**Environmental Project 3**

**Dredging and CAD Cell Investigation, Salem Harbor**

**GLS 470: Field Camp 1**

**Goal:** The ultimate goal of this assignment is to gain valuable experience in conducting an environmental assessment of a real-world problem. You will be working for *Viking Consulting, LLC* as an environmental geologist. Your company has been hired by the City of Salem to assess an appropriate location for contaminated dredge spoils from the proposed dredging of the South River, Salem, MA. Your boss has made you the project manager.

**Objectives:** This exercise will introduce you to the following:

1. Plan and conduct coastal marine seismic surveys (bathymetry and sub-bottom sonar)
2. Adjust bathymetry data for tidal stage and produce a bathymetric chart
3. Calculate the volume of sediment to be dredged to achieve the goals of the client.
4. Process and interpret sub-bottom sonar data using state-of-the art processing software
5. Interpret seismic reflectors and produce isopach maps of sediment unit thicknesses
6. Address the theory of seismic reflection sub-bottom analyses, and the strengths and weaknesses of different seismic frequencies
7. Produce lithologic logs of sediment cores
8. Identify and interpret the correlations between litho-stratigraphic units and seismic-stratigraphic units
9. Read a bathymetric chart
10. Accurately locate yourself in a marine field environment (without GPS!)
11. Accurately measure, record, and summarize data in the field
12. Take thorough and organized field and lab notes
13. Synthesize and interpret data
14. Work in a safe and productive manner on the water and on land
15. Write a professional-quality environmental geologic report that synthesizes data collected and interpreted, and provides recommendations to the client regarding the original question of concern

**Introduction:**

The city of Salem is interested in dredging the South River as outlined in the Salem Harbor Plan, published in 2008. The city has hired your environmental consulting company to determine the feasibility of the dredging, and where the dredge spoils might be sequestered. Specifically, the city has hired you to answer the following questions:

1. What will be the volume of dredge spoils that will need to be disposed of?
2. Assuming the dredge spoils are contaminated, will it be feasible to dispose of the material in a confined aqueous disposal (CAD) cell located in one of the city’s target areas? The three target areas are:
   1. The area northeast of Derby Wharf,
   2. The dredged turning basin adjacent to the power plant,
   3. Cat Cove.

Salem’s plan specifically calls for the South River Basin (west of the Congress Street bridge) to be dredged six feet below the MLLT (mean low low tide) depth and at least ten feet away from any sea walls. The South River channel (east of the Congress Street Bridge) and Salem Wharf are to be dredged twelve feet below the MLLT value.

**Instructions**

*Volume of Dredge Spoils*: You will be given a bathymetric chart of the South River corrected to MLLW. The grid is 0.01 minute increments, which means that each cell is 61’ wide and 45’ tall. This results in a surface area of each grid cell of 2745ft2. If you multiply this area by the average thickness to be dredged for each cell, it will give you a volume in cubic feet. When you add all of the volumes together, you will have calculated the total volume of material to be dredged. You will want to convert from cubic feet to cubic meters to compare to your sub-bottom data. A good resource for this is [www.onlineconverstion.com](http://www.onlineconverstion.com).

*CAD Cell Locations*: This is a multi-step process that is largely driven by sub-bottom sonar data interpretations. For each of the three sites, you and your group will need to make a survey plan for acquiring the data. Once data are collected, you will need to process the data and identify the seafloor, Holocene/Pleistocene disconformity, and acoustic basement. You will then use these data to produce isopach maps of both Holocene (estuarine) and Pleistocene (glaciomarine) thickness.

You will need to compute the volume of Pleistocene material for each site in order to determine if there is enough space to accommodate the dredge spoils. You can calculate the volume in the same way that you calculated the volume of material to be dredged.

**Final Product**:

A final report to the client will be due at 5:00 PM on XXX.  The report should have the following sections:

**Abstract** (200 word maximum)

**Introduction and Background** (what does Salem want to do; what were you hired to do; background information on CAD cells, contaminated seds, etc)

**Methods** (sub-bottom collection, bathy survey, geophysical processing, volume calculations, etc)

**Results** (Present all of your results for the project.  I suggest organizing results into two sections: 1) what is the nature of the proposed dredged spoils (volume, contaminated?), and 2) data on the stratigraphy in the potential CAD locations, isopach maps, etc)

**Discussion** (This is where you discuss your recommended sites for a CAD cell with pros and cons for the various sites; also discuss uncertainties here)

**Conclusions** (brief 1-2 paragraphs summarizing your findings and recommendations)

**References Cited** (use GSA Bulletin format, found on their web page)

**Appendix 1**: Optimum sonar configuration report for each target site

**Appendix 2**: All sub-bottom data in your SonarWiz project burned to CD or DVD.

The text need not be long, but the report will likely be long due to the appendices and figures.

Remember, the specific questions to be addressed in your report to the client are:

1. What is the volume of sediment (cubic feet and cubic meters) that will need to be dredged from the South River to meet client goals?
2. Which of the three target areas in Salem Harbor would be the best potential site for a CAD cell?

I expect that to have a complete report you will need at least the following figures:

1. Locus map showing Salem with respect to the rest New England (find a simple line map at d-maps.com), and a zoom in showing the harbor with South River and each of the target CAD cell locations labelled (GoogleEarth, scanned chart, etc),
2. Map with all sub-bottom line locations (Pull this out of SonarWiz),
3. Bathymetric chart of South River,
4. At least one "Money Shot" example profile from each target location with seafloor, disconformity, and acoustic basement reflectors shown and labeled, and the Holocene and Pleistocene sediment packages clearly labeled.  Be sure they have scales and vertical exaggeration reported,
5. Holocene isopach map for each of the three target areas,
6. Pleistocene isopach map for each of the three target areas,
7. Map of Salem Harbor illustrating proposed CAD cell location.