

BROWNFIELD REDEVELOPMENT OF KOPPERS SEABOARD SITE IN KEARNY, NEW JERSEY

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ABSTRACT: This paper describes the ongoing remediation and brownfield redevelopment project at the former Koppers Seaboard Site in Kearny, New Jersey. The remediation/redevelopment of the 687,990 square meter site, utilizing processed dredged materials (PDM) and pending redevelopment, will help allow vital regional shipping to continue, and renders the site suitable for industrial use. The site was the location of the Koppers Seaboard Coke and By-Products plant, which was razed in 1979. Significant contamination remains from past operations, which included coke production, gas conditioning, and coal-tar refining. A Remedial Action Work Plan (RAWP) was approved by the New Jersey Department of Environmental Protection in 1998. The RAWP proposed to contain contaminants on-site, using a barrier system along the Hackensack River, and capping of the site using PDM. PDM placement was initiated in late 1997 under an interim state approval, and will require approximately three years to complete placement operations. The PDM is manufactured, offsite, by stabilizing dredged materials with Portland Cement and other admixtures. The final thickness of the PDM cap will be about ten m, providing a total storage capacity of about 3,440,000 m³ of PDM. The PDM cap eliminates direct-contact exposure to contaminated materials and contaminated storm-water runoff. A steel sheet pile wall and a slurry wall have been installed, which reduces migration of contaminants to acceptable levels in ground water prior to discharging to the Hackensack River. The property owner intends to redevelop the property for industrial or commercial usage following site remediation. A proposed Conceptual Master Plan provides a layout that could accommodate one 1,160-m² and five 890-m² pads for industrial facilities. Vehicular, rail, and water access are all available to the site.

INTRODUCTION

This paper provides a description of the ongoing site remediation and brownfield redevelopment project at the former Koppers Seaboard Site in Kearny, New Jersey. Remediation of the site is in progress, and will result in a site that is suitable for redevelopment. A principal component of the project is the beneficial use of processed dredged materials (PDM) to cap the site. Benefits of the PDM cap include elimination of direct-contact exposure to contaminated surface soils, elimination of contaminated storm water runoff from the site into the Hackensack River, and elevation of the ground surface above the 100-year flood plain to allow redevelopment. The project also provides a location for the placement of significant quantities of PDM from the Port of New York and New Jersey. This paper discusses the former industrial usage of the site and the resulting contamination, the brownfields remediation of the site utilizing PDM and other methods, and a conceptual master plan for the redevelopment of the site.

The Port of New York and New Jersey is suffering from silting channels and berths, and a lack of dredged materials disposal capacity, particularly since ocean disposal was essentially phased out in September 1997. Permitted upland disposal facilities are in high demand. To maintain harbor channels and berths, approximately 4,600,000 m³ of material must be dredged annually. In addition, there is a backlog of approximately 15,300,000 m³ of materials for which dredging is required. The buildup of contaminated sediments is currently threatening the multibillion-dollar trade and commerce market linked to the Port of New York and New Jersey. The remediation of the Koppers site with processed dredged materials

will provide an important repository for dredged materials from the Port.

SITE DESCRIPTION

The site is located in the Town of Kearny, in Hudson County, New Jersey, at One Fish House Road. Major highways near the site include the New Jersey Turnpike and Routes 1 and 9. The site is approximately 687,990 m² in area, most of which lies north of a New Jersey Transit commuter rail line. The site is bounded to the north and east by the Hackensack River, and to the west by a drainage ditch. The site is accessible by barges via an existing dock. The site is generally flat, with the exception of a dike structure that is present along the majority of the northern boundary of the land and the Hackensack River. The dike structure was originally constructed to minimize flooding of the site, and has existed since the early 1900s.

The site was the location of the Koppers Seaboard Coke and By-Products plant. Operations included coke production, by-product recovery, and gas cleaning/conditioning. The original facility construction was reportedly completed in the early 1900s. Operations at the facility were conducted until about 1979, when the facility was razed.

Information obtained from soil borings, piezometers and monitoring wells were used to provide an understanding of the presence and distribution of lithologic units across the site. The site is located over a marshland that was built up with fill materials through industrial development.

Constituents of interest (COI) generally include polynuclear aromatic hydrocarbons (PAHs), volatile aromatics (VOAs), cyanide, and to a lesser extent trace metals. Site-related COI in ground water have been detected in site granular fill above state ground-water standards, and to a much lesser amount in the sand/silt zone. Dense nonaqueous phase liquids (DNAPL) are present in isolated areas within the former coal-tar distillation facility area. Generally, soils across the site contain detectable levels of certain COI above State nonresidential, direct-contact, soil cleanup criteria (NRDSCC). Fig. 1 below illustrates the impacted areas and components of the remedy to be subsequently discussed.

The environmental condition of the site is being addressed

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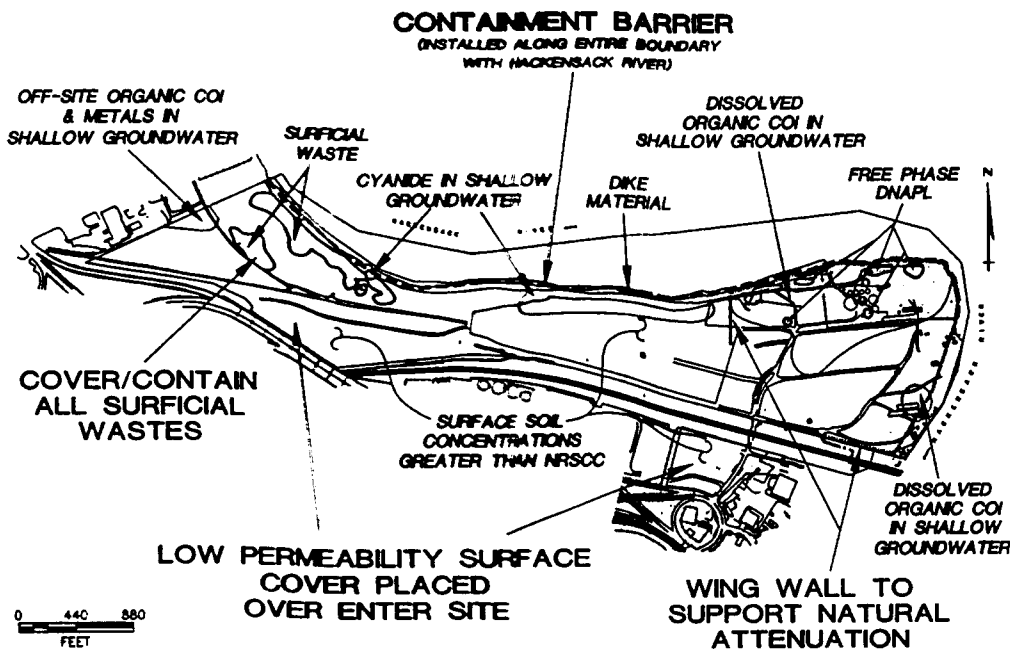


FIG. 1. Site Contamination and Remediation Features

in accordance with a 1986 agreement known as an Administrative Consent Order (ACO), which is in effect between the New Jersey Department of Environmental Protection (NJDEP) and the responsible entity associated with the former Koppers Company.

In 1997, an agreement was executed between the Hudson County Improvement Authority (HCIA, the present owner of the site), Beazer East, Inc., (formerly known as the Koppers Company), and ECDC Environmental, L.C. (now SK Services East), whereby SK Services East, along with their project management consultant Investment Recovery, LLC (IRL), will perform the remediation of the site.

SITE REMEDIATION

In May 1998 a RAWP was approved by the NJDEP. Based on the RAWP, components of the remediation have been constructed. A principal component of the RAWP is reduction of the flow of contaminants off-site by enhancing the natural attenuation of ground-water constituents of interest (COI), using a barrier system along the Hackensack River, and capping of the site using PDM. Combined, the barrier system and PDM cap will act to reduce and redirect ground-water gradients across the site, thus increasing the travel time for COI to reach the Hackensack River. It has been modeled that through natural attenuation, COI will be reduced to acceptable levels prior to discharge to the river.

PDM will be used to cap the entire surface of the site. The PDM is manufactured from raw dredged materials (RDM) dredged from the Port of New York and New Jersey shipping channels. Typical geotechnical characteristics of RDM vary widely, and generally include 1–3% total organic carbon (TOC), 50–65% moisture, 2–20% sand, 10–90% silt, and 10–90% clay. The RDM may also contain contaminants, such as PAHs and metals, that may exceed the State's NRDCSCC. The RDM is dredged and transported by barge to ECDC's processing facility in Port Newark. A slurry of portland cement is prepared, injected, and blended with the RDM in the barge, using a rotary mixer mounted on a backhoe. Other admixtures may also be utilized, subject to bench scale treatability studies, property owner approval, and regulatory agency approval. The PDM stabilizes contaminants, and is required to achieve project-specific soil placement criteria (SPC) prior to placement at the site. The resulting PDM is transported by barge to the

former Koppers site. The PDM is offloaded using a clamshell mounted on a spud barge, and loaded onto off road dump trucks. The dump trucks place the PDM in stockpiles for subsequent spreading and compacting. The PDM is then tested in the field for geotechnical properties such as unconfined compressive strength (UCS) and permeability to ensure that the site meets remedial goals and is suitable for redevelopment. The thickness of the PDM cap will be about 10 m, providing a total storage capacity at the site of about 3,440,000 m³. Dredged material placement was initiated in late 1997, under an Interim Fill Plan approved by NJDEP, and is anticipated to take up to three years to complete.

The conceptual grading plan included in the RAWP proposed placing structural fill at a 2H:1V side slope to achieve a side-slope crest of 10.5 m above mean sea level (msl). From the side-slope crest, a minimum 2% slope was proposed to a peak ground surface elevation of 13.5 m for the surface cover. In all, the surface cover is anticipated to beneficially reuse about 3,440,000 m³ of PDM. To manage traffic and stormwater runoff, several access roads and sedimentation basins were proposed. Settlement plates were installed at the original ground surface to measure the settlement of subsurface soils. An extensive geotechnical investigation including both land and river borings as well as laboratory analysis was performed for the proposed surface cover in order to establish adequate factors of safety for the project. Performance criteria are as follows:

- At least 0.66 m of the PDM must meet permeability requirements of 1×10^{-6} cm/s.
- Exposed PDM must not exceed NJDEP nonresidential direct-contact soil cleanup criteria requirements.
- The PDM must have an unconfined compressive strength of at least 211 Kg per square centimeter.

The surface cover will be constructed in 0.6 m lifts to allow the PDM to dry and be compacted. An extensive PDM chemical and geotechnical and surface cover geotechnical program will be conducted to ensure performance criteria are met.

Benefits of the surface cover are as follows:

- Elimination of direct-contact exposure to contaminated surface soils.

- Elimination of contaminated storm-water runoff from the site into the Hackensack River.
- Large reduction of infiltration of storm water into existing contaminated soils.
- Elimination of potential exposure of ecological receptors to site contaminants.
- Enhancement of the natural attenuation of contaminated groundwater.
- Elevation of the ground surface to greater than the 100-year flood plain.

The use of dredged materials in this manner is encouraged by, and is consistent with, applicable regulatory guidance such as the October 7, 1996, *Joint Dredging Plan for the Port of New York/New Jersey* issued by the United States Army Corps of Engineers in October, 1996, and *The Management and Regulation of Dredging Activities and Dredged Materials in New Jersey's Tidal Waters*, issued by the NJDEP in October, 1997.

The barrier wall will consist of both a steel sheet pile wall (SSP) and a slurry wall. The SSP has been designed to provide a barrier along the entire northern, and a portion of the eastern, boundary (ending at the barge dock) of the land and the Hackensack River. The SSP has been installed with either welded or sealed joints, and has been driven into a varved or organic clay stratum; it has a top elevation of about 3 m above msl. A portion of the SSP is cantilevered. Tie-backs will be provided as necessary. Along much of the alignment, the SSP has been installed in the intertidal zone. Approximately 2,100 m of SSP will be installed. A PDM key will be placed behind much of the wall for stability and environmental purposes.

Along much of the eastern portion of the site, a slurry wall has been constructed to cut off contaminated ground-water flow toward the Hackensack River and to contain DNAPL. The slurry wall has been constructed of a soil/bentonite mixture, and has a permeability of 1×10^{-7} cm/s or less. The slurry wall has a minimum thickness of approximately 0.9 m, will extend up to 8 m below ground surface, and will extend approximately 0.9 m into the subsurface confining layer. The slurry wall has been constructed behind the substructure of an existing 300-m long site dock. The slurry wall has also been extended as a wing wall in the area known to have DNAPL present. Fig. 2 provides a typical cross section of the barrier wall.

The main benefits of the barrier wall are that it

- Eliminates migration of DNAPL into the Hackensack River
- Enhances the natural attenuation of contaminated ground water
- Serves as a structural element of the site surface cover

A 3,785 m³ above-ground storage tank and its contents of approximately 2,250 m³ of former plant process materials will be removed for off-site recycling or reuse. The contents of the tank have been classified by the generator as listed hazardous waste K-141. Options being considered for disposal of the waste materials include recycling at either a coke or coal tar facility, and beneficial reuse as a fuel at cement kilns or other permitted facilities. Following removal and off-site disposal of the tank contents, the steel tank will be recycled as scrap.

Based on historical well records, several former production wells installed in the early 1900s were suspected to exist at the site. Investigation of historical records revealed potential locations of former production wells and their depths. An investigation, which included a magnetometer survey, electronic pipe tracing, and test pit excavations, was conducted to locate two former production wells. Following location of the wells, oversized casings were installed to allow access into the wells from the ground surface. It was discovered that both wells had former pump housings, lodged within the annulus of the well, that prevented access to the well's bottom for sampling and abandonment purposes. Following several unsuccessful attempts to remove the housings, specialized "fishing" tools were fabricated to attempt to extricate the obstructions. The fishing tools also proved unsuccessful in removing the obstructions. Following downhole investigations including caliper measurements, temperature, and television monitoring, a program was undertaken to sample one production well that was free of obstructions to a depth of 96 m. Sampling was conducted, utilizing low-flow sample collection techniques, in conductive zones packed off at 15-m intervals. Results of the ground-water sampling indicated that no site-related constituents of interest have migrated into the deep bedrock zone. Based on the results of the sampling, the wells will be abandoned in accordance with regulatory requirements.

An interim remedial measure (IRM) for DNAPL recovery has been in operation at the site for the past five years. DNAPL is being recovered from the top of the first confining unit, which is either a meadow mat or organic clay located approximately 3–5.6 m below the ground surface. The IRM system consists of a combination of seven recovery wells and approximately 90 m of recovery trenches. The above-ground components of the IRM system consist of two 19 m³ primary separation and storage tanks, and an oil/water coalescing separator. Treated ground water is discharged to an infiltration trench hydrogeologically upgradient of the area of DNAPL extraction via a New Jersey Pollutant Discharge Elimination System (NJPDES) discharge to ground water permit. Extensive ground-water monitoring is conducted to meet permit requirements. Approximately 22 m³ of DNAPL at less than 3% moisture has been recovered and recycled off-site at a coal tar

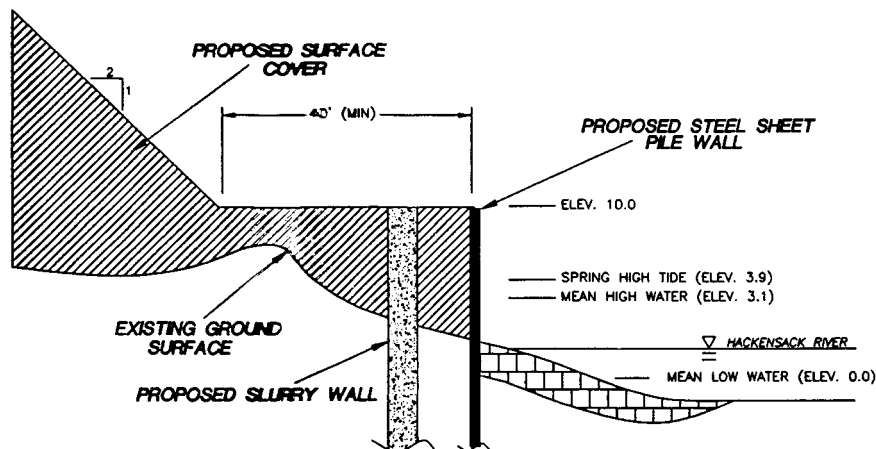


FIG. 2. Detail of Barrier Wall

distillation facility. Following installation of the barrier wall, the IRM will be decommissioned in accordance with an approved RAWP.

Site preparation activities necessary to implement the barrier wall and surface cover construction are being implemented. These activities include

- **Utility Relocation:** A plan to relocate an overhead electrical transmission line is currently being implemented. An out of service gas line will be abandoned, and a Town of Kearny water supply line will be reestablished for future use.
- **Access Road Construction:** Temporary site access roads will be constructed during remediation to facilitate construction of the barrier wall and placement of the PDM.
- **Wetlands Mitigation:** Approximately 3,060 m² of combined tidal and freshwater wetlands exist on site. A plan to enhance the intertidal zone outboard of the SSP in addition to off-site mitigation will be conducted to offset the loss of wetlands that will occur as a result of the remediation.
- **Monitoring Well Installation:** New monitoring wells necessary to evaluate the performance of the remedial activities, or to implement hydraulic control if required, will be installed.
- **Building Demolition:** An existing building will be demolished and utilized for temporary road construction.

Various local and state permits necessary for remediation and redevelopment have been identified and obtained, as follows:

- Stormwater permits
- Soil erosion and sediment control plan approval
- A Hackensack Meadowlands Development Commission Zoning Certificate
- A 404 Section 10 ACOE permit
- Waterfront Development Permits
- Stream Encroachment Permits
- Recycling Permits (For recycling of demolition debris)
- Acceptable Use Determination (AUD)

REDEVELOPMENT OF THE FORMER KOPPERS SITE

HCIA intends to redevelop the property for industrial or commercial usage following placement of PDM on the site. This section presents the design parameters and basis assumptions used for the development of the site Conceptual Master Plan. A RAWP was developed by Key Environmental, Inc.,

(KEY) that includes grading plans for the placement of dredge material on the site. The Conceptual Master Plan uses the basic grading scheme developed by Key, and provides a conceptual layout for commercial–light industrial development and associated site access, utilities, and storm-water management. As a result of this development study, it has been concluded that the proposed dredge fill can be placed without compromising the development potential of the property. The PS&S plan attempts to maintain the general grading scheme developed by Key to the greatest degree possible, while making the changes necessary to accommodate the conceptual site development.

The raw dredged material is mixed primarily with portland cement to reduce soil permeability and to stabilize and encapsulate contaminants within the dredge material. The addition of the cement increases soil cohesion, enabling an increased angle of repose and therefore an increased sideslope angle of 2H:1V. A topsoil cap to facilitate vegetative growth, or other means to prevent erosion, will also be developed.

Earthwork calculations were performed using AutoCAD Release 14 to determine the amount of dredge material that could be placed on the site, based on the grading conditions as shown on the PS&S Conceptual Master Plan. Two methods were used to determine earthwork quantities; (1) the average end area, and (2) the grid. Both methods contrast existing and proposed contours. Both methods conclude that about 3,440,000 m³ of PDM could be placed at the site, based on the Conceptual Master Plan grading. It has been assumed that the dredge material will not experience significant shrinkage and swelling. Therefore, shrinkage and swelling factors were not taken into account.

The Conceptual Master Plan produces a relatively flat area, with a 2% cross slope, of about 11,220 m² on top of the fill material that could be utilized for development. The Conceptual Master Plan provides a general layout that could accommodate one 1,160-m² and five 890-m² pads for industrial facilities, as shown in Fig. 3.

The building layouts assume a 120-m column grid spacing. The plan includes associated parking, truck loading bays, and roadways, along with a u-turn on the west side of the top fill area. Sufficient area remains for several additional facilities.

Good site access is essential for a viable commercial or industrial development. The subject parcel has several site constraints, including the dredge fill, the Hackensack River to the north and east, and the New Jersey Transit railroad to the south, which place limits on site access. However, vehicular, rail, and water access are all available to the site.

Vehicular ingress is proposed at the west end of the site ramping off the westbound side of the Belleville Turnpike

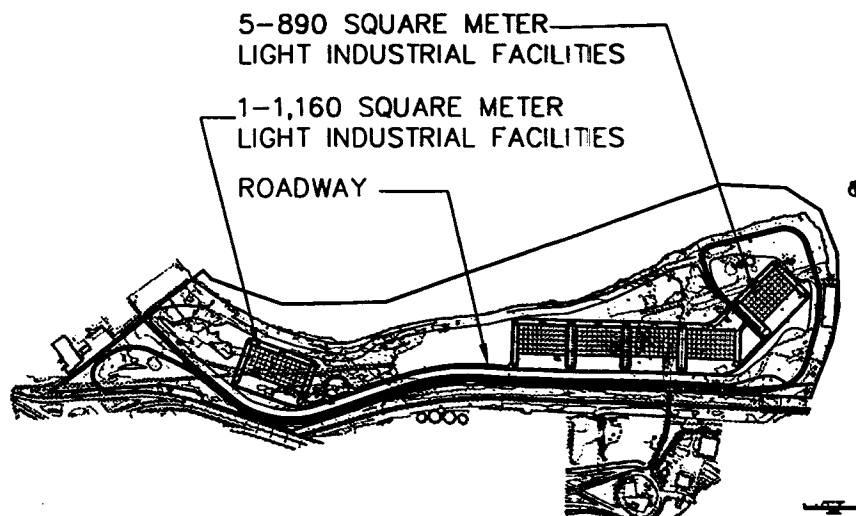


FIG. 3. Conceptual Development Plan

(NJDOT Route 7). Vehicular egress from the site will be maintained through an existing tunnel beneath the New Jersey Transit railroad grade located in the southeast corner of the site.

A rail siding increases the potential of an industrial or commercial site. At one time, a rail line had entered the site from the west and crossed through it to its eastern end. A potential new alignment enters the site at the same point as the original siding and shifts to the south, paralleling the roadway along its north side. It continues to the east end of the site terminating adjacent to the docking facilities.

The availability of site access via the Hackensack River, which borders the site to the north and the east, adds additional potential to future site development. No attempt has been made to design a comprehensive docking facility at this time. For conceptual purposes, the existing loading platform on the east end of the site has been maintained.

Site storm-water management will consist of a network of storm-water inlets, underground piping, perimeter swales, and wetlands impoundment basins to drain the road, railway, and fill side slopes. The concept plan anticipates that more innovative water quality methods, such as vortex devices, will be used to treat runoff from the developed areas. All site runoff will eventually drain to the adjacent Hackensack River. For conceptual purposes, all storm-water management facilities have been designed to address water quantity and quality impacts for the 100-year frequency, 24-hour storm.

Three wetlands impoundment basins have been placed on the site to route and provide treatment of storm water collected by the perimeter swales from the fill side slopes, the road, and railway. The basins have been designed to safely route the 100-year frequency, 24-hour storm.

The site is served by the Town of Kearny water system. At present, there is an active meter pit with a 30.5-cm diameter service on the site, together with a simple network serving various inoperable hydrants and post indicator valves. The distribution network serving this area of Kearny primarily relies upon a 61-cm diameter main along Harrison Avenue and a .9-m diameter main along the south side of Route 7 (Belleville Turnpike). The Town of Kearny's water supply system reportedly has a capacity of approximately 64,345 m³/day.

No sewage conveyance or treatment facilities exist at the site at this time. Based upon studies done for previous development projects, sewage treatment for this tract is apparently best provided by the Passaic Valley Sewage Commissioner's (PVSC) Publicly Owned Treatment Works (POTW) Facility located approximately 4.8 Km south of the site across Newark Bay, in Newark. Conveyance to PVSC would probably require the construction of significant off-site gravity sewers and/or pressure forcemains (up to 3,350 m). Reportedly, PVSC has available capacity at their 1,514,000 m³/day facility.

No active gas service is presently provided to the site. Gas service is readily available to the site and the surrounding vicinity through Public Service Electric and Gas Company (PSE&G). An abandoned 41 cm, steel gas transmission line bisects the property, and three 35 Kg/cm² gas mains end just south of the Conrail lines on the southern boundary of the site.

Electric service to the Koppers Site is provided by PSE&G. Existing overhead electric facilities consist of one circuit energized at 26,400 V and one circuit energized at 13,200 V. Part of the PSE&G transmission grid, in the form of two 138,000 V (138 KV) tower lines, skirts the southeastern edge of the property. This electric system supplied energy to the former Koppers Coke operation, and could be tapped once again to supply electric power for any proposed development at the site.

The site is located within the Hackensack Meadowlands portion of the Town of Kearny. Area land use is predominantly

industrial. Land uses to the south (i.e., beyond the Conrail line and Belleville Turnpike) are industrial. The South Kearny Industrial Area (SKIA) is located further south. Land use on the opposite shore of the Hackensack River is characterized by industrial, vacant industrial, and vacant land. The site is within the zoning jurisdiction of the Hackensack Meadowlands Development Commission (HMDC), a state agency. The HMDC's zoning designations and land use objectives supersede local land use controls. The site is zoned Heavy Industrial by HMDC.

BROWNFIELDS REDEVELOPMENT

The Koppers Site is one of the largest sites to undergo brownfields remediation and redevelopment. A number of aspects of State Brownfield and Contaminated Site Remediation Act and brownfields initiatives were incorporated into the RAWP and approved by the NJDEP:

- Soil cleanup criteria specifically intended for nonresidential properties (restricted use soil cleanup criteria) are used as a part of the evaluation of whether remedial actions are necessary. The remedial goal was not to treat site soils to achieve a numerical nonresidential concentration standard, but to contain site soil in a manner protective of human health and the environment.
- Engineering controls, in the form of a cap over the entire site, access gates, and signage, are being used to further reduce exposure to contaminants that are allowed to remain on site. The engineering controls are a significant part of the remedial action because they provide a protective remedy at a much lower cost than treating contaminated site materials. The reduced remediation cost encourages the remediation and redevelopment of sites that may have otherwise lain dormant.
- Institutional controls, in the form of a deed notice, will be used to further reduce exposure to contaminants allowed to remain on site. The deed notice will provide notice to interested parties of the nature and extent of contamination on site, restrict usage to industrial usage, require maintenance of the site cap, and prohibit disruption of the cap without prior governmental approval. Like engineering controls, institutional controls are a low-cost method to the reduce risk of exposure to contaminated materials.
- Ground-water contamination is addressed by containment within the barrier wall and by allowing monitored natural remediation to occur. A ground-water monitoring plan is being implemented to monitor the improvement in ground-water quality over time. Restoring ground-water quality to potable quality is not a remedial goal. Potable usage of ground water is prohibited by an institutional control known in New Jersey as a Ground Water Classification Area (CEA).

Implementing a brownfields remediation project of this scale entails a number of challenging issues, among them gaining all the requisite approvals from the municipality, the HMDC, the HCIA, the NJDEP, and the U.S. Army Corps (for wetlands mitigation issues). The project site is in a heavy industrial area; it was perceived to provide an economic benefit to the region, and thereby gained the support of the local officials.

CONCLUSIONS

The remediation and redevelopment of the former Koppers site utilizing processed dredged sediments from the Port of New York and New Jersey provides the public with several

benefits. First, the provision of a location for the placement of about 3,440,000 m³ of dredged sediments from the Port of New York and New Jersey allow vital shipping to continue. Second, a large contaminated site is being remediated in part from the direct application of processed harbor sediments. The ongoing remedial action will contain contaminants on-site, using a barrier system along the Hackensack River, and capping

of the site using PDM. The PDM cap eliminates direct-contact exposure to contaminated materials and contaminated storm-water runoff. A steel sheet pile wall and a slurry wall are under construction, and will reduce migration of contaminants to acceptable levels at the Hackensack River. Finally, the formerly fallow site will be rendered suitable for industrial use, thereby generating jobs and revenues for the local economy.