MEMORANDUM

To:	Michael McGovern, City of Lowell
From:	Stephen Vetere, PE, LSP, Nobis Engineering
Subject:	Summary of Geoenvironmental Findings, Existing Lowell HS and Cawley Site
Date:	May 30, 2017

The following is a brief summary of the findings of subsurface environmental investigations conducted during the MSBA Feasibility Study for the Lowell High School.

Existing Lowell High School

- The focus of Phase II site assessment activities was on the portion of the campus located to the west of the canal, since this is where the vast majority of demolition and construction (and therefore direct contact with soil) would occur under the proposed Addition/Renovation Options included in the February 2017 Preliminary Design Program.
- The portion of the existing high school west of the canal is built on the former location of the Merrimack Manufacturing Company. Most of the area was formerly occupied by tenement homes for mill workers, but the extreme northwest corner of the campus was formerly part of the mill complex.
- The existing high school is underlain by 5 to 8 feet of historical fill material consisting of sand and gravel with traces of brick, concrete, coal, and ash. In one soil boring, the remnants of what is believed to be an old concrete foundation were encountered.
- The presence of historical fill does not, in and of itself, represent a hazard to site users. Fill materials are currently inaccessible to site occupants because they are either beneath the building foundations or covered by vegetated topsoil material.
- However, historical fill materials do tend to contain anthropogenic contaminants such as polycyclic aromatic hydrocarbons (PAHs) and heavy metals. These contaminants are ubiquitous in urban areas as a consequence of the combustion of wood or coal (i.e. wood ash or coal ash), as a component of asphalt pavement, or from the burning of fossil fuels.
- Ten soil samples were collected from the existing high school site to evaluate soil conditions in areas where potential future construction activities would result in exposure to soils by construction workers and generation of excess soils requiring off-site reuse or disposal.
- Review of soil sampling results suggests that historical fill materials present throughout the existing high school site contain levels of PAHs and lead that would not permit unrestricted use of any excess soils that must be taken off site during construction. Therefore, there will likely be additional costs associated with the reuse or disposal of excess soils generated

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during construction activities at the existing high school site. These costs could be mitigated through the on-site reuse of fill material beneath new buildings, to the extent feasible based on the space available and the structural suitability of the material.

- Review of soil sampling results indicates that arsenic concentrations in shallow soils located adjacent to the railroad tracks are above levels that are suitable for a school campus, and therefore require removal and off-site disposal. MassDEP has been notified of this condition, and plans are underway to have these soils removed from the site.
- Budgeting for a school addition/renovation project on the existing high school site should include provisions for the handling and management of contaminated soils, since it is likely that fill materials in the upper 5 to 8 feet contain PAHs and metals typical of urban fill. Estimated cost ranges: Full Renovation: $30K; Addition/Renovation 2: $75K-$150K; Addition/Renovation 3: $90K-$180K.

Cawley Site

- The Cawley Site has been used for recreational purposes since at least 1938.
- Nobis completed a Phase I site assessment for the Cawley Site. Based on the review of historical records, as well as subsurface investigation records from explorations completed by other consultants during the Feasibility Study, the primary environmental concern for this site is the presence of historical fill material in the northern portion of the site, beyond the outfield fence of the Martin Softball Field. Soil borings and test pits excavated in this area identified fill materials including soil with traces of metal, brick, glass, and concrete.
- A Phase II assessment completed in May 2017 indicated that the extent of fill material is limited to the area north of the softball field. Review of soil sampling results suggests that historical fill materials present to the north of the softball field contain levels of PAHs that would not permit unrestricted use of any excess soils that must be taken off site during construction. Therefore, there will likely be additional costs associated with the reuse or disposal of excess soils generated during construction activities at the Cawley Site. These costs could be mitigated through the on-site reuse of fill material beneath new buildings or parking areas, to the extent feasible based on the space available and the structural suitability of the material.
- A second minor environmental concern was identified through the review of environmental records for the Cawley Site. A former gasoline filling station located at 780 Rogers Street remains open from a MassDEP regulatory perspective. This former retail gasoline facility contains both soil and groundwater contamination associated with a historical release from a gasoline underground storage tank. The inferred groundwater flow direction is from this site toward the extreme southern portion of the Cawley Site, toward the parking area south of the Alumni Baseball Field. The extent of groundwater contamination does not currently extend beneath the Cawley Site, however if extensive withdrawal of groundwater were to occur during construction of a new school, it is possible that contamination could be drawn toward the site. Considering the proposed school plan for the Cawley Site, this scenario is considered unlikely and therefore does not warrant consideration for additional project cost.
- Budgeting for a school project on the Cawley Site should include provisions for the handling and management of contaminated soils, since it is likely that fill materials to the north of the

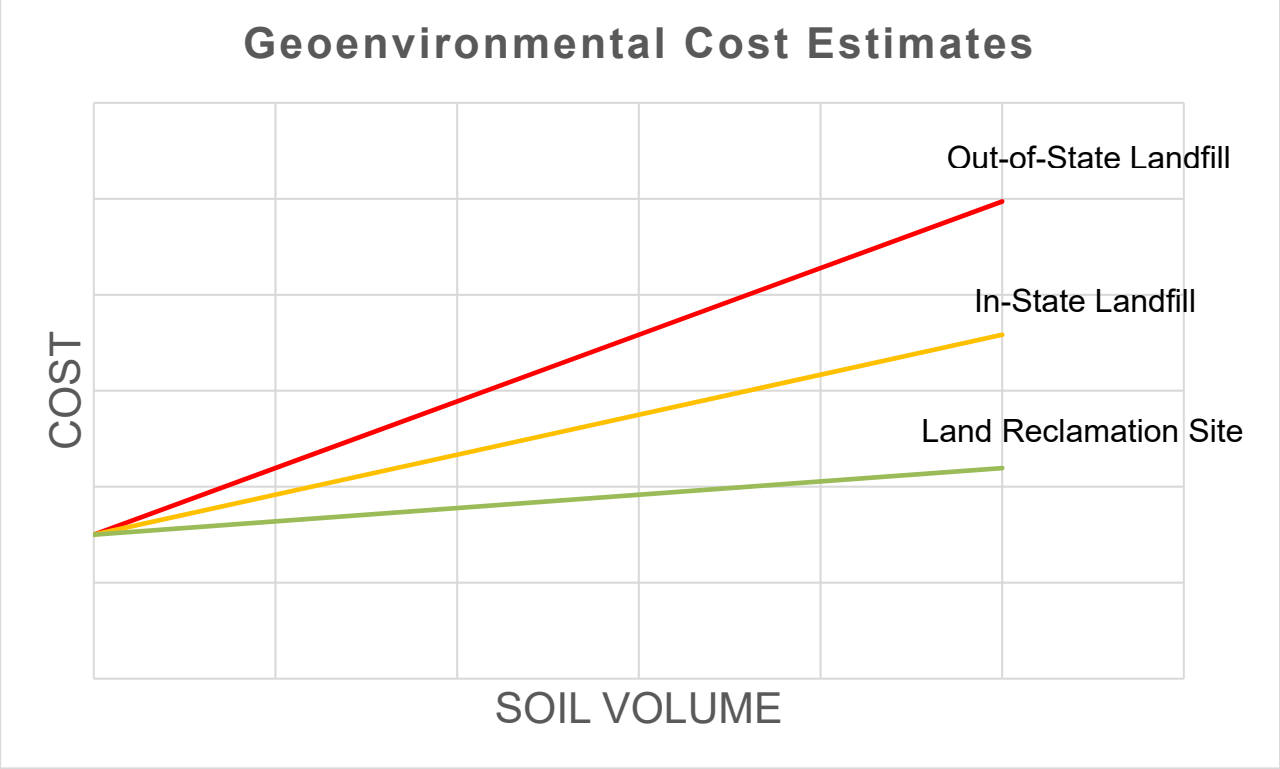
softball field contain PAHs and metals typical of urban fill. Estimated cost ranges: 4-story option: $125K-$250K, 5-story option: $80K-$160K.

All cost estimates should be considered order-of-magnitude budgetary estimates based on the information available to the project team at this early point in the design process. Estimates will be refined as the design progresses and a preferred option is selected.

These budgetary estimates are based on a preliminary estimate of the potential volume of soil that might be removed from each site in order to facilitate construction of new buildings under each scenario. This volume of soil is converted to a tonnage, then multiplied by a range of potential off-site reuse/disposal costs (per ton) that are likely based on the laboratory data from soil samples collected during the Phase II investigations.

The volume of soil removed from the site during construction is dependent upon the design of the new buildings and the extent to which the existing soil is suitable to support new construction. The price per ton to reuse or dispose of excess soils generated during the project is dependent upon the types and concentrations of contaminants present in the soil.

The following graphic provides a general illustration of the sensitivity of these cost estimates to changes in volume or reuse/disposal costs.



June 1, 2017

Mayor Edward J. Kennedy, Jr.
and
Members of the City Council

Councilors, below is a more detailed analysis of the geoenvironmental issues at each site and the following refined cost ranges. These estimates are based on the information available at the present time, and will be refined further in subsequent phases of the project, once we've moved on to a selected option, as additional information relative to the design of that option becomes available. The ranges reflect the uncertainty associated with projecting specific design details at the feasibility stage of the project.

Full Renovation

- Assume very limited disturbance of soil such that very small volume of soil requires off-site reuse or disposal.
- Budget includes preparation of Soil Management Plan and Health and Safety Plan to prepare for potential exposure to soils containing urban fill.
- Some construction-phase oversight of work activities included to monitor site conditions and oversee implementation of project plans.
- Arsenic remediation costs not included.
- Cost estimate $30,000

Addition/Renovation Option 2

- Assume soil characterization similar to current knowledge, therefore 75% of soil <RCS-1 ($25/ton) and 25% soil COMM-97 ($75/ton).
- Assume 2 to 4 foot depth of excavation in new foundation areas, with all soil required to leave the site to achieve designed grades.
- Total estimated area of new foundations = 18,000 SF (this does not include new buildings constructed on the current footprint of the Field House)
- Assume existing material below 2 to 4 feet is suitable structurally to support construction of new building(s).
- Estimate assumes no hazardous waste and no PCBs detected in soil at time of characterization.
- Estimate assumes transportation and disposal costs only, assume earthwork already included in base construction price and no backfill material needed.
- Arsenic remediation costs not included.
- Order-of-magnitude cost estimate for off-site transportation and disposal of soil = $75,000 to $150,000.

Addition/Renovation Option 3

- Assume soil characterization similar to current knowledge, therefore 75% of soil <RCS-1 ($25/ton) and 25% soil COMM-97 ($75/ton).
- Assume soil conditions on 75 Arcand Drive are similar to those on the high school site.

- Assume 2 to 4 foot depth of excavation in new foundation areas.
- Assume limited on-site reuse of soil to bring up the grade in Field House footprint areas not to be occupied by new buildings.
- Total estimated area of new foundations = 34,000 SF (this does not include new buildings constructed on the current footprint of the Field House)
- Assume existing material below 2 to 4 feet is suitable structurally to support construction of new building(s).
- Estimate assumes no hazardous waste and no PCBs detected in soil at time of characterization.
- Estimate assumes transportation and disposal costs only, assume earthwork already included in base construction price and no backfill material needed.
- Order-of-magnitude cost estimate for off-site transportation and disposal of soil = $90,000 to $180,000.

Cawley 4 Story Option

- Assume only soils displaced from area north of Martin Softball Field will require additional cost due to environmental contamination, all other soil suitable for unrestricted use.
- Assume current size and configuration of 4-story building footprint.
- Rough estimate of fill area = 120,000 SF.
- Characterization of historical fill similar to current knowledge, therefore 75% of soil <RCS-1 ($25/ton) and 25% soil COMM-97 ($75/ton).
- Assume 2 to 4 foot depth of excavation in new foundation areas within historical fill areas (estimated area = 30,000 SF).
- Assume no removal of soil required to construct new parking areas, therefore historical fill will remain below parking areas.
- Assume existing material below excavation depth is suitable structurally to support construction of new building or parking lot.
- Estimate assumes no hazardous waste and no PCBs detected in soil at time of characterization.
- Estimate assumes transportation and disposal costs only, assume earthwork already included in base construction price and no backfill material needed.
- Order-of-magnitude cost estimate for off-site transportation and disposal of soil = $125,000 to $250,000.

Cawley 5 Story Option

- Assume only soils displaced from area north of Martin Softball Field will require additional cost due to environmental contamination, all other soil suitable for unrestricted use.
- Assume current size and configuration of 5-story building footprint.
- Rough estimate of fill area = 120,000 SF.
- Characterization of historical fill similar to current knowledge, therefore 75% of soil <RCS-1 ($25/ton) and 25% soil COMM-97 ($75/ton).
- Assume 2 to 4 foot depth of excavation in new foundation areas within historical fill areas (estimated area = 15,000 SF).

- Assume no removal of soil required to construct new parking areas, therefore historical fill will remain below parking areas.
- Assume existing material below excavation depth is suitable structurally to support construction of new building or parking lot.
- Estimate assumes no hazardous waste and no PCBs detected in soil at time of characterization.
- Estimate assumes transportation and disposal costs only, assume earthwork already included in base construction price and no backfill material needed.
- Order-of-magnitude cost estimate for off-site transportation and disposal of soil = $80,000 to $160,000.

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