Superfund Program
Proposed Plan

U.S. Environmental Protection Agency
Region 2

Garfield Groundwater Contamination Superfund Site
Garfield, New Jersey

May 2016

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan describes the remedial alternatives that the United States Environmental Protection Agency (EPA) considered to remediate contaminated groundwater at the Garfield Groundwater Contamination Superfund site (site) identifies EPA's preferred alternative along with the reasons for this preference.

The preferred alternative calls for in-situ treatment of the remaining chromium contamination at the original source, in-situ reduction of contamination in the overburden groundwater, and restrictions on groundwater use until the overburden groundwater is restored. The preferred alternative would also continue basement monitoring and mitigation until the overburden groundwater is restored, to prevent exposure to chromium that could enter basements with contaminated groundwater.

This document is issued by EPA, the lead agency for site activities, and the New Jersey Department of Environmental Protection (NJDEP), the support agency. EPA, in consultation with NJDEP, will select the final remedy for the site after reviewing and considering all information submitted during a 30-day public comment period. EPA, in consultation with NJDEP, may modify the preferred alternative or select another action presented in this Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all alternatives presented in this document.

EPA is issuing this Proposed Plan as part of its community relations program under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund). This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation (RI) Report - Garfield Groundwater Contamination Superfund Site and the Garfield Groundwater Contamination Superfund Site Feasibility (FS) Study, as well as in other documents contained in the Administrative Record for this site.

MARK YOUR CALENDARS

Public Comment Period

May 9, 2016 to June 8, 2016

EPA will accept written comments on the Proposed Plan during the public comment period.

Public Meeting

May 19, 2016 at 7:00 P.M.

EPA will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held at the Garfield Senior Center, 480 Midland Ave., Garfield, NJ.

The Administrative Record files are available for public review at the following information repositories:

EPA Region 2 Records Center
290 Broadway, 18th Floor
New York, New York 10007-1866
(212) 637-4308
Hours: Monday-Friday – 9 A.M. to 5 P.M.

Garfield Public Library
500 Midland Ave., Garfield, NJ
(973) 478-3800

SITE DESCRIPTION

The site is located in a mixed commercial and residential neighborhood in the City of Garfield, Bergen County, New Jersey. The extent of the site is defined by the presence of chromium in the groundwater at concentrations at or greater than the New Jersey Groundwater Quality Standard of 70 micrograms per liter (µg/L). The source of groundwater contamination has been identified as the former EC Electroplating (ECE) facility at 125 Clark Street in Garfield. The ECE property covers approximately 0.65 acres. It is bounded by Clark Street to the north, Lincoln Place to the west, Sherman Place to the east, and residential properties to the south (Figure 1).

SITE HISTORY

EC Electroplating was founded in the late 1930s and operated until March 2009. The facility was used as a custom metal plating shop that electroplated chromium, copper, and nickel onto machined parts. One large cylindrical storage tank and three additional vertical tanks were used to store chromic acid plating solution. There were two documented spills at the site that may have been sources of contamination. In December 1983, the large tank failed, releasing chromic acid directly to the shallow groundwater. One groundwater pumping well was installed to recover the spilled chromium, but the complete mass was not recovered before the pumping shut down in 1985. In May 1996, a spill of process wastewater was mitigated by the Bergen County Hazardous Materials team. The results of EPA's groundwater investigation suggest that other spills or leaks of chromic acid may have occurred at the facility.

In October 2002, NJDEP requested EPA assistance to assess and mitigate chromium-contaminated groundwater infiltrating into basements of buildings in Garfield. From 2008 to 2015, EPA surveyed properties and sampled dust in the basements of residential and commercial properties. Properties where basement dust samples exceeded the site-specific removal action level (RAL) for hexavalent chromium were decontaminated and the basements were sealed and/or had drainage systems installed to prevent groundwater infiltration.

EPA documented a determination of significant threat for the site based on basement dust sampling results in the 2010 E.C. Electroplating (Garfield Groundwater Contamination Site) - Determination of Significant Threat Memorandum. It was determined that exceedances of the RALs, as well as the potential for future contamination at levels exceeding these values represented an unacceptable risk to individuals who may be exposed to hexavalent chromium dust on basements surfaces. Dust on potentially contaminated surfaces in the basements was sampled by wiping an area (10 centimeter x 10 centimeter) and analyzing the hexavalent chromium mass on the wipe. For basements used as a living space (high use), EPA developed a RAL of 1.1 micrograms of hexavalent chromium per wipe. For basements used for laundry and storage (low use), a RAL of 8.7 micrograms of hexavalent chromium per wipe was developed. As of 2015, more than 500 properties were inspected and 14 of the properties required removal actions to address chromium-contaminated dust in the basements.

In April 2010, the New Jersey Department of Health and the US Agency for Toxic Substances and Disease Registry issued a health consultation which assessed the potential chromium exposures to area residents based on previous sampling investigations conducted by EPA in residential and commercial properties. Both agencies concluded that there is evidence of a complete exposure pathway regarding ingestion of and dermal contact with surface dust containing chromium. Both agencies also concluded that past, present and future exposures represent a public health hazard via the ingestion of chromium dust in some basements. In September 2010, ATSDR issued a Public Health Advisory for the site, recommending that EPA take immediate measure to dissociate residents and others from the basement area of the properties showing the highest chromium levels in surface dust to prevent exposures from continuing.

In June 2011 EPA conducted a site assessment of the abandoned EC Electroplating facility. EPA's assessment identified hazardous materials within vats, tanks and drums at the facility which presented and immediate threat to the surrounding community, and further identified the facility as the source of chromium contamination in groundwater. EPA removed all hazardous materials from the facility and disposed the materials at appropriate facilities. In 2012 all buildings and above-ground structures on the ECE property were demolished by EPA.

Following the removal of the building and its contents, EPA conducted a comprehensive soil investigation on the ECE property to determine the extent of chromium contamination present in the soils and substructures of the former facility. EPA mobilized to the ECE property in October 2013 to excavate contaminated soils and concrete which exceeded 20 milligrams per kilogram (mg/kg) of hexavalent chromium (NJDEP soil cleanup criteria). A total of 1,180 tons of concrete was removed from the site, including 897 tons that was disposed of as hazardous waste. The total soil removed from the site was 5,686 tons. Of the soil removed, 2,701 tons required disposal as hazardous waste. Only soil above the water table was addressed in this action. Post-excavation samples were collected and all excavated areas were backfilled and compacted with certified clean fill. The surface of the site was then covered with clean backfill and capped with asphalt in May 2014.

The Garfield Groundwater Contamination Superfund Site was placed on EPA's National Priorities List in September 2011.

EPA initiated a shallow groundwater study in 2010 and then expanded the investigation to overburden and bedrock groundwater, residential soils, surface water, and sediments. The groundwater investigation included installation of conventional and multiport wells, downhole geophysical profiling, packer testing, a matrix diffusion study, and a groundwater-surface water interaction study. There are currently 52 overburden and bedrock wells in EPA's monitoring network. The results of this investigation were used to complete the human health and ecological risk assessments. EPA also conducted additional studies on aquifer testing, in-situ reduction of hexavalent chromium in groundwater, and an ecological risk assessment of sediments in the Passaic River. EPA continues to investigate and mitigate exposure to chromium caused by the intrusion of contaminated groundwater into the basements of buildings located in Garfield.

SITE CHARACTERISTICS

Physical Setting of the Site

The former ECE property is located in Garfield approximately 0.6 miles east of the Passaic River (Figure 1). The topography of the 0.65-acre ECE property is flat and the property is enclosed by an eight foot high screened chain link fence. The neighborhood immediately surrounding the ECE property consists of a mixture of residential and commercial properties. The ECE property is currently zoned residential.

Site Geology and Hydrogeology

Groundwater occurs within two hydrogeologic systems in Garfield — the unconsolidated overburden materials and fractured sedimentary bedrock. The overburden material underlying the region consists of a thick layer of unconsolidated glacial sediments and fill material. Groundwater flow in the overburden materials is predominantly controlled by local topography. The depth to groundwater in Garfield is generally less than 20 feet below ground surface.

The bedrock at the site consists of interbedded siltstones, mudstones, and fine- to coarse-grained sandstones. Groundwater flow in the bedrock aquifer is controlled by fractures and bedding planes. At the ECE property source area, there is limited groundwater flow upward from the bedrock aquifer into the overburden. Outside the source area, the overburden groundwater generally flows downward into the bedrock aquifer.

Groundwater from the overburden aquifer discharges to the Passaic River. The Passaic River on Garfield's western border is tidally influenced and its width is generally 200 to 300 feet, with an estimated depth of 5 to 10 feet in the center. The river sediments are principally composed of sand and have low levels of organic carbon.

Nature and Extent of Contamination

The ECE property is considered the source area of the site based on the known releases of chromic acid and the chromium impacts to soil and groundwater at the property (Figure 2). Although EPA removed contaminated soils above the water table, there is still a zone of very high chromium concentrations immediately below the water table that is a source of groundwater contamination. The maximum hexavalent chromium concentration found in groundwater in 2014 was 269,000 µg/L at monitoring well EPA-32-OB, near the historical location of the chromic acid tanks at the former ECE facility. The shallow bedrock aquifer beneath the ECE property also has high levels of hexavalent chromium, 1,370 µg/L at EPA-13-BR in 2014. The dominant form of chromium in the groundwater across the site is hexavalent chromium, but there is also trivalent chromium present.

Outside the source area, the greatest concentration of hexavalent chromium in an overburden well was 14,900 µg/L at well EPA-06-OB in 2014 (Figure 3). The average hexavalent chromium concentration in the overburden plume is estimated to be 3,420 µg/L.

The hexavalent chromium groundwater plume extends north of the ECE property to Van Winkle Avenue and south to Commerce Street. In the area of the plume, shallow groundwater that infiltrates into basements can transfer hexavalent chromium to the floor or walls.

The overburden plume flows to the west and discharges to the Passaic River. Hexavalent chromium and total chromium in samples from the surface water of the Passaic River do not exceed the NJDEP Ecological Screening Criteria in the area of the plume. However, the Passaic River sediment samples from this area are elevated in hexavalent chromium and total chromium.

SCOPE AND ROLE OF ACTION

The overall strategy for the Garfield Groundwater Contamination site is to remove principal threat waste, protect residents from exposure to hexavalent chromium contamination, and restore groundwater to levels acceptable for beneficial use. EPA is addressing the cleanup in two phases, called Operable Units. This Proposed Plan addresses Operable Unit 1 (OU1): the basements, ECE property source area, and overburden groundwater. The overburden aquifer is a source of hexavalent chromium contamination to the deeper bedrock aquifer. The groundwater in the bedrock aquifer will be addressed as Operable Unit 2.

PRINCIPAL THREAT WASTE

EPA's removal actions addressed hazardous materials, buildings, subsurface structures, and soils at the former ECE facility. These actions removed all of the "principal threat" wastes at the site (see inset box).

> **WHAT IS A "PRINCIPAL THREAT"?**
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> The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes an expectation that EPA will use treatment to address the principal threats posed by a Site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund Site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, surface water or air, or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material; however, Non-Aqueous Phase Liquids (NAPLs) in ground water may be viewed as source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria This analysis provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

SUMMARY OF SITE RISKS

The purpose of the risk assessment is to identify potential cancer risks and noncancer health hazards at the site assuming that no further remedial action is taken. As part of the RI/FS, a baseline human health risk assessment (HHRA) was conducted to estimate the risks and hazards associated with the current and future effects of contaminants on human health and the environment (see adjoining box "What is Risk and How is it Calculated"). A screening-level ecological risk assessment (SLERA) and baseline ecological risk assessment (BERA) were also conducted to assess the risk posed to ecological receptors due to site-related contamination.

Human Health Risk Assessment

Groundwater

The HHRA began with selecting chemicals of potential concern (COPCs) in groundwater that could potentially cause adverse health effects in exposed populations. Although the groundwater is currently not used for drinking water purposes, the HHRA assumed groundwater could be used as a source of drinking water in the future.

In this assessment, exposure point concentrations were estimated using the 95% upper-confidence limit (UCL) of the average concentration of the contaminant. Chronic daily intakes were calculated based on the reasonable maximum exposure (RME), which is the highest exposure reasonably anticipated to occur at the site. The RME is intended to estimate a conservative exposure scenario that is still within the range of possible exposures.

Cancer risks and noncancer health hazards from exposure to contaminated groundwater were evaluated for adult and child residents. The excess lifetime cancer risk estimate is 5 x 10-1. The calculated hazard index (HI) is 141 for adult and 355 for the child. The contaminant associated with the elevated risk and hazard is hexavalent chromium. For these receptors, exposure to hexavalent chromium in groundwater results in an excess lifetime cancer risk that exceeds EPA's target risk range of 1 x 10-4 to 1 x 10-6 and an HI above the acceptable level of 1. Several other contaminants, namely arsenic, trichloroethylene, dieldrin and cyanide were also associated with unacceptable risk and/or hazard. However, these contaminants are not considered site-related based on their distribution and frequency within the hexavalent chromium groundwater plume.

Soil

None of the residential soil samples exceeded the 20 mg/kg hexavalent criteria. Following the excavation of soil and concrete from the ECE property, EPA performed a risk assessment on the remaining soil that was separate from the baseline HHRA for

WHAT IS RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at the site in various media (*i.e.*, soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil and ingestion of and dermal contact with contaminated groundwater. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a "reasonable maximum exposure" scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other noncancer health hazards, such as changes in the normal functions of organs within the body (*e.g.,* changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and noncancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential risk of developing cancer and the potential for noncancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a "one in ten thousand excess cancer risk;" or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 10^{-4} to 10^{-6}, corresponding to a one in ten thousand to a one in a million excess cancer risk. For noncancer health effects, a "hazard index" (HI) is calculated. The key concept for a noncancer HI is that a "threshold" (measured as an HI of less than or equal to 1) exists below which noncancer health hazards are not expected to occur. The goal of protection is 10^{-6} for cancer risk and an HI of 1 for a noncancer health hazard. Chemicals that exceed a 10^{-4} cancer risk or an HI of 1 are typically those that will require remedial action at the site.

groundwater. The risk assessment considered both residential and commercial exposure to hexavalent chromium (no other constituents exceeded screening levels) in the remaining soil.

The HIs for the residential adult and the residential child from exposure to surface soil are 0.003 and 0.04, respectively, and the excess lifetime cancer risk is 3 x 10-5. For the worker, the HI from exposure to surface soil is 0.002 and the excess lifetime cancer risk is 1 x 10-6. For the excavation worker, assuming an exposure duration of 250 days, the HI is 0.4 and the cancer risk is 8 x 10-6. Because the cancer risks and noncancer hazards were well below EPA's target levels, the removal action of soil excavation is considered protective of human health for current and future commercial/industrial, as well as residential uses. Therefore, no further action for soils is necessary.

Ecological Risk Assessment

During the Remedial Investigation, a SLERA and a BERA were conducted to evaluate the potential for risk to ecological receptors from contamination. Potentially complete exposure pathways for ecological receptors included areas where groundwater discharges to the Passaic River. Ecological receptors evaluated included benthic organisms and water column-dwelling aquatic life within the Passaic River along with mammals and birds. The ecological risk assessments demonstrated that chromium concentrations in surface water do not represent a potential risk to aquatic life, and that there is negligible potential for chromium in sediment and surface water to represent a risk to mammalian and avian wildlife.

EPA completed an additional risk assessment in 2014 to further define the risk from chromium to benthic organisms inhabiting the eastern shoreline of the Passaic River. Based on a 42-day *Hyalella azteca* survival, growth, and reproduction toxicity test, chromium levels in sediments pose no ecological significant risk to survival and reproduction in the benthic invertebrate community and the effects on growth are expected to be minimal. Therefore, based on the results of this bioassay, ecological impacts are not expected in the benthic invertebrate community.

Risk Assessment Summary

It is EPA's judgement that the Preferred Alternative identified in this Proposed Plan is necessary to limit potential human health risks from actual or threatened releases of hazardous substances into the environment.

REMEDIAL ACTION OBJECTIVES

Before developing cleanup alternatives for a Superfund site, EPA establishes remedial action objectives (RAOs) to protect human health and the environment. The human health risk assessment showed that the site-related contaminants are total chromium and hexavalent chromium. Chromium may pose a risk to human health through groundwater ingestion, and hexavalent chromium may pose risks through groundwater use and contact with hexavalent chromium dust. The following RAOs address the human health risks posed by contaminated groundwater at the site:

RAO 1. Restore the chromium-contaminated groundwater to levels acceptable for future beneficial use as a drinking water resource.

RAO 2. Prevent exposure to chromium concentrations in groundwater above acceptable levels.

RAO 3. Minimize the potential for infiltration of contaminated groundwater into basements and transfer of hexavalent chromium onto basement surfaces.

RAO 4. For basement surfaces contaminated by groundwater infiltration, prevent direct contact with and ingestion of hexavalent chromium concentrations above acceptable levels.

For RAOs 1 and 2, the New Jersey Ground Water Quality Standards for Class II-A Ground Water apply. The RALs will be used to determine whether basements have been remediated to levels that are within the acceptable risk range for RAO 4.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA requires that each selected site remedy be protective of human health and the environment, be cost-effective, comply with other statutory laws, and utilize permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. In addition, the statute includes a preference for the use of treatment as a principal element for the reduction of toxicity, mobility, or volume of the hazardous substances. Potentially applicable technologies were identified and screened with emphasis on the effectiveness of the remedial action. Those technologies that passed the initial screening were then assembled into five remedial alternatives. The timeframes below for construction do not include the time for designing the remedy or the time to procure necessary contracts. In addition they do not include timeframes to reach remediation goals. Because each of the action alternatives are expected to take longer than five years to achieve remediation goals, a site review will be conducted every five years (five-year reviews) until remediation goals are achieved.

Groundwater modeling performed during the RI/FS indicates that high chromium concentrations at the ECE property are a source to the overburden aquifer, and addressing the source area will accelerate restoration of the overburden aquifer can only be achieved by first addressing this source area. Alternatives 2A and 2B would be applied to the source area at the ECE property, including the contaminated groundwater in the overburden and shallow bedrock. Alternatives 3, 4, and 5 would include source treatment (either Alternative 2A or 2B) and address overburden groundwater contamination beyond the ECE property.

Common Elements for Alternatives 2A, 2B, 3, 4, and 5

To prevent exposure to hexavalent chromium in basements, inspections and mitigation actions will continue in the area impacted by contaminated groundwater. Actions including decontamination, the application of sealants, and/or the installation of drainage trenches and sumps would be executed as necessary.

The aquifer recovery timeframes for the remedial alternatives are long, on the order of decades. Until the remediation goals can be met, potential exposure to contaminated groundwater will be eliminated by the designation of an institutional control. The institutional control will be a New Jersey Ground Water Classification Exception Area that restricts the use of the contaminated aquifer. Groundwater monitoring would be performed in the source area and overburden plume to evaluate the hexavalent chromium concentrations and the effects of the remedy.

For the cost estimates of each alternative, EPA assumed 30 years of implementing the remedy. However, the time required to achieve groundwater restoration in RAO 1 would be greater than 30 years for all of the alternatives. Based on EPA's groundwater modeling, it is expected to take at least 80 years to restore the groundwater.

Alternative 1 - No Action

The No Action alternative was retained for comparison purposes as required by the NCP. Under this alternative, no action would be taken to remediate the contaminated groundwater at the site, and no institutional controls would be implemented.

Total Capital Cost: $0
Operation and Maintenance: $0
Total Present Net Worth: $0
Estimated Construction Timeframe: 0 years

Alternative 2A – Source Area Soil Mixing, with Pump and Treat

Soil mixing would be applied to the contaminated zone of soils in the source area on the ECE property. A backhoe or auger would be used to distribute a chemical reagent to the soil. The reagent would be a reducing amendment that converts hexavalent chromium to the less toxic and less mobile form of trivalent chromium. Source mixing can be completed within one year.

Below the zone of soil mixing, contaminated groundwater would be extracted from the shallow bedrock at the source area. Extraction wells would be installed along the west side of the ECE property to maximize capture of the highest hexavalent chromium concentrations. The extracted groundwater would be treated by ion exchange or chemical reduction and then reinjected or discharged to surface water. Additional monitoring wells would be installed to assess concentration trends and reducing conditions across the source area. The optimal mixing locations and reagent selection would be developed during the remedial design.

This alternative is expected to reach the New Jersey Ground Water Quality Standard at the source area, however it would not address downgradient groundwater contamination. EPA would review this action at least every five years until the RAOs are achieved.

Total Capital Cost: $8.0 million
Operation and Maintenance: $5.9 million
Total Present Net Worth: $13.9 million
Estimated Construction Timeframe: 2 years

Alternative 2B – Source Area In-Situ Reduction and Pump and Treat

In-situ injections would be performed in the contaminated groundwater in the source area. A grid of injection wells would be installed and a reducing amendment would be periodically injected into the wells to convert hexavalent chromium to trivalent chromium. In 2014, EPA carried out a pilot study using emulsified vegetable oil with magnesium sulfate injections in the source area groundwater. Hexavalent chromium concentrations significantly decreased in two monitoring wells. The results of this 2014 work would be applied to a design for this alternative.

Contaminated groundwater would be extracted from the shallow bedrock at the source area. Extraction wells would be installed along the west side of the ECE property to maximize capture of the highest hexavalent chromium concentrations. The extracted groundwater would be treated and then reinjected or discharged. New monitoring wells would be installed to assess concentration trends and reducing conditions across the source area. The optimal injection locations and reagent selection would be developed during the remedial design phase.

As in the case of Alternative 2A, this alternative is expected to reach cleanup levels within the source area beneath the ECE property; however, it would not address downgradient groundwater contamination. EPA would review this action at least every five years until the RAOs are achieved.

Total Capital Cost: $3.3 million
Operation and Maintenance: $6.9 million
Total Present Net Worth: $10.2 million
Estimated Construction Timeframe: 2 years

Alternative 3 – Source Treatment and In-Situ Reduction

Under this alternative, basement actions and source treatment as described in Alternative 2A or 2B would be implemented.

Overburden plume treatment would be implemented with a series of in-situ reduction barriers arranged perpendicular to the flow of the groundwater plume. The reduction barriers would be established by injecting a reducing agent into an array of permanent injection wells. The wells would be installed in the most contaminated areas of the plume; however the location of the barriers would be limited to the City of Garfield streets or right-of-ways. The optimal injection well layout and reagent selection would be developed during the remedial design phase. The timeframe for in-situ barrier injections is assumed to be 30 years. EPA would review this action at least every five years until the RAOs are achieved.

Total Capital Cost: $14.1 million
Operation and Maintenance: $23.2 million
Total Present Net Worth: $37.3 million
Estimated Construction Timeframe: 2 years

Alternative 4 – Source Treatment and Pump and Treat

Under this alternative, source treatment as described in Alternative 2A or 2B would be implemented.

A pump and treat system would be installed to extract and treat the highest concentrations of hexavalent chromium within the overburden plume. Groundwater extraction wells located within the City of Garfield streets and right-of-ways would be designed to maximize removal of the hexavalent chromium mass from the overburden groundwater. The extracted water would be conveyed to a treatment plant to be treated by ion exchange or chemical reduction and precipitation. Following treatment, extracted groundwater would be discharged into the sanitary sewer or into the Passaic River. The optimal well field design and treatment process options would be developed during the remedial design phase. EPA would review this action at least every five years until the RAOs are achieved.

Total Capital Cost: $5.2 million
Operation and Maintenance: $16.9 million
Total Present Net Worth: $22.1 million
Estimated Construction Timeframe: 2 years

Alternative 5 – Source Treatment and Combined Pump and Treat with In-Situ Reduction

Under this alternative, source treatment as described in Alternative 2A or 2B would be implemented.

The in-situ reduction barriers described in Alternative 3 and the pump and treatment system in Alternative 4 would both be implemented to combine hexavalent chromium mass removal with in-situ reduction. The combination of pumping and in-situ treatment would maximize flow of hexavalent chromium through the in-situ reduction barriers, and allow the pump and treatment system to be operated intermittently to optimize removal of hexavalent chromium. The well field design, treatment process options, and reagent selection would be developed during the remedial design phase. EPA would review this action at least every five years until the RAOs are achieved.

Total Capital Cost: $15.9 million
Operation and Maintenance: $33.2 million
Total Present Net Worth: $49.1 million
Estimated Construction Timeframe: 2 years

EVALUATION OF ALTERNATIVES

EPA uses nine criteria to assess remedial alternatives individually and compare them in order to select a remedy. The criteria are described in the box on the following page. This section of the Proposed Plan profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other options under consideration. A detailed analysis of each of the alternatives is in the FS report. A summary of those analyses follows:

Overall Protection of Human Health and the Environment

Alternative 1 would not meet the RAOs and would not be protective of human health and the environment since no action would be taken. Contamination would remain for a long time into the future, while no mechanisms would be implemented to prevent exposure to contaminated groundwater. The toxicity, mobility, or volume (T/M/V) of contamination would not be reduced except through natural attenuation processes that would not be monitored.

Alternatives 2 through 5 would meet the RAOs 2, 3, and 4 for protection of human health through basement mitigation, monitoring, and institutional controls. A combination of Alternative 2A or 2B with Alternatives 3 through 5 would meet RAO 1 by achieving the remediation goal for the shallow aquifer.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternative 1 would not comply with the chemical-specific ARAR for groundwater, which is the New Jersey Ground Water Quality Standard of 70 µg/L chromium (Table 1). Location and action-specific ARARs do not apply for Alternative 1 since no remedial action would be conducted. A combination of a source area Alternative (2A or 2B) with an aquifer restoration alternative (Alternatives 3 through 5) would meet the groundwater standard. Alternatives 2 through 5 will also meet location and action-specific ARARs, such as New Jersey Pollution Discharge System/Discharge to Ground Water regulations for *in-situ* injections and discharge of treated groundwater.

Long-Term Effectiveness and Permanence

Alternative 1 would not be effective or permanent since there would be no measures to prevent exposure to contamination. Alternatives 2A, 2B, 3, 4, and 5 would provide adequate control of risk by implementing basement mitigation actions and institutional controls. The basement mitigation actions in the remaining alternatives would be effective in the long-term since exposure would be controlled, but these measures would not be permanent since there is the potential for recontamination until groundwater is restored. Institutional controls on groundwater use would also be effective until the RAOs are met.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES

Overall Protectiveness of Human Health and the Environment evaluates whether and how an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

Compliance with ARARs evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that are legally applicable, or relevant and appropriate to the site, or whether a waiver is justified.

Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.

Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Long-Term Effectiveness and Permanence

Alternative 1 would not be effective or permanent since there would be no measures to prevent exposure to contamination. Alternatives 2A, 2B, 3, 4, and 5 would provide adequate control of risk by implementing basement mitigation actions and institutional controls. The basement mitigation actions in the remaining alternatives would be effective in the long-term since exposure would be controlled, but these measures would not be permanent since there is the potential for recontamination until groundwater is restored. Institutional controls on groundwater use would also be effective until the RAOs are met.

Alternatives 2A and 2B would be effective and permanently treat the highest concentrations of hexavalent chromium located in the source area in a relatively short period of time; however, they would not address the hexavalent chromium plume outside of the source area. Alternatives 3 and 5 would permanently reduce hexavalent chromium to trivalent chromium and so would be effective in the long-term. Alternatives 4 and 5 would achieve RAO 1 by extracting groundwater and permanently decreasing the mass of hexavalent chromium in groundwater.

Reduction in Toxicity, Mobility, or Volume (T/M/V) through Treatment

Alternative 1 would not reduce the contaminant T/M/V since no remedial action would be conducted. The total volume of contaminated groundwater might increase if the plume expands beyond its current area.

Alternatives 2A, 2B, 3, 4, and 5 would all be effective in reducing the toxicity and mobility of hexavalent chromium in the source area. Alternatives 3 and 5 would be the most effective in reducing the toxicity and mobility of hexavalent chromium. In-situ reduction of hexavalent chromium to trivalent chromium significantly decreases the toxicity and mobility of chromium. Alternatives 4 and 5 would be the most effective in reducing the volume of hexavalent chromium contamination because it would be extracted and removed from the overburden aquifer.

Short-Term Effectiveness

Short-term effectiveness includes an evaluation of the adverse effects a remedy may pose to the community, workers, and the environment during implementation. Alternative 1 would require no time to implement, and would cause no short-term impact to workers, the community or the environment. Continued infiltration into basements would cause potential hexavalent chromium exposures, and no active groundwater cleanup would reduce the groundwater plume mass. Alternatives 2A, 2B, 3, 4, and 5 could have short-term impacts to workers and the community during the remedial actions due to construction and maintenance operations. However, EPA would work with the community to reduce these impacts. Alternatives 2A and 2B would have fewer impacts on the community, because the actions would be contained in the former EC facility area. The excavation and stockpiling of soil and mechanical mixing of overburden soils below the water table in Alternative 2A would pose more short-term impacts to workers and the community than Alternative 2B which utilizes injections. Alternatives 3, 4, and 5 would have significant impacts on the Garfield community due to construction associated with the installation of injection or pumping wells and other infrastructure in the streets, especially considering Garfield's population density. A combination of Alternatives 2A and 5 would have the most short-term impacts on the community, whereas a combination of Alternative 2B and 4 would have the least.

Short-term effectiveness also considers the amount of time until the remedy effectively protects human health and the environment at the site. Alternatives 2A, 2B, 3, 4, and 5 would achieve RAOs 2, 3, and 4 quickly and therefore protect human health through the basement work and the institutional control.

The time to achieve RAO 1 is long for all of the active alternatives, with restoration times for the groundwater estimated in decades. Groundwater modeling was used to estimate the time needed to reach the remediation goal of 70 µg/L for chromium (the New Jersey Groundwater Quality Standard) throughout the entire overburden aquifer. For Alternative 1, groundwater modeling indicated that the remediation goal would achieved after 270 years. If either Alternative 2A or 2B alone were implemented, the groundwater model indicated that the restoration time would be 220 years. A combination of one of the source area alternatives (Alternative 2A or 2B) and Alternative 3 would achieve the RAO in 177 years, and the combination of a source area alternative with Alternative 4 would achieve the RAO in 174 years. Alternative 5 combined with a source area alternative would achieve the RAO in the least amount of time, estimated at 144 years.

Groundwater modeling has a limited capacity to accurately predict restoration timeframes at the RI/FS stage, and the timeframes discussed here and in the RI/FS Report are meant to evaluate the relative performance of the remedial alternatives. The timeframes of a source area alternative combined with Alternatives 3, 4 or 5 are similar whereas selection of a source area alternative alone would take substantially longer to achieve RAO 1.

Implementability

Alternative 1 would be the easiest technically and administratively to implement as no additional work would be performed at the site. Alternatives 2A, 2B, 3, 4, and 5 could all be implemented using locally available technologies and contractors.

Implementation of the source area alternatives would generally be feasible because all structures have been removed from the ECE property. However, the soil mixing component of Alternative 2A would require the removal of up to 14 feet of clean soil to access the contamination, which would make this alternative more difficult to implement compared to Alternative 2B, in-situ injection. In addition, the small size of the site would greatly inhibit the ability to mix the soil properly.

The setting of the site would be a challenge for implementing Alternatives 3, 4, and 5. The overburden plume is located in a densely populated area of Garfield, and there are extensive subsurface and above-ground utilities that may limit the location or number of potential injection or extraction wells. Alternatives 3 and 5 would require a greater number of wells than Alternative 4, but Alternatives 4 and 5 have greater implementability challenges due to the installation of piping needed to convey the extracted groundwater to a treatment system. The discharge of treated groundwater would require installation of additional subsurface piping which reduces implementability for Alternatives 4 and 5 compared to Alternative 3.

Costs

For the source area alternatives, Alternative 2A costs $13.9 million and Alternative 2B costs $10.2 million. The Alternative 2B cost is included in the cost estimates for Alternatives 3, 4, and 5. The cost of Alternative 3 is $37.3 million and the cost of Alternative 4 is $22.1 million. Alternative 5 has a total cost of $49.1 million.

State/Support Agency Acceptance

The State of New Jersey concurs with EPA's preferred alternative as presented in this Proposed Plan.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the Record of Decision, the document in which EPA formally selects the remedy for the site.

PREFERRED ALTERNATIVE

The preferred alternative for cleanup of OU1 groundwater at the site is Alternative 2B with Alternative 3, Source Treatment and In-Situ Reduction.

In the source area, the overburden groundwater would be treated with in-situ injections and the shallow bedrock groundwater will be pumped and treated. The overburden plume outside of the source area will also be treated in-situ, using injection barriers installed downgradient of the source area. A reducing solution would be injected periodically into the wells to convert hexavalent chromium to the less toxic and less mobile form trivalent chromium.

The preferred alternative was selected over the other alternatives because it will be effective in addressing the groundwater contamination and is the most implementable at the site.

EPA expects that the Preferred Alternative will satisfy the statutory requirements of CERCLA §121(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; and 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

Consistent with EPA Region 2's Clean and Green policy, EPA will evaluate the use of sustainable technologies and practices with respect to implementation of the selected remedy.

COMMUNITY PARTICIPATION

EPA and NJDEP provided information regarding the cleanup of the Garfield Groundwater Contamination Superfund Site to the public through meetings, the Administrative Record file for the Site, and announcements published in the local newspaper. EPA and NJDEP encourage the public to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted there.

The dates for the public comment period; the date, location, and time of the public meeting; and the locations of the Administrative Record files are provided on the front page of this Proposed Plan.

For additional information on EPA's Preferred Alternative for the Garfield Groundwater Superfund Site contact:

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(212) 637-3130

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Community Liaison
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U.S. EPA
290 Broadway, 19th Floor
New York, New York 10007-1866

On the Web at:
www.epa.gov/superfund/garfield-groundwater

Table 1. Preliminary Remediation Goals for Groundwater, Garfield Groundwater Contamination Superfund Site OU1, Garfield, New Jersey.

CAS Number	Chemical Name	Unit	NJ Groundwater Quality Standard Class IIA	EPA National Primary Drinking Water Standard	Preliminary Remediation Goal
7440-47-3	Chromium	µg/L	70	100	70

Table 2. Preliminary Remediation Goals for Basement Surfaces, Garfield Groundwater Contamination Superfund Site OU1, Garfield, New Jersey.

Basement Use	Removal Action Level, Hexavalent Chromium
High	110 µg/m^2 or 1.1 µg/wipe
Low	870 µg/m^2 or 8.7 µg/wipe

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Legend

- Conventional Monitoring Well
- Multiport FLUTe Well
- Bastement Study Area and 2011 Groundwater Study Area
- Present Groundwater Study Area
- E.C. Electroplating Site (125 Clark St., Garfield, NJ)

N

0 560 1,120 Feet

Imagery Source: NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS), 2008

Figure 1

Site Plan
Proposed Plan
Garfield Groundwater Contamination Superfund Site
Garfield, NJ 07026

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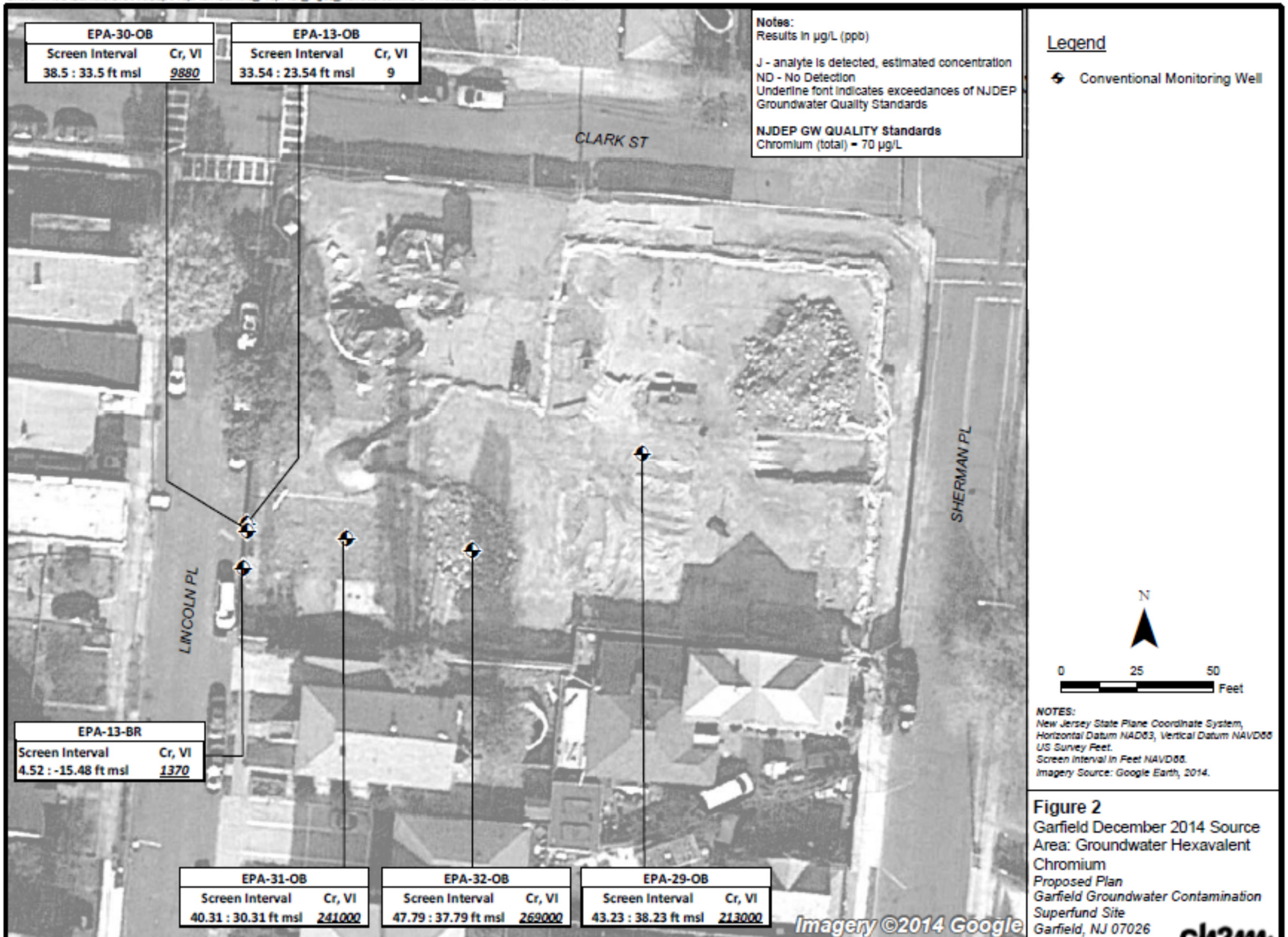
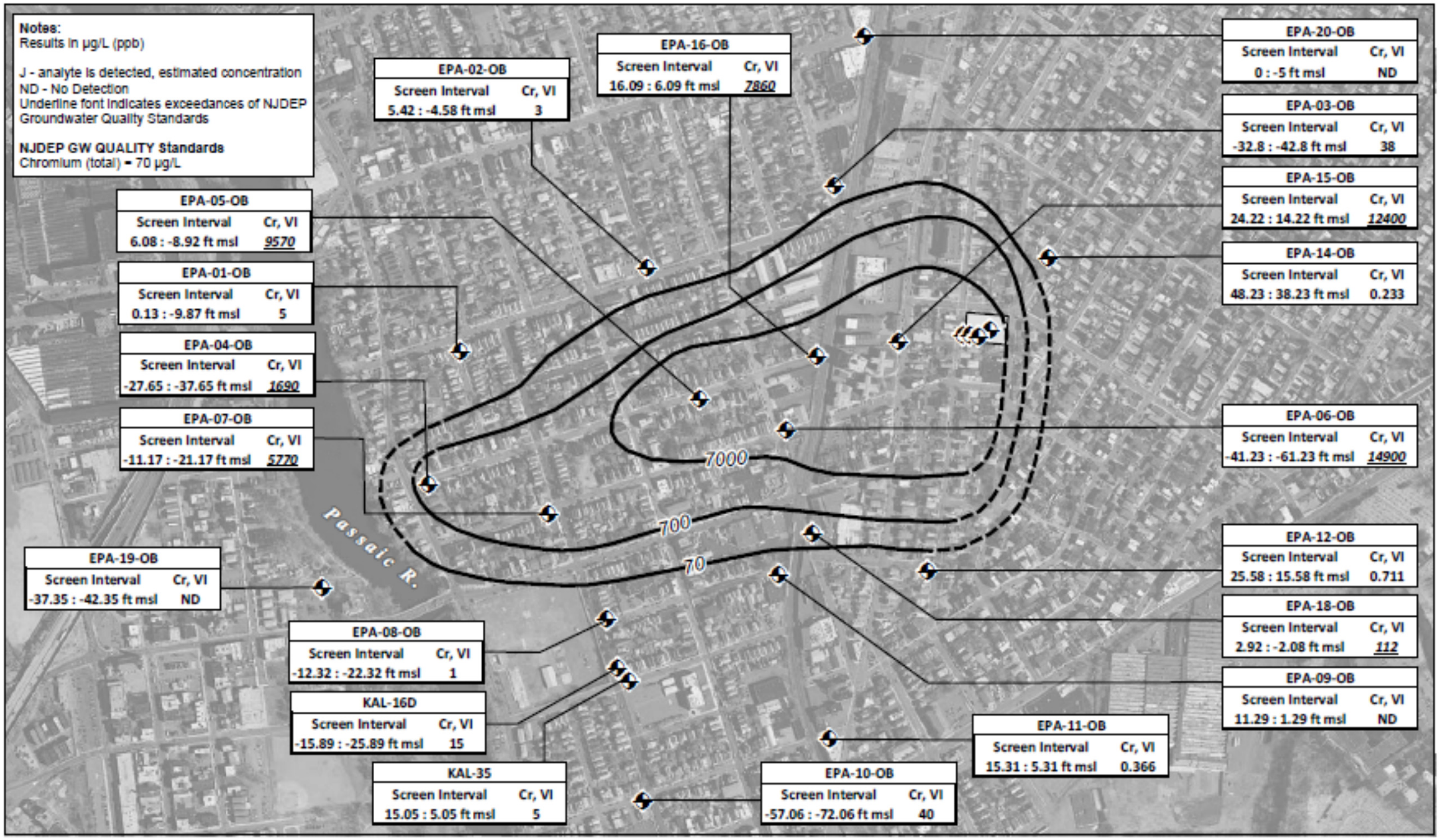


Figure 2
Garfield December 2014 Source Area: Groundwater Hexavalent Chromium
Proposed Plan
Garfield Groundwater Contamination Superfund Site
Garfield, NJ 07026



Conventional Monitoring Well

Approximate Hexavalent Chromium Isoconcentration Contour (µg/L) (Dashed Where Inferred)

E.C. Electoplating Site (125 Clark St., Garfield, NJ)

0 250 500 750 1,000 Feet

N

NOTES:
New Jersey State Plane Coordinate System Horizontal Datum NAD83, Vertical Datum NAVD88 US Survey Feet.
MSL - Mean Sea Level
ND - Not Detected
Imagery Source: National Aerial Imagery Program, 2010
Screen Interval in Feet NAVD88
Overburden elevation ranges from 48.23 to -72.1 ft NAVD88

Figure 3
Garfield December 2014 Overburden
Hexavalent Chromium
Proposed Plan
Garfield Groundwater Contamination Superfund Site
Garfield, NJ 07026

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