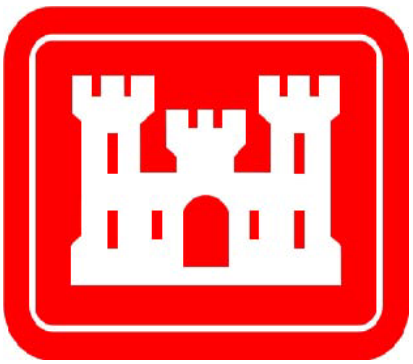

U.S. ARMY CORPS OF ENGINEERS

PRELIMINARY ASSESSMENT

Staten Island Warehouse Formerly Utilized Sites Remedial Action Program (FUSRAP) Site,
Richmond Terrace, New York

September 2011

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Executive Summary

The United Sates Army Corps of Engineers (USACE) conducted a Preliminary Assessment (PA) of the Staten Island Warehouse (SIW) site (the Site) under the authority of the Formerly Utilized Sites Remedial Action Program (FUSRAP) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) [42 U.S.C. 9601 et seq., as amended] and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP [40 CFR 300].

The purpose of this PA is to review all readily available information to determine the need for further action by the USACE to ensure protection of human health and the environment.

The former Staten Island Warehouse in Port Richmond, Staten Island, New York, was used by African Metals Corporation to store high-grade Belgian Congo uranium ore from 1940 to 1942. The uranium ore was later purchased by the Manhattan Engineering District (MED) in support of MED activities. The Site underwent multiple non government ownerships and the former structures at the Site, including the warehouse, were demolished.

The U.S. Department of Energy (DOE) identified contamination in the northwest corner of the Site in 1980. The DOE conducted an eligibility review in 1985-1986 and determined the Site was not eligible for FUSRAP based on contract language that indicated the Government did not take possession of the ore until it was removed from the Site. However, following the review of additional radiological survey information gathered from the Site in 2008 as well as additional contract language, the DOE declared the Site eligible for inclusion in FUSRAP in October 2009. The DOE then referred the Site to the USACE for appropriate action.

The USACE has reviewed existing, readily available data on the Site. Based on that review; evidence does not indicate a release and/or threat of release of non radiological (chemical) hazardous substance, pollutant, or contaminant from the Nation's early atomic energy program has occurred; there is evidence of a release and/or threat of release into the environment of hazardous substances (specifically radioactive materials) that is not a federally permitted release. However, it cannot be determined at this time, based on available evidence, whether this release is attributable to the Nation's early atomic energy program. USACE recommends that further evaluation of the SIW Site and potential governmental liability is warranted under the CERCLA process.

1.0 Introduction

The former Staten Island Warehouse in Port Richmond, Staten Island, New York, was used by African Metals Corporation (AMC), a subsidiary to the Belgian Union Miniere Du Haut-Katanga Company (Union Company), to store high-grade Belgian Congo uranium ore from 1940 to 1942 (AMC 1942). The uranium ore was later purchased by the Manhattan Engineering District (MED) in support of MED activities (MED 1942a). The Site underwent multiple non government ownerships and the former structures at the Site, including the original ore storage warehouse, were demolished (USACE 1996).

The U.S. Department of Energy (DOE) identified contamination in the northwest corner of the Site in 1980 (DOE 1980). DOE conducted an eligibility review in 1985 and determined the Site was not eligible for remediation under the Formerly Utilized Sites Remedial Action Program (FUSRAP) (DOE 1985). That decision was based on documentation indicating that the U.S. Government did not take possession of the uranium content of the ore until after it was removed from the Site.

In February of 2008 the U.S. Environmental Protection Agency (EPA) conducted a radiological survey of the Site. This survey confirmed results of previous surveys identifying an area of low-level surface radioactive contamination. EPA requested DOE review the 1986 eligibility finding. The findings of the EPA survey and additional contract language reviews, indicating the Government took possession of the material while on the dock, lead the DOE to declare the Site eligible for inclusion in the FUSRAP in October of 2009. The DOE then referred the Site to the USACE for appropriate action.

The U.S. Environmental Protection Agency (EPA) requested that DOE provide historical and technical assistance and review the eligibility decision (EPA 2009a). The DOE initially confirmed the basis for the original decision with respect to the warehouse building, which found that the U.S. Government did not take title to the ore before it was loaded onto barges for transport. However, further research indicated that the contract between the MED and AMC, the owner of the ore, called for delivery "free alongside ship" (f.a.s.), indicating that the purchaser (i.e., the U.S. Government) took custody of the ore on the loading dock (DOE 2009b).

These findings lead the DOE to declare the Site eligible for inclusion in the FUSRAP. In October of 2009 the DOE then referred the Staten Island Warehouse (SIW) site (the Site) to the United States Army Corps of Engineers (USACE) for appropriate action (DOE 2009c).

The USACE conducted a Preliminary Assessment (PA) of the Site under the authority of the FUSRAP in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) [42 U.S.C. 9601 et seq., as amended] and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP [40 CFR 300]. Also used as a reference for this PA was the Environmental Protection Agency (EPA) “Guidance for Performing Preliminary Assessments Under CERCLA” (EPA, 1991). The purpose of this PA is to review information to determine the need for further action by USACE to ensure protection of human health and the environment.

In 1974 the Department of Energy (DOE) created the FUSRAP to address sites used during the early atomic energy program that had residual contamination exceeding current regulatory limits. In the Energy and Water Development Appropriations Act, 1998 [Public Law 105-62, 111 Stat. 1320, 1326] Congress transferred responsibility for administration and execution of cleanup at eligible FUSRAP sites to the USACE. In the Energy and Water Development Appropriations Act, 2000 [Public Law 106-60, 113 Stat. 483, 502] Congress mandated that FUSRAP response actions undertaken by the Secretary of the Army, acting through the Chief of Engineers, be subject to CERCLA and the NCP.

In March of 1999, the USACE and the DOE signed a Memorandum of Understanding (MOU) between the two agencies for the purpose of delineating the responsibilities of each party relating to the administration and execution of the FUSRAP (USACE 1999). Pursuant to that MOU, when a new site is considered for inclusion in the FUSRAP, the DOE is responsible for performing historical research to determine if the site was used for activities that supported the Nation's early atomic energy program. If the DOE concludes that the site was used for the purpose, the Agency will provide the USACE with a determination of eligibility for inclusion in the FUSRAP. The USACE is then responsible for determining whether the eligible site should be designated for cleanup. To make that determination, the USACE first prepares a PA in accordance with CERCLA and the NCP to determine if a response action is appropriate.

1.1 Purpose

The purpose of a PA at eligible FUSRAP sites is to determine if there is an unpermitted release or threat of release, as those terms are defined in Section 101 (22) of CERCLA, of a hazardous substance, pollutant, or contaminant related to the Nation's early atomic energy program at the site that may present a threat to the public health or to the environment. If a PA determines that there is such a release or threat of release, that may present a threat to the public health or the environment, and if the release resulted from work performed as part of the Nation's early atomic energy program, a FUSRAP response action subject to CERCLA requirements is warranted. In such circumstances, the PA will recommend appropriate action to address the release or threat of release. If no such release or threat of release is found, the PA will recommend no further action. The scope of USACE's review during performance of the SIW PA included Site visits by USACE personnel, reviews of historic documentation from past DOE and EPA efforts at the Site, and other sources of information related to the Site.

1.2 Site History

1.2.1 General

The Site is a manmade structure circa (c) 1836, described as a solid-fill pier retained by timber bulk heads (USACE 1996). The primary early use of the Site was a storage and linseed/vegetable oil factory. Several different entities owned and operated the Site from c1859 to post 1943.

- c1859 Houseman Store/Jewett and Dean Linseed
- c1898-? JA Dean and Company (linseed oil mill) (Sanborn 1898)
- c1917-1932 American Linseed Company (linseed oil mill)
- c1932-194?s Archer-Daniels-Midland (linseed/vegetable oils)
- c1951-1953 International Engineering Chemical Co (use unknown) (Sanborn 1951)
- c1953-? Puritan Petroleum Company (Fuel Oil Distribution)

- c1965-? Gulf Oil Company (mooring of floating equipment)

All buildings had been demolished as of 1974 and the Site was used for storage of truck trailers and other equipment (1978-present). The Site is currently used for storage of trailers, construction equipment and other construction related material. The Site is owned by Dolan Transportation Services Inc. (DTS).

Aerial photos spanning from 1931 to 2008 (33 photos representing 27 different years) were reviewed as part of this assessment. Figures 2 and 3 present a summary of this review.

A review of Sanborn Maps from 1898 to 1951 (Sanborn 2011) was also conducted as part of this assessment. Coal and fuel oil use and storage were noted along with property ownership.

1.2.2 Uranium Ore

Fearing a German invasion of the Congo, Edgar Sengier, President of Union Miniere du Haut-Katanga (represented in the United States by African Metals Corporation), arranged for shipment of more than 1,000 tons of pitchblende ore to the United States c1939. (DOE 2009a) Note that the ore had significant value due to its radium content. The ore arrived in the United States in the latter half of 1940 and was stored in steel drums at the Archer-Daniels-Midland (ADM) warehouse, Port Richmond, Staten Island, NY. (DOE 2009b) Arrival of the ore in the United States was announced to appropriate authorities. However, it was the spring of 1942 before interest was expressed on the part of the U.S. Government in the uranium ore stored in the warehouse and the fall of 1942 before action was taken to ultimately acquire the uranium content of the ore (DOE 2009a).

Arrangements were made to deliver 1,823 drums of ore to Lehigh Valley Railroad (LHVRR) lighters at the Dean Mill Plant of the Archer Daniels Company beginning at 8:00 a.m. on November 2nd for shipment to the Seneca Ordnance Depot (SOD), Romulus, New York. The letter also indicates that the transfer of custody of this material to the U.S. Government would be accomplished when delivered Free Along Side ship (f.a.s.), in this case the ships being the LHVRR lighters (DOE 2009a).

Many documents discuss that these initial ores were transported via the LHVRR to SOD. It should be noted that the LHVRR owned and operated several piers in NY Harbor during this time frame (PNYA 1943) and that SOD is located between two lines of the LHVRR. Most notably the LHVRR owned and operated NY Pier 38, on the west side of Manhattan (see Figure 1). Some documents discuss the potential that the ADM facility was used to store or trans-load future ore shipments. This appears unlikely as contract documents state that subsequent ore to be delivered free on board (f.o.b.) at NY Pier 38 (DOE 2009a). Additionally, storage facilities existed at SOD, others were built at the Clinton Engineering Works, TN, and in November of 1943 in Middlesex, NJ (the Perry Warehouse) (UNK 1947). The Perry Warehouse later became known as the Middlesex Sampling Plant and was used to store and assay uranium ores (USACE 2003). The Perry Warehouse was also located along rail lines owned by the LHVRR at the time of shipments of uranium ores from Africa. It should also be noted that the Baltimore and Ohio Railroad ran along the northern edge of Staten Island and just south of the Site at the time of the shipments. Aerial photographs show that large buildings on the Site were demolished between

1944 and 1974 (see Figure 2). A 1976 visual inspection of the Site by DOE confirmed that no buildings remained on Site (DOE 1976). All evidence states that the LHVRR transported the ores imported from Africa. While evidence has not been found to definitively state as such, the evidence does suggest that the ADM facility was only used for the initial commercial (nongovernmental) ore shipment and storage.

2.0 Site Location, Climatic Conditions, Operational History, Current Site Description, and Waste Characteristics

2.1 Location

The Site is located at 2351 Richmond Terrace, Port Richmond, Staten Island, Richmond County, New York (see Figure 3). The site is located at or near the coordinates 40˚38'25'N and 74˚08'31"W. The designated Block and Lot, as per Richmond County, is Block 1105, Lot 26.

The original Dean Mill Plant of the ADM Company was eventually divided into three parcels. One parcel is currently owned by the Port Authority, another parcel is owned by Federal Express, and the last parcel is owned by DTS. The parcel owned by DTS includes the area where radiological contamination was initially identified by Oak Ridge National Laboratory and is now considered the Site. (EPA 2009b)

The overall size of the DTS property is approximately 350' X 500', totaling about 4 - 4.5 acres in surface area. Currently, a portion of the property is being used to store and maintain construction equipment. All that remains at the remainder of the property is a paved parking lot/storage area for trucks and other large vehicles and trailers. The property has 3 distinct levels (sloping beach tide line, flat vegetated west area, and flat current parking areas) with dense vegetation along the perimeters (see Figure 4). It should be noted that since the DOE and EPA investigations additional fill has been added to portions of the DTS property outside of the exclusion fence. Additionally it appears that northern portions of the property continue to erode due to tidal and wave effects.

The northwest portion of the property that was not covered by buildings during 1942 is considered the potential FUSRAP Site. The Site represents roughly 1 acre of the property. The remainder of the property was covered by buildings and other structures during the time frame of MED purchased ore handling (loading f.a.s. lighters) (EPA 2009c). This northwest area is also where contamination has been identified. (DOE 2009a)

2.2 Local Climatic Conditions

The average daily temperatures for the Staten Island range from an average low of 23.1º F in January to an average high of 85.1º F in July. The average annual temperature for the Site ranges from a low of 44.6 °F to a high of 62.6 °F. The elevation of the Site ranges from 3 to 9 feet above mean sea level down to sea level at the shore.

The average annual precipitation of Staten Island is 46.3 inches, with July being the month of highest precipitation (an average of 4.8 inches of rain). The annual snowfall for Staten Island is 29.4 inches which mostly occurs in the months of January and February (Wbase 2011).

2.3 Current Site Description

The property is entirely fenced, except along the Kill Van Kull (KVK) shoreline, and is situated in a commercial/industria1 area. With the exception of the paved parking area, the property boundaries bordering the Kill Van Kull are heavily overgrown with vegetation. (EPA 2009c). There is miscellaneous debris and trash scattered across the Site. A deteriorated chain link fence separates the parking area from the area where contamination has been identified. The Site is accessible from Richmond Terrace.

The property and adjacent properties on the east and south are zoned for commercial use. The property to the west is owned by the Port Authority as part of the Bayonne Bridge area. While the adjacent properties are commercial, residential properties are located along the east side of John Street, a few hundred feet south of the site.

An estimated 28,834 people live within one mile of the site. Nine schools, five hospitals, 32 daycare centers, and a number of other institutional facilities are located within one mile of the Site (EDR 2011b). A database search did not identify any Nursing Homes, Medical Centers, Colleges, Arenas, or Prisons within one mile of the Site (EDR 2011b).

The Bayonne Bridge is immediately adjacent to the Site. The nearest Registered Historical Places are approximately 0.5 miles to the east of the Site. The nearest cemetery is over a mile to the south of the Site. There are 5 cemeteries within 2 miles of the Site.

The site is approximately 9 feet above sea level with a topographic gradient generally to the northwest (EDR 2011a). Based on Federal Emergency Management Agency (FEMA) floodplain data (map #3604970 169F, panel 169 of 457, revision September 5, 2007) most of the Richmond Terrace Site is situated within the 100 year flood plain of the Kill Van Kull Newark Bay waters. This designation is the flood that has a 1% chance of being equaled or exceeded in any given year. The 20x40 meter area designated as the radiologically contaminated area is entirely in this floodplain designation.

2.4 Operational History

The only Site operations related to the Nation's early Atomic Energy program was the handling and loading of uranium ore purchased in 1942 f.a.s. by the MED. Arrangements were made to deliver 1,823 drums of ore to LHVRR lighters (barges) at the Dean Mill Plant of the Archer Daniels Company beginning on 2 November 1942, for shipment to the SOD, Romulus, New York.

At the request of the DOE, a preliminary radiological survey of the Staten Island Warehouse Site was conducted in July of 1980 by members of the Health and Safety Research Division at Oak Ridge National Laboratory to provide information on the radiological condition of the Site and to determine the need for a more extensive radiological survey. Findings indicated that a 20-meter-by-40-meter area of the Site may be contaminated with high-grade Belgian Congo uranium ore. (DOE 2009a)

More recent surveys by the State of NY (1992 and 2003) and the USEPA (2008) have confirmed the presence of uranium contamination in the same area identified by DOE in 1980. These

surveys have not identified radiological contamination in other portions of the property nor on other parcels.

2.5 Waste Characteristics

2.5.1 Non-Radioactive

Previous survey efforts on the property have concentrated on radiological contamination. Chemical characterization information for the property was not located. Since the contamination known on the Site is suspected of being uranium ore the chemicals found in that ore may be present on Site. The uranium ore purchased by the MED had the following average non radiological composition (percentages are rounded) (MED 1942b):

20.4% SiO_2	6.27% PbO
0.7% FeO	0.2% CuO
2.1% Al_2O_3	0.2% P_2O_5
1.7% CaO	0.1% Co+Ni
2.86% MgO	1.1% No_2O_3 (?) [as printed in memo]

Lead is the only potential RCRA metal. It should be noted that although some local disassociation may occur due to environmental factors it is expected that these chemicals would be collocated with the radioactive contamination. Any other potential chemical contamination on Site would not be expected to be related to the uranium ore, and therefore not FUSRAP waste.

2.5.2 Radioactive

Since the contamination known on the Site is suspected of being ore, the radioactive waste at the Site would be comprised of uranium ore (theoretically spilled during delivery and loading of lighters) and natural background levels of radionuclides in soils. The ore was on average 68.7% U_3O_8. (MED 1942b) The uranium isotopes are expected to be present in their natural isotopic abundance (99.274% U-238, 0.006% U-234, and 0.720% U-235) (Shleien 1992). Radium and other daughter products of the U-238 and U-235 decay chains are expected to be present in equilibrium with their parents. Table 1, lists the expected long lived radionuclides and their expected activities in a 68.7% uranium ore.

Table 1, Expected Long Lived Radioactivity in a 68.7% U_3O_8 ore.

Radionuclide	[1]Activity pCi/g	Radionuclide	[1]Activity pCi/g
U-238	193,829 +/- 48	U-235	8,862 +/- 279
U-234	198,359 +/- 17,621	Pa-231	8,862 +/- 279
Th-230	198,359 +/- 17,621	Ac-227	8,862 +/- 279
Ra-226	198,359 +/- 17,621		
Pb-210	198,359 +/- 17,621		

[1] Uncertainty is provided to address minor uncertainty in the assumed isotopic U fractions and assumed U content of ore. It should not be confused with counting uncertainty.

The DOE conducted a limited preliminary survey in 1980 and identified a radiologically contaminated area measuring approximately 20 x 40 meters. This area is located near the north-western corner of the Site. The potential exists for pieces of ore, a mixture of ore and soils, or other similar wastes to be encountered. Table 1 activity concentrations are considered worst case

(ore). Data from previous investigations demonstrates activity concentrations at a fraction of that expected in the ore.

3.0 Physical Conditions

3.1 Geology

Staten Island is located in New York Harbor and together with several smaller islands, forms Richmond County and the Staten Island borough of New York City. The island has approximately 35 miles of waterfront and has an area of almost 60 square miles (Encyclopedia Britannica 2011).

Staten Island includes parts of four major physiographic provinces of the New York City Region: 1) Manhattan prong of New England Upland; 2) Newark Basin; 3) Atlantic Coastal Plain; 4) a terminal moraine of one or more of the Pleistocene glaciers. (DGL 2010).

The sedimentary rock units of the Newark Basin that comprise bedrock units on Staten Island include: 1) the Stockton Formation consisting of sandstones and arkoses; 2) the Locatong Formation consisting of siltstones and shales; and 3) the Passaic Formation consisting of shale, siltstone, sandstone, and conglomerate (Benimoff 2003). The Palisades Sill that is composed of diabase underlies a portion of northeast Staten Island. Ledges of bedrock consisting of serpentinite are exposed throughout the upland areas on Staten Island (USDI 2003).

Staten Island has been at the southern terminus of various periods of glaciations. The evidence of these glacial periods is visible in the form of glacial erratic and kettle ponds (Wikipedia 2011). Much of Staten Island is covered by the east-west trending Harbor Hill moraine, the terminal moraine of the last Wisconsin Stage glacier (USDI 2003).

A map of Staten Island indicates that the northern portion of the island, including the Site area, is covered by glacial till (Benimoff 2003); however, the surface material at the Site may consist of artificial fill. The geologic map of Staten Island indicates that the bedrock is comprised of the Palisades Sill (DGL 2010). The Jurassic Palisades Sill is a westerly dipping igneous body that intruded between Triassic-age sedimentary units, and is composed of diabase, a dark-colored, coarse-grained intrusive rock. See Figure 5.

A review of the NYSDEC Unique Geologic Features database shows the nearest such feature is approximately 1 mile east-southeast of the Site (NYSDEC 2011). See Figure 10.

3.2 Hydrogeology

Surficial materials at the Site are believed to consist of a combination of native glacial till and artificial fill. Although either type of material could be permeable enough to yield water, the total thickness is expected to be on the order of only 10-20 feet, and the proximity to Kill Van Kull increases the probability that groundwater extracted from the surficial materials would be non-potable. Flow-direction in these surficial materials is expected to be generally northward (Soren 1988); however, tidal influence is high in this setting, and therefore flow-direction varies somewhat with the tides. These unconsolidated surficial materials are underlain by the Jurassic Palisades Sill with negligible primary permeability (Soren 1988). Secondary permeability

created by joints and fractures may be present in the unit; however, vertical hydraulic gradient in this near-shore setting would be expected to be upward in general, although tidal influence may periodically reverse the gradient. (DGL 2010) See Figure 5 (Soren 1988).

3.3 Animals, Vegetation, and Sensitive Environments

The Site is an inactive man made pier. There are no known sensitive habitats and any that may have existed near the Site are highly disturbed by past activities and the industrial nature of the area around the Site. There is limited viable habitat for sensitive ecological receptors under the current conditions.

The USACE New York District has done multiple evaluations over the past 30 years related to the Port of New York and New Jersey channel-deepening projects in the area. Portions of the Newark Bay and the KVK have been included in the investigations, although much data is limited only to the Newark Bay. The investigations have sought to understand affected environments and environmental impacts to benthos, finfish, shellfish, avifauna, other wildlife, and threatened and endangered species. There is potential for some species to occur in the area, to include the American peregrine falcon, yellow crowned night heron, and southern bald eagle. Some aquatic species to include several species of sea turtles and the short nose sturgeon have been located in areas near the KVK. The Site is located in a area identified by the State as a Rare Plants and Rare Animals area (NYSDEC 2011). Approximately one mile west of the Site, in the KVK, is the Shooter Island Bird Sanctuary, and approximately 2 miles west of the site is the Harbor Huron State Wildlife Management Area (NYSDEC 2011). There are no State Significant Natural Communities within 1 mile of the Site. See Figure 10. Preliminary research indicates no anticipated impacts to endangered and threatened species as a direct result of work at or near this site (USACE 2005).

There are no State designated wetlands within a half mile of the Site (NYSDEC 2011). Approximately 1 mile west of the Site are the non regulated Richmond Terrace Wetlands (Google maps 2011). There are no state Regulated Freshwater Wetland Act areas within 1 mile of the Site (NYSDEC 2011). See Figure 10.

4.0 Pathways

4.1 Soil and Air Pathways

The Site is an inactive earth filled pier which has been filled with varying depths of material (USACE 1996). Previously identified contaminated material exists in the surface and subsurface soil of the Northwest portion of the property (DOE 1980).

The Port Authority of New York property borders the Site to the west and a private company borders the property to the east. The nearest cross streets to Richmond Terrace are John Street and Nicholas Avenue. The area around the Site is mixed commercial, industrial and residential properties. The Bayonne Bridge crosses immediately overhead of the Site to the west.

The Site is in an industrial area of Port Richmond, Staten Island, NY. It is fenced from public access and an additional fence was previously constructed as a barrier from persons walking into the area of suspected contamination from the work areas of the Site (EPA 2009c). The Site is currently secured on three sides with an eight foot high chain link fence, except for the northern boundary which abuts the KVK. The property remains fenced and secured with a lock. The property remains off limits to all but the most ardent trespassers, however, a Site walk through did identify that shore areas of the Site were used by local fishermen. The contaminated area does not see much foot or vehicle traffic due to the thick vegetation in this area of the Site. However, some aerial photographs indicate varying levels of brush clearing and site grading at different times. See Figure 4 for current Site conditions.

The evidence of local fisherman using portions of the Site and the photos showing areas of Site grading indicate a completed pathway for exposure of recreational receptors and Site workers to site contaminants from direct contact with contaminated soils or inhalation of dusts generated from those soils.

Radiological Characterization:
Minimal disturbance of soils in the northwest portion of the Site has occurred since the 1980 preliminary Site investigation conducted by DOE (DOE 1980).

The 1980 DOE investigation included gamma scanning on all parcels of the former ADM property. See Figure 6 for elevated scanning results. Three samples were collected from the current Site as part of the 1980 DOE investigation. One sample from the northwest corner in an elevated scan area was collected (sample ST-1). A layer of contamination was found at 35-40 cm below ground surface. The sample ST-1 results were 660 picoCuries per Gram (pCi/g) U-238, 590 pCi/g Ra-226, and less than minimal detectable concentration for Th-232.

The 1980 DOE report concluded: *"There is evidence that a 20 m x 40 m area may have been contaminated with high-grade Belgian Congo uranium ore; …. "*

A 1992 investigation by the New York State Department of Environmental Conservation (NYSDEC) confirmed the presence of radiological contamination at the Site (NYSDEC 1992). The investigation included scanning (Figure 7) and collection of 1 grab sample and samples from 5 borehole locations. Results are presented in Figure 8. Sample results were as high as 49,190 pCi/g for U-238. It should be noted that the 3 highest sample results were of wood and not soil. The lab report for samples 0722219-072221 stated "*Recount data versus original data on these three samples show poor precision. This is due to inadequate sample size available for counting. The material for these three samples was not soil but was organic (wood) material. The quantity of sample for analysis after drying was very small and was not sufficient to completely fill a standard gamma counting geometry."*

The highest soil sample results were 412 pCi/g U-238, 455 pCi/g Ra-226, and less than minimal detectable concentration for Th-232. Elevated scan and sample results were from the same area identified in the 1980 DOE report.

The 1992 NYSDEC report concluded: "The survey identified the presence of areas of contamination which were at least three times background including an area which was over 167

times background. It is believed that analysis of the soil samples will show that there is significant contamination present to warrant a clean-up."

A 2003 investigation by NYSDEC included scanning of previous ADM parcels south of Richmond Terrace and visual inspection of the previously identified area of contamination on the northwest corner of the current Site (NYSDEC 2003). No samples were collected.

With regard to the Site visual inspection the 2003 report states: "Approaching the location, we could see a thick hedgerow of trees. Peering through these trees, we could see the fence. Therefore, the consensus of the group was that this area appears to be secure and inaccessible."

With regard to the overall survey (including the parcel to the south of Richmond Terrace) the 2003 report concludes: "While this radiological survey did not cover 100 % of the property, this radiological survey gives a fair indication that the property is not grossly contaminated, as no unaccounted areas of radioactivity were identified."

On February 20, 2008, a Removal Site Evaluation (RSE) was performed at the Site by a joint assessment team consisting of the U.S. Environmental Protection Agency (EPA) Region 2, NYSDEC, and the New York City Department of Health, which found the same contaminated area (EPA 2009b). An additional six soil samples and one air sample were collected during this investigation.

The results of the air sample were summarized in the RSE report as follows: *"An air sample, using a glass fiber filter, was also collected at the area with the highest gamma reading and greatest soil contamination based upon the gamma spectroscopy analyses performed by the NYSDOH lab. The air sample was collected at a rate of 5 cubic feet per minute (din) for one hour, within the normal breathing zone. The sample was subsequently analyzed by a Ludlum 3030 alpha/beta counter. No elevated readings were detected, indicating that the radiologically contaminated area is not an inhalation concern if soils are not disturbed."*

Six soil samples were collected from the previously identified 20m x40m area of contamination. The maximum sample result was 1,187 pCi/g U-238, 1,102 pCi/g Ra-226, and less than minimal detectable concentration for Th-232.

The RSE report concluded: "*Based upon the available information, a release of CERCLA hazardous substances (radionuclides) has occurred at the Site, which is a facility as defined in CERCLA. A CERCLA Removal Action is warranted to mitigate the threats and potential threats to public health or welfare and the environment from the high levels ofU-238 and Ra-226 in surface and subsurface soils. Most of the surface and subsurface soil samples collected and analyzed by gamma spectroscopy are many orders of magnitude higher than the Uranium mill tailing standard (40 CFR Part 192.12) of 5 pCi/g."*

Based on the above data, there is evidence of a release and/or threat of release into soil of hazardous substances (radioactive materials) that is not a federally permitted release. However, it cannot be determined at this time, based on available evidence, whether this release is attributable to the Nation's early atomic energy program.

Non Radiological (Chemical) Characterization:

Information on chemical characterization at the Site was not found or known to exist. As discussed in paragraph 2.5.1, uranium ore also contains various amounts of other elements. Any potential FUSRAP chemical contamination on Site would be that found in the ore and likely comingled with radiological contamination.

As a man made structure with known various times of fill placement, chemical contamination of Site soils is not unexpected. The Jewett White Lead Company Site is being addressed by EPA and is located in Port Richmond also. While not adjacent to the SIW Site, investigations of properties around the Jewett White site demonstrated that lead contamination was present but from sources other than the Jewett White site (e.g. leaded gasoline, leaded paint, etc.) (EPA 2009d). Chemical contamination not present in the uranium ore or comingled with the ore is not within the scope of FUSRAP.

There is no data to determine if there is a release and/or threat of release into the environment of non radiological (chemical) hazardous substances, pollutants, or contaminants resulting from the Nation's early atomic energy program.

4.2 Groundwater Pathway

Onsite Ground Water: Ground water studies at the Site were not found or known to exist. As a manmade structure, materials at the Site are believed to consist of a combination of native glacial till and artificial fill. Although either type of material could be permeable enough to yield water, the total thickness is expected to be on the order of only 10-20 feet, and the Site extends into the KVK which indicates that ground water extracted from the construction materials would likely be highly influenced if not representative of surface waters. Flow, if present, would be expected to be to the north and influenced by the tides and surface water movement.

Offsite groundwater: Staten Island ground water is recharged primarily by precipitation. Ground water originates in the central portions of the island and radiates outward. Flow near the Site is therefore expected to be to the north. Island fresh water is surrounded on all sides by salt water interfaces (Soren 1988). The diabase underlying the Site has low permeability and is not considered a viable source of ground water. Staten Island ground water has not been used for drinking water since 1970 (Soren 1988). New York City provides it drinking water from upstate resources via aqueducts and piping.

A well search identified 2 supply wells within a half mile, and another 26 supply wells within 4 miles of the Site. One Public Water Supply Well was identified approximately 2.5 miles north of the Site in Bayonne, NJ, however the status of that well could not be determined. All but the well in Bayonne would be considered up gradient or side gradient of the Site. A shallow groundwater drainage divide represented by the KVK to the north of the Site prevents any impact to the Bayonne well from the Site. See Figure 11.

The evidence indicates an extremely low potential for exposure of potential receptors to Site contaminants via the groundwater pathway.

There is no data to determine if there is a release and/or threat of release into groundwater of hazardous substances, pollutants, or contaminants (radioactive materials or chemicals) related to the Nation's early atomic energy program.

4.3 Surface Water Pathway

Surface water does not exist on the Site. The Site extends into the KVK. Significant erosion of the northwest portion of the Site is evident in aerial photos and was confirmed during USACE Site visits. Site photos from previous investigations show the known area of contamination to extend to the areas impacted by erosion and/or tidal influences. Wind, river inflow, and tidal influences commonly cause the water current and sediment flows in the KVK to switch directions (Chant 2001).

The KVK is an interstate water body and is classified by the NYSDEC as SD (NYCDEP 2011). The usage of Class SD saline surface waters is fishing. SD waters should be suitable for fish survival. It is also classified by New Jersey (NJ) as impaired (contamination exceeds NJ water quality standards for dioxin, pesticides, PAH, and PCBs) and SE3 (Surface Water Quality Standards N.J.A.C. 7:9B). The designated uses of SE3 saline waters of estuaries are: secondary contact recreation; maintenance and migration of fish populations; migration of diadromous fish; maintenance of wildlife; and any other reasonable uses. Many studies of the KVK report chemical contamination and a long history of petroleum spills and contamination. The KVK is not a source of public drinking water.

The evidence indicates a potential for a completed pathway for direct contact of recreational users (fishermen) of the KVK to Site contaminants via direct contact with surface water.

There is no data to determine if there is a release and/or threat of release into the surface water of hazardous substances, pollutants, or contaminants (chemicals) resulting from the Nation's early atomic energy program. Based on the above data, there is evidence of a release or threat of release (erosion) into the surface water of hazardous substances (radioactive materials) that is not a federally permitted release. However, it cannot be determined at this time, based on available evidence, whether this release is attributable to the Nation's early atomic energy program.

Sediment Characterization

The most recent and comprehensive study of Site sediments was conducted by USACE for the Port of New York and New Jersey channel-deepening project (USACE 2000). While sediments do exist in the KVK (Beda 2000), the bottom of the KVK is reported to be primarily bedrock and subject to "*intense scouring*" (USACE 1997).

The shore area around the Site is rocky and littered with metal, concrete, and wood debris. This debris limits exposure of transients to sediments, however, the erosion of the Site does indicate a potential for a completed pathway for recreational receptors (fishermen) to be exposed to Site contaminants via sediments.

There is no data to determine if there is a release and/or threat of release into the sediments of hazardous substances, pollutants, or contaminants (chemicals) resulting from the Nation's early

atomic energy program. However, based on the above data, there is evidence of a release or threat of release (erosion) into the sediment of hazardous substances (radioactive materials) that is not a federally permitted release. However, it cannot be determined at this time, based on available evidence, whether this release is attributable to the Nation's early atomic energy program.

5.0 Combined Pathway Conclusion

The DOE and NYSDEC investigations addressed surface and near surface radiological contamination. The existing exclusion fence and heavy vegetation limit the soil and air exposure pathways. Limited data exists on potential subsurface contaminant levels and depths. The data that is available, however, indicates that radiological contamination remains in the northwest area of the Site.

Completion of the soil and air pathway by activities such as construction at the Site is possible. This presents a potential for a hazard to human health and the environment. There is evidence to indicate a release of hazardous substances (radioactive materials) to Site soils has occurred. However, it cannot be determined at this time, based on available evidence, whether this release is attributable to the Nation's early atomic energy program. There is no data to determine if there is a release and/or threat of release into the environment of non radiological (chemical) hazardous substances, pollutants, or contaminants resulting from the Nation's early atomic energy program.

Site and offsite groundwater quality is unknown. Ground water is not used for drinking water. The potential for off-site receptor exposures via the groundwater pathway is highly unlikely and not expected in the future. There is no evidence of a release or threat of release into Site or offsite groundwater of radioactive materials or chemicals related to the Nation's early atomic energy program.

Evidence does indicate a release of hazardous substances (radioactive materials) to surface waters has occurred. Due to the Site proximity to surface water and potential for continued erosion and flooding, a potential release of hazardous substances to the surface water pathway does exist (primarily from water contact with contaminated soils). Surface water is not used as a source of drinking water and its use is limited to fishing and fish survival, thus limiting the surface water exposure pathway.

EPA performed an exposure assessment in 2008 (EPA 2008). The evaluation focused on the radioactivity remaining in soil within the 20m x 40m area identified in 1980. The potential exposure routes to the residual radioactivity in soil for the outdoor site worker and adolescent/adult trespassers were external gamma radiation, inhalation of airborne respirable particulates, and inadvertent ingestion of contaminated soil. Exposure Point Concentrations (EPC) were based on the 99% upper confidence limit of data collected from previous investigations discussed in Section 4.1 herein.

Results of the risk and dose assessment are presented in Table 2. These risks and dose are considered very conservative and biased high because the wood samples discussed in paragraph

4.1 herein were used as part of the EPC determination dataset. It is likely that these results are overestimated thus resulting in an overestimate of the EPC.

Table 2. EPA SUMMARY OF NET CANCER RISK AND DOSE

Receptor	Exposure Pathway	Net Cancer Risk	Net Dose (mrem/yr)
Outdoor Site Worker	External	4.13E-03	251.4
	Inhalation	6.76E-06	2.6
	Ingestion	2.72E-06	0.4
Adolescent Trespasser	External	3.06E-03	359.1
	Inhalation	6.15E-06	4.5
	Ingestion	3.61E-06	3.8
Adult Trespasser	External	5.70E-03	359.1
	Inhalation	1.15E-05	4.5
	Ingestion	1.01E-06	3.8

Although data gaps limit the complete assessment of exposures, the potential does exist for exposure to current and future occupants of the Site and persons offsite to Site contaminants. The completion of surface water, soil, and/or air exposure pathways would present a hazard to human health and the environment.

6.0 Summary and Conclusions

The SIW Site is a manmade structure comprised of varying fill materials. Radioactive contamination of Site soils exists in the northwest corner of the Site. Findings of previous Site surveys and further review of MED contract language lead the DOE to declare the Site eligible for inclusion in the FUSRAP. The DOE then referred the Site to the USACE for appropriate action.

The USACE has reviewed existing, readily available data on the Site. Based on that review; evidence does not indicate a release and/or threat of release of non radiological (chemical) hazardous substance, pollutant, or contaminant from the Nation's early atomic energy program has occurred; there is evidence of a release and/or threat of release into the environment of hazardous substances (specifically radioactive materials) that is not a federally permitted release. However, it cannot be determined at this time, based on available evidence, whether this release is attributable to the Nation's early atomic energy program.

Although data gaps limit the complete assessment of exposures, the potential does exist for exposure to Site workers, recreational users, and potential future occupants of the Site to Site contaminants.

A more detailed analysis such as a CERCLA Site Inspection is recommended. Review of the existing site information did not indicate a need to take an immediate removal action to protect human health or the environment.

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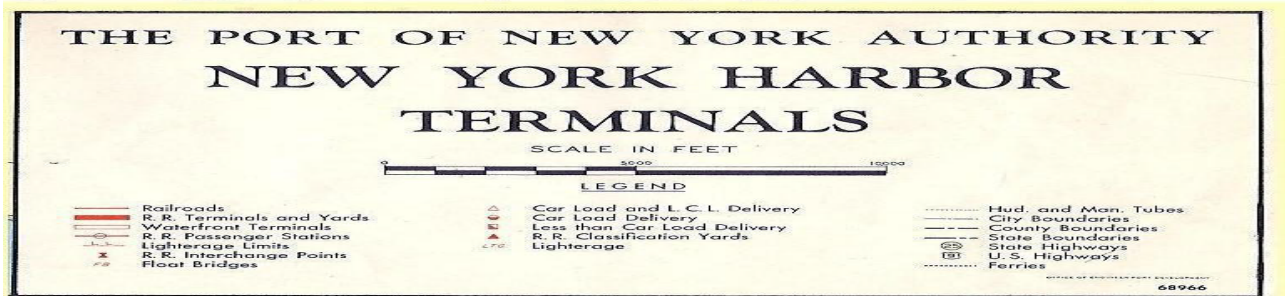


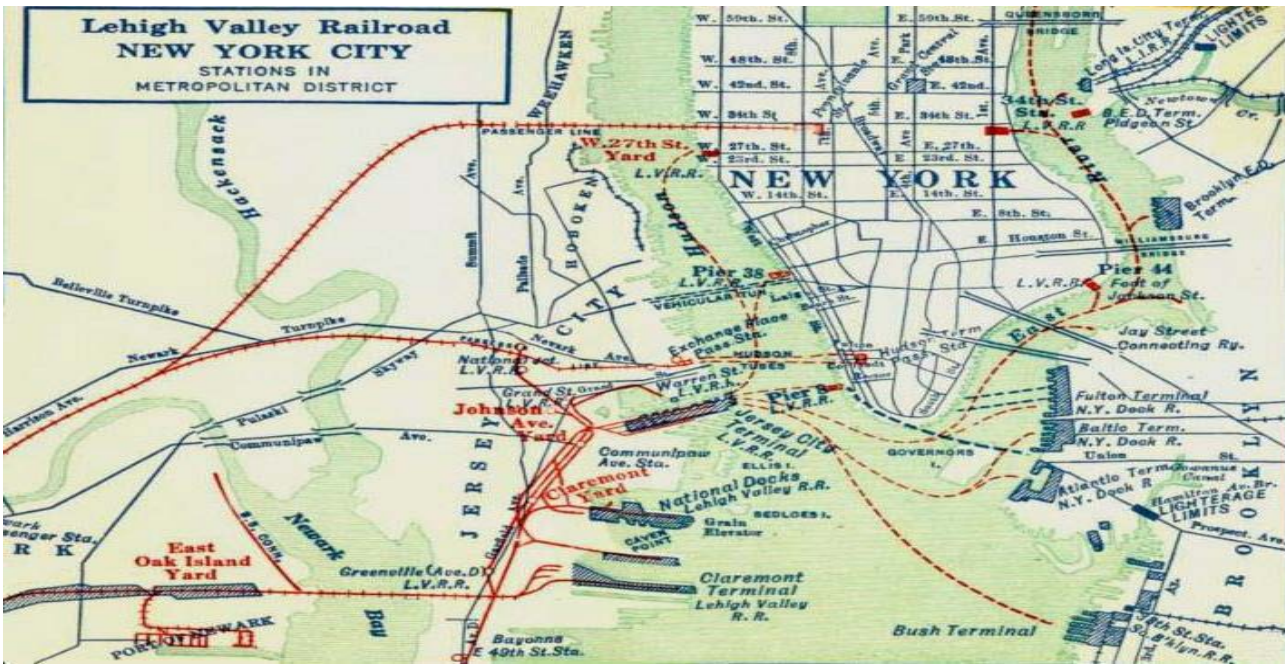
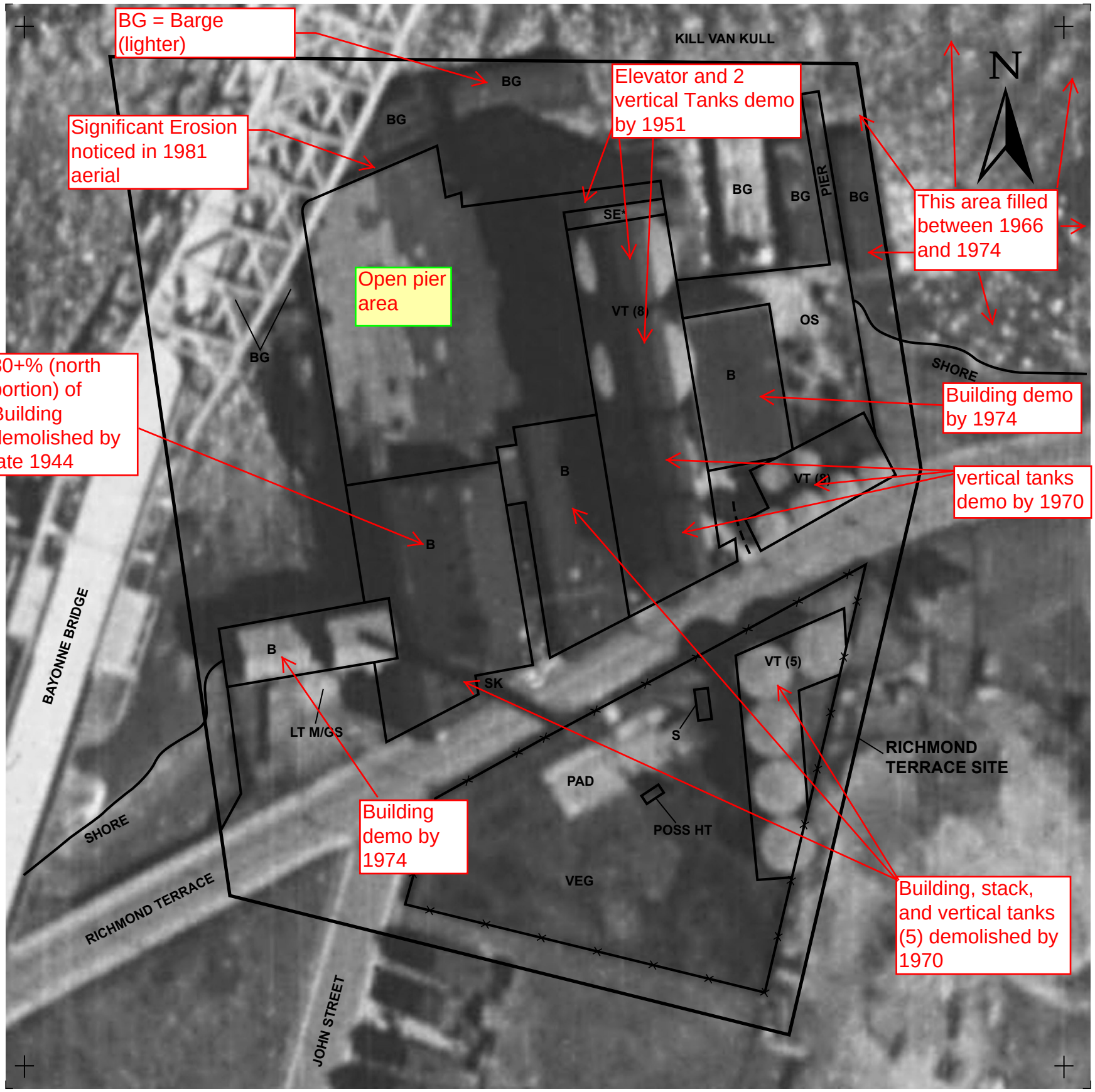


Figure 1. SIW PA; 1943 New York Harbor Pier and 1956 LHVRR Map

Staten Island Warehouse FUSRAP Preliminary Assessment



RICHMOND TERRACE SITE
STATEN ISLAND, NEW YORK **APRIL 28, 1940** **APPROX. SCALE 1:1,067**

Figure 2. SIW PA; Site Layout 1940 And Changes Seen In Aerial Photo Reviews

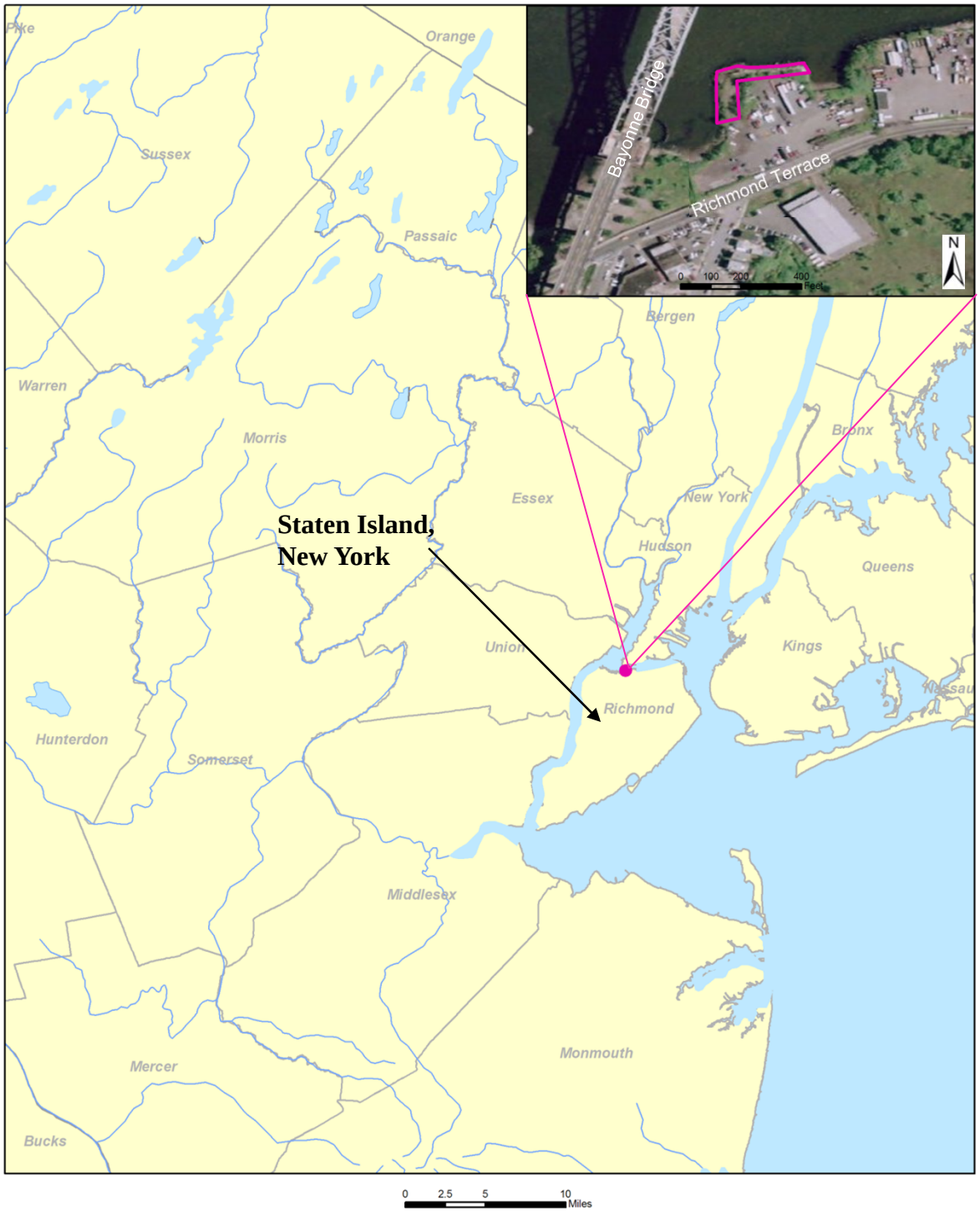
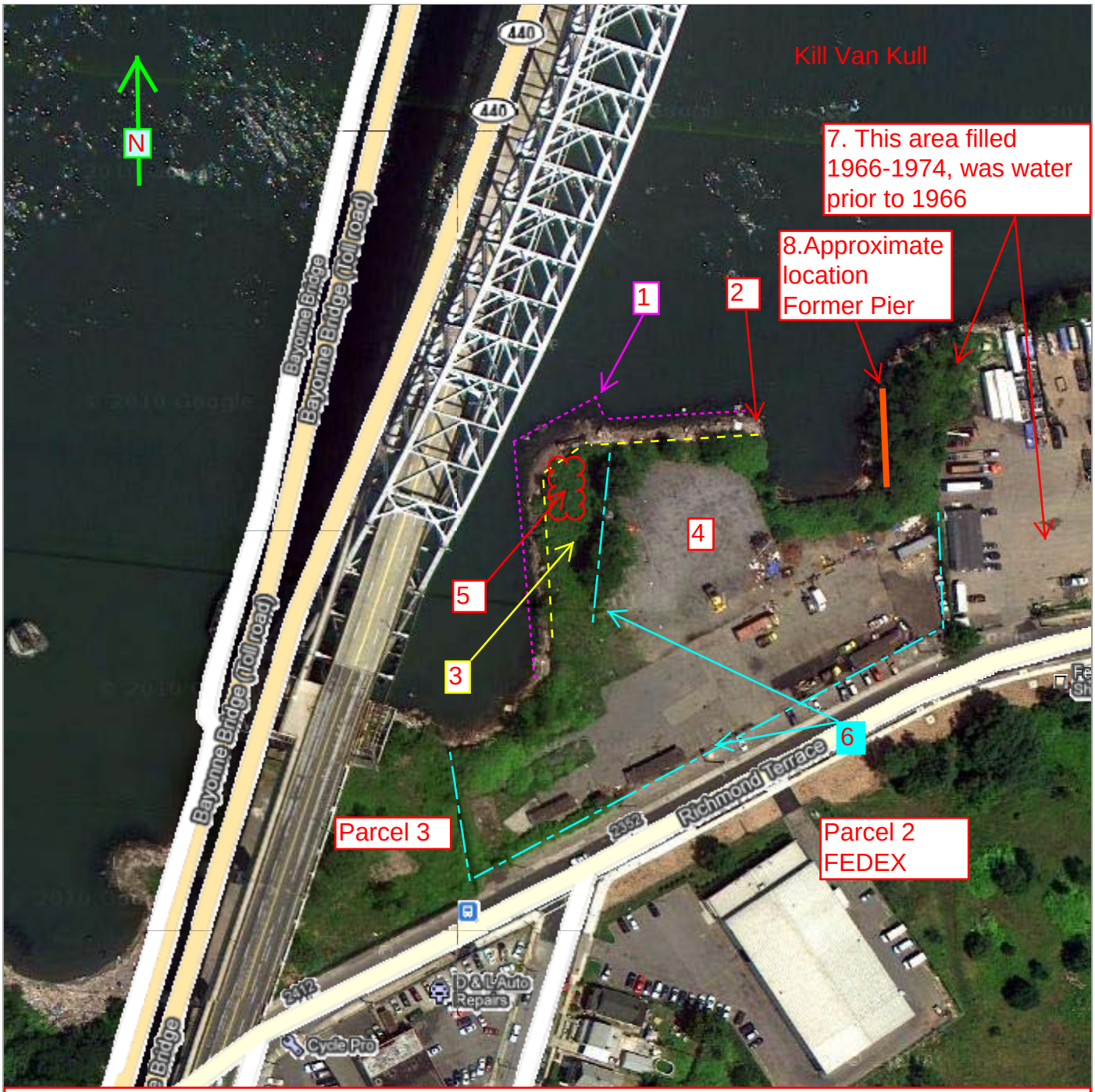


Image Source: ESRI World Imagery

Figure 3 Staten Island Warehouse FUSRAP Site Location Map

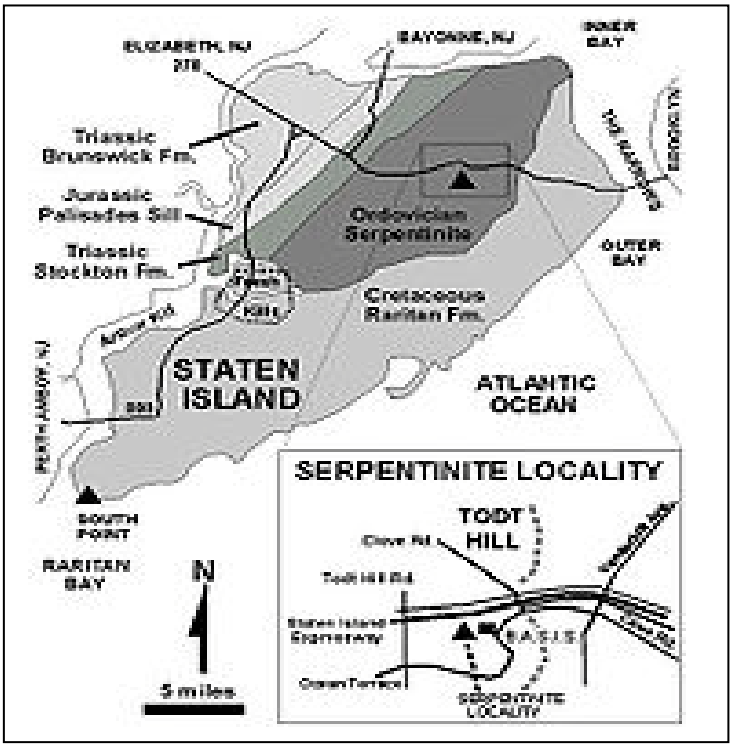
U.S. Army Corps of Engineers

Staten Island Warehouse FUSRAP Site



1. Original Pier outline 1940-1970s, eroded and underwater at low tide
2. Current Beach area mostly under water at high tide, 3-4 feet below #3
3. Level close to that of original pier, possible fill late 1970s
4. Level of more recent fill (post 1992), 2 to 3 feet higher than #3, recycled asphalt
5. Approximate area of elevated gamma readings
6. Chain link Fence

Figure 4. SIW PA; Site Layout



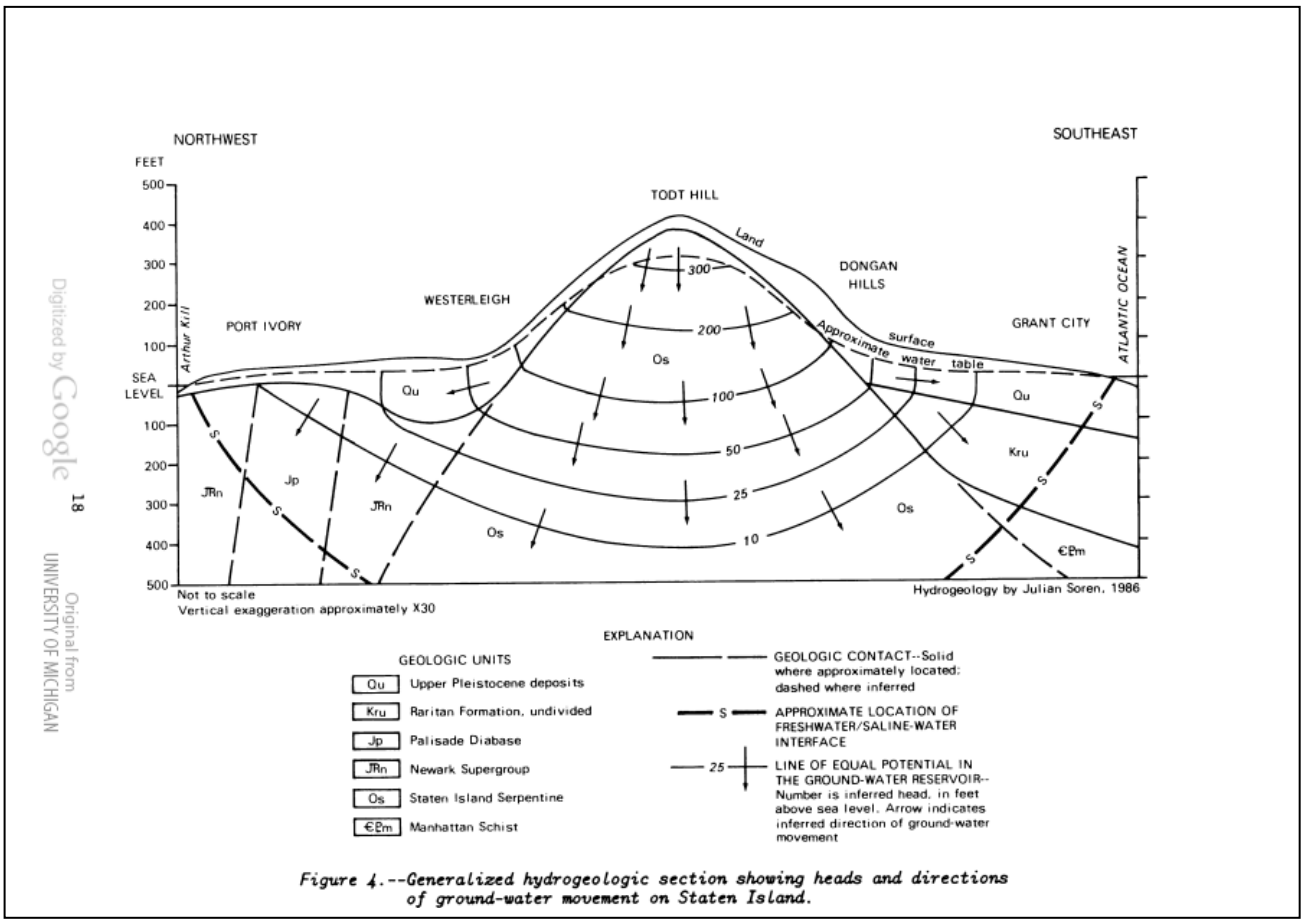


Figure 4.--Generalized hydrogeologic section showing heads and directions of ground-water movement on Staten Island.

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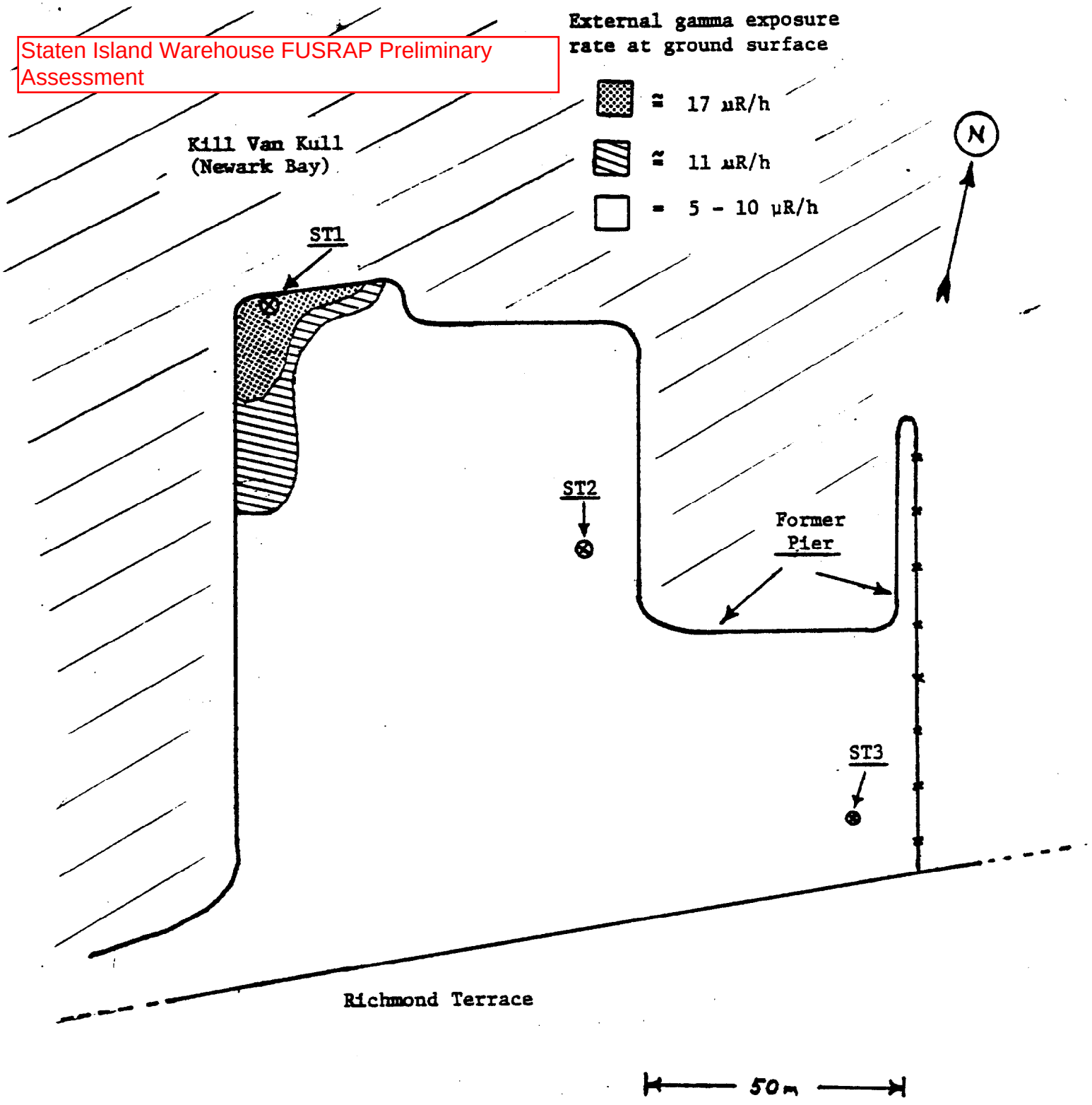
Original from UNIVERSITY OF MICHIGAN

Figure 5. SIW PA; Staten Island Geology and Generalized Ground Water Flow Diagram



External gamma exposure rates observed at ground surface on Parcel 1 and location of three surface soil samples.

Figure 6. SIW PA; 1980 DOE Gamma Walkover and Sample Locations

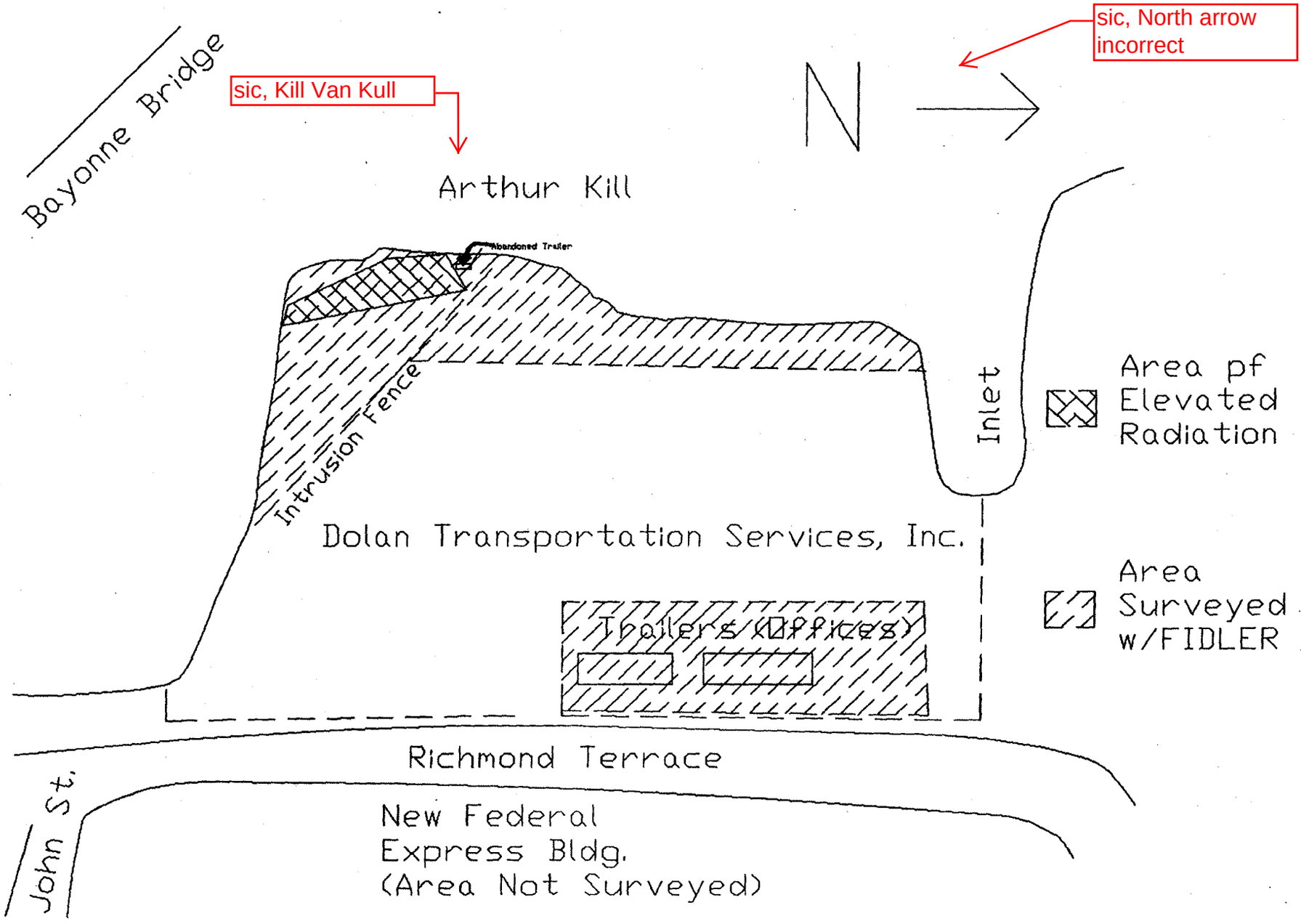


Figure 7. SIW PA; NYSDEC Gamma Scanning Drawing

Radiological Soil Sample Concentrations (pCi/g) collected from Richmond Terrace Site.

Sample ID	Sample Location	Sample wt (g)	Sample Depth (inches)	U-238			U-235			Ra-226[a]			Th-232		
885056[b]	#1	584.0	0-6	14.04	+/-	2.90	1.37	+/-	0.34	15.46	+/-	0.5	0.77	+/-	0.1
885057[b]	#2	722.0	0-6	2.63	+/-	1.48	0.33	+/-	0.16	3.84	+/-	0.2	0.39	+/-	0.1
885058[b]	#3	601.5	0-6	8.37	+/-	2.83	0.92	+/-	0.35	17.26	+/-	0.6	0.65	+/-	0.1
885059[b]	#4	529.8	0-6	116.4	+/-	8.91	9.45	+/-	0.89	90.27	+/-	2.8	0.83	+/-	0.2
885060[b]	#5	528.7	0-6	1187	+/-	45.1	89.17	+/-	3.92	1102	+/-	33		<	0.7
885061[b]	#6	576.6	0-6	3.40	+/-	1.97	0.60	+/-	0.21	6.088	+/-	0.3	1	+/-	0.1
885062	#7	646.8	0-6		<	1.03		<	0.12	1.333	+/-	0.1	0.73	+/-	0.1
ST 1[c]		NS	13-16	660	+/-	19.8	N/A			590	+/-	1.2	ND		
NR-2-92-003-072206[d]	B		0-2	121.0	+/-	13.00	9.65	+/-	0.72	95.3	+/-	2.2	1.8	+/-	1.70
NR-2-92-003-072207[d]			2-4	31.6	+/-	7.80	1.96	+/-	0.41	16	+/-	1.2	3.8	+/-	2.1
NR-2-92-003-072208[d]			4-6	32.0	+/-	16.00	2.30	+/-	1.00	16.3	+/-	2.5		<	4.0
NR-2-92-003-072209[d]			6-10	17.7	+/-	3.50	N/A			2.7	+/-	0.5		<	1.0
NR-2-92-003-072210[d]			10-14	4.4	<	2.40	N/A			0.99	+/-	0.2	1.33	+/-	0.6
NR-2-92-003-072211[d]			14-16.5	4.7	+/-	2.70	N/A			1.53	+/-	0.4	1.72	+/-	0.8
NR-2-92-003-072212[d]	C		0-2	28.5	+/-	5.60	3.09	+/-	0.37	44.4	+/-	1.2	3.1	+/-	1.2
NR-2-92-003-072213[d]			2-4	191.4	+/-	2.80	19.30	+/-	1.60	383.1	+/-	4.8		<	4.1
NR-2-92-003-072214[d]			4-6	34.5	+/-	7.90	3.54	+/-	0.59	51.7	+/-	1.7		<	39.0
NR-2-92-003-072215[d]			6-11	15.6	+/-	2.50	N/A			1.06	+/-	0.2	1.32	+/-	0.5
NR-2-92-003-072216[d]			11-14	7.1	+/-	2.20	N/A			1.01	+/-	0.3	1.32	+/-	0.5
NR-2-92-003-072217[d]			14-17	8.6	+/-	3.10	N/A			1.15	+/-	0.3	1.49	+/-	0.7
NR-2-92-003-072218[d]	D		0-2	412.0	+/-	23.0	25.50	+/-	1.20	455.9	+/-	3.9		<	3.1
NR-2-92-003-072219[d]			2-4	49190	+/-	973	2983	+/-	53	38840	+/-	160		<	131.0
NR-2-92-003-072220[d]			4-6	9984	+/-	563	616	+/-	32	2212	+/-	77		<	76.0
NR-2-92-003-072221[d]			6-8	27860	+/-	1021	1342	+/-	45	4109	+/-	101		<	86.0
NR-2-92-003-072222[d]			8-12	83.4	+/-	5.80	5.05	+/-	0.31	26.69	+/-	0.8	1.67	+/-	0.8
NR-2-92-003-072223[d]			12-17.5	21.2	+/-	3.20	1.17	+/-	0.15	2.89	+/-	0.4	2.41	+/-	0.8
NR-2-92-003-072224[d]	E		0-6	345.0	+/-	17.0	22.64	+/-	0.97	237.8	+/-	3		<	2.4
NR-2-92-003-072225[d]			6-12	20.9	+/-	2.80	1.49	+/-	0.17	4.36	+/-	0.4	2.22	+/-	0.7
NR-2-92-003-072226[d]			12-16.5	7.7	+/-	2.70	N/A			2.41	+/-	0.4	2.30	+/-	0.6
NR-2-92-003-072227[d]	NS		12-16.5	182.0	+/-	11.0	12.66	+/-	0.53	254.90	+/-	1.5	2.40	+/-	1.0

(a) The Ra-226 concentration determined from the Pb-214 analysis is used instead of that determined by the Bi-214 analysis.

(b) Soil samples collected on February 20, 2008 by EPA, NYSDEC, and NYDOH.

(c) Soil sample collected on July 10, 1980 by Oak Ridge National Laboratory. Preliminary Radiological Survey Report of the Former Staten Island Warehouse Site, October 1980.

(d) Soil samples collected on July 14, 1992 by NYSDEC. NYSDEC Inspection Field Report, July 22, 1992.

N/A - Not Applicable, sample was not analyzed for this radiological parameter.
ND - Non-Detectable NS - Not Specified

Figure 8. SIW PA; Radiological Soil Sample Data From Previous Investigations

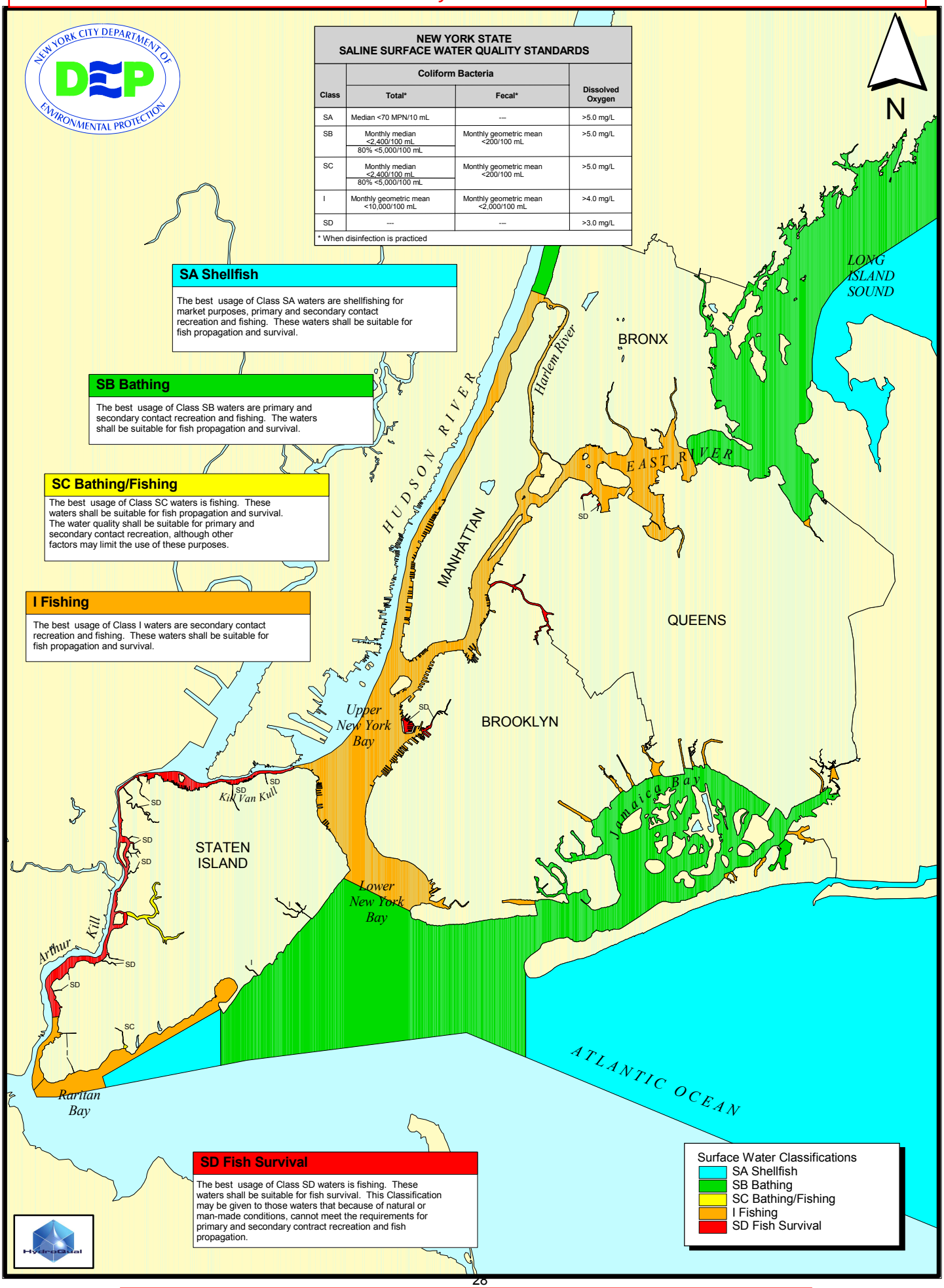
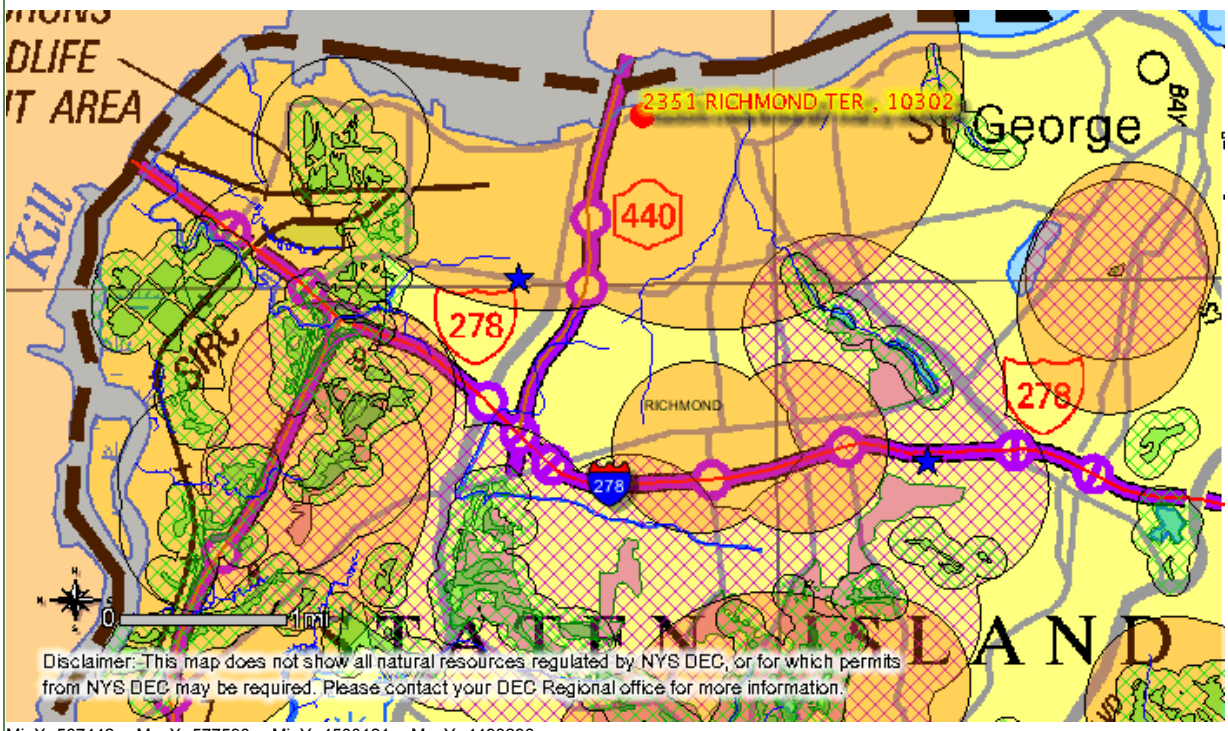


Figure 9. SIW PA; NYDEP Surface Water Classifications

Staten Island Warehouse FUSRAP Preliminary Assessment

SIW PA Figure 10 ERM NYSDEC



MinX: 567442, MaxX: 577590, MinY: 4500121, MaxY: 4493296

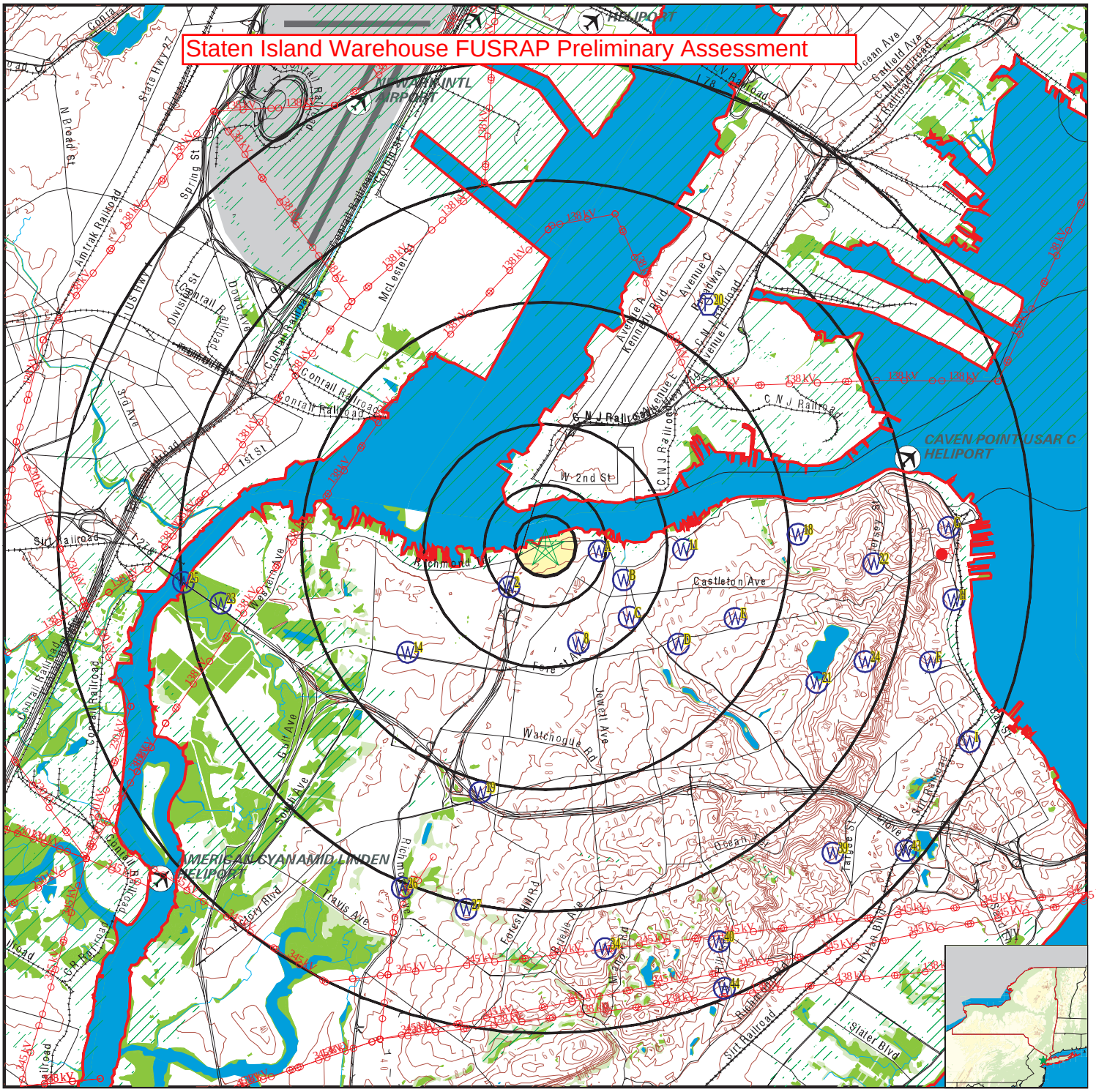
Visible Layers

- Classified Streams
- State-Regulated Freshwater Wetlands
- Wetland Checkzone
- State-Regulated Freshwater Wetlands
- Rare Plants and Rare Animals
- Unique Geological Features
- Natural Communities Nearby
- Significant Natural Communities
- Interstate Highways

Disclaimer:This map was prepared by the New York State Department of Environmental Conservation using the most current data available. It is deemed accurate but is not guaranteed. NYS DEC is not responsible for any inaccuracies in the data and does not necessarily endorse any interpretations or products derived from the data.

Figure 10. SIW PA; NYSDEC Environmental Resource Map

PHYSICAL SETTING SOURCE MAP - 3164828.1s



- County Boundary
- Major Roads
- Contour Lines
- Power transmission lines
- Airports
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons

- Groundwater Flow Direction
- GI Indeterminate Groundwater Flow at Location
- GV Groundwater Flow Varies at Location
- HD Closest Hydrogeological Data
- Oil, gas or related wells
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

SITE NAME: Staten Island Project ADDRESS: 2351 Richmond Terrace Staten Island NY 10302 LAT/LONG: 40.6397 / 74.1395	Figure 11 SIW PA, Physical Setting Source Map

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