



# Center for Coastal Studies Provincetown

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Ms. Carole Ridley  
Coordinator, Pleasant Bay Alliance  
PO Box 1584  
Harwich, MA 02645

27 August 2018

**RE: Proposal to continue recording, analyzing and reporting on tide data on behalf of the Pleasant Bay Resource Management Alliance.**

Dear Ms. Ridley:

This letter outlines our proposal to continue our study of tides at Meetinghouse Pond, Chatham Harbor and the adjacent region to benefit management of the greater Pleasant Bay system.

## Overview

In August, 2012, the Center for Coastal Studies (“CCS”) reported to the Pleasant Bay Resource Management Alliance (“the Alliance”) the results of a tidal study that had been requested by the Alliance. The study revealed significant interannual variations in tidal range and mean tide levels at Meetinghouse Pond and Chatham Harbor, and the report suggested that those variations resulted from a combination of regional sea level changes and local geomorphic changes in the Pleasant Bay/Chatham Harbor system.

In a second report to the Alliance, Analysis of tidal data from Meetinghouse Pond, Chatham Fish Pier and Boston: January 2012 – June 2015, submitted in November, 2015, CCS noted a 25-month trend of decreasing tidal range at Chatham Harbor, and suggested that changes in the physical characteristics of the estuary’s hydraulic system – primarily extension and narrowing of the tidal channel at the south inlet - were responsible.

Recognizing the potential navigational implications of a continuing decrease in tidal range at the south inlet, and the value of monitoring such change, CCS continued the tidal research following completion the second report and, in October, 2016, submitted a third, Analysis of tidal data from Meetinghouse Pond, Chatham Fish Pier and Boston: July 2015 – July 2016. This document reported a continuation of decreasing tide range at Chatham Harbor over the study period. Minimum values reached in 2016 were as much as 30 cm (1 ft) less than maximum ranges recorded in 2010 and 2011 (Figure 5a). It also reported that tidal range at Meetinghouse Pond, which had reached a maximum in 2010, three years following initiation of North Inlet, had continued its decrease since that time – finally reaching, in 2016, tidal ranges characteristic of the years prior to the inlet formation.

Equally significant were the new report's findings regarding the changing pattern of differences between mean low water (MLW) levels at Meetinghouse Pond and Chatham Harbor (Figure 6b). Beginning in 2010 differences between MLW levels at the two stations increased until 2013, when Chatham Harbor low water levels stood some 50 cm below those at Meetinghouse Pond. However, for the following three years - and continuing to the present time – the difference in level decreased at an average rate of about 5 cm per year.

Low water levels in the Pleasant Bay/Chatham Harbor system are indicative of its tidal flow characteristics – a greater gradient (downward slope from Meetinghouse Pond to Chatham Harbor) indicates stronger ebb currents at South Inlet. Since the ebb dominance of that inlet (initiated in 2007 by the opening of North Inlet) plays a significant role in maintaining it, the observed decrease in difference between low water levels is a matter of concern and should be carefully monitored.

Accordingly, we propose to continue tidal measurements and analyses for the Alliance for another two years, From 01 July 2018 through 30 June 2020 with a final report due by December 2020.

### **Proposed Scope of Work**

*Meetinghouse Pond tidal characteristics.* Data retrieved from the NPS tide recorder that is deployed at Meetinghouse Pond will be compiled, corrected for atmospheric pressure, and analyzed to determine monthly tidal characteristics with respect to the NAVD88 vertical datum. The data will be processed at CCS using matlab software to produce monthly mean high and low water, mean sea level, and tidal range statistics.

*Chatham Harbor and Boston Harbor tidal characteristics.* A similar set of tidal statistics for Boston Harbor will be obtained from the relevant NOAA website. Chatham Harbor tide data will be obtained from one or both of two sources: the NOAA website and the NPS tide recorder established at Chatham Fish Pier in March, 2015. The NPS instrument was established because of malfunction of the NOAA recorder, but at present both recorders are functional. The NPS data will be processed as described above (for Meetinghouse Pond data).

*Interpretation and reporting.* The resulting set of tidal statistics will be analyzed to determine the patterns and trends of change over time at each station and between the stations. Those trends and patterns will be reported annually, and a final report will summarize, interpret, and discuss the results with respect to changing tidal and oceanographic dynamics as well as the changing coastal morphology of the system. Since the final report will include a cumulative view of the newly acquired data together with data previously acquired and discussed, it will provide - as the time series lengthens - ever greater insight into the coupled tidal, sea level, and geomorphological processes operating within the system.

*Time intervals of study.* This study will report on tide data collected between July 2018, and June, 2020 (see, "Time Frame" below); monthly tide data will be presented and described in annual reports. The first report (discussed above) focused on data for the period, July 2018 – July 2019. The second annual report will be devoted to tide data acquired over the period, July 2019 -

June 2020, and the final report will cover a five-year period, July 2015 – June 2020. All work will be completed by December 31, 2020.

### **Deliverables**

Annual reports will be submitted presenting results of the work in the form of graphs and brief text. A final report will include a discussion of the results with respect to the coastal sedimentary and tidal dynamics of the system.

### **Time Frame**

The project will continue until 31 December 2020, with data collection ending in June 2020. It includes, as the first annual report, a report issued in December 2019 that covered the period, July 2018 – July 2019, while the final report will be submitted in December 2020.

### **Costs**

Dr. Graham Giese will be responsible for the proposed study and reports. CCS will charge \$5,500 for YR 1 and \$6,000 for YR 2 for a total project cost of \$11,500, covering all necessary salary, overhead and operational costs. CCS will invoice the Alliance for work satisfactorily completed.

Thank you for the opportunity to submit this research proposal.

Sincerely,

A handwritten signature in cursive script that reads "Richard Delaney". The signature is written in black ink on a light-colored background.

Richard Delaney  
President and C.E.O.