United States
Environmental Protection
Agency

Sustainability Principles and Cleanup Site Examples

Office of Site Remediation Enforcement
Office of Enforcement and Compliance Assurance

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Climate Change Adaptation, Mitigation, and Resiliency Case Studies

Gowanus Canal Superfund Site, Brooklyn, New York

Background

The Gowanus Canal Superfund site is a 1.8-mile man-made canal located in Brooklyn, New York. The canal is in a mixed-residential-commercial-industrial area with waterfront properties. The canal was constructed in the mid-1800s in an area previously occupied by Gowanus Creek, its tributaries, and lowland marshes. Most of the canal is lined with retained structures or bulkheads, which has stripped the canal of natural wetlands and a natural shoreline.

In the late 1860s, large quantities of wastes were dumped directly into the canal including household waste, industrial effluent, and stormwater runoff. Discharges included hazardous substances such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, metals, and volatile organic compounds (VOCs). Due to stagnation and issues with flushing devices in the canal, much of the contamination remains today in sediments and upland sources. In addition, upland contaminated areas adjacent to the canal, such as the Fulton Municipal Works Manufactured Gas Plant ("MGP"), Carroll Gardens/Public Place, and former MGP facilities, continue to discharge hazardous compounds into the waterway. EPA is currently coordinating with New York State Department of Environmental Conservation (NYSDEC) to clean up these contaminated areas, but at present, such discharges continue. Furthermore, in sufficiently rainy conditions, combined sewers at the Owls Head and Red Hook wastewater treatment plants tend to overflow into the canal. Major storm events can lead to canal flooding, thus impacting industrial, commercial, and residential areas that may serve environmental justice populations. Although the canal is covered by a fish advisory, the canal is regularly used for subsistence fishing, largely by the surrounding communities with environmental justice concerns.

Highlights of climate change adaptation, mitigation, and resiliency language contained in the site Record of Decision

2013 Gowanus Canal Superfund Site Record of Decision:

> "The location and capacity of the retention tanks will be determined during the remedial design. The capacity of the retention tanks will need to accommodate the projected additional loads 84 to the combined sewer system as a result of current and future

residential development, as well as a result of periods of high rainfall, including future rainfall increases that may result from climate change" (Pages 83-84)

EPA estimates that larger tanks capturing approximately twice the amount of the first flush of the design storm event from two CSO outfalls would provide an initial estimate of the degree of control needed to ensure protectiveness of the remedy. (Footnote 33: EPA recognizes that, in the future, there may be more frequent large rainfall events due to climate change.) (Page 55)

Armor the sediment cap with stone. (Page 59)

Conclusion

From the above language in the record of decision (ROD), EPA incorporates the effects of climate change into cleanup strategies. EPA uses a variety of tools, including its Climate Change Indicators for Heavy Precipitation, to identify future rainfall increases that may require EPA to strengthen or enhance its selected remedy to protect against the effects of climate change. For example, the selected remedy at Gowanus Canal requires EPA to add the reinforced the "armor" layer on the dredged sediment to mitigate erosion from increased rainfall, as well as to enlarge the CSO retention tanks to account for periods of high rainfall based on climate change modeling. These techniques fall under the category of climate change adaptation and resiliency measures as they accommodate current and future trends, while increasing the resiliency of the site to these trends.

More information is available on the Gowanus Canal Superfund site profile web page.

Portland Harbor Superfund Site, Portland, Oregon

Background

The Portland Harbor Superfund site, located in Portland, Oregon, includes the harbor and a portion of the lower Willamette River, and is contaminated with PCBs, PAHs, dioxins/furans, pesticides, and heavy metals from decades of industrial use. The river serves as a vital ecological, economic, and cultural resource. At six areas of the site, early-action emergency cleanup initiatives have addressed immediate threats to human health and the environment. EPA completed early actions at the Gasco-NW Natural/Siltronic and Terminal 4 areas in 2005 and 2009, respectively. Early cleanups within the Portland Harbor site, Triangle Park, and U.S. Moorings early-action areas have also been completed and are being monitored. Additional early actions, including Arkema (a former pesticide manufacturing facility) and River Mile 11E, are ongoing or near completion.

Highlights of climate change adaptation, mitigation, and resiliency language contained in the site Record of Decision

2017 Portland Harbor Site Record of Decision:

> In this region, avoiding or minimizing impacts to the aquatic environment and floodway need to be considered and evaluated to meet CWA § 404 and federal floodway requirements as well as climate change impacts. (Page 108)
>
> Caps will also be designed to withstand more frequent floods with higher peak flows more common with climate change. (Page 113)
>
> The site-wide and sediment management area (SMA) specific evaluations of flood rise will need to consider 500-year flood elevation and freeboard and be based on the best-available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science. (Page 126)
>
> In general, climate change is expected to result in increased winter flow, decreased summer flow, lower snowpacks and earlier peak within the Willamette River. (Page 127)
>
> Uncertainties associated with potential climate change will be incorporated into the flood rise evaluation and cap design elements. (Page 127)
>
> EPA should consult its own Climate Change Adaption Technical Fact Sheet as well as other tools that it has developed to incorporate the impacts of climate change into its Superfund Program. (Page 2, 135)

Conclusion

The Portland Harbor case shows that the Superfund program can be utilized not only for clean up, but to engineer the site to bolster climate resiliency. EPA closely studied climate science to determine potential effects of both human-caused climate issues (e.g., flood rise) and natural events (e.g., earthquakes). The site is another example where cap design is specifically engineered to increase climate adaptation and resilience. Additionally, there is language in the case reporting that EPA already has tools (such as the "Climate Change Adaptation Technical Fact Sheet") that incorporates climate change into its Superfund program.

More information is available on the Portland Harbor Superfund site profile web page.

Terry Creek Dredge Spoil Areas/Hercules Outfall, Brunswick, Georgia

Background

The Terry Creek Dredge Spoil Areas, also known as the Hercules Outfall Superfund site is located in Brunswick, Georgia near the confluence of three waterways: Terry Creek, Dupree Creek, and the Back River. The site consists of the outfall from the former Hercules Pesticide Plant as well as two dredge spoil areas. The outfall was used from 1911 until 1972 to discharge untreated wastewater contaminated with toxaphene, a chlorinated pesticide, from its pesticide plant into Dupree Creek. After 1972, the wastewater was treated to remove toxaphene, which significantly reduced discharged amounts of toxaphene. Toxaphene production ceased at this location in 1980. Terry Creek and Dupree Creek were dredged by the U.S. Army Corps of Engineers (USACE) several times between 1938 and 1989 and dredge spoils were placed in the dredge spoil areas. Dredge spoils, soils, and sediments in the spoil areas are contaminated with toxaphene. In addition, fish in the Terry and Dupree creeks are contaminated and the creeks themselves contain contaminated sediments.

Within a one-mile radius of the facility, around 80% of the population is identified as a minority and around 62% of the population is identified as low-income. The Terry Creek community immediately adjacent to the Terry Creek outfall consists of residential homes and mobile homes. Brunswick County is predominantly African American and contains a sizeable Latinx population. This population has been exposed to contamination for almost 100 years from the same site.

Highlights of climate change adaptation, mitigation, and resiliency language contained in the site Record of Decision

2017 Terry Creek Dredge Spoil Areas/Hercules Outfall Interim Record of Decision:

> When implementing a remedy at a Superfund site, pursuant to the Office of Solid Waste and Emergency Response's (OSWER) (now the Office of Land and Emergency Management) June 2014 "Climate Change Adaptation Implementation Plan," EPA should take into consideration the effects of climate change. (Page 16)
>
> Since the Terry Creek site is located on the coast of Georgia, possible effects of climate change could include rising sea levels, storm surges, and strong hurricanes. The OU1 Focused remedial investigation/feasibility study (RI/FS) included a conceptual model to understand the sources of flows to the Outfall Ditch evaluating the simulated discharge flows for various extreme precipitation events ranging from a 2- to a 100-year, 24-hour storm event. (Page 16)
>
> The selected interim remedy will provide protection of human health and the environment by eliminating, reducing, or controlling risks at OU1 through removal of some sediments,

rerouting the existing outfall ditch into a new concrete lined ditch, covering remaining sediments in the existing outfall ditch with a liner and clean, compacted soil after rerouting the ditch, and armoring the former outfall ditch with riprap at the confluence of Dupree Creek to prevent erosion and protect against storm surges, a process referred to as coastal hardening. (Page 51)

These measures, in combination with monitoring, implementation of institutional controls, maintenance of the selected interim remedy, and ongoing five-year reviews account for possible effects of climate change in the remedy selection process. (Page 51)

EPA agrees that climate change may impact the permanence of the selected OU1 interim remedy. Regular inspections and as-needed repairs will assure that erosion or other issues will be dealt with promptly resulting from either weather events or man-made activities. (Page 49)

Conclusion

In this case, EPA published an interim ROD (IROD) years after initial cleanup efforts began that admitted their proposed plan would be impacted by the effects of climate change. To combat this, the IROD implemented several climate change resiliency, mitigation, and adaptation measures. This demonstrates the importance of implementing climate change measures in initial agreements. Without them, cleanup efforts may be inadequate or ineffective.

More information is available on the Terry Creek Dredge Spoil Areas/Hercules Outfall Superfund site profile web page.

Onondaga Lake Superfund Site, Onondaga County, New York

Background

Onondaga Lake, located along the northern side of the City of Syracuse in Onondaga County, New York covers an area of 4.6 square miles. The Onondaga Lake Superfund site includes the lake and seven major and other minor tributaries and upland sources of contamination. The lake receives water from a drainage basin of approximately 285 square miles, located almost entirely within Onondaga County.

Industrial and municipal sewage discharge has been placed in Onondaga Lake for more than 100 years. In 1946, Allied Chemical started a mercury cell process that resulted in waste streams containing mercury and heavy metals being discharged by its facilities at Willis Avenue and Bridge Street. Honeywell International, Inc.’s ("Honeywell") Semet Residue Ponds are another source of contamination to the lake. While Honeywell is the site’s primary potentially responsible party (PRP), other industrial and manufacturing facilities located along the shore or

tributaries to the lake are sources of contamination to the lake. Site investigations and cleanup activities are ongoing. EPA and New York State have determined that the site poses no immediate threat to human health or the environment while studies are underway.

Highlights of climate change adaptation, mitigation, and resiliency language contained in the site Record of Decision

2014 Lower Ley Creek Portion of the Onondaga Lake site Record of Decision for OU25:

> This will help reduce scour and resuspension of underlying sediments because of wind/wave action, but it may not be coarse enough to meet the predicted erosive force of a 100-year storm event, which is the design basis for the surrounding area. (Pages 33-34)

2020 Second Five-Year Review Report for Lake Bottom Subsite of the Onondaga Lake Superfund Site

> Site-specific bench-scale testing with and subsequent modeling demonstrated that granular activated carbon (GAC) will effectively adsorb the various dissolved organic contaminants, allowing development of a cap design to be effective for 1,000 years or longer. (Pages 10 - 12)

The installed cap was designed for an effective life span of 1,000 years and was constructed of varying types of single-layer and multi-layer caps using sands, gravels, cobbles, topsoil and amendments (Page 12)

Conclusion

EPA's cleanup strategy with the Onondaga Lake Superfund site demonstrates the Agency's commitment to implementing sustainability and climate resiliency into site cleanup. EPA specifically designed caps that would be protective for more than 1,000 years and resilient to climate effects such as storms and erosion.

More information is available on the Onondaga Lake Superfund site profile web page.

General Motors Massena Central Foundry Superfund Site, Massena, New York

Background

The General Motors Central Foundry Division Superfund site located in Massena, New York, once operated as an aluminum die-casting plant for Chevrolet. While in operation, industrial wastes were generated and disposed of on-site, leading to PCB contamination in ground water, soils, and sediments on the site and in nearby areas. Cleanup at the site is ongoing, and, because of initial cleanup measures, in 2020 the site was analyzed and deemed not at risk for damage due

to climate change. Completed cleanup measures implemented strategies to mitigate effects of both human-caused and natural climate change. The analysis concluded that the site was not at risk due to surface water drainage ability being three times greater than the required capacity, extra drainage layers, armored caps, and over 400,000 cubic yards of clean fill, all of which promote flow runoff and avoid erosion.

Highlights of climate change adaptation, mitigation, and resiliency language contained in the site Five Year Review

Fourth Five-Year Review Report For GM Massena Central Foundry Superfund Site St. Lawrence County, New York

> Remedy performance is currently not at risk due to the expected effects of climate change in the region and near the site. (Page 12)
>
> Surface water drainage around the landfill is designed to shed more than three times the capacity required by State regulations. (Page 12)
>
> The subaqueous cap in the St. Lawrence River has a large armor stone layer on top of sand, carbon, and gravel, which was inspected by EPA divers in 2017 and 2019 and has not shown evidence of ice scour or washouts. (Page 10)
>
> The property has been covered with approximately 400,000 CY of clean fill over an 84 - acre area and graded to promote sheet flow runoff and avoid erosion. (Page 12)

Conclusion

The General Motors case demonstrates the benefits of incorporating sustainability and climate resilience measures into initial cleanup efforts. Climate change is expected to cause increased future rainfall events, but the site's highly developed water drainage system is expected to handle this increase. In other cases that did not initially incorporate these measures, EPA would often go back and perform remedial actions to increase climate resilience. However, when climate resilience measures are implemented from the original agreement—i.e., larger drainage systems and erosion prevention—remedial action is not required or much more limited, saving time and resources.

More information is available on the General Motors (Central Foundry Division) Superfund site profile web page.

Incorporating Ecosystem Services Concepts as Part of the Remedial Process

Callahan Mining Corp., Brookville, Maine

Background

The Callahan Mine Corp. Superfund site is in the village of Harborside in the Town of Brooksville, Maine. The former Callahan Mine was operated as an open-pit zinc/copper mine from the late 1800s until 1972. The mining operation and facilities were developed adjacent to and beneath the Goose Pond tidal estuary. The site includes: the 120-acre former Callahan Mine property, including the former industrial operations area, waste rock piles, and a tailings impoundment; Goose Pond, which includes Dyer Cove, the submerged former Mine Pit, Stink Cove, and the wetlands within Goose Pond; Goose Cove; and the Residential Use Area.

During ore exploration in the 1940s to 1950s, zinc, copper, lead, arsenic, and cadmium were found in the ore. To better facilitate open pit mining, the State of Maine passed legislation that permitted creating and constructing two dams in 1967 that were used to drain the 75-acre Goose Pond estuary. Open pit mining at the site occurred from 1968 to 1972.

A wetland delineation survey was performed as part of the OU1 FS (Feasibility Study). The objective of the survey was to identify and delineate Maine Department of Environmental Protection (DEP) Protected Natural Resources and Federal jurisdictional wetlands at the site. The wetland delineation survey included salt marsh/tidal wetlands, freshwater wetlands, and streams, and a review of potential vernal pools.

Highlights of ecosystem services language contained in the site Record of Decision

2019 Callahan Mine Superfund Site Final Record of Decision

> Representative aquatic ecological receptors include aquatic plants, benthic macroinvertebrates, water column invertebrates, fish, semi-aquatic birds (e.g., spotted sandpiper, great blue heron, osprey, and bald eagle), and semi-aquatic mammals (e.g., river otter). Representative terrestrial receptors include invertebrates, birds (e.g., robin, red tailed hawk), and mammals (e.g., white-footed mouse and short-tailed shrew). (Page 34)

The OU1 ROD mentioned, "[t]he principal functions and values for the estuarine wetlands are fish and shellfish habitat. In addition, the estuarine salt marsh provides sediment/toxicant reduction and sediment/shoreline stabilization as a primary function/value. The Wetland Delineation and Functional Assessment Report is Appendix B to the OU1 Feasibility Study Report. (Page 29)

In accordance with Federal Executive Order 11990, 'Protection of Wetlands,' EPA has determined that there may be unavoidable adverse impacts to wetlands and aquatic resources." However, the Special Findings made clear that "[w]herever possible, wetland areas will be restored. (Page 3)

Installation of a horizontal drain, or other drainage methods (e.g., vertical wells or drains), to facilitate the dewatering of the Tailings Impoundment and the collection and treatment of the discharge from the horizontal drain, or other drainage methods (e.g., vertical wells or drains), in a constructed wetland. (Page 87)

Mitigation, restoration, and compensation for wetland impacts, including the dredging and subaqueous disposal of Dyer Cove and Goose Cove sediments that contain mine waste in the CAD cell in the submerged former mine pit, along with other measures that may be identified in remedial design. (Page 96)

Conclusion

Preservation and/or restoration of the wetlands in and around the site was critical in its remedial design. Although Executive Order 11990 required preservation and restoration, the nature and requirements of the remediation processes, as well as a consideration of the attributes and services (i.e., ecosystem services) provided by wetlands were necessary for the protection of human health and the environment. See EPA's Why Wetlands are Important web page for more information.

More information is available on the Callahan Mine Corp. Superfund site profile web page.

Centredale Manor Restoration Project Superfund Site, North Providence, Rhode Island

Background

The Centredale Manor Restoration Project Superfund site is in North Providence, Rhode Island, and is contaminated with dioxin and other contaminants. The main site area, called the "source area," consists of about nine acres. As a result of chemical production and drum reconditioning on the site, nearby soil, ground water, surface water, and sediment in the adjacent and downstream river and ponds was contaminated.

EPA site investigations from 1999 to 2012 characterized contamination in source area soil, ground water, sediment, floodplain soil, surface water, and biota. EPA identified the presence of chemicals such as dioxin and polychlorinated biphenyls (PCBs) in the soil. To address immediate risks, EPA did several early cleanups from 1999 to 2002, such as: fencing the site, capping contaminated soil, reconstructing the Allendale Dam, and restoring Allendale Pond. Additional caps were also installed in 2005 and 2009. The site is being addressed through federal and PRP actions.

The remedy was selected in the 2012 Record of Decision (ROD). For more information, please see the Fact Sheets, Updates, and Public Meeting Documents for what is being done in each area of the site.

Highlights of ecosystem services language contained in the site Record of Decision

2012 Centredale Manor Superfund Site Record of Decision

> The remedial measures selected . . . will prevent direct contact with contaminated soil and sediment that presents an unacceptable risk; prevent movement of contaminants into the Woonasquatucket River that could result in exceedances of water quality criteria; comply with federal drinking water standards at the Source Area; allow fish consumption and contact and additional non-contact recreational use of the river; and reduce risk to wildlife. (Page 2)
>
> In the Special Findings section, the ROD indicated that pursuant to Section 404 of the Clean Water Act and Executive Order 11990, wetlands will be impacted but "EPA will minimize potential harm and avoid adverse impacts on resources, to the extent practical, by using best management practices to minimize harmful impacts on the wetlands, wildlife, or habitat. Impacted areas will be mitigated consistent with the requirements of federal and state laws." (Page 4)
>
> Placement of a thin layer soil cover over the remaining contamination in the Oxbow to facilitate enhanced natural recovery and preserve valuable habitat. (Page 2)
>
> Long-term monitoring and maintenance to protect the integrity of the Resource Conservation and Recovery Act (RCRA) cap, upland combined disposal facility (CDF), Allendale and Lyman Mill dams and thin-layer wetland cover. (Page 2)
>
> Mitigation of wetlands and floodplains. (Page 2)

Conclusion

The terms used in the Centredale Manor-Restoration Project Superfund site ROD are consistent with the terminology and concepts associated with ecosystem services, particularly those of wetlands. Preserving valuable habitat and mitigating and restoring the benefits of wetlands were key points in the decision-making process and were endorsed by inclusion into the ROD.

More information is available on the Centredale Manor Restoration Project Superfund site profile web page.

Peterson/Puritan, Inc. Superfund Site, Lincoln/Cumberland, Rhode Island

Background

The 500-acre Peterson/Puritan, Inc. Superfund site encompasses over two miles of industrial and residential property in the towns of Cumberland and Lincoln in north-central Rhode Island. The site "study area" encompasses a wide variety of land uses, including former and active industrial and commercial areas, state and local recreational areas, the Blackstone River, and a former landfill. The site also includes interspersed areas of undeveloped land, floodplain, and wetlands.

Historically, various companies on the site engaged in aerosol packaging, chemical manufacturing, warehousing, and land filling. While in operation, these companies disposed of chlorinated volatile organic compounds (VOCs), process wastes from chemical manufacture, municipal waste, commercial waste, and sewage sludge. During routine sampling in 1979, the Rhode Island Department of Health (now the Rhode Island Department of Emergency Management (RIDEM)) discovered chlorinated VOCs in water collected from the Quinnville well field and Lenox Street municipal well. Subsequent investigations by Peterson/Puritan, Inc. and EPA determined that site activities had contaminated soil and ground water.

The site was placed on the National Priorities List in September 1983. The site was divided into two operable units (OU1 and OU2). Of importance is OU2 and its corresponding ROD that sets forth its selected remedy, which addresses contaminated floodplain soils, sediment, and ground water. The entire portion of OU 2 is also located within the John H. Chafee Blackstone River Valley National Heritage Corridor, where, in 2014, the Blackstone River Valley National Historical Park was established.

Highlights of ecosystem services language contained in the site Record of Decision

2015 Peterson/Puritan Superfund Site Record of Decision for OU2

> An overarching objective in conducting the cleanup for OU 2 is to . . . ensure that aesthetic considerations are incorporated and compatible with the development of the National Historical Park within the Blackstone Valley Heritage Corridor. (Page 5)

> The cap must be constructed to protect against flooding, up to a 500-year event, and effectively manage stormwater. (Page 19)
>
> Wetland and floodplain habitats will be restored after the contamination is addressed, to the extent practicable. (Page 6)
>
> Institutional controls to protect the subaqueous cover from future disturbance and long-term O&M/monitoring of the subaqueous cover as necessary to ensure protectiveness is included in this action while provisions for passive recreational use (such as canoeing/kayaking) will be permitted. (Page 7)
>
> The selected response action addresses low-level threat wastes by capping waste, including hazardous waste, and consolidating contaminated soils and sediments; controlling potential exposures through institutional controls; restoring habitats disturbed by the response action. . . . and ensuring continued active or passive recreational use along the river corridor, as practicable. (Pages 7-8)
>
> To address remedial measures that may affect floodplain resources, EPA will conduct necessary mitigation measures to protect downstream receptors in the floodplain and to address concerns about maintaining the aesthetics of the riparian corridor. (Page 136)

The remedial action objectives (RAOs) for the selected remedy for each area/media of OU 2 are:

> Prevent exposure to ecological receptors from soil contaminants that present an unacceptable ecological risk. (Page 81)
>
> Prevent infiltration and washout during flooding, up to a 500-year flood event. (Page 81)

Conclusion

This was a complicated case resulting in two OUs and the consolidation of hazardous waste. Complicating the matter further is the site's location in the Blackstone Valley Heritage Corridor. As such, aesthetics of the Corridor was a prime consideration for the remedial action. Aesthetics, as well the other attributes identified above, are part of the broader palette of principles forming the basis for ecosystem services.

More information is available on the Peterson/Puritan Superfund site profile web page.

Onondaga Lake Superfund Site, Onondaga County, New York

The background for the Onondaga Lake Superfund site is available in the Climate Change Adaptation, Mitigation, and Resiliency Case Studies chapter, page 7.

Highlights of ecosystem services language contained in the site Record of Decision

This is a complex site with multiple sub-sites and Operable Units (OUs) and applicable Records of Decision (ROD).

2005 Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site Record of Decision:

> Completion of a lake wide habitat restoration plan. (Page ii)
>
> The selected remedy also includes habitat enhancement, which is an improvement of habitat conditions in areas where CERCLA contaminants do not occur at levels that warrant active remediation, but where habitat impairment due to stressors has been identified as a concern. (Page iii)
>
> Habitat reestablishment will be performed consistent with the lake wide habitat restoration plan in areas of dredging/capping. (Page iii-iv)
>
> As needed in order to shape and resize the landfill to meet landfill cap performance standards and address riparian protection concerns, dispose of some landfill material offsite; Restore areas disturbed by remediation, including excavated riverbanks and riparian zone, to return such areas to pre-remediation conditions (e.g., the functions, values, characteristics, vegetation, habitat, species use, and other attributes), to the extent feasible. (Pages 4-5)
>
> The excavation and capping components of the remedy will prevent direct contact with contaminants by human and ecological receptors. (Pages i-ii)

Conclusion

The cited ROD and other RODs associated with the Onondaga Lake Superfund site refer multiple times to restoration or reestablishment of the lake's multiple and varied habitats that form the "lake wide habitat" or ecosystem. Acknowledging pre-remediation conditions such "functions, values, characteristics, vegetation, habitat, species use, and other attributes" are the conditions considered in a multiple systems approach found in the study of ecosystem services.

More information is available on the Onondaga Lake Superfund site profile web page.

Iron Horse Park Superfund Site, Billerica, Massachusetts

Background

The Iron Horse Park Superfund site is a 553-acre industrial complex located in Billerica Massachusetts and includes manufacturing and railyard maintenance facilities, open storage areas, landfills, and wastewater lagoons. A long history of activities at the site has resulted in the contamination of soil, ground water, and surface water. Although part of the same NPL listing, these three OUs are distinct areas of the site. Cleanup is complete in OU1 – a former 15-acre wastewater lagoon area, and OU2 – a 60 - acre landfill. OU3, which encompasses the rest of the site, is characterized by numerous source areas, an extensive wetland system, multiple property owners, a complex history, and widespread environmental impacts. Due to its complicated nature, OU3 was ultimately divided into two OUs. This record of decision (ROD) addresses the seven areas of concern located within the original OU3. What is now defined as OU3 addresses capping and source control measures, that will be implemented to address potential sources of contamination and to prevent the further spread of contamination to ground water, surface water, and sediment. The potential remediation of site wide surface water, sediment and ground water will be addressed as a part of OU4.

Highlights of ecosystem services language contained in the site Record of Decision

2004 Iron Horse Superfund Site Record of Decision

> Issuance of this ROD embodies specific determinations made by the Regional Administrator pursuant to CERCLA and section 404 of the Clean Water Act, 33 U.S.C. § 1251 et seq., the remedy is the least damaging practicable alternative for protecting aquatic ecosystems at the site under the standards of 40 CFR Part 230. (Pages 3-4)
>
> Due to the location of these areas of concern (AOCs) in or near wetlands and/or floodplain areas, EPA cannot identify a less damaging practicable alternative for each AOC that would avoid impacting the wetland and/or floodplain areas while adequately addressing site risks. (Page 4)

Conclusion

The selected remedy specifically identifies "protecting aquatic ecosystems" as desirable goal and the remedy is the "least damaging alternative" for that goal. "Wetlands are important features in the landscape that provide numerous beneficial services for people and for fish and wildlife. Some of these services, or functions, include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters and maintaining surface water flow during dry periods. These valuable functions are the result of the unique natural characteristics of wetlands." (From EPA's "Why are Wetlands Important? web page.)

More information is available on the Iron Horse Park Superfund site profile web page.

Incorporating Environmental Justice as Part of the Remedial Process

Kansas City Structural Steel Superfund site, Kansas City, Kansas

Background

Kansas City Structural Steel Superfund site was a former smelting facility located in Argentine community of Kansas City, Kansas. The facility is located on a 22-acre site, which was used for smelting and refining of gold, silver, and lead from 1880 until 1901. From 1901 to 1984, the site was used to produce steel products. The plant closed in 1987 and led many in the Argentine community to lose their jobs and led to the community's economic decline. site investigations revealed heavy metal contamination in soils and ground water, including lead that posed a risk to sensitive populations of children and infants through inhalation of airborne dust.

Highlights of environmental justice language contained in Fact Sheet

Kansas City Structural Steel Superfund Site Fact Sheet[1]

Language indicating that environmental justice was involved includes references to the majority Latinx population of the area; the sustained involvement of community groups in cleanup; and further involvement of community groups in creating opportunities for economic growth and development. (Pages 2-5)

Conclusion

Community members were involved throughout the cleanup process and community organizations worked with EPA to create opportunities for employment and economic growth. In 2012, the area was sold under a prospective purchaser agreement to retail developers to create a commercial center featuring a Walmart neighborhood market as its primary business. This redevelopment has led to restoration of jobs and greater access to affordable, healthy food in the community.

Information is available on the Kansas City Structural Steel site information web page.

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[1] Reuse and Benefit to Community: Kansas City Structural Steel Site, U.S. Env't Prot. Agency (Oct. 2015), https://semspub.epa.gov/work/07/30244587.pdf (last visited Sep. 15, 2023)

Celotex Corporation Superfund Site, Chicago, Illinois

Background

The Celotex Corporation Superfund site, located in in Chicago, Illinois, and was a former asphalt-roofing facility that operated until the early 1990s. The facility is in the Little Village neighborhood of Chicago, one of the largest Latinx communities in the country. The community has been overburdened with pollution over several decades of industrial activity and community members face several public health impacts and obstacles to economic prosperity. Asphalt roofing operations at the facility had led to contamination of soils with coal tar and polycyclic aromatic hydrocarbons (PAHs) that washed onto neighboring yards.

Highlights of environmental justice language contained in Enforcement Document

Celotex Corporation Superfund Site Enforcement Document[2]

> Language indicating that environmental justice was involved in site cleanup includes explicit references to environmental justice, descriptions of the community as consisting of minority populations, and descriptions of historic overburdening of the population with pollution from industrial activities in the area. (Pages 2-3)

Conclusion

EPA worked with the community during cleanup operations. The community created an environmental justice organization to advocate for cleanup that would protect current and future generations in the neighborhood. The community prioritized access to green spaces and the facility was transformed into a large park for the community through use of prospective purchaser agreements between EPA and the Chicago Park District. The La Villita Park opened to the community in December 2014.

More information is available on the Celotex Corporation Superfund site profile web page.

Former Kil-Tone Company Superfund Site, Vineland, New Jersey

Background

The Former Kil-Tone Company Superfund site, located in Vineland, New Jersey, consists of approximately 4.1 acres in a mixed residential commercial area with environmental justice concerns. The Former Kil-Tone Company manufactured lead and arsenic based pesticides from about 1917 until about 1933. Soils, sediment, surface water, and ground water contaminated with lead and arsenic have been identified on the site and downgradient of the site. The site is located

[2] "Cleanup Enforcement in Action: Addressing Needs in Chicago, Illinois"(Dec. 2018)

nearby a primarily Spanish-speaking community. This community has been subject to other contamination from industrial uses in the area from an adjacent fuel distribution facility that reported a release of petroleum hydrocarbons in 1989.

Highlights of environmental justice language contained in site Record of Decision

2019 Former Kil-Tone Superfund Site Record of Decision OU2

Language indicating that environmental justice was involved in the site cleanup includes explicit references to environmental justice, repeated exposure of the community to pollutants, and descriptions of a minority population. (Pages 1, 3)

Conclusion

Since the community is primarily Spanish-speaking, EPA has included a bilingual community involvement coordinator for the site. Documents associated with the cleanup are made available in both English and Spanish and published in English and Spanish newspapers. EPA conducted an interim removal action at the site in 2016 and plans to excavate soil in the residential and non-residential properties in the area and backfill the excavated areas with clean fill. The area is expected to remain mostly residential, with some nonresidential properties.

More information is available on the Former Kil-Tone Company Superfund site profile web page.

Gowanus Canal Superfund Site, Brooklyn, New York

The background for the Gowanus Canal Superfund site is available in the Climate Change Adaptation, Mitigation, and Resiliency Case Studies chapter, page 1.

Highlights of environmental justice language contained in site Record of Decision

2013 Gowanus Canal Superfund Site Record of Decision

Language indicating environmental justice involved in this case includes explicit references to environmental justice and descriptions of long-term exposure of the surrounding community to pollution from the canal. (Pages 2, 23, 86-87)

Conclusion

EPA augmented its interaction with the community in response to heightened interest, holding separate public meetings for the RI and the FS and in each of the Carroll Gardens and Red Hook neighborhoods. EPA also held several follow-up meetings to discuss community concerns and allowed an extended 90-day public comment period for the proposed plan. The remedy selected for the area includes dredging of contaminated sediments, construction of a multilayered cap to

prevent migration of PAHs and non-aqueous phase liquids (NAPLs), off-site treatment of contaminated sediments followed by beneficial reuse, and implementation of institutional controls. EPA and NYSDEC also plan to address the upstream contamination risks and institute controls on the combined sewer overflows.

More information is available on the Gowanus Canal Superfund site profile web page.

Montrose Chemical Corporation, Torrance, California

Background

The Montrose Chemical Corporation Superfund site is located in Torrance, California in a community with environmental justice concerns, known as the Harbor Gateway Community. Harbor Gateway is diverse, with much of the population identifying as Latinx. The median annual income of the community is lower than the county median annual income. The location consists of commercial, industrial, and residential use buildings and is not expected to change.

A former dichlorodiphenyltrichloroethane (DDT) manufacturing plant operated on the site from 1947 to 1982 and contaminated soil and ground water beneath the property. East of the Montrose site is another Superfund site, the Del Amo Superfund site, which is the location of three former manufacturing plants. The Del Amo manufacturing plants produced styrene and butadiene that were used to manufacture synthetic rubber. The Del Amo site also includes contaminated soil and ground water, which has mixed with the contamination from the Montrose site. Since the properties are adjacent and pollution from each has mixed, EPA is treating the cleanup as one effort. Between 1950 and 1971, Montrose released DDT and associated waste into the sewer system that was discharged into the Palos Verdes peninsula in the Pacific Ocean. This discharge has led to contamination of the water and sediments in the Port of Los Angeles and the Palos Verdes Peninsula and subsequent contamination of the fish in the area.

Highlights of environmental justice language contained in site Record of Decision

2020 Montrose Chemical Corporation Superfund Site Record of Decision

Language indicating that environmental justice concerns were involved at the site include descriptions of community involvement, descriptions of the community, and references to meetings and fact sheets being provided in multiple languages. (Pages 15, 17, 160)

Conclusion

EPA interviewed community members, conducted several public meetings, and distributed information in both Spanish and English. EPA has issued community involvement plans and has taken the community's concerns into account during its cleanup. The state of California has issued a fish advisory for fish caught on the Palos Verdes shelf.

More information on the Montrose Chemical Corporation Superfund site profile web page.

San Jacinto River Waste Pits Superfund Site, Harris County, Texas

Background

The San Jacinto River Waste Pits Superfund site, located in Harris County, Texas consists of a set of impoundments built in the mid-1960s for storing waste products, such as solid and liquid pulp from Champion Papers paper mills. The paper mill wastes contained dioxins and furans, which were formed as a byproduct of using chlorine as a bleaching agent for the paper. Large-scale ground water extraction in the area resulted in regional subsidence of the land and partial submergence of the northern impoundments in the 1970s and 80s and transfer of contaminants to the San Jacinto River. The southern impoundments were used for the dumping of various anthropogenic wastes in addition to paper mill waste since the early 1970s. Although the area immediately adjacent to the waste pits is an uninhabited commercial-industrial region, the most immediately adjacent residential communities have environmental justice concerns. These regions are known as Channelview, Lynchburg, and Highlands and consist of a large Hispanic population. Some members of the community also use the waterway for outdoor recreation or fishing.

Highlights of environmental justice language contained in site Record of Decision

2017 San Jacinto River Waste Pits Superfund Site Record of Decision

Language indicating environmental justice concerns are involved in the cleanup include explicit references to environmental justice and community engagement. (Pages 14-15)

Conclusion

EPA has conducted a series of local meetings and interviews with residents. EPA has since updated its community involvement plan to emphasize promotion of community awareness and understanding and encourage opportunities for public comment and community engagement.

More information is available on the San Jacinto River Waste Pits Superfund site profile web page.

Terry Creek Dredge Spoil Areas/Hercules Outfall, Brunswick, Georgia

The background for the Terry Creek Dredge Spoil Area Superfund site is available in the Climate Change Adaptation, Mitigation, and Resiliency Case Studies chapter, page 7.

Highlights of environmental justice language contained in site Record of Decision

2017 Terry Creek Superfund Site Record of Decision OU1

Language indicating that environmental justice was involved was explicit references to environmental justice, to descriptions of the resident population as having been exposed to contamination for long periods of time, and to the demographic makeup of the neighborhood. (Pages 37-38)

Conclusion

EPA has been engaged with the community and has launched the Brunswick/Glynn County Community Based Environmental Project to emphasize community involvement. Through this project, EPA has held several public meetings and mailed out newsletters. EPA aims to physically remove contaminated sediments from the outfall ditch and thus reduce exposure to toxaphene contamination. The ditch is planned to be sealed off and filled. Lastly, EPA plans to conduct a long-term monitoring plan in the area to evaluate the effectiveness of the planned remedies.

More information is available on the Terry Creek Dredge Spoil Areas/Hercules Outfall Superfund site profile web page.

Incorporating Greener Cleanup Concepts as Part of the Remedial Process

Pharmacia & Upjohn Co., LLC Superfund Site, New Haven, Connecticut

Background

The Pharmacia & Upjohn Co., LLC Superfund site, located in North Haven, Connecticut, is a 13-acre facility that was once used as a research and development laboratory, including chemical manufacturing. As a result of the chemical manufacturing, spent solvents, reactive and ignitable wastes, and unused commercial chemicals were generated and managed in a storage container area.

Cleanup of the site began in 1989 and used various enforcement orders that allowed cooperation between EPA, Pfizer (the successor to Pharmacia), and the Connecticut Department of Energy & Environmental Protection (CT DEEP). Throughout the cleanup process, Pfizer utilized the ASTM's Standard Guide for Greener Cleanups ("Guide"). The Guide is voluntary and implements stepwise cleanup processes that reduce the ecological footprint. The corrective actions aim to produce the following benefits: remove a greater amount of chemicals; reduce impacts on surrounding communities; lower the carbon footprint; and reduce long-term ground water pumping. Using the Guide, Pfizer was able to implement 87 greener cleanup best management practices (BMPs).

Highlights of greener cleanup language contained in the 2016 Administrative Order on Consent Settlement Agreement

2016 Administrative Order on Consent

> Respondent shall treat extracted ground water and aqueous waste streams generated during corrective measures implementation (CMI) prior to discharge to the Quinnipiac River and/or to constructed on-site wetlands. (Page 13)
>
> Vapors generated in the subsurface during pilot-scale testing and full-scale in-situ thermal remediation (ISTR) shall be captured with a vapor extraction system and treated on site. (Page 14)
>
> Respondent shall define a vegetation species and planting schedule during the design phase for all ecological enhancement areas based on the ability to provide foraging and breeding

habitat for the desired fauna (birds, mammals, and reptiles/amphibians). Cover soil thickness and types, and surface water hydrology will be designed to facilitate the growth of the specific plant species and the development of desired fauna habitat enhancements. (Page 20)

P&U shall prepare a community relations plan that builds upon its current stakeholder and community outreach program to include any material changes in the level of concern or information needs of the community that are anticipated to occur during design and construction activities. (Page 3-6 Scope of Work)

Conclusion

The Pharmacia case illustrates that implementing greener cleanups can benefit not only the environment but surrounding communities. Throughout the cleanup process, EPA and Pharmacia/Pfizer engaged the community and ensured they were attuned to the community's needs. This resulted in a holistic cleanup that was both beneficial for the community and reduced environmental impacts.

Ballard Mine Superfund Site, Soda Springs, Idaho

Background

The Ballard Mine was an open-pit phosphate mine in Southeast Idaho, active from 1951-1969. It covers about 534 acres and has waste rock dumps, open pits, and an abandoned haul road. Nature has taken over most of the site except for some pit areas and steep dump slopes. Cleanup of the site has been challenging due to the large amount of waste rock containing selenium, arsenic, uranium, and radon-222, which has required ongoing environmental management.

The initial cleanup assessment for the site was completed in 2009 and a remedy was selected in 2019. The Selected Remedy for this site is a combination of engineered source controls, treatment technologies, and other approaches. "A key element of the combined remedy is controlling the release of contaminants from waste rock dumps and mine pits by backfilling pits; consolidating, grading, and shaping waste rock; and constructing an approximately 5- to 6-foot-thick engineered cover system over more than 500 acres."[3] As of today, the site is not yet ready for its anticipated reuse.

Highlights of greener cleanup language contained in the 2019 Final Record of Decision for the Ballard Mine

> Use renewable energy and energy conservation and efficiency approaches, including Energy Star Equipment. (Page 16)

[3] *Final Record of Decision for the Ballard Mine*, U.S. ENV'T PROT. AGENCY REGION 10, 1,1 (Aug. 2019) https://semspub.epa.gov/work/10/100176934.pdf.

Use cleaner fuels such as low sulphur fuel or biodiesel, diesel emissions controls and retrofits, and emission reduction strategies. (Page 16)

Use water conservation and efficiency approaches including WaterSense products. (Page 16)

Use locally sourced materials when available and financially competitive. (Page 16)

Use reused or recycled materials within regulatory requirements. (Page 16)

Minimize transportation materials and use rail rather than truck transport to the extent practicable. (Page 16)

Conclusion

EPA's sustainable, greener cleanup approach to the Ballard Mine has effectively reduced risks to human health and the environment by addressing contaminants in the waste rock, while ensuring that the methods used to do so do not result in further environmental harm.

More information is available on the Ballard Mine Superfund site profile web page.

Incorporating Long Term Stewardship Concepts as Part of the Remedial Process

Monsanto Co – J F Queeny Plant Superfund Site, St. Louis, Missouri

Background

The Monsanto Co – J F Queeny Plant Superfund site, located in St. Louis, Missouri, operated as a chemical manufacturing facility from 1901 to 2006. In April 2019, Soulard Second Street, LLC entered into a bona fide prospective purchaser agreement (BFPPA) with EPA and the Department of Justice (DOJ) to carry out several cleanup actions at an 8.3-acre parcel of the facility to address polychlorinated biphenyl contamination. One such action was the installation of a vapor mitigation system and the remote, telemetry-based system to monitor the operation of the vapor mitigation system. In finalizing the BFPPA settlement with Soulard, EPA determined that this action would provide valuable protection of the remedy and reuse opportunities at the facility.

Highlights of long term stewardship language contained in the 2019 Administrative Settlement Agreement and Order on Consent

2019 ASAOC with Soulard:

> Installation of a remote, telemetry-based system to monitor, on a real-time basis, the continued operation and functionality of the installed vapor mitigation system. (Page 9)
>
> During Purchaser's ownership of the Property, on-going monitoring and maintenance of the vapor mitigation system, telemetry-based monitoring system, and the engineered PCB barrier, by creation of an EPA-approved operations and maintenance plan that describes the controls, provides warnings and sets out procedures for satisfying the requirements of the Environmental Covenant. (Page 10)

Conclusion

Vapor intrusion system remote computer monitoring, which detects whether vapor mitigation systems remain operational, is an advanced monitoring technology and approach to monitor and maintain institutional and engineering controls at sites and facilities. The remote, telemetry-based vapor monitoring system included in the agreement is an example of leveraging advanced monitoring to help ensure long-term stewardship and achieve the cleanup and beneficial reuse of a blighted property.

Information is available on the Monsanto Co – J F Queeny Plant information web page.

U.S. Ecology Facility, Sheffield, Illinois

Background

The U.S. Ecology facility is a 46-acre hazardous waste facility in Sheffield, Illinois.It operated from 1968 to 1983. While it was in operation, it accepted industrial, laboratory, and agricultural hazardous wastes. Ground water monitoring has been ongoing since a 1985 Resource Conservation and Recovery Act (RCRA) administrative order on consent (AOC). A new AOC was negotiated on September 22, 2020, that establishes long-term stewardship obligations such as: a long-term stewardship plan, five-year remedy reviews, annual institutional control certifications, and routine sampling and analysis. This long-term stewardship AOC will establish post-closure care obligations beyond the life of the landfill permit issued through Illinois EPA.

Highlights of long-term stewardship language contained in the 2019 Administrative Settlement Agreement and Order on Consent

2020 AOC with U.S. Ecology:

> This Order provides for the performance of long-term stewardship of the site through monitoring and maintenance activities, as well as completion of additional corrective action activities at or in connection with the facility, if deemed necessary. (Page 1)
>
> In entering this Order, the mutual objectives of EPA and Respondent are . . . to allow for the performance of Work pursuant to a long-term stewardship plan approved by EPA that will remain in effect following expiration or termination of the RCRA Post-Closure Permit issued by the Illinois Environmental Protection Agency. (Page 2)
>
> All future post closure activities, including ground water monitoring and corrective action. (Page 2)
>
> Respondent has developed a long-term stewardship plan that includes the following elements, at minimum: an inspection protocol to confirm the integrity of the source control

remedy, a leachate collection schedule and disposal plan, a ground water monitoring network and frequency of monitoring, a statistical methodology to evaluate ground water plume trends, monitored natural attenuation parameters and analysis methodology, updated standard operating procedures (SOPs) and quality assurance project plan (QAPP), point of compliance monitoring, annual reporting, five-year remedy reviews, financial assurance and contingency plans. (Page 7)

Conclusion

The U.S. Ecology case demonstrates how long-term stewardship can be implemented into RCRA enforcement agreements. U.S. Ecology had been engaging in ongoing monitoring efforts, but the 2020 AOC made the long-term stewardship plan legally binding. Going forward, U.S. Ecology is required to continually monitor the site, even after the state of Illinois EPA permit expires.

A summary of the 2020 ASAOC is available from the Agency's Agreement with US Ecology Establishes Long-Term Stewardship Requirements at Facility in Illinois web page.