TOWN OF OYSTER BAY
BETHPAGE COMMUNITY PARK
INTERIM REMEDIAL MEASURE - CONSTRUCTION AREA

ADDENDUM TO THE REMEDIAL ACTION PLAN

MARCH 2006

Prepared For:

Town of Oyster Bay
Department of Public Works

H2M GROUP
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1.0 INTRODUCTION

This Addendum to the Remedial Action Plan addresses general and specific comments provided by the New York State Department of Environmental Conservation (NYSDEC) with regards to the Interim Remedial Measure Investigation Report and Remedial Action Plan, dated November 2005 (11/2005 IR/RAP), and the Supplemental Investigation Report, dated December 2005 (12/2005 SIR), for the designated construction area (Construction Area) at the Bethpage Community Park in Bethpage, New York (Site). Included in this Addendum to the Remedial Action Plan is an evaluation of remedial alternatives for the Construction Area of the Bethpage Community Park.

The Town of Oyster Bay entered into an Order on Consent with the NYSDEC in an effort to expedite remediation and redevelopment of an approximately 7-acre portion of the 18-acre Park. The 7-acre area of the Park identified in the Consent Order is also designated as the Construction Area. Consistent with the requirements of the Consent Order, environmental cleanup activity is being conducted as an Interim Remedial Measure (IRM). The reports identified above (11/2005 IR/RAP and 12/2005 SIR) document results of the IRM work completed to date including a site investigation and proposed remedial action plan.

The extensive IRM remedial investigation conducted at the Bethpage Community Park identified contamination in surface and subsurface soils. Soil contaminants primarily included metals such as arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg) and zinc (Zn), polychlorinated biphenyls (PCBs), and select semi-volatile organic compounds (SVOCs). Groundwater sampling identified select chlorinated organic compounds above NYSDEC Class GA drinking water standards but no significant on-site (Construction Area) sources were

identified for this contamination. Soil vapor sampling identified the presence of volatile organic compounds (VOCs) in the IRM area primarily in the vicinity of the existing ice rink.

Based on the results of the IRM remedial investigation, a remedial action plan was proposed in the 11/05 RAP and 12/05 SIR that primarily consisted of a significant soil excavation program targeting contaminated soils above State cleanup guidelines (NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #4046 Recommended Soil Cleanup Objectives (RSCOs)) to a depth of 10 feet and targeted removal of higher contamination areas to deeper depths (i.e., up to 20 feet below grade). The NYSDEC has requested an evaluation of additional remedial alternatives against a suggested list of criteria including applicable, or relevant and appropriate regulations (ARARs) and State Criteria Guidelines (SCGs), overall protection of human health and the environment, short term effectiveness, long term effectiveness and permanence, reduction in toxicity, mobility and volume, implementability, cost, and community acceptance.

In response to the NYSDEC's request, this Addendum to the Remedial Action Plan includes an evaluation of alternative remedial strategies. The criteria used for evaluation of remedial alternatives are based on standards for Federal sites regulated under the National Contingency Plan (NCP, 40 CFR Part 300.43) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and New York State sites regulated under 6 NYCRR Part 375-1.10. The NYSDEC also sets out the same remedial remedy evaluation criteria in the Draft DER-10 Technical Guidance for Site Investigation and Remediation [Section 4, December 2002] (DER-10).

2.0 RESPONSE TO NYSDEC COMMENTS ON PREVIOUSLY PROPOSED RAP

The New York State Department of Environmental Conservation provided a response letter on February 10, 2006 to the Interim Remedial Measure Investigation Report and Remedial Action Plan, November 2005, and the Supplemental Investigation Report, December 2005, prepared by H2M on behalf of the Town of Oyster Bay. In general, the NYSDEC reported that the IRM sampling program undertaken by the Town was comprehensive and focused in nature, and

generated soil, groundwater and soil vapor data that was more than adequate to characterize the Construction Area. The February 10, 2006 letter included certain general and specific comments. These comments were considered and are addressed in various sections of this report. The majority of comments were first responded to in a letter from H2M to the NYSDEC, dated March 14, 2006. A copy of the response letter is provided in Appendix A.

A specific recommendation by the NYSDEC was to perform an evaluation of remedial alternatives for the IRM area considering the significant scope of the IRM investigation. This Addendum to the Remedial Action Plan has been primarily prepared to provide the remedial alternative evaluation.

3.0 SITE HISTORY AND DESCRIPTION

The Site is currently owned by the Town of Oyster Bay, but was formerly owned and operated by Grumman Aircraft Engineering Corporation, a predecessor to Northrop Grumman Systems Corporation (Northrop Grumman). Prior site investigation reports, prepared on behalf of Northrop Grumman, have indicated that the site had been utilized by Northrop Grumman for waste disposal activities including industrial wastewater treatment sludge disposal, spent paint booth rag disposal, possible used oil disposal, and fire training activity that included ignition of waste oil and jet fuel. Previous site investigations by others documented contaminant impacts to site soils from these activities including the presence of elevated concentrations of metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and polychlorinated biphenyls (PCBs). In addition, prior investigation reports documented volatile organic compound impacts to groundwater at the site.

The Bethpage Community Park, which occupies approximately 18-acres, is located in Bethpage, New York, on the west side of the intersection of Stewart Avenue and Cherry Avenue. The site is located within the Town of Oyster Bay in Nassau County. A site location map is presented in Figure 1. The park includes a pool, skating rink, baseball field, tennis courts, children's play areas and parking. As mentioned, prior to being donated to the Town of Oyster Bay, the subject site was owned by Grumman Aircraft Engineering Corporation, a predecessor to Northrop

Grumman Systems Corporation. Ownership of the site was transferred to the Town of Oyster Bay in 1962, after which, the Town constructed the present-day Park. The community actively utilizes the site. In 2002, portions of the site were closed due to the identification of PCB and metals impacts above state guideline concentrations in surface soils. Some remediation of surface soils has been performed although other portions of the site remain closed to this day pending remediation.

A number of environmental investigations have been conducted relative to the Park prior to the IRM effort undertaken by the Town of Oyster Bay. Two significant soil sampling programs were implemented by Northrop Grumman in recent years, a March/May 2002 soil sampling event and a May/June 2003 sampling event. Northrop Grumman also conducted groundwater sampling in June, September and November 2003. These events were documented in two reports dated June 2002 and December 2003. A soil vapor investigation was performed and documented in a report by ARCADIS G&M, Inc., Summary of Soil Vapor Sampling Results, Bethpage Community Park – Operable Unit 3, June 2005.

The Town of Oyster Bay intends to improve the Park grounds through construction of new facilities including an indoor ice rink. The anticipated redevelopment activities will impact approximately 7-acres of the site. The Construction Area, as it is identified within the IRM, extends from the north border of the property in a southerly direction approximately central to the site. The construction area is shown on Figure 2. Planned redevelopment activities include the construction of a new rink building as well as upgrading of surrounding parking areas and utilities. The proposed redevelopment will require site excavation.

4.0 DESCRIPTION OF IRM WORK COMPLETED

In accordance with the NYSDEC-approved May 2005 IRM Work Plan, an extensive field investigation was performed to characterize the nature and extent of contamination in both soil and shallow groundwater within the boundaries of the Construction Area and those neighboring areas anticipated to be impacted by construction activity. Soil and groundwater investigation efforts included analysis for PCBs, VOCs, SVOCs, and metals (including hexavalent chromium

and cyanide). The results of the field investigation were presented in the 11/2005 IR/RAP and 12/2005 SIR.

4.1 Site Investigation Findings

This section provides a summary of the remedial investigation component of the IRM for the Bethpage Community Park.

4.1.1 Soil Investigation

The soil investigation was completed during two field sampling programs. Most investigation activities were completed in May and June 2005 and documented in the 11/2005 IR/RAP. Additional investigation activities were completed in September 2005 and documented in the 12/2005 SIR. A total of 160 soil borings were completed during the soil investigation using a combination of direct-push and hollow-stem auger drilling methods. This included 119 shallow borings that were advanced to a minimum depth of 10 feet below grade, and 41 deep borings that were advanced to a depth of 60 feet below grade. The soil boring locations were based on a grid format covering the IRM construction and related areas with an approximately 50-foot on-center node spacing. Samples were generally retained at two-foot intervals from grade to 10 feet below grade and in two-foot cores at 10 foot intervals between 10 feet and 60 feet below grade, i.e., 18-20 feet, 28-30 feet, 38-40 feet, 48-50 feet and 58-60 feet. Soil samples were analyzed for a combination of PCBs, VOCs, SVOCs, metals (including hexavalent chromium (Cr^{6+})) and cyanide.

Soil sample analytical results were compared to New York State cleanup guidelines (NYSDEC TAGM #4046 RSCOs). Predominant metals detected above RSCOs were arsenic (As), cadmium (Cd), chromium (Cr), mercury (Hg) and zinc (Zn). A site plan summarizing the sampling locations with metal concentrations detected at or above their respective RSCOs is provided as Figure 3. PCB concentrations ranged from non-detectable in some locations to a high of 550 mg/kg at boring location G7 at a depth of 8-10 feet below grade. The NYSDEC TAGM #4046 RSCO for PCBs is 1 mg/kg for surface soils and 10 mg/kg for subsurface soils. At depths between grade and 10 feet below grade, PCBs were identified in 55 of the 160 boring locations at concentrations greater than 1 mg/kg. PCB concentrations exceeded 1 mg/kg in

surface soils in 31 of the 160 boring locations and exceeded 10 mg/kg in subsurface soils in 9 boring locations. A site plan summarizing PCB soil concentrations above 1 mg/kg, based on the findings of the 11/2005 IR/RAP and 12/2005 SIR, is enclosed as Figure 4. It should be noted that similar figures were included in the 11/2005 IR/RAP and 12/2005 SIR. However, in the 11/2005 IR/RAP, the figure number was incorrectly referenced in the text of the report.

The soil investigation identified cyanide in approximately 18 boring locations. The highest concentrations of cyanide were 84.0 mg/kg at G4 (8-10), 23.4 mg/kg at I10 (6-8) and 14.4 mg/kg at G3 (8-10). However, NYSDEC TAGM #4046 does not identify a RSCO for cyanide considering the stability of cyanide is dependent on the chemical form.

Volatile organic compounds (VOCs) were not detected in Site soils with the exception of two boring locations near the Southwestern boundary of the Construction Area. At boring location I1, total xylenes were detected at a concentration of 3.3 mg/kg, exceeding the RSCO of 1.2 mg/kg. At boring location J1, 1,2-dichloroethene was detected at a concentration of 0.76 mg/kg, exceeding the RSCO of 0.3 mg/kg, and trichloroethylene was detected at a concentration of 17.0 mg/kg, exceeding the RSCO of 0.7 mg/kg.

Semi-volatile organics were detected in 47 of the 160 boring locations above the RSCOs. The semi-volatile contaminants that exceeded their individual RSCOs were polycyclic aromatic hydrocarbons (PAHs) and included benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene and dibenzo(a,h)anthracene. However, not all of these contaminants were detected at each location. The NYSDEC TAGM #4046 recommends a comparison of individual compounds with their respective RSCOs. In the proposed 4/95 TAGM, the NYSDEC identifies a total carcinogenic SVOC (i.e., PAHs) concentration of 10 and 50 mg/kg as a cleanup objective. There is a noted discrepancy in this TAGM as both values are reported within the document. Total carcinogenic SVOC concentrations exceeded 10 mg/kg in 9 boring locations and exceeded 50 mg/kg in two boring locations. A site plan summarizing VOC and SVOC soil concentrations above RSCOs, based on the findings of the 11/2005 IR/RAP and 12/2005 SIR, is provided as Figure 4.

More specific details on the soil investigation program are provided in the 11/2005 IR/RAP and 12/2005 SIR.

4.1.2 Groundwater Investigation

A total of five groundwater monitoring wells were installed within the IRM Construction Area during the remedial investigation. Four of the monitoring wells were installed in June 2005 as part of the initial IRM site investigation. The fifth monitoring well was installed during the supplemental site investigation to enable an improved evaluation of hydraulically upgradient groundwater quality conditions. The monitoring well locations are presented on Figure 2 and are identified as CAMW-1, CAMW-2, CAMW-3, CAMW-4, and CAMW-5. Groundwater samples were collected from each monitoring well and analyzed for PCBs, VOCs, SVOCs, metals (including hexavalent chromium (Cr^{6+})) and cyanide. Construction details for the monitoring wells were provided in the 11/2005 IR/RAP and 12/2005 SIR.

The groundwater investigation did not identify any PCBs in the groundwater. With regards to metals, only sodium was detected in on-site wells above NYSDEC Class GA Groundwater Quality Standards. However, sodium is not typically considered a significant environmental concern and was not deemed to warrant further investigation as part of this IRM. Volatile organic compound sampling identified the presence of 1,2-dichloroethene and trans-1,3 dichloropropene in four of the monitoring wells. In general, the VOCs were reported at approximately 10 times higher concentrations in the hydraulically downgradient locations. However, no source areas for the VOC contaminants of concern were identified within the limits of the Construction Area during the comprehensive soil investigation. Chlorodifluoromethane (Freon-22) was detected at an estimated concentration of 200 µg/l in monitoring well CAMW-4, which is located downgradient from the existing skating rink. Soil vapor sampling, to be discussed in the following section (3.1.3 Soil Vapor Investigation) and as documented in the 11/2005 IR/RAP and 12/2005 SIR, identified dichlorodifluoromethane (Freon-12) in the soil vapor in the vicinity of the existing rink.

4.1.3 Soil Vapor Investigation

A soil vapor sampling program was implemented as part of the IRM field investigation to determine whether soil and/or groundwater contamination is producing significant levels of VOCs in the vadose (unsaturated soil) zone, and to evaluate the potential for current and future human exposure. The soil vapor sampling was performed in 17 locations across the IRM Construction Area. Most samples, however, were concentrated in the vicinity of the existing ice rink. The soil vapor sampling locations are shown on the site plan provided as Figure 2. All soil vapor samples were analyzed for Target Compound List VOCs via EPA Method TO-15.

Volatile organic compounds identified during the soil vapor investigation were predominantly 1,2-dichloroethene, trichloroethene and tetrachloroethene. Dichlorodifluoromethane (Freon-12) was also detected in the soil vapor sampling locations in the vicinity of the existing ice rink. The soil investigation did not identify any source areas for these volatile compounds. Considering these findings, the 12/2005 SIR recommended that any new buildings contemplated as part of future site development in areas with significant soil vapor contamination include provision for vapor intrusion mitigation as a design consideration. This action plan was approved by the NYSDEC and NYSDOH in a February 10, 2006 comment letter from NYSDEC to H2M (see Appendix A).

4.2 Exposure Assessment Summary

An exposure assessment was prepared as part of the 11/2005 IR/RAP to qualitatively evaluate the contaminants of concern and the affected media with respect to potential exposure pathways and receptors for human health. Provided herein is a partial reiteration of the exposure assessment including certain supplemental and clarifying information to serve as a component of the evaluation of alternative remedial options for the IRM Construction Area and to address NYSDEC comments. It should be noted that the exposure assessment is not meant to imply that there was a past or there is a present human exposure hazard to the contaminants of concern.

For the Construction Area within the Bethpage Community Park, the following exposure pathways were evaluated:

- Ingestion of contaminated soil.

- Inhalation of vapors and/or dust.
- Direct contact with potentially contaminated surface runoff.
- Ingestion of contaminated groundwater.
- Dermal contact with contaminated soils.
- Dermal contact with contaminated groundwater.

Potential human receptors in the vicinity of the site include:

- Visitors to/workers at the site.
- Residents that live in the area.
- Construction workers involved with remedial activities or site redevelopment activities.

The following conservative scenario assumptions were made in the qualitative exposure pathway analyses. It should be noted that these assumptions are for the purposes of the exposure assessment and do not imply that the identified circumstances are occurring or have occurred in the past.

- Contaminated soil in contact with groundwater and contaminants in soils released to groundwater. (Is should be noted that the IRM field investigation did not find evidence of soil contaminant source areas within the Construction Area limits contributing to groundwater contamination).
- Contaminated unsaturated soils releasing fugitive dust into the atmosphere during any intrusive soil excavation activities.
- Individuals who visit or work at the property coming into contact with potentially contaminated on-site surface and unsaturated-zone soils.
- Remedial efforts exposing potentially contaminated soils and groundwater on and off of the property.

4.2.1 Exposure and Pathway Overview

To evaluate potential exposures to the site in a qualitative fashion, various exposure scenarios were classified in terms of the general release mechanisms including:

1. Transport of soil impacts to groundwater.

2. Volatilization.
3. Erosion producing dust during remedial measures.
4. Direct contact to soil and potentially contaminated groundwater.
5. Water runoff.

Direct exposures to the chemicals of concern from the above-referenced mechanisms could potentially occur in the following ways:

1. Ingestion of contaminated soil.
2. Inhalation of vapors from volatilization of soil contaminants or from soil vapor.
3. Inhalation of potentially contaminated dust during intrusive soil disturbance.
4. Direct contact with potentially contaminated runoff water.
5. Ingestion of contaminated groundwater.
6. Dermal adsorption of contaminants via direct contact with contaminated soils and groundwater.

Potential exposure pathways are examined for functionality and completeness as follows:

Functional Exposure Pathways – A functional pathway requires that a contaminant source, release mechanism and transport mechanism be present. If any of these three components is absent, the pathway is considered nonfunctional.

Complete Pathway – A complete pathway requires a functional exposure pathway, potential receptors to the exposure and an exposure/uptake route. An exposure is considered incomplete if one or more of these components are missing.

Exposure Pathways

This section provides an evaluation of the five exposure pathway components and their status with respect to the subject site. The evaluation is performed to determine whether the exposure pathways are considered functional, i.e., present or potentially present at the subject site. It should be noted that a functional exposure pathway does not indicate the presence of an actual

exposure hazard. A functional exposure pathway requires additional conditions to be present in order to be considered 'complete,' i.e., potential receptors and an uptake route.

1. Ingestion of Contaminated Soil

Based upon the results of the IRM field investigation, PCBs, metals and select polynuclear aromatic hydrocarbons (PAHs) were detected above NYSDEC cleanup guidelines (i.e., RSCOs) in the on-site unsaturated-zone soils resulting in a contaminant source. These contaminants were also detected in on-site surface soils (i.e., 0-2 feet below grade). Subsurface impacted soils could also be brought to the surface or exposed during excavation activities. Therefore, this exposure pathway is considered functional.

2. Inhalation of Vapors

The IRM field investigation identified the presence of contamination within the Construction Area that was predominantly due to PCBs, metals and select polynuclear aromatic hydrocarbons. These contaminants are not volatile at standard temperatures and pressures. Some VOC contamination was identified in site soils but was predominantly limited to the western portion of the Construction Area. Soil vapor sampling confirmed the presence of elevated concentrations of some volatile contaminants in the soil vapor. There is potential for human exposure to vapors from on-site contamination so this exposure pathway is considered functional.

3. Inhalation of Dust during Intrusive Soil Excavation

PCBs, metals and select polynuclear aromatic hydrocarbons were detected in on-site soil samples, including surface soils, above NYSDEC concentrations of concern. This exposure pathway is considered functional due to a contaminant source; a release mechanism (contaminants present in the near-surface soil samples) and a transport mechanism (identified contaminants released during excavation or soil disruption activities).

It should be noted that in comparison with the 11/2005 IR/RAP, this exposure pathway evaluation has been modified to address potential exposure to dust during any intrusive soil

excavation rather than just soil excavation activities associated with remedial action within the Construction Area.

4. Direct Contact with Potentially Contaminated Runoff Water

The majority of the Construction Area is developed with buildings and parking areas. Stormwater in these areas is conveyed through drainage systems. Remaining areas of the Construction Area are unpaved but covered with grass that permits stormwater infiltration into the subsurface. There is typically no ponding of stormwater on the unpaved areas. Therefore, the potential for human exposure to potentially contaminated site runoff is considered low and this exposure pathway is considered nonfunctional due to a lack of a contaminant source.

5. Ingestion of Contaminated Groundwater

There are several public water supply wells owned and operated by the Bethpage Water District in the vicinity of the site. Due to documented VOC contamination in area groundwater by others, all public water supply wells in the vicinity of the site are tested for contaminants and treated for organic compounds. Groundwater sampling during this investigation confirmed VOC contamination in on-site groundwater.

Although this exposure pathway contains a documented contaminant source (VOC contaminated groundwater) and a transport mechanism (hydrogeologic flow of contaminated groundwater), the ingestion of contaminated groundwater exposure pathway will not be considered functional for the purpose of this effort due to engineering controls already in place in the local water supply infrastructure, the off-site nature of the pathway, and the fact that remediation of the impacted groundwater is being addressed by others under a separate Order on Consent with the NYSDEC.

6. Dermal Adsorption of Contaminants via Direct Contact with Contaminated Soil

As discussed in previous subsections, PCBs, metals and select polynuclear aromatic hydrocarbons were detected in on-site soil samples above NYSDEC concentrations of concern. Therefore, this exposure pathway is considered functional due to the presence of a

contaminant source, a release mechanism (contaminants present in the surface soil samples) and a transport mechanism (contaminants released during potential surface excavation activities and/or interaction with surface soils).

7. Dermal Adsorption of Contaminants via Direct Contact with Contaminated Groundwater

Volatile organic compounds were detected in groundwater samples above NYSDEC concentrations of concern. However, as reported above, an infrastructure is already in place for treatment of the local water supply. Therefore, this exposure pathway is not considered functional for the purpose of this effort.

Complete Pathways

A complete pathway requires a functional exposure pathway, receptors to the exposure and an exposure/uptake route. As indicated in Section 6.1.1, there are four functional exposure pathways with respect to human health that will be evaluated in this section including:

1. Ingestion of contaminated soil.
2. Inhalation of vapors from volatilization of soil contaminants.
3. Inhalation of potentially contaminated dust during any soil disturbance or excavation.
4. Dermal adsorption of contaminants via direct contact with contaminated soils.

This section of the human exposure assessment details potential receptors and exposure/uptake routes.

Visitors to/Workers at the Site

The potential for visitors and/or workers on the site to be exposed to site-related contaminants includes:

- Ingestion of on-site contaminated soils - This pathway may be considered complete for on-site visitors and/or workers due to the presence of impacted surface and subsurface soils at the site.
- Inhalation of vapors – The potential exists for on-site visitors/workers to be exposed to VOC vapors emanating from impacted soil piles during future remediation or

construction excavation activities. The potential also exists for future site workers or visitors to be exposed to adverse indoor air quality from permeation of contaminated soil vapor (i.e., soil vapor intrusion). Inhalation of vapors is considered a complete pathway.

- Inhalation of dust – The potential exists for on-site visitors/workers to be exposed to airborne dust impacted by PCBs, metals and select organic aromatics from future soil excavation activities. The potential also exists for visitors to be exposed to dust if future site use or recreation activities involve disturbing the surface soils. Inhalation of dust is considered a complete pathway.
- Dermal adsorption of contaminants via direct contact with contaminated soil – The potential exists for workers to be exposed to contaminated soils during intrusive on-site activities and for visitors if recreation activities involve disturbing the surface soils.

Residents Who Live in the Area

The potential for residents who live in the area of the site to be exposed to site-related contaminants includes:

- Ingestion of contaminated on-site soil – No residents live within the Park limits so this pathway is not considered complete.
- Inhalation of vapors – The potential exists for an inhalation exposure for residents to vapors that may be present during remediation or construction activities that involve subsurface excavation activities. However, such activities would involve a community air monitoring program that would greatly reduce any potential vapor exposure hazard to residents. This pathway is not considered complete.
- Inhalation of dust – Fugitive airborne dust from surface and subsurface soils from the site may be encountered during remediation or construction activities that involve excavation activities. Such activities should incorporate mitigation measures that reduce or eliminate fugitive dust. In addition, during any such activity a community air monitoring program would be initiated that would greatly reduce the likelihood of dust exposure to residents. This pathway is not considered complete.
- Dermal adsorption of contaminants via direct contact with contaminated soil – Residents are not likely to be in direct contact with impacted soil from the Site, unless visiting the Park (See visitors/workers at the Site above). This pathway is not considered complete.

Construction Workers

Construction workers could potentially be exposed for short periods of time to contaminants of concern during site remediation or construction activities. However, all work will be required to be performed in accordance with a Health and Safety Plan (HASP), with knowledge of site conditions, and while utilizing appropriate personal protective equipment, as specified in the HASP. Therefore, the qualitative risk is considered low for construction workers. It is acknowledged that the Health and Safety Plan, prepared and enacted by the remedial/construction contractor, will not be approved by the NYSDEC, as inaccurately stated in the 11/2005 IR/RAP. A community air monitoring program will be required during any remedial construction.

4.2.2 Risk Characterization

A qualitative risk characterization based upon potentially complete functional pathways and exposure/uptake routes was prepared. Based on the potentially complete exposure pathways, Visitors/Workers at the Site were identified to have potential risk from 1) ingestion of contaminated soil, 2) inhalation of vapors, 3) inhalation of contaminated dust during remediation or any soil intrusive activities and 4) dermal absorption from contact with contaminated soil. The qualitative potential risk for each exposure pathway and potential receptor population is summarized in Table 3.2.2. As shown in Table 3.2.2, the qualitative potential risks are identified as Present, Minor or Not Present. A qualitative potential risk characterized as Present means that there is the potential for exposure through the corresponding functional pathway to the identified receptor population. A Minor qualitative potential risk means that the potential for exposure is very low and unlikely. As indicated in a February 10, 2006 comment letter from NYSDEC (see Appendix A), the NYSDEC would characterize a minor risk as acceptable. Not Present is used to characterize potential risk for exposure pathways with virtually no potential to affect the identified receptor population. Table 3.2.2 has been clarified from the version presented in the 11/2005 IR/RAP (Table 6.2.2).

In response to comments from the NYSDEC regarding Visitors/Workers at the Site and ingestion of contaminated soil as not being a complete pathway, it is reiterated that this potential

risk is present and a complete pathway. The presence of this risk is primarily based on visitors to the site and potential contact with contaminated surface soil in unpaved areas.

The risk characterization provided herein is based on the Exposure Assessment results and conservatively identifies the potential exposure risks at the Site. Past and/or present exposures to site contaminants through the identified exposure pathways are not assumed or insinuated.

4.3 Previously Proposed Remedial Action Plan

The 11/2005 IR/RAP and 12/2005 SIR presented a Remedial Action Plan based on the results of a comprehensive field investigation comprising soil, groundwater and soil vapor sampling. The Remedial Action Objective (RAO) was to identify a remedial strategy that is protective of human health and the environment, meets the intended objectives of the IRM, and takes into consideration the proposed future use and potential future use of the Site.

The following remedial strategy was proposed in the 11/2005 IR/RAP and 12/2005 SIR

1. Remediate all impacted soils within the confines of the Consent Order defined site to NYSDEC RSCO concentrations to a depth of ten feet below grade. A depth of ten feet below grade was chosen because most typical construction/development activity would not require deeper excavation.

2. Remediate historical fill areas to NYSDEC RSCO concentrations. Historical fill areas were defined as areas identified by aerial photography as being potential release areas and confirmed as fill areas (debris and non-native soils) through boring log information obtained from the field investigation. Areas identified through boring logs to include fill material even if not suspected through aerial photography were subject to this initiative.

3. Remediate all source areas affecting groundwater quality or soil vapor to NYSDEC recommended soil cleanup objective concentrations for subsurface soils. For the purpose of this initiative, source areas are defined as impacted soils that are currently affecting groundwater or soil vapor quality, or that have the potential to negatively affect groundwater or soil vapor quality. This potential is a function of the nature of the

contaminant, the contaminant concentration, the location of the impact, and any mitigating factors.

4. Any identified impacts that are subject to more than one of these strategic initiatives will be remediated to meet the more conservative (i.e., more comprehensive cleanup) initiative.

The first criteria of the proposed remedial strategy provided for remediation of all contaminated surface and near surface soils to a depth of ten feet. The extent of remediation was to be based on the NYSDEC RSCOs although for PCBs, the RSCO cleanup objective of 1 mg/kg for surface soils was recommended as the cleanup guideline to a depth of 10 feet. The more stringent guideline of 1 mg/kg was initially selected to enable future site use and redevelopment to conventional excavation depths with minimal exposure concerns, including revised surface grade elevations. The potential exists that current "subsurface" soil may at some point in the future become "surface soil," i.e., top 0-2 feet of soil, should changes to the site involve a change in surface grade elevation.

The second criteria of the remedial strategy provides for remediation of contaminated fill areas identified from historical records, such as aerial photographs or site records, and identified from soil classification information obtained during the IRM field investigation. These areas generally had the highest contamination from PCBs and metals based on the results of the comprehensive field investigation. The fill areas identified during the field investigation were characterized with wood and miscellaneous debris including man-made fibrous material and included boring locations G4, G6-G8, I1, I8, J1, J6 and N9, as depicted on Figure 2.

The third criteria of the remedial strategy provides for remediation of all source areas (impacted soils) affecting or having the potential to affect groundwater or soil vapor quality to NYSDEC recommended soil cleanup objective concentrations for subsurface soils.

In summary, the proposed remedial strategy specified remediation of all contaminated soils to a depth of ten feet and fill areas to depths of up to 20 feet below grade. The proposed remedial strategy would result in the removal of the majority of site contamination. A buffer of 10 feet

was selected between grade and any residual contamination left in place. In addition, the more significantly contaminated fill areas were to be addressed through deeper excavation. Remediation of all soils to the specified depth permits future site changes, improvements and maintenance operations such as installation of footings, support buildings, recreational equipment, fencing, lamp posts, curbs, new pavement, revised drain piping, new foundations, and revised surface gradients, to depths less than ten feet to proceed without exposure concerns.

Based on the results of the soil vapor investigation, the proposed remedial strategy also recommended that any enclosed spaces contemplated as part of the proposed development activity include provision for soil vapor mitigation (i.e., prevention of soil vapor intrusion) as a design consideration. Remediation of groundwater was not recommended as part of the initial proposed remedial strategy as groundwater impacts are being addressed under a remedial investigation being conducted by Northrop Grumman.

5.0 DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

The IRM remedial investigation summarized in the 11/2005 IR/RAP and 12/2005 SIR documented the presence of PCB, metals, VOC and SVOC contamination in Site soils, and VOC contamination in soil vapor. The Remedial Action Objective (RAO) for the Site is to implement a remedial strategy that is protective of human health and the environment with regards to the documented contamination and takes into consideration the continued future use of the Site as a community park.

General response actions with regards to soil contamination include 1) No action, 2) Implementation of Institutional Controls, 3) Containment, 4) In-Situ or Ex-Situ Treatment, and 5) Excavation. No action is a baseline alternative typically included as a response alternative for sites where a formal Remedial Investigation/Feasibility Study (RI/FS) is required. The No Action alternative may, in fact, specify no remedial activity or specify limited measures such as limiting access to contaminated areas or performing regular monitoring or sampling. A Limited Action alternative, as defined in Section 5.2, was identified as a possible remedial alternative for the Bethpage Community Park IRM.

Institutional controls are non-physical restrictions such as signage or deed restrictions implemented to limit access to contaminated soil. For the Bethpage Community Park IRM, institutional controls are not considered as a stand-alone remedial alternative considering near-term Site redevelopment plans anticipate the excavation or movement of approximately 31,000 cubic yards of contaminated soil. Institutional controls, however, will be incorporated into other potential remedial alternatives for the Bethpage Community Park IRM.

Containment is a general response action in which contaminated areas are isolated to minimize potential contact or exposure and prevent migration of contaminated media to non-contaminated areas. Containment may include capping contaminated areas or constructing barriers to prevent migration. Caps and barriers should be impermeable or have low-permeability to prevent hydraulically-driven migration of contaminants. Containment was not considered as a stand-alone remedial alternative considering near-term Site redevelopment plans that anticipate a significant excavation of contaminated soil. However, a form of capping is incorporated into some of the potential remedial alternatives as a method to reduce exposure to contaminated soils.

Treatment is a general response action that can be performed in-situ (in-place) or ex-situ (out of place after excavation). Treatment is an action to stabilize or immobilize contaminants in the soil. Treatment options such as solidification, chemical stabilization, thermal desorption and thermal destruction were not considered for the Bethpage Community Park IRM due to the range of contaminants identified within the Construction Area, i.e., PCBs, metals, VOCs and SVOCs. Treatment methods are generally specific for particular types of contamination and discrete areas. Treatment alternatives for the range and extent of contaminants at the Site would not be practical.

Excavation as a response action for soil contamination consists of the removal of impacted soil media with either on-site or off-site disposal. For the Bethpage Community Park IRM, various excavation alternatives with off-site disposal were evaluated.

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5.1 Applicable or Relevant and Appropriate Requirements (ARARs) and State Criteria Guidelines (SCGs)

Applicable or relevant and appropriate requirements (ARARs) are cleanup standards promulgated under federal or state environmental facility listing laws that specifically address hazardous substances or contaminants at CERCLA sites or at sites with problems or situations sufficiently similar to those encountered at CERCLA sites.

New York State does not have ARARs in its statute. The NYSDEC Division of Environmental Remediation (DER) uses New York State Standards, Criteria and Guidelines (SCGs) for evaluation of remedial alternatives at Inactive Hazardous Waste Sites (TAGM #4030, revised 05/15/90).

The SCGs utilized for the Bethpage Community Park IRM remedial investigation included chemical specific guidelines listed in TAGM #4046 (Determination of Soil Cleanup Objectives and Cleanup Levels, 01/24/94, and as revised in a proposed TAGM dated 4/95) for soil and 6 NYCRR Part 703 (Class GA Standards) for groundwater. For metals, TAGM #4046 Recommended Soil Cleanup Objectives (RSCOs) identify a precise value or, in some cases, a Site Background (SB) concentration. During evaluation of soil data in the 11/2005 IR/RAP and 12/2005 SIR, the upper range of the Eastern USA Regional concentration was used as the cleanup objective for metals identified with Site Background as the RSCO. For PCBs, the RSCO is 1 mg/kg for surface soils and 10 mg/kg for subsurface soils. With regards to TAGM #4046 for remediation purposes, surface soils are typically considered to be the top 24 inches of soil. However, the depth for surface soils can also be specifically set by the NYSDEC Project Manager. In the 11/2005 IR/RAP and 12/2005 SIR, surface soils were conservatively expanded to include the top 10-feet of soil. It was reasoned that this depth would account for any planned or future redevelopment and/or maintenance activities at the Park. Continued use of the site as a community park would likely require more soil intrusive activities over time than a commercial property as recreational facilities are periodically upgraded and renovated. These renovations may include changes in surface grade elevation.

5.2 Identification of Remedial Alternatives

A total of five remedial alternatives were developed for the Bethpage Community Park IRM based upon a review of available response actions and the nature and extent of contamination within the IRM Construction Area. The potential remedial alternatives that have been screened for evaluation include:

- Remedial Alternative I - Limited Action
- Remedial Alternative II - Remediation to 2-Foot Depth and Cap
- Remedial Alternative III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas
- Remedial Alternative IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas
- Remedial Alternative V - Complete Removal of Impacted Soils

These remedial alternatives (RAs) are screened in the subsequent sections for effectiveness, implementability and cost, in accordance with 40 CFR 300.430 (e)(7). During remedial alternative screening, effectiveness refers to whether the remedial alternative reduces or contains the soil contamination to meet the site remedial action objectives and reduces the potential threat to human health and the environment. Implementability evaluates whether the remedial alternatives can be put into practice considering institutional, schedule, technology and personnel constraints. Cost is quantitatively used to evaluate remedial alternatives relative to one another while providing a comparable level of effectiveness and implementability. Costs are generally rated as low, moderate or high.

The proposed remedial alternatives address soil contamination within the IRM Construction Area as well as neighboring areas anticipated to be impacted by construction activity. Regardless of which alternative is ultimately implemented for remediation of soil impacts, it has been recommended that new buildings constructed in areas with significant soil vapor concentrations incorporate a system to mitigate soil vapor intrusion. Groundwater remediation is not addressed as part of any remedial alternative for the IRM area. Groundwater impacts are being addressed as part of a Consent Order between NYSDEC and Northrop Grumman.

5.2.1 Remedial Alternative I – Limited Action

A Limited Action alternative was identified as a baseline remedial alternative for the Bethpage Community Park IRM. As opposed to a No Action alternative, the Limited Action alternative includes the removal of contaminated soil that will be excavated as part of planned site redevelopment activities, which include demolition of an existing ice rink, construction of a new indoor rink building, regrading and reconstruction of parking areas, and reconfiguration of the Park entrance. The planned site redevelopment is expected to require the excavation of approximately 31,000 cubic yards of soil contaminated above NYSDEC TAGM #4046 RSCOs. The planned redevelopment activities will affect most of the IRM Construction Area except for the western portion of the Construction Area, which is currently utilized for shuffleboard courts, basketball courts, bocce ball, picnic area and handball courts. Under Alternative I, all excavated contaminated soil will be removed and properly disposed off-site at a permitted facility. Furthermore, this remedial alternative will include the implementation of an environmental easement and institutional controls to minimize exposure to contaminated soils remaining within the boundaries of the IRM Construction Area. Following site redevelopment, excavated areas will be essentially capped with a new building or paved parking areas. Contaminated surface soils would remain exposed at grade in certain areas of the site where redevelopment is not planned, such as the picnic area in the northwest section of the Construction Area.

5.2.1.1 Effectiveness

Excavation and off-site disposal of soils that are removed as part of construction activities will eliminate a significant volume of contaminated soil from the IRM Construction Area. However, higher contamination documented during the remedial investigation at deeper depths and in areas not designated for construction will remain. Therefore, potential exposure with contaminated soils will remain in some locations. The Limited Action alternative will only be partially effective in eliminating the complete functional pathways for exposure to contaminants.

5.2.1.2 Implementability

The Limited Action alternative comprising removal and off-site disposal of soils excavated as part of planned construction activities can be readily implemented. Implementing the Limited Action alternative will require minor inconveniences to the planned redevelopment activities. Excavated soils will need to be re-directed for off-site disposal rather than re-utilized on-site. This alternative will not increase the scope of remedial excavation compared with the volume of soil required to be removed for new construction. Additional equipment and personnel to accomplish the remedial excavation will also be required during the new construction work.

5.2.1.3 Cost

The cost for the Limited Action alternative would be relatively low compared to the other alternatives. The Limited Action Alternative does not increase the scope of remedial excavation beyond the construction excavation requirements needed to accomplish the planned site redevelopment.

5.2.1.4 Screening Evaluation Conclusion

Although the Limited Action alternative includes a significant removal and off-site disposal effort for contaminated soil, it does not address potential exposure concerns in the western portion of the Construction Area. This alternative is, therefore, not considered further for analysis herein.

5.2.2 Remedial Alternative II – Remediation to Two-Foot Depth and Cap

RA II for the Bethpage Community Park IRM comprises excavation and removal of contaminated soils throughout the Construction Area, as well as areas anticipated to be impacted by construction activity, to a depth of two feet. In addition, as with the Limited Action Alternative, all contaminated soil exceeding TAGM objectives that will be excavated as part of the site redevelopment and construction activities will be removed and disposed off-site at a permitted facility. This remedial alternative will leave some higher contamination on-site, albeit beneath a clean soil cap or beneath impervious paving, requiring the implementation of an environmental easement and institutional controls that limit site activity and future development. A remedial excavation plan for RA II is provided as Figure 5.

The planned site redevelopment is anticipated to require a minimum two-foot excavation in most areas to facilitate new construction except for the western portion of the IRM Construction Area, which is currently utilized for shuffleboard courts, basketball courts, bocce ball, picnic area and handball courts. Site redevelopment was not initially planned for the western portion of the IRM Construction Area. However, reconstruction in-kind will be required if the area is remediated to a significant depth. RA II can be achieved by removing and disposing off-site all soils excavated as part of the planned redevelopment activities and, in addition, excavating contaminated soils to a two-foot depth in the pervious areas of the western portion of the IRM Construction Area. In this manner, RA II is comparable to the Limited Action Alternative (RA I) plus the removal of the contaminated soils to a two-foot depth in the pervious areas. The total volume of additional soil excavated, removed and disposed off-site under Remedial Alternative II compared with the Limited Action Alternative is estimated to be 5,000 cubic yards.

5.2.2.1 Effectiveness

Excavation and off-site disposal of soils that are removed as part of the redevelopment activities will eliminate a significant volume of contaminated soil from the IRM Construction Area. The additional removal of contaminated soils to a two-foot depth in all pervious areas not addressed as part of planned construction activities will limit potential human exposure with contaminated soils that are left in place. This remedial alternative will be effective in reducing potential human exposure to contaminated soil during typical day-to-day site activities. However, higher contamination concentrations, documented in the 11/2005 IR/RAP and 12/2005 SIR, at deeper depths will remain in place.

5.2.2.2 Implementability

RA II is considered highly implementable. Soils excavated and removed as part of planned redevelopment activities will be disposed off-site rather than reused on-site. Equipment and personnel mobilized to accomplish the remedial excavation will be able to perform the additional removal of the nominal two-feet from the pervious western portion of the IRM area with relatively minor additional effort.

5.2.2.3 Cost

The cost for RA II is considered to be relatively low compared to other alternatives. This alternative does not significantly increase the scope of remedial excavation beyond the construction excavation requirements needed to accomplish the planned site redevelopment. The additional remedial excavation to achieve a two-foot contaminated soil removal in the pervious sections of the IRM Construction Area compared with the soils that are designated to be removed as part of planned construction is estimated to be 5,000 cubic yards.

5.2.2.4 Screening Evaluation Conclusion

RA II includes a significant removal and off-site disposal effort for contaminated soil and reduces potential human exposure concerns by providing an impervious surface or minimum two-foot clean soil barrier between grade and contaminated soil. This alternative is retained for further analysis herein.

5.2.3 Remedial Alternative III – Remediation to Two-Foot Depth and Cap plus Targeted Removal of Fill Areas

RA III for the Bethpage Community Park IRM is comparable with RAII but includes additional excavation in select areas to remove historical fill areas that were documented during the remedial investigation to have high levels of contamination. As with RA II, all contaminated soil exceeding TAGM objectives that will be excavated as part of the site redevelopment and construction activities will be removed and disposed properly off-site at a permitted facility. A minimum two-foot excavation will also be performed across pervious areas to remove contaminated near-surface soils.

As part of RA III, the targeted removal of fill areas necessitates additional excavation between 10 and 20 feet deep in some locations. The total volume of additional soil excavated, removed and disposed off-site under RA III compared with RA II is estimated to be 21,000 cubic yards. This equates to a total remedial excavation of approximately 57,000 cubic yards. This alternative, however, will result in the removal of the most significant contamination within the IRM Construction Area. A remedial excavation plan for RA III is provided as Figure 6.

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5.2.3.1 Effectiveness

RA III will result in the excavation, removal and off-site disposal of a significant volume of contaminated soil from the IRM Construction Area. This remedial alternative will be effective in reducing potential human exposure to contaminated soil during typical day-to-day site activities. Higher contamination concentrations identified as historical fill areas in the 11/2005 IR/RAP and 12/2005 SIR will also be remediated and offer environmental protection from these potential source areas.

5.2.3.2 Implementability

RA III involves a significant excavation program with depths of up to 20 feet in documented fill areas. However, planned excavation depths can be accomplished with conventional excavation equipment. Accordingly, RA III is considered readily implementable. As with RA II, soils excavated and removed as part of planned redevelopment activities will be disposed off-site rather than reused on-site. Equipment and personnel mobilized to accomplish the remedial excavation will be able to perform the additional removal of two-feet from the western pervious portion of the IRM area and the designated fill areas.

5.2.3.3 Cost

The cost for RA III is considered to be moderate relative to the other alternatives considered. This alternative increases the scope of remedial excavation beyond the remedial construction excavation requirements needed to accomplish the planned site redevelopment by approximately 21,000 cubic yards.

5.2.3.4 Screening Evaluation Conclusion

RA III includes all remedial excavation specified as part of RA II plus the targeted removal of historical fill areas to depths up to 20 feet below grade, which were documented to have the highest contamination. Potential human exposure concerns are reduced by providing a minimum two-foot barrier between grade and contaminated soil in pervious areas. This alternative is retained for further analysis.

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5.2.4 Remedial Alternative IV – Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

RA IV for the Bethpage Community Park IRM is essentially the same as the remedial action plan proposed in the 11/2005 IR/RAP and 12/2005 SIR. This remedial alternative specifies the excavation and off-site disposal of all contaminated soil throughout the IRM Construction Area to a depth of 10-feet as well as the targeted removal of historical fill areas that were documented during the remedial investigation to have higher levels of contamination. Also included for remediation are certain areas outside the Construction Area that may by impacted by the construction activity. These areas have been revised in comparison to the IR/RAP and SIR based on updated details on the proposed construction activity.

As with RA III, the targeted removal of fill areas necessitates additional excavation below 10 feet in some locations. The total soil volume to be excavated as part of this remedial alternative is approximately 100,000 cubic yards. This alternative will result in the removal of the most significant contamination within the IRM Construction Area, all documented PCB impacts, provide improved environmental protection and nearly eliminate any potential human exposure to contamination. A minimum buffer of 10 feet will be provided between surface and subsurface contamination allowing for virtually unrestricted future use of the Park within the Construction Area. A remedial excavation plan for RA IV is provided as Figure 7.

5.2.4.1 Effectiveness

RA IV will result in the excavation, removal and off-site disposal of most contaminated soil from the IRM Construction Area. This remedial alternative will virtually eliminate potential human exposure to contaminated soil during typical day-to-day site activities and any worker related exposure from site activities involving intrusive soil excavation. RA IV is effective in providing low potential human exposure and environmental protection.

5.2.4.2 Implementability

RA IV involves a significant excavation program with depths of up to 20 feet in documented fill areas. As with RA III, planned excavation depths can be accomplished with conventional

excavation equipment. Although the scope of remedial excavation is significant, RA IV is considered implementable.

5.2.4.3 Cost

The cost for RA IV is considered to be high compared with the alternative remedial options.

5.2.4.4 Screening Evaluation Conclusion

RA IV includes an excavation of all contaminated soil within the IRM Construction Area to a depth of 10 feet plus the targeted removal of historical fill areas to depths up to 20 feet below grade. Potential human exposure concerns are nearly eliminated by providing a minimum 10-foot barrier between grade and contaminated soil. All documented PCB impacts are removed, and environmental protection is provided through the removal of potential higher contamination source areas. This alternative is retained for further analysis.

5.2.5 Remedial Alternative V – Remediation of all Soils to TAGM Objectives

RA V for the Bethpage Community Park IRM is the excavation and removal of all soil contamination exceeding TAGM objectives. Based on contamination documented in the 11/2005 IR/RAP and 12/2005 SIR, this remedial alternative would result in soil excavation to depths of up to 40-60 feet in some locations. The total soil volume to be excavated as part of this remedial alternative would be approximately 269,000 cubic yards.

5.2.5.1 Effectiveness

RA V would be effective in eliminating all soil contamination to a depth of 60 feet within the boundaries of the IRM Construction Area.

5.2.5.2 Implementability

Under RA V, removal of all documented soil contamination would necessitate excavation in large areas to depths between 40 and 60 feet. This requirement is beyond conventional excavation depth and would dictate the use of specialized equipment and excavation methods. This remedial alternative is not considered readily implementable.

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5.2.5.3 Cost

The cost for RA V is considered to be extremely high compared with the alternative remedial options. The projected cost for this remedial alternative is shown in Table 6.0.1.

5.2.5.4 Screening Evaluation Conclusion

RA V is a thorough soil remediation plan resulting in the removal of all documented soil contamination in the IRM Construction Area. To accomplish the necessary remedial excavation, specialized excavation equipment and methods would be necessary. As reported in the 11/2005 IR/RAP and 12/2005 SIR, the deeper contamination that would drive excavation to depths of 30-60 feet was typically metals such as arsenic and, in some locations, chromium. In most locations, these contaminants were also not detected continuously from near surface soils to the deeper locations. In consideration of the limited benefits in removing all contamination at the expense of the substantial cost, this alternative is not retained for further analysis.

6.0 COMPARISON OF REMEDIAL ALTERNATIVES

Five remedial alternatives were identified and screened in Section 5.2 that could potentially be used to meet the remedial action objectives for the IRM Construction Area. All remedial alternatives were based on varying extents of excavation and off-site disposal of contaminated soil. The remedial alternatives deemed appropriate for further evaluation for the Bethpage Community Park IRM include:

- Remedial Alternative II - Remediation to 2-Foot Depth and Cap
- Remedial Alternative III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas
- Remedial Alternative IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

A descriptive summary of these remedial alternatives with estimated soil remedial volumes, remediation time and cost is provided in Table 6.01.

In consideration of 6 NYCRR Part 375-1.10 and NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, Remedial Alternatives II, III and IV are further evaluated in this section using the following criteria:

1) Compliance with ARARs/SCGs
2) Overall Protection of Human Health and the Environment,
3) Short-Term Effectiveness
4) Long-Term Effectiveness and Permanence
5) Reduction of Toxicity, Mobility or Volume through Treatment
6) Implementability
7) Cost
8) Community Acceptance

In addition, as indicated in DER-10 [Section 4.2, Development and Evaluation of Alternatives], the screened alternatives were also evaluated based upon "(1) Current, intended and reasonably anticipated future use of the site; (2) Removal of source areas of contamination, and; (3) Containment of contamination." The results of this evaluation are used to select the most appropriate remedial alternative.

6.1 Compliance with ARARs/SCGs

Compliance with ARARs/SCGs addresses whether or not a remedial alternative will meet applicable environmental laws, regulations, standards, and guidelines. For the Bethpage Community Park IRM, NYSDEC TAGM #4046 guidelines are used as the SCGs.

RA II – Remediation to 2-Foot Depth and Cap

This remedial alternative is compliant with ARARs/SCGs to the minimum specified remediation depth of two feet in pervious areas. As with all remedial alternatives (RA II, RA III and RA IV), additional contaminated soil will also be removed, as necessary, to facilitate site redevelopment. Therefore, the remedial depth will be greater than 2 feet in some locations, as shown on Figure 5.

This remedial alternative will leave contaminated soil in place below a depth of two feet in areas not designated for deeper excavation as part of site redevelopment and construction. Some contamination to remain under this remedial alternative includes areas with PCB impacts greater than 50 mg/kg. In accordance with 6 NYCRR Part 371.4, solid wastes containing 50 mg/kg or greater PCBs are listed hazardous wastes.

RA III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas

This remedial alternative is compliant with ARARs/SCGs to the remedial depth specified, as shown in Figure 6. The minimum remedial depth will be two feet in pervious areas. Deeper remediation will be performed in areas designated for construction and in historical fill areas. This remedial alternative will remove the most significant contamination in the historical fill areas. In areas with soil contamination that are not-designated for remedial excavation to facilitate construction or historical fill areas, contamination will remain beneath the surface.

RA IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

Of the three remedial alternatives considered for further evaluation, this remedy offers the greatest level of compliance with ARARs/SCGs. This remedial alternative specifies remedial excavation to a minimum depth of 10 feet and, therefore, is compliant with ARARs/SCGs to the minimum depth of 10 feet. As with RA III, this remedial alternative specifies excavation of historical fill areas.

6.2 Overall Protection of Human Health and the Environment

Protection of Human Health and the Environment evaluates the ability of each remedial alternative to eliminate, reduce or control through removal, treatment, engineering controls or institutional controls, the exposure risks at the Site, and achieve the remedial action objectives (RAOs).

The Exposure Assessment summarized in Section 4.2 for the Bethpage Community Park IRM identified complete functional pathways with potential exposure risk to visitors/workers at the site from 1) ingestion of contaminated soil, 2) inhalation of vapors, 3) inhalation of

contaminated dust during remediation or any soil intrusive activities and 4) dermal absorption from contact with contaminated soil. The potential exposure hazard for inhalation of vapors includes vapors generated from soil piles during excavation and through soil vapor intrusion into human-occupied spaces. Each remedial alternative under consideration will address soil vapor intrusion through incorporation of vapor intrusion mitigation measures in the design of any future site buildings in the areas with significant soil vapor contamination.

The RAO for this program was to identify a remedial strategy that is protective of human health and the environment, meets the intended objectives of the IRM, and takes into consideration the proposed future use and potential future use of the Site.

RA II – Remediation to 2-Foot Depth and Cap

This remedial alternative would serve to reduce the exposure hazards identified during the exposure assessment. For visitors and workers at the site, the potential exposure from ingestion of contaminated soil would be reduced to minor, and, therefore, considered an acceptable risk. This remedial alternative will result in a minimum two-foot clean soil barrier in pervious areas between grade and deeper contaminated soil. Most areas designated for construction will be finished with an impervious barrier such as paving or covered with a new recreational facility building. Workers at the site are more likely to encounter soils below two feet than visitors due to site maintenance or development activities. However, workers will be adults and less likely to ingest contaminated soil.

For visitors to the site, the potential exposure risk from inhalation of vapors, inhalation of contaminated dust and dermal contact with contaminated soil is minor considering visitors will not typically be excavating any soil beneath a depth of two feet. In addition, the majority of the Site will be covered with an impervious barrier. The potential exposure hazard from inhalation of vapors, inhalation of contaminated dust and dermal contact with contaminated soil remains for workers at the site during any intrusive soil activity beneath a depth of two feet.

This remedial alternative is protective of public health i.e., visitors to the site. Assurance for protection of worker health would necessitate the implementation of institutional controls

limiting invasive soil activity without proper health & safety review and consideration. However, this remedial alternative does not address historical fill areas on the site identified with higher levels of contamination. These areas remain as potential environmental liabilities. The site investigation suggests that the contaminants in these areas are not significantly mobile and that these areas are currently not adversely impacting groundwater quality. However, given the level of contamination in these areas, there is a greater potential for contamination to mobilize should site conditions (i.e., surface configuration, stormwater infiltration, etc.) change. In addition, since the concentrations of contamination in the fill areas are higher than most other places within the Construction Area, potential site worker exposure concerns are more significant in these areas should future site work necessitate disturbing these soils.

RA III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas

As with RA II, this remedial alternative would serve to reduce the exposure hazards identified during the exposure assessment. The exposure assessment evaluation for visitors and workers at the site would be consistent with RA II. This remedial alternative addresses historical fill areas on the site identified with higher levels of contamination, and eliminates these areas as potential environmental liabilities. However, as with RA II, RA III would require implementation of institutional controls limiting any invasive soil activity without proper health & safety review and consideration due to impacted soils that would remain below the 2-foot level.

RA IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

As with RA II and RA III, this remedial alternative would reduce the potential functional pathways for visitors to the site to minor (i.e., acceptable risk). Furthermore, the potential functional pathways for workers at the site would also be considered minor since typical invasive soil activities rarely exceed a depth of 10 feet. With this remedial alternative, institutional controls would not be necessary for normal site operations and typical site redevelopment and maintenance activity. The potential for worker exposure to vapors from soil piles during remediation would be minor due to the implementation of a Health & Safety Plan and Community Air Monitoring Program.

This remedial alternative addresses historical fill areas on the site identified with higher levels of contamination, and eliminates these areas as potential environmental liabilities.

6.3 Short-Term Effectiveness

Short-term effectiveness evaluates the potential short-term adverse impacts and risks of the remedial alternative upon the community, workers, and the environment during implementation. Engineering controls used to mitigate short-term impacts and the time required to accomplish the remedial alternative are also estimated.

For each of the excavation-based remedial alternatives considered for the Bethpage Community Park IRM, adverse impacts to the community include closure of the Park facilities during remediation and construction activities, noise, construction vehicular traffic on local roadways, and potential dust and vapor generation. For each alternative, noise generation will be limited to select day-time hours and qualitatively monitored for levels commensurate with standard construction equipment. Dust and vapor generation will be monitored through the use of a Community Air Monitoring Program (CAMP) that can be used to cease remedial operations if thresholds for VOCs and airborne particulates are exceeded. Dust suppression measures will be employed during all intrusive soil excavation.

Adverse impacts to workers during implementation of any remedial alternative will be addressed through the application of the CAMP and adherence to a contractor-generator and Town-approved Health & Safety Plan.

An adverse impact to the environment may include potential contamination of surface water runoff. This would be controlled during site development activity through use of project specific contractor specifications, temporary stormwater diversion, and implementation of a NYSDEC State Pollutant Discharge Elimination System (SPDES) Permit and a Stormwater Pollution Prevention Plan (SWPPP), if appropriate and where required.

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RA II – Remediation to 2-Foot Depth and Cap

This remedial alternative offers the lowest risk for potential adverse impacts to community, workers, and the environment. This is based on the estimated soil volume for remedial excavation, which for this alternative is estimated to be 36,000 cubic yards. This volume exceeds the projected remedial excavation required to facilitate the planned site redevelopment by approximately 5,000 cubic yards. As indicated in Table 6.0.1, the estimated time to accomplish the RA II remedial alternative is 45 days.

RA III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas

This remedial alternative offers a relatively greater risk for potential adverse impacts to community, workers, and the environment than RA II. The estimated soil volume for remedial excavation is estimated to be 57,000 cubic yards. The estimated remediation site work time is 71 days.

RA IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

Relative to the three remedial alternatives, RA IV offers the highest risk for potential adverse impacts to the community, workers, and the environment. The estimated soil volume for remedial excavation is estimated to be 100,000 cubic yards. The estimated site work time for remediation is 125 days.

As stated above, all potential impacts on the community would be moderated through project planning and monitoring. Potential adverse impacts from vapors and dust would be addressed through the implementation of a CAMP. Excavation work will be performed in accordance with a Health & Safety Plan for workers. The potential impact to the community from construction vehicular traffic, primarily noise and traffic congestion on public roadways, would be controlled to a limited extent through adherence to normal daily work hours. It should be noted that the estimated remediation times reported above assume an excavation rate of approximately 800 cubic yards per day. With continual loading, this equates to the transport of approximately 27 tractor-trailer dump trucks per day.

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6.4 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence evaluates whether the remedial alternative will remain effective over a long period of time. This criterion considers whether the remedial alternative will continue to meet the remedial action objectives in the future and provide continued protection to human health and the environment. This criterion is more often important for remedial alternatives that contain, stabilize or treat contaminated media on-site. This is because the effectiveness of a containment, stabilization or treatment method may decrease over time. For the remedial alternatives considered for the Park IRM, the alternative that removes the most contamination will offer the highest level of long-term effectiveness and permanence.

RA II – Remediation to 2-Foot Depth and Cap

This remedial alternative requires the implementation of institutional controls to minimize the potential for future exposure. Regular maintenance of these controls, such as signage and personnel training, will be required. As long as the institutional controls remain in place, long-term effectiveness should remain. However, regardless of the institutional controls, documented contamination in historical fill areas will remain a potential environmental liability, as discussed in Section 6.2 above.

RA III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas

As with RA II, this remedial alternative requires the implementation of institutional controls to minimize the potential for future exposure. Regular maintenance of these controls, such as signage and personnel training, will be required. As long as the institutional controls remain in place, long-term effectiveness should remain.

RA IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

This remedial alternative offers the highest level of long-term effectiveness and permanence. RA IV will remove all PCB impacts within the designated Construction Area and most significant soil contamination. Institutional controls limiting site worker activities that may disturb subsurface soils are also not necessary to a depth of 10 feet. Administrative efforts to maintain any institutional controls will be minimized.

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6.5 Reduction of Toxicity, Mobility and Volume

This criterion evaluates whether the remedial alternative reduces the toxicity, mobility and volume of the site contamination.

Remedial alternatives RA II, RA III and RA IV include excavation of contaminated soil and differ in the volume of soil designated for removal. Given that the proposed construction work will change the surface configuration of the site, stormwater drainage, infiltration patterns and mobility of contaminants could change. Toxicity of the on-site contaminants that remain following remedial excavation are not altered for any of the three alternatives. The volume of contaminated soil within the IRM Construction Area would be reduced as the scope of remedial excavation increases from RA II to RA IV.

RA II – Remediation to 2-Foot Depth and Cap

Of the remedial alternatives under consideration, this remedial alternative results in the lowest volume reduction of documented soil contamination. The estimated volume of soil to be remediated for this alternative is approximately 36,000 cubic yards. This is based on the volume of contaminated soil that will be excavated as part of planned site redevelopment and the removal of the top two-feet of contaminated soil in the pervious western portion of the Construction Area.

This remedial alternative does not address historical fill areas on the site identified with higher levels of contamination. Since the concentrations of contaminants in the fill areas are higher than most other places within the Construction Area, there is a greater potential for contamination to mobilize should site conditions (i.e., surface configuration, stormwater infiltration, etc.) change. Therefore, the fill areas remain as potential environmental liabilities even though the site investigation suggests that the contaminants in these areas are not significantly mobile and that these areas are currently not adversely impacting groundwater quality.

RA III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas

Remedial Alternative III increases the remedial excavation designated under RA II by approximately 21,000 cubic yards through the additional excavation of historical fill areas that were documented with the highest contamination on site.

RA IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

Remedial Alternative IV is the most comprehensive remedy under consideration for the IRM Construction Area and results in the largest reduction in volume of site contamination. This alternative includes the removal of all contamination above TAGM objectives to a depth of 10-feet plus the additional removal of historical fill areas. The estimated scope of remedial excavation is 100,000 cubic yards.

6.6 Implementability

Implementability evaluates the technical and administrative feasibility of the remedial alternatives.

RA II – Remediation to 2-Foot Depth and Cap

As discussed in Section 5.2.2, RA II is considered highly implementable. Soils excavated and removed as part of planned redevelopment activities will be disposed off-site rather than reused on-site. Equipment and personnel mobilized to accomplish the remedial excavation will be able to perform the additional removal of the pervious two-feet from the western portion of the IRM area with relatively minor additional effort.

RA III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas

RA III involves a relatively significant excavation program with depths of up to 20 feet in documented fill areas. However, planned excavation depths can be accomplished with conventional excavation equipment. Accordingly, RA III is considered readily implementable. Equipment and personnel mobilized to accomplish the remedial excavation for the planned site redevelopment will be able to perform the additional removal of two-feet from the pervious western portion of the IRM area and the designated fill areas.

RA IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

RA IV involves the most significant excavation program with depths of up to 20 feet in documented fill areas. As with RA III, planned excavation depths can be accomplished with conventional excavation equipment. Although the scope of remedial excavation is significant, RA IV is considered reasonably implementable.

6.7 Cost

This criterion is used to evaluate the estimated present worth of capital, operation, maintenance and monitoring costs for the remedial alternatives. Estimated capital costs for remedial alternatives RA II, RAIII and RA IV are provided in Table 6.0.1. The cost of backfill following remedial excavation is included in the cost comparison but site restoration is excluded. Site restoration will be performed as part of the site redevelopment and will be equivalent for all alternatives. Furthermore, yearly operating and maintenance costs are excluded considering such costs will be fairly equivalent for the three remedial alternatives. Long term administrative and maintenance costs for RA IV should likely be less than RA II and RA III considering this option provides a minimum buffer of 10-feet between any residual contamination and nearly all anticipated future site activities will not require intrusive soil activity beneath 10-feet.

RA II – Remediation to 2-Foot Depth and Cap

The projected cost for this remedial alternative is approximately $6.0M. Remedial alternative II is the least costly alternative.

RA III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas

The projected cost for this remedial alternative is approximately $11.9M. Remedial Alternative III costs are estimated to be more than RA II and less than RA IV.

RA IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

The projected cost for this remedial alternative is approximately $19.0M. Remedial Alternative IV includes the highest cost impact of the three alternatives.

6.8 Community Acceptance

This criterion evaluates the public's comments, concerns and overall perception of the remedial alternatives. Prior to implementation of a remedial alternative for the Bethpage Community Park IRM, the public will be informed of the details of the proposed alternative in accordance with a NYSDEC-approved Community Participation Plan (CPP) for this project. The CPP includes an informational meeting during which the public will have the opportunity to express any concerns regarding the Remedial Action Plan. Prior to implementing any alternative, the public's concerns will be evaluated in accordance with the CPP.

Based on experience with community feedback on a similar remedial program within the Town of Oyster Bay, it is anticipated that the majority of residents will tend to prefer the most extensive cleanup option, i.e., the remedial alternative that removes the most contamination.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The comprehensive remedial investigation summarized in the 11/2005 IR/RAP and 12/2005 SIR documented soil contamination in the Bethpage Community Park IRM Construction Area from PCBs, metals, VOCs and SVOCs (PAHs). These reports included a recommendation to implement a remedial strategy consistent with Remedial Alternative IV as identified herein. As requested by NYSDEC, additional alternatives have been identified and evaluated within this report. Following an initial screening of general alternatives, three potential remedies were further evaluated against the remedial action objective of the IRM, which was to identify a remedial strategy that is protective of human health and the environment, meets the intended objectives of the IRM, and takes into consideration the proposed future use and potential future use of the Site. The criteria that the remedial alternatives were evaluated against is consistent with NYSDEC requirements and included 1) compliance with Applicable or Relevant and Appropriate Requirements, and Standards, Criteria and Guidance (ARARs/SCGs), 2) overall protection of human health and the environment, 3) short-term effectiveness, 4) long-term effectiveness and permanence, 5) reduction of toxicity, mobility or volume, 6) implementability, 7) cost, and 8) community acceptance. In addition, as indicted in NYSDEC Technical Guidance

for Site Investigation and Remediation (Draft DER-10, December 2002), the various alternatives were evaluated in consideration of 1) current, intended and reasonably anticipated future use of the site, 2) removal of source areas of contamination, and 3) containment of contamination.

Of the five potential remedial alternatives identified and screened, the following three were further evaluated and compared for implementation at the site:

- Remedial Alternative II - Remediation to 2-Foot Depth and Cap
- Remedial Alternative III - Remediation to 2-Foot Depth and Cap plus Targeted Removal of Fill Areas
- Remedial Alternative IV - Remediation to 10-Foot Depth plus Targeted Removal of Fill Areas

Based on the evaluation criteria of DER-10, the recommended remedial alternative is RA IV - Remediation to 10-Feet plus Targeted Removal of Fill Areas. This takes into account compliance with cleanup guidelines (ARARs/SCGs), protection of human health and the environment, short and long-term effectiveness, reduction of toxicity, implementability, cost, community acceptance, current, intended and reasonably anticipated future use of the site, removal of source areas of contamination, and containment of contamination. Remedial alternative RA IV results in the removal of the vast majority of site contamination including 100 percent of identified PCB impacts that exceed referenced cleanup guidelines. Significantly contaminated historical fill areas are addressed through deeper excavation. In addition, RA IV provides a buffer of at least 10 feet between grade and any residual impacts left in place. Remediation of contaminated soils to the specified depth permits future site renovation and maintenance operations such as installation of footings, support buildings, recreational equipment, fencing, lamp posts, curbs, new pavement, revised drain piping, new foundations, and revised surface gradients, to depths less than ten feet to proceed without exposure concerns and the need for associated health and safety requirements.

Remedial alternatives RA II and RA III are not recommended for implementation. RA II is not deemed to be sufficiently protective of human health and the environment considering highly contaminated historical fill areas would remain at the site. While remedial alternatives RA III

met the goals of the exposure assessment, which identified potential risk to Visitors/Workers at the Site, it does not support the long-term reasonably anticipated future use of the site. The Park is projected to remain a public recreational facility that will require intrusive subsurface work to support operation and maintenance activities and may undergo additional redevelopment and redesign in the future. Remedial alternatives RA II and RA III are encumbered with exposure concerns and health and safety requirements for any future site work below grade. RA IV allows for unrestricted use of the property with regards to soil contamination to a depth of 10 feet.

H2MGROUP

FIGURES

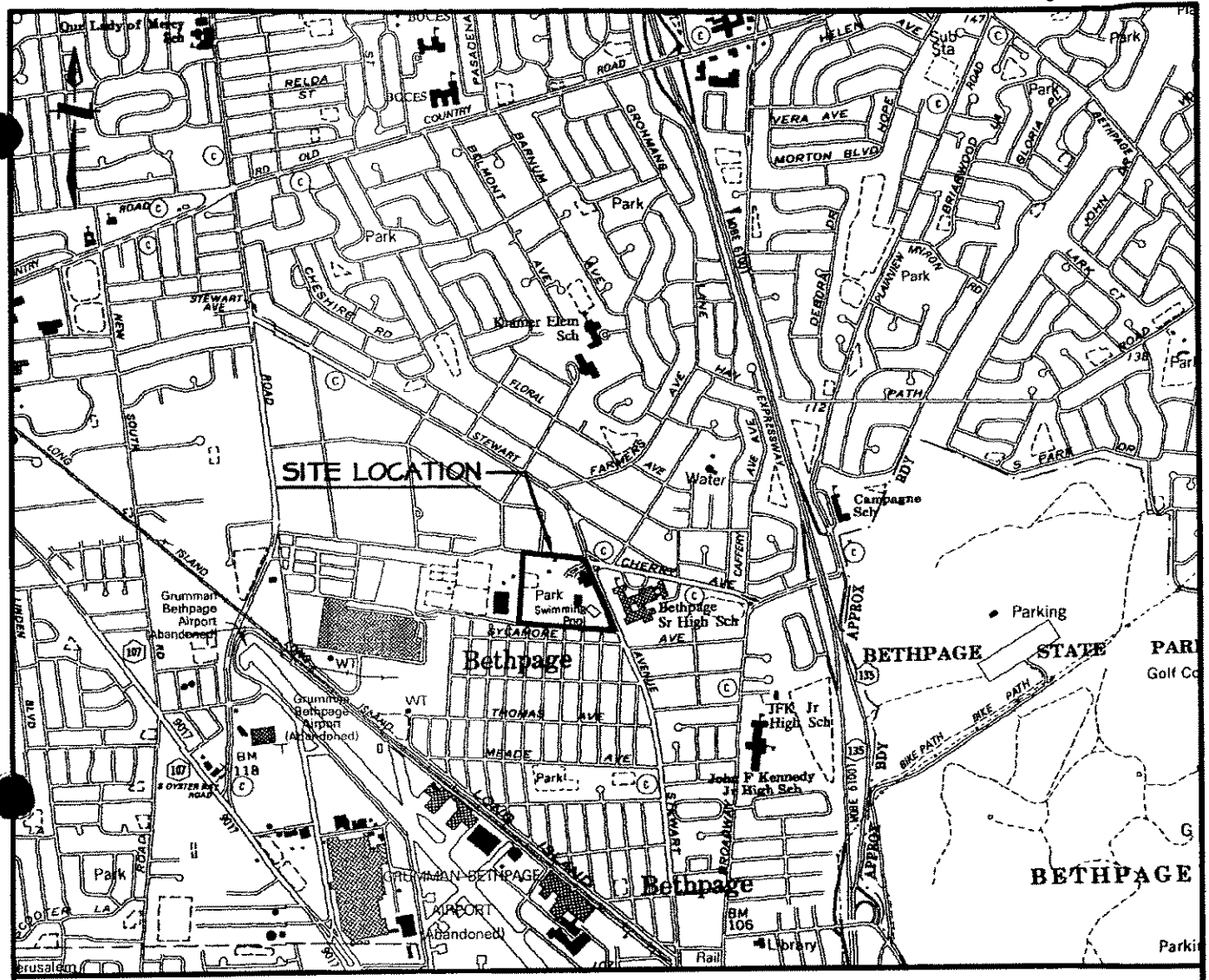

FIGURE 1. SITE LOCATION

SCALE: 1" = 2000'

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