

## 6.0 Summary of Nature and Extent

This summary of the nature and extent of impacts combines subsurface visible impact observations from the RI and previous investigations and provides the nature and extent of analytical impacts observed in each media investigated during the RI.

### 6.1 Surface Soil

The majority of the Current Site is covered with impervious materials (urban fill) and has been redeveloped since the cessation of MGP operations. The surface soil sample results and the presence of non-MGP contaminants like PCBs and pesticides illustrate that the present day Current Site surface soil quality has not been impacted by the former MGP operations.

### 6.2 Subsurface Soil

Based on the visible impacts and subsurface soil analytical results, subsurface MGP-related impacts are evident in three areas: 1) soil west of the Previously Remediated Area 2) in the vicinity of the former tar tanks along the Gowanus Canal, and 3) in the northern corner of the Lowes parking lot adjacent to the Gowanus Canal. The vertical extent of these impacts has been delineated. The horizontal extent of the visible, MGP-related impacts has been delineated. The horizontal extent of subsurface soil analytical impacts has generally been delineated although the distribution, source, and extent of impacts immediately adjacent to the Gowanus Canal and along the southwestern edge of the Current Site near SB-6 and SB-7 is uncertain. Several sources of potential contamination to the Gowanus Canal have been identified as summarized in Appendix A and include tar and MGP-related impacts. Other potential historic and current sources of impacts to the Gowanus Canal and the flushing and dredging operations within the canal, as presented in Section 2, complicate the interpretation of visible and analytical impacts within and adjacent to the canal.

Visible impacts in the northern corner of the parking lot adjacent to the Gowanus Canal and within the former Cranford Asphalt Manufacturing Company site do not appear to be connected with the visible impacts noted in former MGP areas of the Historic MGP Site based on the distribution of visible impacts illustrated in cross section and by elevation as described in subsection 5.1.

The visible impacts in the SB-9 area adjacent to the canal appear separate from the Previously Remediated Area and may be associated with the former structures beneath the Pathmark building, however drilling and subsurface investigations could not be performed in this area to further evaluate the distribution due to the hours of operation for the Pathmark supermarket and the retail nature of the business. The impacts observed in SB-9 in the vicinity of former tar tanks beneath the Pathmark building along the Gowanus Canal are at an elevation slightly above the elevation of the bottom of the canal and continue to approximately 30 feet below the bottom of the canal. Based on these elevations, the SB-9 area impacts may originate from former MGP structures and/or from the canal. The visible impacts observed in SB-19 on the west side of the canal are within the same elevation as the impacts noted in SB-9. LNAPL collected from MW-20S near SB-19 is not tar-related, based on forensic testing demonstrating that there are other sources of the impacts observed on the western side of the canal.

The visible impacts observed south of SB-9 in SB-4, MW-4D1, and MW-4D2 may originate from the former tar tanks near SB-9 and other former structures beneath the Pathmark building, the former Brooklyn Alcatraz Asphalt operations, the impacts within the Gowanus Canal, and/or the Previously Remediated Area. Visible tar impacts were noted in borings in sediment beneath the canal and northwest of the canal at SB-19 at an elevation consistent with visible impacts noted in SB-4. However, based on the elevation of the observed impacts in and adjacent to both sides of the canal (SB-4/MW-4 on the east side and SB-19 on the west side), the historical and current use of the properties surrounding the Canal, the redistribution of impacted sediments within the Canal due to tidal fluxes, the Flushing Tunnel, and CSOs, the distribution and source of these impacts is uncertain and could also include the canal itself. The current and historic uses of the property and the adjacent properties may also represent sources of impacts on the western side of the canal, as summarized in Appendix A.

Visibly impacted subsurface soils were delineated along the southwestern and northeastern borders of the Current Site. Subsurface soils along the southwestern edge (SB-6 and SB-7) of the Current Site contain concentrations of PAHs above the Commercial Use SCOs although the constituent distribution suggests these impacts may not originate from a MGP source.

### 6.3 Groundwater

Groundwater samples collected from beneath the RI Study area contain MGP-related and other compounds at concentrations above the AWQSGVs. The possibly MGP-related compounds detected at concentrations that are above AWQSGVs include BTEX, PAHs, and limited occurrences of cyanide (two locations in shallow zone only). Compounds unrelated to MGP operations that were detected in groundwater samples at concentrations above the AWQSGVs include chlorinated VOCs and MTBE. All of these compounds were detected in RI groundwater samples collected from the shallow, intermediate, and deep groundwater zones.

Shallow zone groundwater impacts are present in four areas:

1. the vicinity of and downgradient of former MGP structures
2. along the southwestern property boundary
3. in the northern corner of the Lowes parking lot
4. in upgradient monitoring well MW-1S

Groundwater samples collected from MW-1S also contained MTBE, a gasoline additive suggestive of an additional VOC source in the Current Site vicinity. The NYCDOS UST NYSDEC Spill site may contribute to impacts detected in the sample collected from MW-1S.

In general the greatest impacts were detected in the intermediate zone groundwater samples, consistent with the most visibly impacted soil horizon. Impacts were not detected in the groundwater samples collected from the intermediate and deep zones at upgradient locations MW-1I and 1D.

The deep zone MGP-related groundwater impacts appear to be limited to the area of the former tar tanks adjacent to the Gowanus Canal (MW-9D). Chlorinated VOCs appear to be more widespread than non-chlorinated VOCs, although low benzene concentrations above standards were detected in all of the groundwater samples collected from deep wells in the parking lot north-northeast of the Current Site.

Groundwater impacts are evident at the southwestern and western edge of the Current Site, along the Gowanus Canal, in all three of the groundwater zones investigated during the RI. No impacts were noted in

either of the two deepest wells in the RI Study Area (MW-4D1 and MW-4D2) screened directly above the Gardiners Clay and directly below the Gardiners Clay, in the upper portion of the Jameco Gravel unit, respectively.

Primary field parameters used to document the potential for natural intrinsic biodegradation of dissolved organic compounds in groundwater under a MNA approach include DO and ORP. DO is the preferred terminal electric acceptor (TEA) used by microbes during natural degradation of organic compounds, therefore, reduced DO levels within and near known former source areas indicate that aerobic biodegradation is/has occurred in areas most impacted by the dissolved constituents of interest (COIs). ORP is a measure of the energy yield in the groundwater available to the microbes during the respiration process. Highly positive ORP values indicate areas where reactions are taking place under aerobic conditions (high energy yield to microbes), while lower to negative values indicate areas where anaerobic reactions (lower energy yield to microbes) predominate.

Collection of field readings including DO and ORP are susceptible to field meter calibration and the inherent difficulty in gathering DO results despite the use of sealed flow through cells using low-stress/low purge methods. Despite these difficulties, patterns often develop that, overall, document intrinsic biodegradation of dissolved organic compounds in groundwater is occurring.

Groundwater from the shallow groundwater wells showed generally low DO and negative ORP levels for most wells with the lowest DO concentrations at three wells (MW-5S, MW-7S, and MW-8S) in close proximity and downgradient of the area of highest dissolved COI impacts associated with well MW-3S. The most negative ORP readings were noted in groundwater from MW-7S and MW-3S, where the lowest DO concentrations were generally noted. Higher DO and ORP values were noted in wells adjacent to the Gowanus Canal at wells MW-9S and MW-19S, where lower COI concentrations were noted.

For the intermediate zone, DO concentrations were lowest in groundwater purged from wells MW-3I, MW-4I, and MW-5I within or downgradient of the area of highest COI impacts. The most negative ORP readings were noted at MW-3I, MW-4I, MW-5I, and MW-9I. Higher DO and ORP values were noted in groundwater at outlying cross-gradient or upgradient wells for which significantly lower COI concentrations were detected in groundwater samples. The highest DO and most positive ORP values were noted with upgradient well MW-1I, fitting the conceptual summary that intrinsic biodegradation is occurring in the areas most impacted by dissolved COI impacts in groundwater.

For the deep zone, DO concentrations were highest in groundwater purged from upgradient well MW-1D and wells MW-5D and MW-23 where non-detect to low dissolved COIs were detected in groundwater samples and lowest in groundwater from wells MW-9D and MW-21D. ORP values were somewhat inconsistent but indicated near lowest recorded levels in groundwater purged from MW-9D, where the highest dissolved COI concentrations were noted in groundwater samples.

In summary, the patterns of the DO and ORP results combined with groundwater flow directions in each interval support the conceptual model that intrinsic biodegradation of dissolved phase COIs is occurring in shallow, intermediate, and deep groundwater zones beneath the RI Study Area.

## 6.4 Soil Vapor and Indoor Air

Carbon disulfide was the only MGP-related constituent detected in sub-slab vapor (SV-1: 2010 sampling event) above NYSDOH's background indoor air values. However, carbon disulfide was not detected in the paired indoor air sample. In addition, there were detections of various constituents in the ambient air samples during the sampling event consistent with urban background concentrations. Based on the

collected data, there were no MGP-related constituents detected in indoor air above background concentrations. However, four non-MGP-related compounds (1,2-dichloropropane, 1,4-dichlorobenzene, chloroform, and trichlorofluoromethane [Freon 11]) were detected in indoor air above background concentrations. In general, the concentrations of VOCs detected in the indoor air are comparable with those detected in the ambient air and those typically found in indoor air of non-residential buildings.