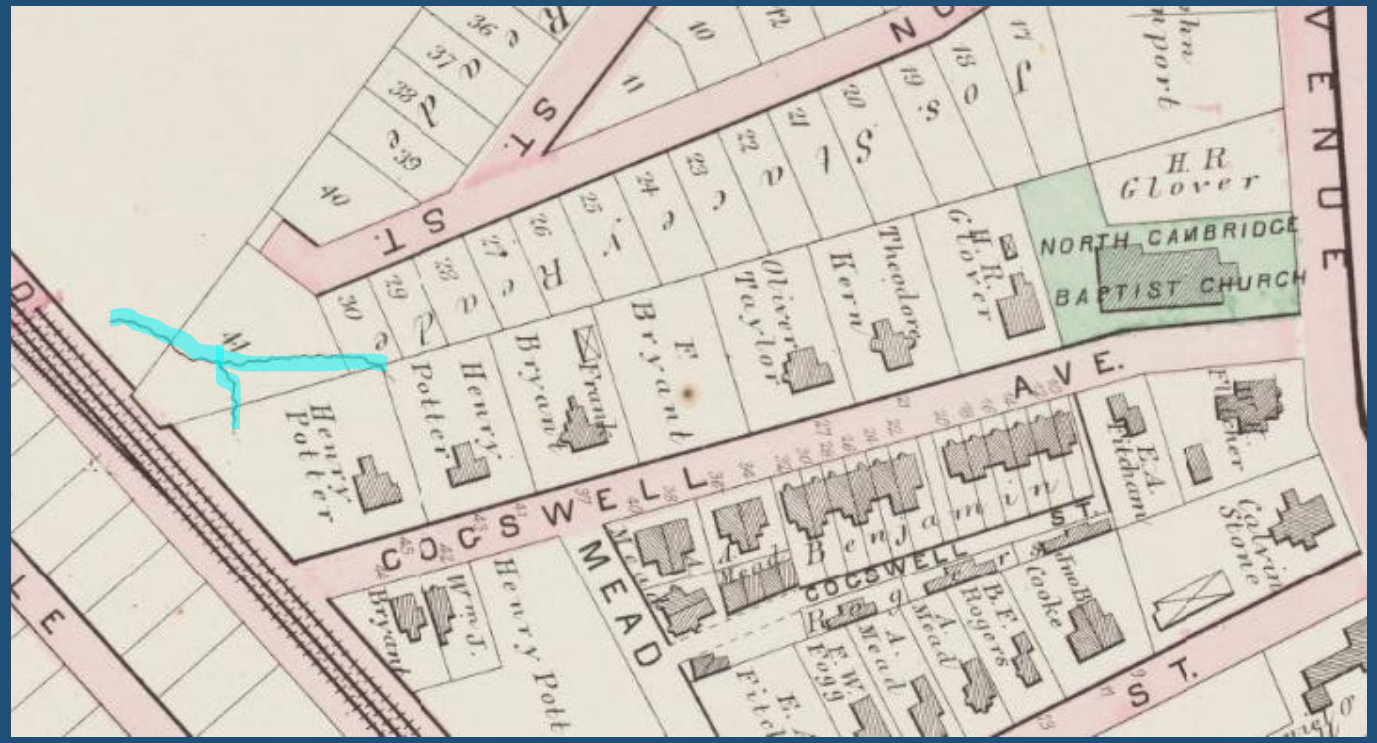
The Mystic River Watershed, 1904

Source: John R. Freeman, *Report on Improvement of the Upper Mystic River and Alewife Brook.* Boston, 1904


AVENUE
NORRIS ST.
RICE ST.
LISLE ST.
SPRUCE STREET
FAIRFIELD ST.
PEMBERTON ST.
CROVELAND ST.
SWELLEN AVE.
MEAD ST.
CRESCENT ST.
RECENT ST.
RICHDALE
WALDEN ST.
RAILROAD
FITCHBURG
RAYMOND ST.
HUBBARD AVE.
SARGENT STREET
DUBLIN ST.
L. L. Cushing Jr.
Estate of Rice
Mrs. H. Rice
Horace Saunders & Others
David W. Berry
Gage
Henry Potter
New England

1873





me, and this conveyance is made to said Enoch, subject to any rights of drainage which may exist on account of an ancient water course which runs through the premises now improved as a stone drain, also to the right of a stone drain from Lot No. Three on the Plan referred to, leading into the water course referred to, and now improved as a stone drain, and also subject to the following reservations, restric

Middlesex County Registry of Deeds, Book 790 pp 189-190 (1857)

37 Cogswell Avenue (1854). First floor 6’ above sidewalk.

Historic Wetlands in the Alewife Brook Watershed

Source: William Brewster, *Birds of the Cambridge Region*. Cambridge, 1906

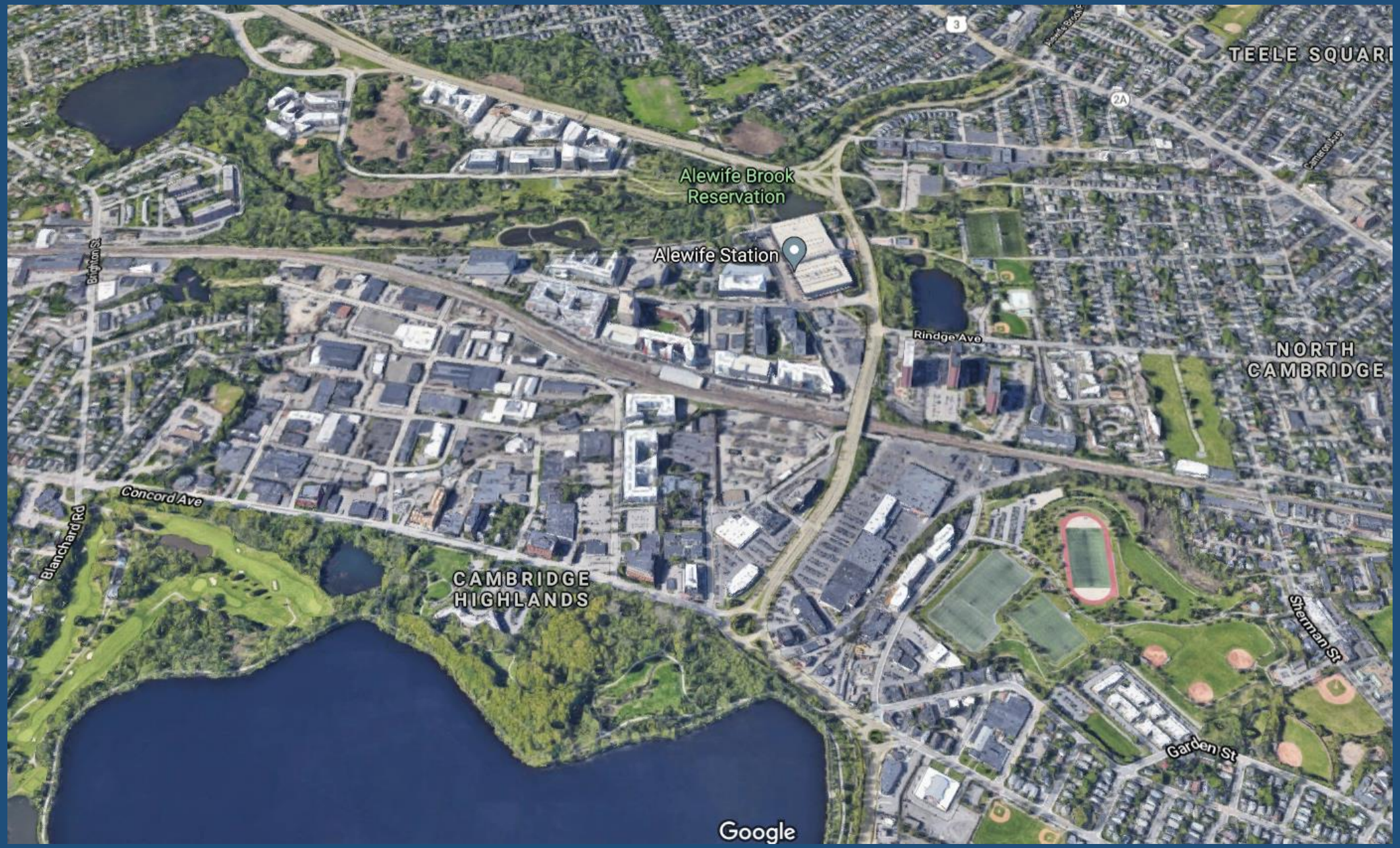
A portion of the Fresh Pond Marshes as they exist to-day. The hills in the distance are in Watertown. Photo by William Lyman Underwood.

Source: John R. Freeman, *Report on Improvement of the Upper Mystic River and Alewife Brook.* Boston, 1904

Fresh Pond Marshes Drained and Filled for Development, 1952

Cambridge Historical Commission

Alewife Area, 2021



Google Maps, 2021

Broadway at Hampshire Street in the Port Neighborhood, July 10, 2010

Cambridge Department of Public Works