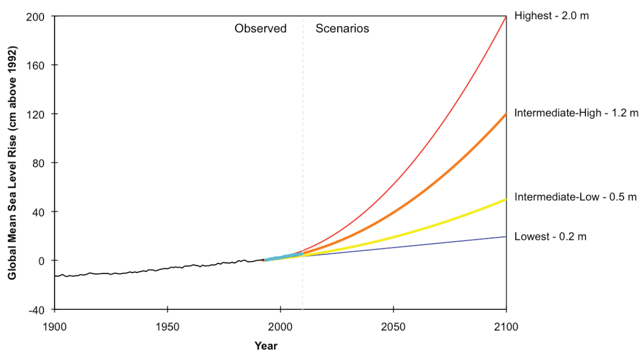
# Appendix A

**SLR Analysis and Calculations**

The methodology presented in NOAA's report is similar to the methodology described in the US Army Corps of Engineers guidance document for incorporating future sea level change considerations in civil works programs (USACE Circular 2011), except that the coefficients in the equations for the three SLR scenarios are different.




Local mean sea level changes can be estimated by considering tide gage records in combination with models or actual measurements of Earth's local tectonic movement. The NOAA tidal gage at Boston Harbor (station ID 8443970) has recorded an increase in relative mean sea level of 2.63 mm (+/- 0.18 mm) annually based on monthly mean sea level data from 1921 to 2006. Over that same time period, the global rate of sea level rise was about 1.7 mm annually. This implies that there is about 1 mm per year local land subsidence in the relative sea level record for the Boston area (MA Adaptation report 2011). This rate of subsidence will be factored in the global SLR scenarios to determine the relative SLR for Cambridge by 2030 and 2070.

The method to calculate global SLR as predicted by the "Highest" and "Intermediate-High" scenarios is based on the equations provided in the NOAA Technical Report on "Global Sea Level Rise Scenarios for the United States National Climate Assessment" published in December 2012. According to this report, the non-linear trajectory of SLR is represented by the following quadratic equation:

$$E(t) = 0.0017t + bt^2 \qquad (1)$$

where 't' represents years starting from 1992, which is the mid-point of the current NOAA National Tidal Datum Epoch (NTDE) starting from 1983-2001, b is a constant, and E(t) is the global SLR in meters as a function of t. To fit the curves, the constant 'b' has a value of 1.56E-04 (Highest Scenario), and 8.71E-05 (Intermediate-High Scenario)

However, if it is required to estimate a projected rise in global SLR for any of the above scenarios, but starting in a year more recent than 1992, the following equation is proposed by the NOAA report (2012):

$$E(t_2) – E(t_1) = 0.0017(t_2-t_1) + b(t_2^2 – t_1^2) \qquad (2)$$

Where $t_1$ is the time between the beginning year of interest and 1992 and $t_2$ is the time between the ending year of interest and 1992. For this study, we considered the beginning year of interest as 2013 since the study is being conducted now. The ending years of interest are 2038, 2063 and 2088 as the 25-, 50 and 75-year time horizons..

The table below shows relative SLR estimates for South Shore communities in 10-year increments based on global SLR estimates (according to equation 2) and local subsidence effects. Note that these values may be higher as they do not include the possible increase in relative SLR due to changes in regional circulation patterns of up to 8 inches by 2100.

| Scenarios | 2020 | 2030 | 2038 | 2040 | 2050 | 2060 | 2063 | 2070 | 2080 | 2088 | 2090 | 2100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Global SLR (from 2013) - "Highest" (feet) | 0.21 | 0.61 | 1.00 | 1.10 | 1.70 | 2.40 | 2.63 | 3.21 | 4.11 | 4.91 | 5.12 | 6.23 |
| Land subsidence (feet) @ 0.04 in./ year | 0.03 | 0.06 | 0.08 | 0.09 | 0.12 | 0.15 | 0.17 | 0.19 | 0.22 | 0.25 | 0.25 | 0.29 |
| Total Relative SLR - "Highest" (feet) | 0.24 | 0.67 | **1.08** | 1.19 | 1.82 | 2.56 | **2.80** | 3.39 | 4.33 | **5.16** | 5.37 | 6.52 |

Note: Relative SLR for a scenario is the sum of global SLR for that scenario and land subsidence. For example, relative SLR of 5.16 ft. by 2088 (75 years) according to the "Highest" scenario is the sum of global SLR of 4.91 ft. and land subsidence of 0.25 ft. by 2088.