Appendix 1a: Original survey from Pritchett and Freeman, 1903

Appendix 1b: Original survey from Ferullo, DiPietro, and Shaughnessy, 1981

Appendix 1c: Original survey from Breault et al, 2000

WATER DEPTHS, THICKNESS OF POST-1908 SEDIMENT, AND SEDIMENT SAMPLING LOCATIONS,
LOWER CHARLES RIVER, MASSACHUSETTS

by
Robert F. Breault, Kevin D. Reisig, Lora K. Barlow, and Peter K. Weiskel
2000

Appendix 1d: Publically available format for the 2016 survey.

Lower Charles River Depth Chart

CRAB and MIT Sea Grant Chart Project

www.charlesriverallianceofboaters.org/chart.html

http://seagrant.mit.edu/charleschart/

Introduction to the Chart Project

Sediment deposition continues to be a problem in the Charles River. In recent years, buildup of sediments has caused several incidents that resulted in property damage and personal injury. While sediment buildup appears to be a larger problem where major tributaries empty into the Charles, such as Laundry Brook, Hyde Brook, Faneuil Brook, Muddy River, and Stony Brook, once the sediment is in the river it can spread to other areas. There have also been extraordinary events, such as water main breaks in Weston in May, 2010 and near the Anderson Bridge in August, 2015, both of which moved large amounts of sediment. This problem is not limited to the areas upstream of the Boston University (BU) Bridge. A significant bar upriver of the Massachusetts Avenue Bridge is shallow enough and large enough to be a navigational hazard to both sailboats and motorboats.

It has been difficult to marshal the resources to remediate areas impacted by increasing sedimentation since much of the knowledge about the shallows and bars has come from the daily experiences of the boaters on the river but not supported by quantitative data. To address this issue, the Charles River Alliance of Boaters (CRAB) developed a partnership with the MIT Sea Grant College Program to create a chart of the river depth between the Charles River Dam and the Watertown Dam, and to monitor changes in the river bottom in the future. Based upon some feasibility studies done in late 2015, more detailed and extensive measurements were undertaken in 2016.

The initial scope of the project is described below:

1. Depth Measurement

The project team used a Lowrance HDS-7 chartplotter/fishfinder with Point-1 GPS, HST-WSBL broadband, and LSS-2 sidescan sonar transducers for depth measurements. In areas of the river that are wide, survey lines were spaced between 30 and 65 feet apart and driven at speeds generally between 3 and 4.8 knots. Where the river is narrow, several passes were made up and down the river over multiple weeks. Broadband sonar was used during the entire survey, resulting in recordings of both depth and relative hardness of the river bottom, as well as time and position of each sonar reading. In addition, sidescan sonar was used downriver of the BU Bridge to capture images of the river bottom and objects of interest.

2. Influence of Daily Water Releases

As part of flood control measures, water from the river is released from the Charles River Dam into Boston Harbor at low tide and held in the river at high tide. This causes the water level in the river to change several inches over the course of a day. A USGS gauge at the First Street Bridge in Cambridge records this variation in the height of the watersheet. While this gauge is a good measure of the river level downstream of the BU Bridge, there were no gauges between this location and the Watertown Dam.

In order to better understand the variation in watersheet over the entire survey area, the project team installed Crain 4 ft. stream gauges and Onset HOBO Model #U20L-04 Water Level Data Loggers at Riverside Boat Club, Herter Park, and Community Rowing facilities. These additional gauges provided insight into how the height of the watersheet varies along the length of the river. During the 2016 summer, the gauges indicate that the river acted as a lake, with the height of the watersheet varying uniformly along its gauged length within .1 ft. If there had been more rainfall or more substantial dam releases, it was expected that the height of the watersheet would have varied along the length of the river. We plan to keep the additional gauges installed for a few years and to monitor how the height of the watersheet changes during periods of significant rainfall.

In order to more accurately determine the depth of the river, all raw depth measurements have been adjusted to account for the variation in the height of the watersheet, and referenced to a First Street Bridge gauge height of 107.5 ft.

3. Development of Digital Charts

The raw sonar data gathered in the field was first processed using ReefMaster PRO mapping software. This generated two-dimensional contours of both depth and relative hardness that were then exported as ESRI shapefiles. ReefMaster was also used to construct sidescan sonar mosaics of the river bottom. ArcGIS ArcMap was used to organize additional geospatial data, including landmarks, elevated structures, detailed shorelines, and contour annotation into completed charts.

The web version of the chart is the product of a simplified workflow combining the best of ArcGIS and open-source web mapping frameworks. The refined, multi-layer map package developed in ArcMap is uploaded to ArcGIS Online, where the individual layers are made available as Web Map Services (WMSs). WMSs is then used to import the ArcGIS Online layers into a mobile-friendly, highly-customizable web environment coded in Leaflet and CartoDB javascript frameworks.

Statement of Accuracy

Vertical Uncertainty: This chart represents depths as determined by fishfinder sonar and is based on echo from the top layers of sediments. Given these readings, transducer uncertainty, and related factors, the depth accuracy is stated as +/-5%. In areas of loose sediments, manual measurements could result in depths several tenths of a foot greater than those based on fishfinder sonar.

Horizontal Uncertainty: Based on specifications of the GPS used in the survey, horizontal accuracy is stated as 3m. except in areas where GPS satellite signal is degraded, such as under bridges, especially the Zakim Bridge. Uncertainty in lateral position may give rise to additional uncertainty in depth. Also, as an artifact of chart processing, depths immediately adjacent to walled sections above the BU Bridge are depicted as sloped contours rather than discrete steps.

Project Personnel

Carl Zimba: Project Coordinator, Charles River Alliance of Boaters
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Ben Bray: Website development, MIT Sea Grant College Program

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- Charles River Conservancy
- Generous individuals

Financial contributions to support this project can be made at www.CharlesRiverAllianceofBoaters.org/chart.html

Notice

This chart is intended to be used as an aid to recreational boaters, but should not be relied upon for navigational purposes because of the limitations on scale and ever-shifting depths of the river. The use of this chart is at the user's sole risk. The user agrees that neither CRAB nor MIT shall be responsible for any injuries or property damage that a user or others suffer or cause from the use of this chart or any Data related to the Project. The user shall indemnify and hold CRAB and MIT harmless from any claims arising from its use.

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