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Attachment 3

LSPA CLIMATE CHANGE SUBCOMMITTEE

FICTIONAL CASE STUDY #1 –

COASTAL FLOODING AND LNAPL DISPOSAL SITE

Climate Change Vulnerability Assessment, October 2022

-- Site Exposed, Remedy Likely Vulnerable --

I. Conceptual Site Model (CSM)

Site Characteristics:

The site is the Fan Pier Courthouse at 12 Northern Avenue, Boston, MA 02110. The 4.56-acre site is covered by a ten-story building, masonry walkways, and landscaping. The site building is serviced by natural gas and municipal water and sewer.

Site Area

The site is in a commercial area and is adjoined by Boston Harbor to the north, multi-story office buildings to the east, Northern Avenue to the south, and Fort Point Channel to the west. The disposal site is within flood zones.

Site History:

The site was originally part of Boston Harbor until the filling of this section of South Boston in the mid-1800s. The site was covered by warehouses and railroad spurs from the late 1800s to approximately 1970. The current courthouse facility was constructed in 2000.

Site Geology (This is an estimate of geological conditions for this case study):

The site is located on Boston Harbor and is approximately 5 feet above sea level. The site subsurface geology consists of approximately 20 feet of fill, over sand and gravel, over silt and clay, over glacial till, over bedrock. The water table is approximately 5 feet below ground surface within the fill material, and the groundwater flows to the north to Boston Harbor and to the east to the Fort Point Channel.

Site Oil and Hazardous Material Use (This is a fictitious scenario created for this case study):

Various hazardous materials and oil have been stored on the site during its extensive industrial use prior to the construction of the courthouse. In 2000, a 10,000-gallon, No. 2 fuel oil underground storage tank (UST) was installed adjacent to the northern extent of the site building and approximately 100 feet from Boston Harbor. The site building was recently converted to natural gas heat, so the UST was removed.

Response Actions (This is a fictitious scenario created for this case study):

On January 4, 2018, the UST was removed and appeared to be rusted. Evidence of petroleum contaminants was observed in surrounding soil. Four soil samples were collected from the excavation and screened in the field using a Photo Ionization Detector (PID) and the MassDEP headspace method. Two of the samples showed headspace readings above 100 ppmv. On January 5, 2018, the headspace readings exceeding 100 ppmv were verbally reported to MassDEP, which issued a Notice of Responsibility with a Release Tracking Number (RTN) of 0-00000. The MassDEP also verbally approved Immediate Response Action (IRA) activities that included additional assessment and excavation of up to 100 cubic yards of petroleum impacted soil.

The four samples were subsequently analyzed by a chemical laboratory for extractable petroleum hydrocarbons (EPH) and volatile petroleum hydrocarbons (VPH). EPHs were detected in soil at concentrations below Massachusetts Contingency Plan (MCP) Method 1 S-1/GW-1 standards. Twenty cubic yards of impacted soil was transported to a licensed disposal facility after the completion of the required chemical analyses for the disposal facility.

Additional assessment discovered light non-aqueous phase liquid (LNAPL) in the area of the former UST at a depth of four to six feet. The LNAPL was subsequently determined to be stable, non-mobile, and less than 1/2-inch in thickness. The removal of the LNAPL was determined to be infeasible in accordance with the MassDEP LNAPL Policy simplified method. An MCP Method 3 Risk Characterization concluded that the disposal site had achieved No Significant Risk.

Climate change vulnerability considerations were incorporated throughout the MCP process for this RTN from the development of the CSM to the selection of the type of MCP closure. Additionally, a final climate change vulnerability assessment, as discussed below, was completed when considering if a Permanent Solution Without Conditions is applicable.

II. CLIMATE CHANGE VULNERABILITY

Climate change vulnerabilities will change over time. Current Resilient.MA layers provide estimates of projections (e.g., sea level rise) up to 2030, mid-century (2050), mid-late century (2070), and the end of century (2100). The LSP considers the potential impacts of climate change for the "reasonably foreseeable future." For this case study, the primary planning horizon is 30 years or 2050.

Changes in Precipitation (inland flooding, drought & landslides):
The MCP regulatory closure for this disposal site may be vulnerable to climate change risks posed by increased future precipitation. The four ResilientMA.org precipitation layers (Extreme Precipitation >1, >2, >4 inches, and projected) indicate that the site would be impacted by extreme precipitation. The MCP regulatory closure is contingent on the determination of the stability of the LNAPL (under current climate, i.e., precipitation and groundwater conditions) as described in the MassDEP LNAPL simplified method. Increased precipitation could mobilize the LNAPL by elevating it to the ground surface. Therefore, the disposal site **may be vulnerable** to changes in precipitation.

Sea Level Rise (coastal flooding, coastal erosion)
The MCP regulatory closure of this disposal site may be vulnerable to climate change risks posed by future sea level rise. The site is at an elevation of approximately 5 feet above sea level and on the shore of Boston Harbor. The Resilient MA "Sea level Rise" layer indicates that the sea level may rise 2.4 feet by 2050. For boundary considerations when planning Best Management Practices (BMPs) and other mitigation, the LSP notes that the 'high 2100 scenario' projects a sea level rise of 7.6 feet. The Resilient MA "Sea Level Rise and Coastal Flooding (NOAA)" layer with a predicted rise of 5 feet indicates that the sea level may rise so that the outer extent of the site may be covered, but not the area of the UST. Because sea level rise projections may lead to future inundation of portions of the site, LNAPL could rise with the water table closer to the ground surface and erosion will be more likely. Therefore, the disposal site **may be vulnerable** to sea level rise.

Rising Temperatures (average/extreme temperatures, wildfires, and invasive species)
The disposal site's MCP regulatory closure does not rely on conditions, such as pavement barriers or a vegetative cover, which could be adversely affected by rising temperatures. Therefore, the site is **not expected to be vulnerable** to increased temperature.

Extreme Weather (hurricanes/tropical storms, severe winter storms/nor'easters, and storm surges)
The MCP regulatory closure for this disposal site may be vulnerable to extreme weather risks (hurricanes/tropical storms, severe winter storms/nor'easters, and storm surges). The Resilient MA "hurricane surge inundation zones layer" indicates that the site will be flooded by category 1, 2, 3 and 4 hurricane surge inundation zones. The MCP regulatory closure is contingent on the determination of the stability of the LNAPL (under current climate, i.e., precipitation and groundwater conditions) as described in the MassDEP LNAPL simplified method. Flooding from hurricane surges could mobilize/elevate the LNAPL to the ground surface and/or erode shallow overlying soil that currently limits exposure to LNAPL. Therefore, the disposal site **may be vulnerable** to flooding from extreme weather.

III. Conclusion

Future climate change vulnerabilities are considered when reviewing proposed MCP regulatory closure options. The uncertainties associated with climate change predictions increase with time. Therefore, more weight in the planning process is given to shorter term projections for a reasonably foreseeable future. However, projections further into the future may be considered as boundary conditions for mitigation planning purposes. MCP climate change impact assessments for disposal sites rely on available climate change and flooding projection sources, which include Resilient MA and Federal Emergency Management Agency's (FEMA) National Flood Hazard maps/layers. Resilient MA is a resource clearing house of climate change projections that has been developed for Massachusetts. It provides Massachusetts climate change tools to support decisions regarding climate resilience for local planners, practitioners, policy makers, and the public. FEMA provides Flood Hazard Maps for most of the United States, including portions of Massachusetts.

In consideration of the foreseeable future conditions, the following recommendations could be considered in the future:

1. Further removal of LNAPL prior to submitting a Permanent Solution Statement.
2. Implement nature-based solutions to minimize the impacts of storm surge (From ITRC SRR).
3. Maintain reactive coir mats, soft caps, armor, and hard caps to stabilize and shield surfaces from erosion, storm surges, and tidal influence (from ITRC SRR).
4. Maintain monitoring wells with longer screens so that possible LNAPL can be observed during large water table fluctuations and possible downgradient monitoring wells to assess possible horizontal migration.