

Developing Back Bay

Pre-Handout

Scope and Background

This is your third project and substantially different from the first two. It is actually a large scale planning project and as such, it is open ended. Its complexity requires that the design is done by a team with each team member concentrating on a specialty. You should follow the design process as given to you in the lectures.

The intent of this project is to have you define the constraints (boundary conditions) as part of the problem formulation. While it may be unusual to have such a “wide open” project, it is a good way to start with any planning or design project to assume very relaxed boundary conditions. This will give you the freedom to come up with innovative solutions even when you add constraints.

In this particular exercise you will not only have the opportunity to plan and design a different “Back Bay” but you will be able to compare what was actually done with what one (you!!) could have done.

Imagine Boston in the topographical shape of the late 18th century!

When the first settlers founded Boston, its topography looked much different from what it looks now. At that time Boston was a pear-shaped peninsula, which was connected to the mainland only through a narrow neck. (Figure 1).

The peninsula was bordered by large tidal flats and had many inlets and coves. One of these, North Cove, was cut off by a mill dam/causeway already in 1640 (Figure 2). On a small scale, the shoreline was changed more or less continuously from that time onwards. However, changes on a larger scale did not occur until the beginning of the 19th century.

Design Task

You are charged with the development of the Back Bay area based on the topography as it existed around 1800 (Figures 3, 4) but using modern construction technology and satisfying present day requirements. You have to create a mixed residential-commercial area with 50,000 inhabitants. You are completely free in your choice of buildings, access (transportation), utilities, providing foundations and so on.

The result of your work should be in form of a rough plan indicating residential/commercial zones, major streets or other access. In an accompanying report (max. 4 pages, double-spaced) you should explain how your design satisfies the boundary conditions and how it addresses structural, aesthetic and environmental concerns. You should also indicate if what you propose will end up with medium or with high costs. More specific comments on the deliverables are given on the next page.

Very important: Do not assume that what has been done, i.e. the present Back Bay, is the best solution!

Topography

The topography of Boston you have to work with is as shown in Figures 3 and 4. [For your information, a map of the present Back Bay with the late 18th century shoreline is presented in Figure 5.] 1. The Charles River was a tidal basin with the tides varying between el. 100.8 ft. (mean low water level) and el. 110.2 ft. (mean high water level). The highest reported tide occurred in 1851 with el. 116.6 ft. The elevation of the adjacent land is approximately 117 feet. (See next section for explanation of elevations.) As mentioned above, part of the Charles River bottom was exposed during low tide, forming so-called tidal flats. Conversely, during high tides, the water level in Boston Harbor may be such to cause considerable backflow into the Charles River. If this occurs in conjunction with major rainfall and large flows in the Charles River, the shore areas can be flooded.

While you are completely free to plan “your Back Bay” in the Charles River Basin, you should not include the original peninsula in your design, except for the connections to your new Back Bay.

Geology, Rules of Thumb for Foundations

A typical soil profile of the present Back Bay is shown in Figure 6. Note: There was no fill when the original Back Bay was developed. So you have to decide if you want to fill and how much. One-story buildings can be placed directly on the fill without basements, 3-5 story buildings can be placed on the fill with a 1-story basement. Higher buildings require correspondingly more basements. High rises up to 15 stories can be put on piles reaching into the till; higher buildings have to put on piles reaching the bedrock. Clearly deeper foundations cause higher costs.

As indicated earlier, you should work with the most modern construction technology and materials. If you want to fill the area with soil before building, you can either use gravel from gravel pits in the Needham area or from dredging in the Charles River next to Back Bay. (You need to think about the consequences using these material resources, however.)

Protection from High Tides

One of the options you may consider is to close off the Charles River from Boston Harbor (as it is done now). Keep in mind, however, that what you propose will have some environmental impacts, which you have to address.

Several other cities have installed facilities to protect themselves from high tides. Here are some examples:

London: Complete. The Thames barriers are open during normal operation but closed during surge tides (see Figures 7 – 8).

Venice: Being built. To protect the lagoon from high tides, a new barrier system is being built (see Figure 9).

Environmental Issues

You might replace some of the tidal basin with fill. This will have several effects that you need to consider: Less available volume for tidal inflow, less available volume for rainwater accumulation (both locally and from upstream). Also, buildings, streets, etc. will have an effect on the groundwater and vice versa. Your design should minimize negative environmental effects or, even better, have positive effects.

Cost

No detailed cost calculations are required. You have to estimate, however, if your scheme will involve medium or high costs. You have to provide some arguments of how you get your estimates.

Deliverables

- Land use plan with transportation network, building type both re. use and height, and other land usage. (You can use something like Figure 10 as a framework for your plan.) This is part of the report below.
- Report with figures (the figures are in addition to the 4 page text) describing:

- Land use reasoning
 - Foundation cross-sections for typical buildings, transportation structures
 - A "type plan" for one of the buildings with the surrounding area
 - Utilities concept (utilities = gas, electricity, telephone, freshwater, wastewater)
 - Concept to handle rain - and groundwater
 - Concept to handle tidal problems
 - Cost Estimate "Medium or High". Provide arguments why you get the particular estimate.
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- Oral presentation

Figure 1. Boston Fill 1630-1995
From N.S. Seasholes. Gaining Ground, MIT Press 2003

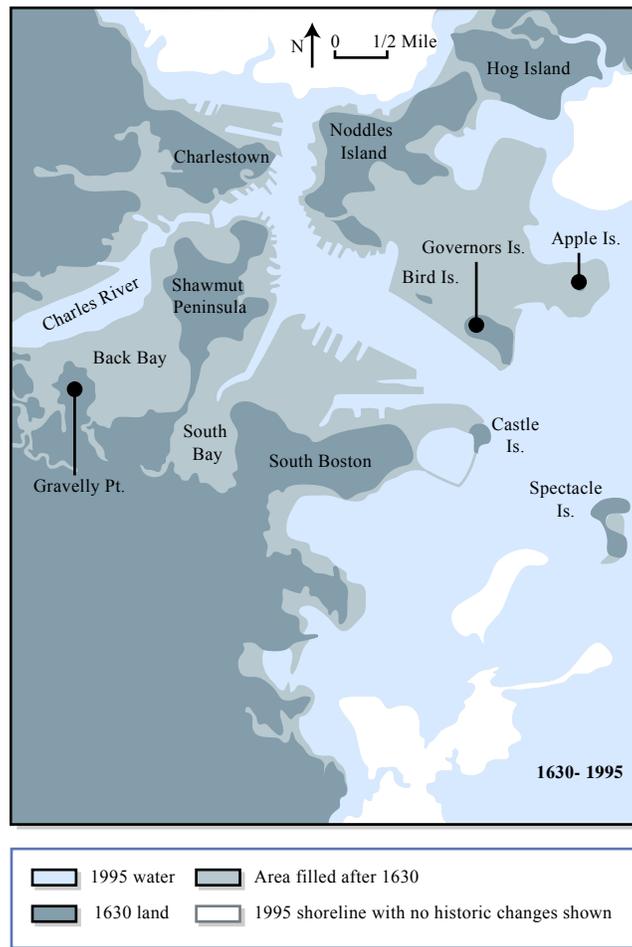


Figure by MIT OCW.

Figure 2. Mill Pond
From N.S. Seasholes. Gaining Ground, MIT Press 2003

Image removed due to copyright restrictions

Figure 3. Boston, 1776.
From Mapping Boston
Leventhal Foundation
Eds. A. Krieger, D. Cobb, 1999

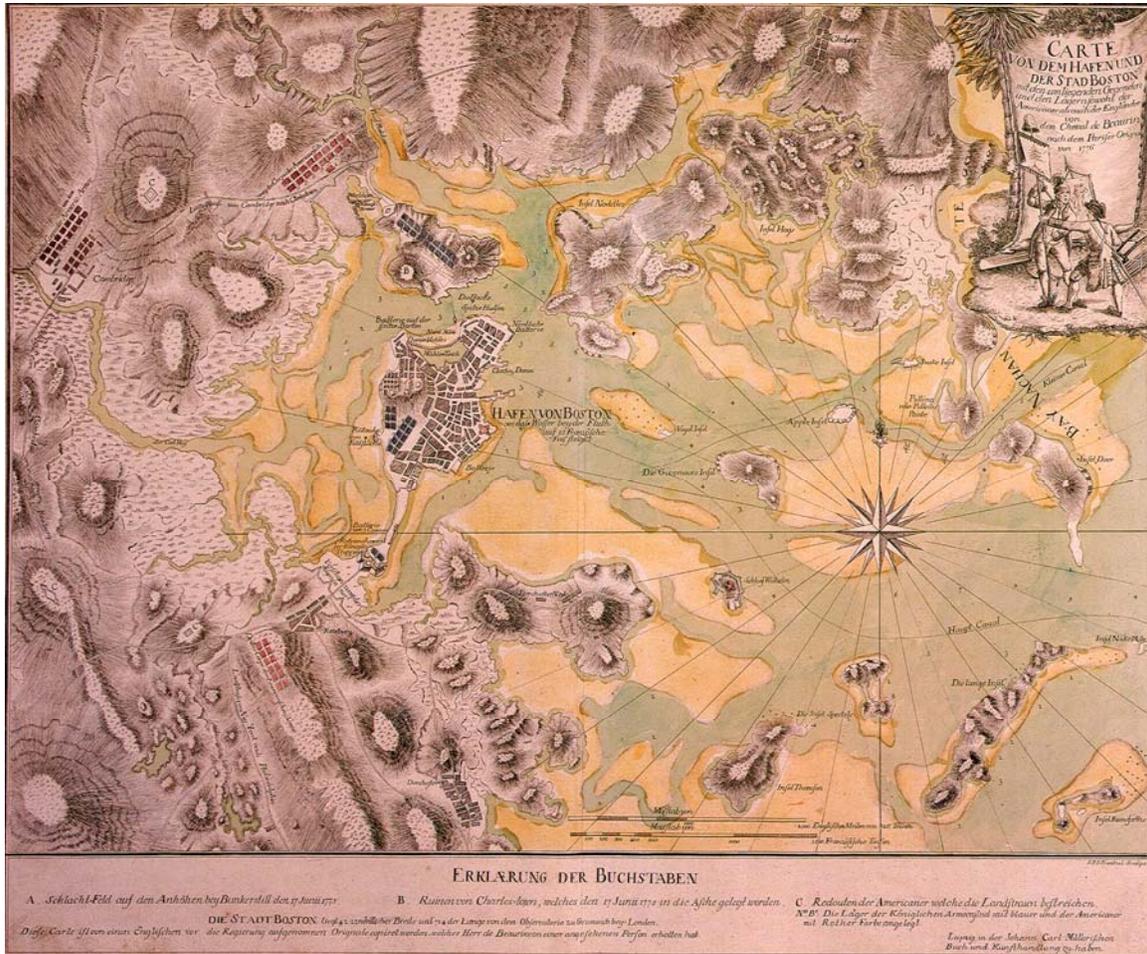


Figure 4. Boston 1814
From Mapping Boston
Leventhal Foundation
Eds. A. Krieger, D. Cobb, 1999

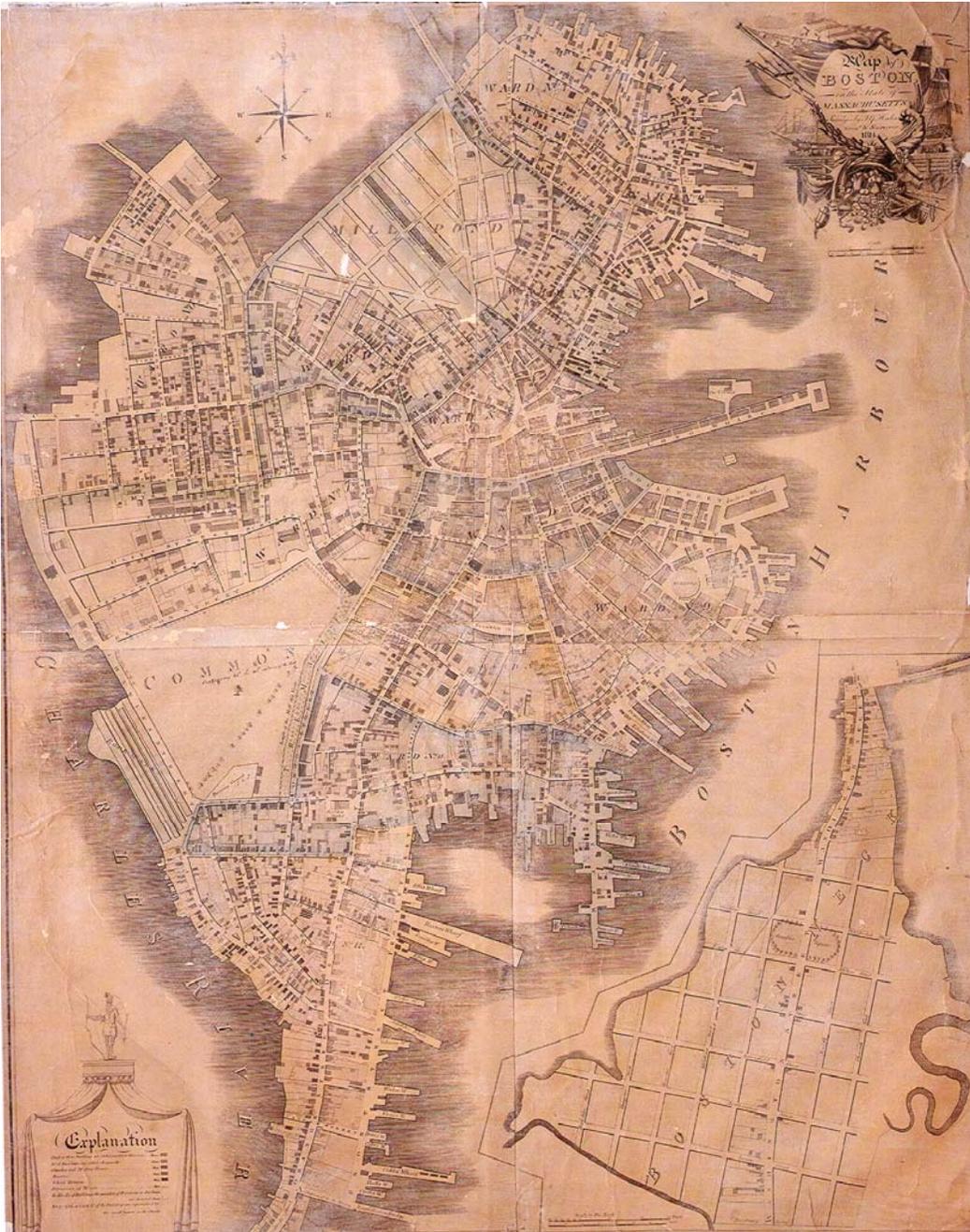


Figure 5. Boston Back Bay – Present Street Map and Original Contour of Boston Peninsula (dash line).

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Figure 6. Typical Soil Profile and Datum Relationships

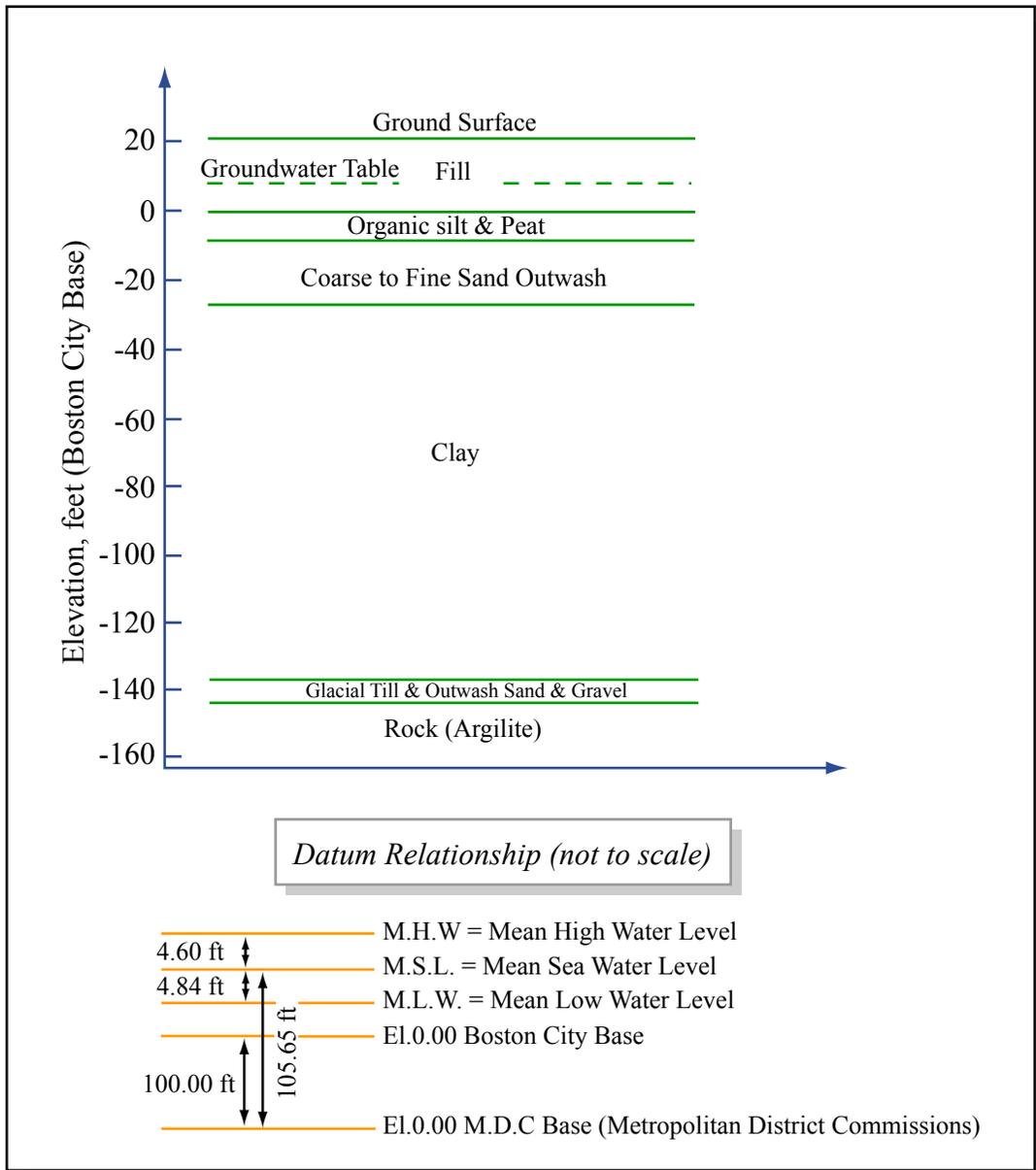


Figure by MIT OCW.

Figure 7. Thames Barrier – Cross Sections of Gate

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Figure 8. Thames barrier – Operation Positions of Gate

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Figure 9. Venice – Proposed Gate System

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Figure 10. Framework Plan (Original Peninsula with Major Streets and Present Bridges).

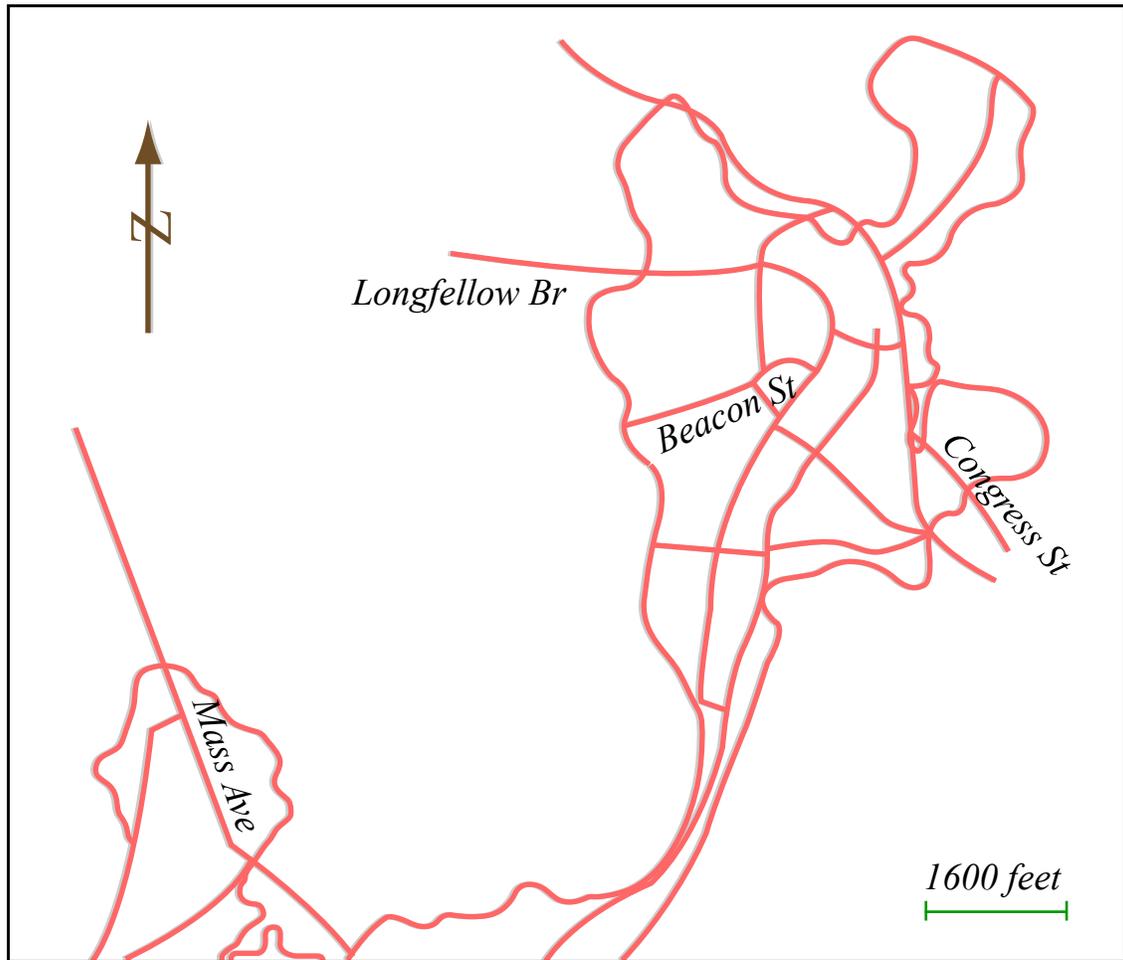


Figure by MIT OCW.