GENERAL SITE INFORMATION, CHARACTERISTICS, AND STATUS

Project Name	***SULLIVAN'S LEDGE***	***ProjectID:*** 01-05
Last Updated:	02/11/03	

City:	New Bedford
County:	Bristol
State:	MA
Country:	USA
Bodies of Water:	Unnamed stream; Middle Marsh Area and adjacent wetlands
US EPA Region:	I
Status (Active, Complete, or Monitoring Only):	Complete
Date On NPL:	1984
ROD/ESD Date:	1989 (OU-1); 1991 (OU-2); 1995 (ESD [OU-1])
Operable Unit:	1, 2
Areas of Concern (length or acres):	OU-1: 12-acre Disposal Area (including the Unnamed Stream floodplain area), soil and sediments from the Unnamed Stream, and two golf course water hazards. OU-2: seven acres of wetland in the 13-acre Middle Marsh and a 0.4-acre adjacent wetland area identified as "Area 4."
Other Characteristics of Water Body:	Unnamed stream flows north from adjacent to the Disposal Area to the Middle Marsh area and water hazards located on the Whaling City Golf Course.
Contaminants of Concern:	PCBs (1254); PAHs
Source of Contamination:	Old quarry pits and adjacent areas located on the disposal site were used for the disposal of hazardous materials and other industrial and solid wastes, which included capacitors, waste oils, volatile liquids, metals, and scrap rubber.
Contaminated Area Physical Characteristics:	OU-1: The volume of contaminated soil in the Disposal Area was originally estimated to be between 46,000 and 82,000 cy with a debris content of 40-80%. OU-2: All wetlands in this study area are classified as bordering vegetated wetlands and all lay within the 25- and 100-year floodplains of the Unnamed Stream.
Type of Regulatory Action:	Superfund. Final.
Overall Status Summary:	Remedy selection was based on ecological-based cleanup levels. Project implementation was delayed for consent decree negotiations and design. Remedial design was approved by USEPA in June 1997 and construction work was bid in July 1997. The site was divided into two OUs: OU-1, a 12-acre Disposal Area including the Unnamed Stream floodplain area, soil and sediment from the Unnamed Stream, and two golf course water hazards; and OU-2, a seven-acre Middle Marsh and an adjacent wetland area, Area 4. The remedy included the removal of an estimated 35,200 cy of streambed and wetland sediments and floodplain soil by excavation for consolidation within the onsite disposal area for covering with an impermeable cap. Remedy implementation began in March 1998 and was performed in three phases. Work started on Phase I and involved the areas of OU-1 located south of Hathaway Road. Sediment and floodplain soil were removed from in and around the Unnamed Stream and a small tributary to the Unnamed Stream, resulting in the removal of 2,100 cy of material. Phase II began in early 1999 on areas included in both OU-1 and OU-2 located north of Hathaway Road. During Phase II, an estimated 7,600 cy of sediment was excavated from the OU-1 areas (the Unnamed Stream, a second tributary, and the two golf course water hazards) and another 25,500 cy of sediment was

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removed from OU-2 areas (Middle Marsh and Area 4). Soil and sediments excavated during Phase I and Phase II were placed in the onsite disposal area and were then capped as part of Phase III activities. Phase III also involved restoration of the remediated wetland areas. The project was completed in February 2001.

Remedial Action Planned:	☑
Risk Assessment:	☑
Remedial Action Implemented:	☑
Status of Dredging	☐
PRPs:	☑
Contacts:	☑
References:	☑
Modeling:	☑
Fishing Advisory:	☐

Key Conditions: dedicated landfill or CDF, hydrodynamic modeling, more-harm-than-good, wetlands

REMEDIAL ACTION PLANNED

Project Name	***SULLIVAN'S LEDGE***	***ProjectID:*** 01-05
Last Updated:	12/01/98	

Target Sediment Cleanup Standards (TSCS): Aquatic areas: 20 µg of total PCBs per gram of carbon (µg/Gc); Non-aquatic areas: 15 mg/kg total PCBs

How TSCS Established: Excess lifetime cancer risk of 10-4 to 10-6 and HI = 1 in aquatic areas. The 20 µg/Gc will reportedly result in interstitial water concentrations less than the PCB ambient water quality criteria of 0.014 µg/L.

Target Bank and Floodplain Cleanup Levels (if applicable): Unsaturated soil in floodplain area: 50 ppm PCBs and/or 30 ppm PAHs. Saturated soil and sediments in floodplain area: 20 µg of total PCBs per gram of carbon (µg/Gc)

Other Target:

Environmental Sample Data References:

- ***Sediment:***
- ***Water:***
- ***Fish:***

Estimated Target Volume: OU-2: 5,200 cy

Planned Disposal Method: Capped, on-site disposal.

Estimated Calendar Time to Implement Remedy: OU-1 work began in Fall 1998; OU-2 work targeted to begin in Spring 1999.

Estimated Time to Implement Remedy: OU-1: 1 year; OU-2: 6 months.

Estimated Cost to Implement Remedy: $2,800,000 (net present worth) for OU-2.

Stated Remedial Action Objectives (and Source): (Source: 1991 ROD)

(1) Reduce exposure of aquatic organisms to PCB-contaminated pore water and sediments either through direct contact or diet-related bioaccumulation;

(2) Reduce exposure of terrestrial and wetland species to PCB-contaminated sediment/soils through direct contact or diet-related bioaccumulation;

(3) Prevent or reduce releases of PCBs to the Unnamed Stream and the Apponagansett Swamp; and

(4) Mitigate the impacts of remediation on wetlands.

Measures of Success to be Used:

Planned Monitoring and Restoration: Middle Marsh Area and Adjacent Wetland Area (Source: 1991 ROD):

"During excavation and dewatering of PCB-contaminated sediments, downstream monitoring of surface water will be conducted to ensure that transport (of contaminated sediments) is not occurring as a result of the excavation."

"Long-term environmental monitoring, including sediment/soil monitoring, shall be performed to determine the degree to which sediment/soils are mobilizing on- or off-site. Sediment/soils in the Unnamed Stream, the stream's tributary, and nearby aquatic areas in the northwest portion of Middle Marsh shall be periodically sampled to determine if contaminants are migrating into these critical aquatic areas. Samples shall be analyzed, at a minimum, for TOC and PCBs."

"Long-term monitoring of the wetlands shall be conducted to ensure the long-term effectiveness of the wetland restoration program."

"During implementation of the remedy, steps will be taken to minimize the destruction, loss and degradation of wetlands, including the use of sedimentation basins or silt curtains to prevent downstream transport of contaminated sediment/soils."

"A wetland restoration program will be implemented upon completion of the remedial activities in wetland areas adversely impacted by remedial action and ancillary activities. In particular, the restoration program for the excavated portions of Middle Marsh and the Adjacent Wetland will be designed to mitigate any future impacts of such activities to those areas. Measures to be used will include adequate sloping of stream banks to prevent excessive sediment/soil erosion into the Unnamed Stream. All excavated areas would be backfilled, graded, stabilized and planted. The area would be restored to detail appropriate elevation contours and similar vegetation would be planted. Organic fill material would be distributed throughout the excavated areas to create grading, elevation and drainage approaching original patterns and to serve as substrate for replacement of vegetation."

"A variety of mitigating measures shall be implemented during and after remedial action including protection of sensitive species, erosion control and turbidity control. Excavation, backfilling and other remedial activities shall be conducted such that the disturbance of the Spotted Turtle, a Massachusetts species of special concern known to occupy Middle Marsh, is minimized. In addition, during remedial design, further investigations will be performed to identify areas where the Mystic Valley Amphipods may be inhabiting. Based on the results of such an investigation, measures shall be planned and implemented to minimize adverse impacts of remedial activities, including wetlands restoration, on the Mystic Valley Amphipods."

Agency Position on Sediment Removal (and Source):

(Source: 1991 ROD)

"EPA has determined that, for this Site, there are no practicable alternatives to the selected remedy that would achieve site goals but would have less adverse impacts on the ecosystem. Unless sediment/soils with contaminants greater than the target levels are excavated, the contaminants in the sediments/soils would continue to pose unacceptable environmental risks."

"EPA believes that the exposure to PCB-contaminated sediments in Middle Marsh and the adjacent wetland present an unacceptable risk to biota exposed to such contaminants. EPA has determined that the source of elevated PCB concentrations in Middle Marsh and the adjacent wetland, is the Sullivan's Ledge Disposal Area."

"EPA will determine when excavation activities should be performed by evaluating public access, weather conditions, stream flow, scheduling constraints and the impacts of construction activities on the state species of concern (Spotted Turtle). EPA does not believe that the remedial actions selected in the ROD will devastate Middle Marsh or its associated wildlife, including the Massachusetts species of concern."

"Excavation and ancillary activities to be performed as part of the selected remedy will be

implemented in a manner that mitigates any contaminant migration downstream. The method of isolating contaminated sediment/soils will be determined during design of the selected remedy, considering the need to mitigate wetland impacts."

"Because the areas to be excavated are wetlands, excavation and associated activities will be performed to minimize adverse impacts to wetland areas. EPA has determined that, for this operable unit, there are no practicable alternatives to the site preparation and sediment/soil excavation components of the selected remedy, that would achieve site goals but would have less adverse impacts on the aquatic ecosystem. Therefore, sedimentation basins and/or silt curtains will be installed downstream to capture any particles that may become suspended during excavation activities. During excavation and dewatering of PCB-contaminated sediments, downstream monitoring of surface water will be conducted to ensure that transport is not occurring as a result of the excavation. Excavated areas shall be isolated by means of erosion (e.g. sandbags, hay bales or earthen dikes) and sedimentation control devices (i.e. sedimentation basins), and diversion structures."

"EPA has concluded that PCB concentrations in Middle Marsh are high when compared to background levels and calculated cleanup levels for the protection of the environment. EPA has determined that actual or threatened releases of hazardous substances from contaminated sediments in Middle Marsh and the Adjacent Wetland, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to biota through aquatic and wetland/terrestrial pathways."

"EPA does not agree that dramatic reductions in PCB concentrations have occurred in Middle Marsh. PCBs in the environment are generally resistant to physical and biological degradation and have a high affinity for organic material such as the sediment/soil in Middle Marsh. Sampling data indicate that PCBs are present throughout the surface sediment/soil in most of Middle Marsh and the Adjacent Wetland and are present at concentrations near 10 mg/kg at depths of up to two feet. In addition, a PCB concentration of 97.0 mg/kg was found at a depth of 0.5 to 1.0 foot near the Unnamed Stream in the Adjacent Wetland, the highest PCB concentration detected in all studies associated with the Middle Marsh operable unit."

"EPA has determined that the PCB concentrations downstream of Hathaway Road are due to long-term releases of contaminated soils from the Sullivan's Ledge Disposal Area. Soil PCB levels at the surface of the Disposal Area are shown to be 1,000 ppm in areas near the Unnamed Stream. On numerous occasions, such as during hydrologic monitoring performed for the Remedial Investigation, flooding of Middle Marsh was observed with extremely turbid water from the Unnamed Stream, ponding of floodwaters in Middle Marsh, and deposition of sediments in areas found to have the highest PCB concentrations. As long as these sediments and soils are uncontrolled, they will continue to act as a source of PCBs to downstream areas including Middle Marsh."

"PCB concentrations have not decreased significantly since the 1989 Remedial Investigation. The 54 percent annual rate of reduction between 1988 and 1990 cited would have reduced PCBs in Middle Marsh to near zero over several years. The data show that this has not occurred. Additional statistical examination of surface PCB concentrations from the two data sets reveals that no statistical reduction in PCB concentrations has occurred. The low degree of change with time in the results is demonstrated by simply removing the "hot spot" data of 20 mg/kg (ME1) and 60 mg/kg (MM-5) from the data sets. The new averages are practically identical; 7.24 and 7.29 for the 1990 and 1988 data, respectively."

"EPA does not believe that dissolution, volatilization, or biodegradation have caused significant

reductions in PCB concentrations in the study area. The Aroclor found in Middle Marsh is Aroclor 1254, a highly chlorinated mixture of PCBs with little solubility in water. Backup information stated that, "The transport and fate of PCBs in aquatic systems and their partitioning into different compartments of the environment depend to a large degree on sorption reaction. Generally, sorption increases with increase in chlorine content of chlorobiphenyl, and with surface area and organic carbon content of the sorbent." TOC and grain size analysis have shown that the sediment in Middle Marsh has a very fine grain size and thus high surface area, and a very high organic content. Less than 1µg/L dissolved PCB was generally found in the pore water and surface water in Middle Marsh indicating that the PCB at this site is partitioned into the solid sediment matrix. The more toxic and readily bioaccumulated hexa- and hepta-chlorobiphenyls are common in Aroclor 1254 and do not dissolve readily in water"

"Similarly, it is only the mono, di, tri, and a few tetra substituted isomers in Aroclor 1254 that have volatility. However, Aroclor 1254, the Aroclor found in Middle Marsh, has predominantly tetra, penta, hexa and other higher isomers that are much less volatile. Binding of PCBs to solids reduces the amount of PCB that volatilizes. Because the PCBs in Middle Marsh were deposited with sediment, the PCBs were already absorbed to silty organic wetland soils which are high in humic acid, greatly reducing the volatility and solubility of the PCBs."

"Further, EPA does not believe that significant biodegration has occurred in Middle Marsh. This is confirmed by examinations of several chromatogram from Middle Marsh which did not exhibit dechlorination."

"Research performed in the New Bedford Harbor which indicates that volatilization is the most significant process occurring at that site, cannot be directly applied to the Middle Operable Unit. As stated above, the degree to which PCBs volatilize is dependent upon the sorbent reaction and sediment characteristics such as surface area and organic carbon content. These variables may be significantly different from site to site, even within the same site. For example, TOC variability within the Middle Marsh area has indicated over a ten fold difference in the range of values. Furthermore, a substantial amount of PCB that entered the water column in the harbor subsequently volatilized to the atmosphere. However, as described above, less than 1µg/L dissolved PCB was measured in the pore water and surface water in Middle Marsh indicating that the PCB at this site is primarily partitioned into the solid sediment matrix.

"EPA believes that replacement of sediments is required under federal and state law. Under Section 404(b) (1) of the Clean Water Act, the remedy cannot have significant adverse environmental consequences, or cannot cause or contribute to significant degradation of waters of the U.S. In addition, all appropriate and practicable steps must be taken to minimize impacts to the aquatic ecosystem. 40 CFR Section 230 specifies that a project involving fill material should be designed and maintained to emulate a natural ecosystem. The restoration should be based on characteristics of a natural ecosystem in the vicinity of the proposed activity to ensure that the restored area will be maintained physically, chemically, and biologically by natural processes. Executive Order 11988, Floodplain Management, and Executive Order 11990, further require that actions in floodplains or wetlands restore and preserve the natural and beneficial values of the wetland and floodplain areas. E.O. 11990 requires that actions in wetlands "consider the maintenance of natural systems including conservation and long-term productivity of existing flora and fauna, species and habitat diversity and stability, and hydrologic utility." Finally, MA DEP Wetlands Protection Regulations concerning dredging, filling, altering or polluting inland wetlands are applicable to the dredging of Middle Marsh and the Adjacent Wetland and require compliance with performance standards of the regulations regarding banks, vegetated wetlands and lands under water, and one-for-one replication of any hydraulic capacity which is lost as the result of this part of the remedial actions."

"The wetland areas in question, especially Areas 2 and 4 are subject to substantial rapid changes in water surface elevation due to stormwater runoff from the upstream urbanized watershed. During hydrologic monitoring, high stream velocities exceeding two feet per second were observed in these areas and significant scouring of the stream bottom and bank sediments. If these areas were excavated and not restored, EPA believes that there would be severe erosion problems, water quality degradation, and failure of any attempt to revegetate these areas due to the increased insurgence of stormwater, erosion, and sedimentation"

"EPA agrees that excavation of another wetland in order to restore Middle Marsh would not be protective of the environment and such a measure would not be taken. However, it is not possible to identify the source of replacement sediment to be used at the site, at this time."

"EPA agrees that plants in Middle Marsh do not accumulate PCBs at significant levels. EPA also agrees that not all cleared vegetation would need to be managed as a hazardous waste and the properly handled material could be managed as a solid waste. The FS clarifies that only contaminated materials such as stumps and vegetation that does come in contact with contaminated mud would need to be managed as a hazardous waste. EPA does not believe that all areas to be remediated could be cleared without generating contaminated vegetation."

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RA Type: Ecological

RA Status: Complete

RA Objectives: "The objectives of the ecological exposure assessment of Middle Marsh were to 1) define the ecological conditions of the study area, 2) identify appropriate remediation goals, 3) determine how remediation would affect the study area, and 4) provide information for mitigation."

Company Performing RA:

RA Reference Report:

RA Summary and Conclusions: (Source: 1991 ROD) "The cleanup levels established in the ROD are based on site-specific factors including total organic content, organic mat coverage, depths of overlying water and other sediment/soil characteristics. Total organic content is a particularly important parameter because it indicates the extent to which contaminants may be available for uptake by the biota."

"Detailed physical, chemical and biological information was collected and evaluated for Middle Marsh to identify aquatic and wetland/terrestrial exposure pathways critical to the transfer of PCBs in Middle Marsh and the adjacent wetland. In particular, PCB tissue data of indigenous biota from the study area was evaluated to determine the extent to which accumulation of PCBs was occurring at the site. Conclusions drawn from evaluation of the information discussed above are pertinent only to the Middle Marsh Operable Unit. Cleanup levels derived to be protective at other sites may be significantly different from the levels established at this site because any number of factors may be different than those at the Middle Marsh Operable Unit."

"This ROD does not attempt to establish ecological-risk based cleanup levels for PCBs to be achieved at all superfund sites. Both human health and ecological risk assessment must be performed at each site to determine endangerment to human health and the environment based on site-specific factors including receptors, exposure pathways and site characteristics."

"The New Bedford Harbor Superfund Site is significantly different from Sullivan's Ledge because it is a saltwater environment with uniquely different sediment substrate, overlying water and environmental receptors. Therefore, it is expected that PCB cleanup levels established for the two sites would be different."

"To assist in the identification of potential exposure pathways, an ecological food chain pathway model was developed. Species included in this model were species that were either observed on site or were expected to occur on site based upon historic occurrence, habitat requirements, food availability, home range requirements, and the likelihood of exposure. Mink were included in the ecological food chain pathway model because: Middle Marsh provides the basic habitat requirements for mink; minks are known to be susceptible to PCBs; and the mink is top level consumer in an area where site-specific data showed that many of its food sources are contaminated with PCBs."

"Mink are expected to use the site because they have historically occurred in the region. While the Middle Marsh system is not considered by EPA to be "optimum" mink habitat, it is nevertheless SUITABLE for mink inhabitation as defined by the presence of life requisites. It has been stated that "the species is tolerant of human activities and will inhabit suboptimum habitats as long as an adequate food source is available". Mink food preferences are varied, and can be classified into 1) aquatic (e.g. fish, frogs and crayfish); 2) semiaquatic (e.g. waterbirds and water associated mammals); and 3) terrestrial (e.g. rabbits and rodents). The importance of each group depends upon availability and season EPA

observations and site-specific studies indicate that Middle Marsh and the adjacent wetlands have relatively high populations of these pray types, particularly high numbers of frogs and small rodents."

"Minks have recently been sighted in nearby areas, including the Apponagansett Swamp, and as road kills in the neighboring town of Dartmouth, Massachusetts. During a site visit on August 26, 1991, mink tracks were observed and photographed in Middle Marsh near the Unnamed Stream. The mink tracks were identified by a certified wildlife biologist. In addition, a number of potentially suitable mink den sites were observed and photographed. Tracks of other small mammals were also observed. This information has been added to the administrative record."

"Secondly, mink was used in the pathway model because it is representative of other sensitive species. Mink are particularly sensitive to PCBs. A study of mink dietary effects found that mink feeding at a level of 0.64 ppm Aroclor 1254 for 160 days either died, were extremely weak, or produced young all of which died during the first day after birth. Therefore, consistent with EPA guidelines, EPA included the mink in the ecological exposure assessment and based protection of the ecosystem and development of remediation criteria (cleanup levels) on this key sensitive indicator species. As a top level predator in the marsh, protection of mink would ensure achievement of the goal of ecosystem integrity and balance. Furthermore, the known susceptibility of mink would provide a margin of error for protection of a variety of environmental receptors for which toxicological data is not known. The use of mink, a species known to be sensitive to PCB, is consistent with EPA guidance. As stated on Page 3-20 of EPA's "Risk Assessment Guidance for Superfund -- Environmental Evaluation Manuel (EPA/540/1-89/001), "Ecologists will often use professional judgment to select a particular organism as an 'indicator species', that is, a species thought to be representative of the well-being and reproductive success of other species in a particular habitat. The indicator species may also be chosen because it is know to be particularly sensitive to pollutants or other environmental changes." In the absence of complete toxicological data of the effects of all pollutants and contaminants on the myriad species found in Middle Marsh, it is reasonable to extrapolate information known about a particularly sensitive species."

The exposure assessment for mink involved the development of appropriate exposure parameters. EPA determined that because of the mink's high trophic level, dietary exposure would be the primary exposure pathway. Analysis of the habitat, prey, and home range requirements suggests that mink using the site may either live, breed, and feed on-site, or live off-site and feed on-site. Densely vegetated wetlands are the preferred habitat of mink; Middle Marsh contains such habitat. There is an abundance of preferred mink prey available, in the form of small mammals, frogs, and small birds . Although on the lower end of home range sizes, the Middle Marsh and surrounding habitat is of sufficient size to support mink because of its dense habitat and abundant prey. It is reported that most minimum hone ranges documented in the literature can be attributed to situations of dense cover and/or high prey abundance. Mink often concentrate their feeding in core areas within their home range. These core areas usually are characterized by high prey densities and are in relatively close proximity to streams. Given the existence of the stream which could represent a core feeding area for mink and the apparent susceptibility of female mink to the lethal and chronic reproductive effects of dietary PCB exposure, EPA determined that the use of the female mink's home range of 20 acres was appropriate. Further, given the short time period (160 days) for the adverse effects of PCBs to occur, EPA decided not to calculate the mink's dietary exposure as an annual average but to address seasonal changes in the mink's diet which could influence its exposure. Accordingly, EPA determined that in Middle Marsh, the mink's winter diet would consist mainly of small mammals."

"Based on site-specific data for sediment/soils and biota, a sediment/soil cleanup level of 15 mg/kg was calculated for wetland/terrestrial areas of Middle Marsh. The cleanup level of 15 ppm was designed to protect mink and other potentially sensitive species from chronic health effects from PCB exposure and to restore the area as viable habitat where mink and other species sensitive to PCBs may exist and breed.

Use of mink as an indicator species may ensure protection of other sensitive species for which toxicological data does not exist. This cleanup level is also protective of carnivorous and insectivorous birds whose calculated cleanup levels were 25.5 and 29.2 mg/kg, respectively. A cleanup level of 15 mg/kg would also result in removal of sediments above cleanup levels developed for birds such as those at stations ME22 (28 mg/kg), ME38 (32 mg/kg), and SL56 (34 mg/kg)."

"EPA applied the 15 mg/kg cleanup level on a point-by-point (never to be exceeded) basis, rather than reducing the average site contaminant concentration to the cleanup level. This method ensures that the mink's dietary level will not exceed 0.64 ppm, which was found to cause reproductive failure and even death, and which is the basis for the ambient water quality criterion and sediment quality criterion for PCBs. EPA believes this method is especially appropriate for Middle Marsh, and is appropriate for mink and other species with feeding habits similar to mink which concentrate their feeding in a core area."

"EPA agrees that Middle Marsh would be used by a small number of mink at a time based on home range requirements. However, EPA disagrees on the use of a larger home range for mink, and that the mink's solitary and "shy" nature would preclude its presence in Middle Marsh. EPA has determined that Middle Marsh will support mink and that the use of a minimum home range is appropriate. Further, EPA believes based on field observations and recent literature that the use of a 65 percent residence time is appropriate. The mink is primarily nocturnal and tolerant of human activity. The daytime use of the surrounding golf course would not deter mink from traveling to and from Middle Marsh. The Unnamed Stream traverses the fairways on both sides of Middle Marsh, and with its associated vegetation and cover would provide a secure travel corridor between Middle marsh and the Adjacent Wetland and /or the Apponagansett Swamp. Finally, EPA disagrees that because mink have highly developed day vision they are more active by day and thus would be disturbed by golf course activity. It is well established that mink are primarily active at night."

It must be noted that the rationale for the cleanup is not to protect one female mink but to restore the area as viable habitat where mink and many other species sensitive to PCB may exist and breed. Under CERCLA, EPA must ensure that its actions provide overall protection of the environment. EPA's objective is to restore Middle Marsh such that it will support all life functions for a balanced indigenous population including top level predators such as the mink, other mustelids, and other sensitive species for which toxicological data does not exist. EPA acknowledges that the overall effects may not be immediate and dramatic, but they are nonetheless important. For example, the removal of top predators could result in increased numbers of small mammals such as mice, which are known to be present in Middle Marsh. As mice feed predominantly on seeds, this could result in reduced diversity of plant species and, as a direct result, a reduced diversity of animals such as birds that require certain plants as habitat."

"EPA has determined that excavation of a portion of Middle Marsh is necessary to ensure that mink and other sensitive species can exist and breed. This approach is consistent with the recommendations of EPA's Science Advisory Board, as articulated in the report entitled Reducing Risk: Setting Priorities and Strategies for Environmental Protection, September 1990 (SAB-EC-90-0211). That reports states:

Ecological systems like the atmosphere, oceans and wetlands have a limited capacity for absorbing the environmental degradation caused by human activities. After that capacity is exceeded, it is only a matter of time before those ecosystems begin to deteriorate and human health and welfare begin to suffer.

In short, beyond their importance for protecting plant and animal life and preserving biodiversity, healthy ecosystems are a prerequisite to healthy humans and prosperous economies. Although ecological damage may not become apparent for years, society should not be blind to the fact that damage is occurring and the losses will be felt, sooner or later, by humans. Moreover, when species and habitat are depleted, ecological health may recover only with great difficulty, if recovery is possible at all. While

the loss of species may not be noticed immediately, over time the decline in genetic diversity has implications for the future health of the human race."

"EPA conducted the ecological exposure assessment for Middle Marsh by making assumptions for home ranges, food source, and other parameters based on the most recent, available scientific information. Based on the most recent literature, EPA believes that home ranges for mink and other species addressed in the ecological exposure assessment were applied appropriately. It is asserted that mink feed in equal proportions over their entire home range. However, as described above , mink have a core area within their home range in which they do most of their feeding. The core area (and the home range) is smaller in areas of high prey density. This core area is also usually associated with a stream. When mink inhabit areas along rivers, creeks, lakes, ponds, and marshes (such as Middle Marsh), their exposure would be weighted toward streambank areas. At this site, the streambank areas are not evenly distributed throughout Middle Marsh and the surrounding area. Two intensive sampling programs have demonstrated that the areas of highest contamination are close to the Unnamed Stream in both Middle Marsh and the adjacent Wetland. Thus, adjusting the cleanup level based on the size of Middle Marsh compared to the mink's home range (13/20 = 0.65) was reasonable and not overly conservative."

"EPA disagrees with the use of an averaged bioaccumulation factor for earthworms. In the conduct of the ecological exposure assessment, EPA decided to use available site-specific data to develop bioaccumulation factors (BAFs). For small mammals, the BAF of 0.07 was based on an average of tissue levels from eleven animals captured at two different stations. However, for earthworms, there were only two data points and EPA was concerned that BAFs for earthworms could significantly exceed 0.29, the higher of the two values. Comparative literature values showed high variability which contributed to uncertainty in the analysis. In this case , EPA decided to select the higher value because of the low confidence in averaging only two values."

"The selected cleanup levels of 20 µg PCB/gram carbon for aquatic areas and 15 mg/kg for all other wetland areas were not designed to reduce the average contaminant concentration to the cleanup level. Under EPA policy, the developed cleanup levels were applied on a point-by-point (never to be exceeded) basis rather than a site average to ensure that future exposure will fall below accepted limits, regardless of where the animal spends its time or obtains its food."

"EPA does not agree with the food chain exposure assumptions presented in that a number of assumptions used in the calculations are inappropriate for Middle Marsh. EPA and its consultants conducted a variety of biological studies in Middle Marsh in order to determine appropriate parameters for calculation of food chain exposure. Several technical arguments are presented below:

- The habitat evaluation conducted by EPA's consultant determined that Middle marsh is poorly suited to muskrat. Thus, EPA does not believe it appropriate to attribute 47 percent of the mink's diet to voles and muskrat.

- Based on site-specific data, EPA does not agree with the selected bioaccumulation factor (0.02) for voles and muskrat. Tissue data from meadow voles collected near the Unnamed Stream by EPA indicate bioaccumulation factors ranging from 0.05 to 0.21.

- EPA does not agree with the use of area averaged PCB concentrations. Cleanup levels were applied on a point-by-point (never to be exceeded) basis. EPA believes this method is especially appropriate for Middle Marsh, and for mink and other species with feeding habits similar to mink which concentrate their feeding in a core area."

"In addition, the method presented (1) uses an annual average diet approach which EPA believes is

inappropriate; and (2) fails to consider exposure to the PCB Aroclor that is actually present at the site. Exposure to the lower chlorinated Aroclors such as Aroclor 1016 does not produce toxic effects as the congeners present in Aroclor 1016 are readily metabolized and are not bioaccumulated. Toxicological studies of mink and other species feeding on the more highly chlorinated Aroclors, such as Aroclor 1254 (the contaminant at Middle Marsh) have shown that sublethal and even lethal effects from relatively low doses of PCB can occur in significantly less than a year. A study of dietary effects found that all adult mink died within 105 days of dietary exposure to 3.57 ppm of PCB Aroclor 1254, the same Aroclor present in Middle Marsh. The short time period for manifestation of health effects could be a significant threat to mink young who remain together from late April/mid-May until fall. It is for this reason that EPA examined the winter diet of mink separately. Given the relative unavailability of frogs and other aquatic species during New England winters, the mink's winter diet could consist almost exclusively of small mammals. This pathway was used to derive the cleanup level presented in the RI."

Further, EPA recognized uncertainty by using the "lowest observed effect level" (LOEL) of 0.64 ppm as a protective dietary level rather than a "no effects level". As described above, the LOEL of 0.64 ppm in diet was shown to cause death and reproductive failure in mink. EPA is concerned that a dietary level below 0.64 ppm could still cause serious sublethal and even lethal effects in mink and other sensitive species. Therefore, the approach used by EPA was not overly conservative, because EPA did not use a safety factor of 10 to adjust the LOEL of 0.64 ppm to a "no effects level". However, applied as a never-to-be-exceeded basis, remediation of PCBs to the cleanup level of 15 ppm would ensure that the minks' and other sensitive species' dietary levels will not exceed 0.64 ppm. Thus, assuming 0.64 ppm is a protective dietary level and without applying a safety factor, mink and other sensitive species would be protected regardless of where they spend their time or obtain their food."

"EPA has determined that it is appropriate to derive a cleanup level in the aquatic area of Middle Marsh to account for uptake of PCBs through an aquatic food chain pathway. In particular, site-specific studies indicate that benthic organisms have accumulated PCBs and that upper trophic level consumers are at risk. As stated in the EPA document "Water Quality Standards for Wetlands":

Applying water quality standards to wetlands is part of an overall effort to protect and enhance the Nation's wetland resources. At a minimum, all wetlands must have uses designated that meet the goals of Section 101 (a) (2) of the CWA by providing for the protection and propagation of fish . . . . and wildlife."

"As described above, the remediation criteria were established to ensure the restoration of a healthy ecosystem, as indicated by conditions suitable for an unaffected, reproducing mink population. In order to achieve this objective, all potential food sources for mink must be free from PCB contamination that would inhibit reproduction or other critical life stages or ecological functions. It is not appropriate to protect only a portion of the mink's diet, based on presumed relative use of available acceptable food sources. All carnivores in the wild utilize food based on availability, and restoration of the population must provide for a variety of dietary mixes. Data presented demonstrates, for example, the variability in mink diet between seasons and from location to location ."

"The RI demonstrates that Middle Marsh supports an aquatic food chain which could be a significant portion of the diet of a mink or other mammalian or avian carnivore. Frogs, tadpoles, and crayfish are abundant in Middle Marsh and fish have been observed in the Unnamed Stream that travels through Middle Marsh. The actual extent of fish is unknown but, based on physical conditions and presence of suitable food, there is no reason why the stream and its tributaries could not support an abundant fish assemblage once contaminants are removed from sediments and the water column. Therefore, a remediation criterion that ensures safe concentrations in aquatic food sources has been established."

"To achieve a safe aquatic food web, the RI/FS evaluated and used sediment remediation criteria. The

indicator used in evaluating sediment criteria was acceptable concentrations of PCBs in the aquatic or aquatic dependent portion of the mink diet. There was no indication of contamination effects on the benthic community and thus protection of the structure of the benthos was not an objective in establishing sediment criteria. ARARs, risk type evaluations, and review of on-site data were used in establishing sediment remediation criteria."

"The interim sediment quality criterion for PCBs represents a standard which is "to-be-considered" (TBC) in the RI/FS process. The interim criterion for PCB was derived based on residue effects and not protection of the benthos from toxic effects of PCB. The sediment quality criterion was designed to ensure that benthic organisms are not exposed to bioavailable concentrations of chemicals greater than what is currently allowed by existing water quality criteria. However, as described above, the objective of sediment remediation criteria for Middle Marsh was control of residue in mink diet, so the interim criteria approach and methods for PCBs was appropriate for Middle Marsh."

"The approach for sediment quality criteria does include assumptions, and in some cases the database is limited; therefore, additional considerations were used in evaluation of remediation criteria. The benthos can bioaccumulate PCB from the sediments via the pore water. Potential mink food sources such as fish, frogs, or crayfish, feed on these benthic animals and can further concentrate the PCB in their tissues. Using the same assumptions established for bioavailability, bioaccumulation, and partitioning in the relevant ARARs for water and sediment quality criteria, a PCB concentration of 0.014 µg/L in the pore water would result in an aquatic food web with PCB concentrations protective of mink reproduction, and thus the indicator was used for a healthy Middle Marsh ecosystem. Based on specific Middle Marsh site conditions of sediment organic carbon concentrations and mink diet, a pore water concentration of 0.014 µg/L would give a sediment remediation criteria of 19.5 µg PCB/Gc, which was used in the RI/FS. This approach was evaluated considering on-site data and was found to be substantiated. Sediment in the Unnamed Stream in excess of two times the upper PCB interim sediment quality criterion resulted in benthic tissue concentrations of approximately 0.4 ppm. The upper SQC is exceeded in much of the aquatic area that was targeted for remediation. These benthic tissue concentrations are close to the levels in mink diet which have been shown to produce reproduction inhibition (0.64 ppm). A diet of benthos (or the adult insects resulting from the benthic larvae) at the measured levels of PCB by fish, crayfish, or frogs could result in tissue concentrations above the levels shown to be harmful to mink."

"Bioaccumulation of PCBs in the Middle Marsh area is further substantiated by benthic and fish sampling in the Unnamed Stream in downstream areas as it flows through the Apponagansett Swamp. This area is also near the New Bedford Municipal Landfill which is also reportedly contaminated with PCBs. Benthic concentrations in the stream were 1.13 ppm Aroclor 1254 in a composite sample from six stations . PCBs were also found in fish at one station. It was concluded that "Bioaccumulation of PCBs is demonstrated by the relatively high levels detected in benthic organisms within the swamp. Transport of this contamination up the food chain to the more mobile biological organisms (i.e. fish) is occurring". This indicated that mink food sources in other areas surrounding Middle Marsh could be contaminated, and that the use of 65 percent residence time (which assumes all other food sources not related to the site are not contaminated with PCBs) was not overly conservative. If, in the calculation of the cleanup level, food sources not found in Middle Marsh had assumed to be contaminated with PCBs, then a lower cleanup level may have been derived."

"One of the uncertainties in the development of the SQC for PCBs and in the ecological exposure assessment for Middle Marsh is the use of the bioaccumulation factor of 45,000 derived from trout studies for uptake of PCBs by aquatic species. However, bioaccumulation factors for Aroclor 1254 are presented in the ambient water quality criterion document for PCBs (EPA, 1980); they range up to 238,000 for the fathead minnow, a species which could inhabit Middle Marsh. In addition, EPA states that "available information strongly indicates that field bioaccumulation factors for PCB are probably a factor of 10 higher

than the available laboratory BAF values" (EPA, 1980). Laboratory values such as those BAFs listed above, are based on direct and respiratory exposure only. The higher field values would result from dietary exposure which would occur for aquatic species in Middle Marsh."

"The SQC model was applied to areas of Middle Marsh that support permanent standing water, even during the dry months of the year. EPA agrees that SQC do not apply to wetland soils or semi-permanently flooded wetland areas. During the RI field studies, much of Middle Marsh was inundated and aquatic invertebrates were found in these areas. Yet SQC were not applied to these areas because the inundation was judged to be seasonal. To determine the presence of aquatic habitat, EPA conducted qualitative biological sampling in August of 1990 to determine the presence of obligate aquatic invertebrates. Aquatic habitat was limited to a large tributary of the Unnamed Stream and nearby areas that were characterized by permanent flooding up to about three feet in depth and obligate aquatic organisms, including amphipods, freshwater clams, isopods, Alderfly larvae, Cranefly larvae, midge large, tadpoles and leeches. These areas are inundated even during mid-summer. They maintain a self-sustaining aquatic community, serve as feeding areas for stream biota, contribute plant and animal material to the stream on a continuing basis, and could support an aquatic pathway for bioaccumulation."

"It is important to note that EPA used the SQC as an indicator of potential wildlife impacts and then field verified the results. The use of SQC as part of an overall ecological risk assessment is consistent with EPA guidance. The EPA publication "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA/540/G-89/004) includes the following statement on Page 1-3 concerning determination of risk:

The objective of the RI/FS process is not the unobtainable goal of removing all uncertainty, but rather to gather information sufficient to support an informed risk management decision regarding which remedy appears to be most appropriate for a given site. . . .These choices [as to the appropriate course], like the remedy selection itself, involve the balancing of a wide variety of factors and the exercise of best professional judgment."

"In the case of Middle Marsh, the pore water PCB concentrations that exceeded the ambient water quality criterion of 0.014 µg/L, the sediment levels that exceeded the sediment quality criterion, and the elevated PCB concentrations in site biota including benthic organisms were a part of the "weight-of-evidence" judgment that there was potential endangerment to wildlife in Middle Marsh. In particular, biological tissue data verified that exposure to PCB sediment concentrations exceeding the upper sediment quality criterion resulted in accumulation of PCBs in benthic organisms, the lowest level of the aquatic food chain. EPA believes that this could result in food chain bioaccumulation, bioconcentration and ultimately exposure of mink and other sensitive species to detrimental dietary concentrations of PCBs."

REMEDIAL ACTION IMPLEMENTED

Project Name:	***SULLIVAN'S LEDGE***	***ProjectID:*** 01-05
Last Updated:	03/19/03	

Physical Target:	Removal of (1) all sediment from the Unnamed Stream from where it enters the 12-acre disposal area to the two golf course water hazards, including two tributaries and the two golf course water hazards; (2) seven acres of Middle Marsh, and (3) all of the Area 4 wetland.
Goals:	Source: Reference A-941 "EPA in its 1991 OU2 ROD identified the following objectives for the OU2 remedial action: • Reduce exposure of aquatic organisms to PCB contaminated pore water and sediments either through direct contact or diet related bioaccumulation; • Reduce exposure of terrestrial and wetland species to PCB contaminated sediment/soils through direct contact or diet related bioaccumulation; • Prevent or reduce releases of PCBs to the Unnamed Stream and the Apponagansett Swamp; and • Mitigate the impacts of remediation on wetlands."
Primary Contractor:	Harding Lawson Associates
Other Contractors:	New England Environmental, Inc. (wetland restoration)
Generic Remediation Method:	Dry excavation
Equipment:	Backhoes; long-reach excavators
Material Handling:	Material removal was performed in two of the three construction phases. Phase I targeted areas south of Hathaway Road and included removal of streambed material from the Unnamed Stream and a small tributary, along with an area of floodplain soil. All removed materials were placed in various areas within the limits of the disposal area cap. Phase II targeted areas north of Hathaway Road and included the remaining portions of the Unnamed Stream, a second tributary, two golf course water hazards, the Middle Marsh, and the Area 4 wetland. The excavated materials were trucked to a treatment pad for stabilization. Stabilization included the addition of 20% lime kiln dust by volume and up to 10% sand by volume; mixing was performed using an excavator. The stabilized material was then loaded into trucks for transport to the on-site disposal area.
Volume Removed:	35,200 cy (OU-1 and OU-2 combined)
Calendar Time:	Began March 1998 and ended February 2001
Time To Implement:	3 years
Total Cost:	OU-1: $16 million; OU-2: $2.5 million
Dredging Cost:	N/A
Disposal of Sediment:	On-site landfill disposal; capping; disposed materials were required to meet specific criteria (e.g., unconfined compressive strength, density/moisture) following placement and prior to cap placement.
Volume of Water:	3,123,500 gallons

Project Name:	***SULLIVAN'S LEDGE***	***ProjectID:*** 01-05
Last Updated:	03/19/03	

Method of Water Treatment:

A treatment system comprising a sand filtration vessel and two carbon units; treated water was discharged to the New Bedford POTW.

Water Discharge Limit:

Air Monitoring During Remediation:

An extensive perimeter air monitoring program was performed from April 6, 1998 through October 2, 2000. Real time air monitoring was performed for VOCs and particulates, along with integrated sampling for PCBs. The required action levels were:

Source: Reference A-942

"VOCs: 10 ppm, with the first alarm being set at 75% of action level, or 7.5 ppm."

"Particulate: 150 ug/m3, with the first alarm being set at 75% of the action level or 112.5 ug/m3."

"In addition, a risk-based average airborne concentration criterion was established for PCBs at 0.6 ug/m3."

Perimeter air monitoring for VOCs was performed only during Phase I activities. The VOC action level was exceeded on 19 separate days and the particulate action level exceeded on 41 separate days.

Water Monitoring During Remediation:

Not performed.

Outcome:

The removal effort resulted in the excavation and on-site disposal of an estimated 35,200 cy of sediment and soil. In all areas of removal, confirmation samples were collected to verify that the target action levels were reached. Sample frequency varied between target areas. In the Unnamed Stream, confirmation samples were collected on 100-ft intervals south of Hathaway Road and at stream station locations north of Hathaway Road. Middle Marsh was divided into 11 separate cells using haul roads. Confirmation sample frequency for Middle Marsh was one sample per 400 linear feet of access road, three samples per interior cell, and one sample per 200 feet of perimeter cell. Where confirmation sample results exceeded target levels, further excavation of the area was typically performed followed by resampling.

Restoration and Post-Monitoring:

Restoration included backfilling the excavated areas of the Unnamed Stream and its tributaries, the two golf course water hazards, and Middle Marsh and Area 4. Backfill material varied depending on the end use of the area being backfilled. The southern channel of the Unnamed Stream (south of Hathaway Road) was completely enclosed within a 72-inch pre-stressed concrete cylinder pipe. Floodplain areas were backfilled with soil borrow and/or embankment materials and covered by the disposal area cap or six inches of topsoil and seed. The Unnamed Stream north of Hathaway Road was backfilled with embankment material, then with 6 inches of a sand gravel mix. The golf course water hazards were backfilled to within one foot of original grade with sand and gravel, followed by one foot of a topsoil/peat borrow mixture (3:1 ratio by volume). Wetland areas were initially shaped with silty sand backfill, then covered with a minimum of 8 inches of wetland topsoil (40 percent silty sand: 60 percent topsoil).

In the Middle Marsh and Area 4, trees, shrubs, and bare root plants were planted and remaining areas were then seeded with a wetland seed mix. The contractor is responsible for inspecting and performing followup maintenance in these areas for a minimum of three years.

Site-Specific Difficulties:

Removal of contaminated sediment from the Unnamed Stream at the bedrock interface sufficiently to meet sediment cleanup criteria was determined impractical following review of initial confirmation sample results. From Reference A-942:

"The results (of the initial round of confirmation samples) indicate that most of the samples are above the sediment cleanup criteria of 20 ug PCB/gram carbon. As discussed on August 4th, the samples were collected after the removal contractor had removed sediment within 2 to 6 inches of bedrock with a 330 excavator equipped with a standard toothed 1 cy bucket. Further sediment removal with that rig is impractical."

"We note that this portion of the Unnamed Stream is being placed in a 72-inch pre-stressed concrete cylinder pipe. As such, stream water will not contact material left in place. The use of an ecologically-based criteria, such as 20 ug PCBs/gram carbon, does not seem appropriate under these circumstances. All of the samples are below the soil clean-up criteria of 10 mg/kg. In addition, it should be noted that the 72-inch pipe is being set on a concrete cradle; the cradle will encapsulate material not removed."

"Based on the above, the oversight contractor made and continues to make the following recommendations:

- That the removal contractor direct its subcontractor to attach a smooth blade to the bucket of its excavator (or the equivalent) and re-excavate to the extent practicable. (Note that complete sediment removal will not be feasible.)

- Following excavation, the removal contractor proceeded with installation of the 72-inch pre-stressed concrete cylinder pipe. Additional sampling is not recommended, as the results are unlikely to be significantly different from the first round."

Monitoring Data References:

- ***Sediment***
- ***Water:***
- ***Fish:***

POTENTIALLY RESPONSIBLE PARTIES

Project Name ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

PRP Name: **PRP INFORMATION NOT RELEASED** ***PRPID:***

Street Address:

City:

State:

KEY CONTACTS

Project Name ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

Last Name: **KEY CONTACT INFORMATION NOT RELEASED** ***Contact ID:***

First Name:

Title:

Company:

Address:

City:

State:

Postal Code:

Work Phone # : ***Other Phone #:***

Fax # :

Email Address:

Project Name ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

Reference Type: A ***ReferenceID:*** 23

Title: ***ROD Decision Summary: Sullivan's Ledge Superfund Site***

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: US EPA Region I

Preparer/Author Address:

Prepared For: General Public

Date Published: June 28, 1989

Key Words and Phrases:

Reference Type: A ***ReferenceID:*** 140

Title: ***EPA Superfund Record of Decision: Sullivan's Ledge, MA, OU-2 (EPA/ROD/R01-91/063)***

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: US EPA Region I

Preparer/Author Address:

Prepared For: General Public

Date Published: September 1991

Key Words and Phrases:

Reference Type: A ***ReferenceID:*** 374

Title: ***Explanation of Significant Differences (for OU-1)***

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: US EPA Region I

Preparer/Author Address:

Prepared For: General Public

Date Published: July 26, 1995

Key Words and Phrases:

Project Name ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

Reference Type: A ***ReferenceID:*** 901

Title: ***Explanation of Significant Differences***

Location: AEM

Category: ROD/Proposed Plan/Action Memo/Decision Document

Prepared by/Author: US EPA Region I

Preparer/Author Address:

Prepared For:

Date Published: September 27, 2000

Key Words and Phrases:

Reference Type: A ***ReferenceID:*** 941

Title: ***Final Remedial Construction Report - Sullivan's Ledge Second Operable Unit***

Location: AEM

Category: Close-Out Report

Prepared by/Author: URS Corporation

Preparer/Author Address: 5 Industrial Way
Salem, NH 03079

Prepared For: AVX Corporation
Myrtle Beach, South Carolina

Date Published: August 13, 2001

Key Words and Phrases:

Reference Type: A ***ReferenceID:*** 942

Title: ***Remedial Construction Report - Sullivan's Ledge Operable Unit 1***

Location: AEM

Category: Close-Out Report

Prepared by/Author: O'Brien & Gere Engineers, Inc.

Preparer/Author Address:

Prepared For:

Date Published: March 2002

Key Words and Phrases:

Project Name ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

Reference Type: B ***ReferenceID:*** 102

Title: ***EPA Decides on Cleanup Decision Based Solely on Ecosystem, Not Health Dangers***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author Address:

Prepared For: Focus

Date Published: December 1991

Key Words and Phrases:

Reference Type: B ***ReferenceID:*** 325

Title: ***Sullivan's Ledge, Massachusetts (EPA ID# MAD980731343)***

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region I

Preparer/Author Address:

Prepared For: General Public

Date Published: April 1, 1998

Key Words and Phrases:

Reference Type: B ***ReferenceID:*** 571

Title: ***EPA Completes Construction of Cleanup Technologies at the Sullivan's Ledge Superfund Site***

Location: AEM

Category: Site Update

Prepared by/Author: US EPA Region I

Preparer/Author Address:

Prepared For: General Public

Date Published: October 15, 2002

Key Words and Phrases:

Project Name ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

ReferenceID: 11

Reference Type: C

Title: ***Construction to begin at Sullivan's Ledge***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author Address:

Prepared For: Superfund Week

Date Published: December 12, 1997

Key Words and Phrases:

ReferenceID: 33

Reference Type: C

Title: ***Sullivan's cap, g.w. cleanup work near***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author Address:

Prepared For: Superfund Week

Date Published: April 25, 1997

Key Words and Phrases:

ReferenceID: 107

Reference Type: C

Title: ***Sullivan's capping, groundwater fix bids near.***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author Address:

Prepared For: Superfund Week

Date Published: August 18, 1995

Key Words and Phrases:

Project Name ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

Reference Type: C ***ReferenceID:*** 233

Title: ***Sullivan's cap, g.w. fix to be bid in fall***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author Address:

Prepared For: Superfund Week

Date Published: May 17, 1996

Key Words and Phrases:

Reference Type: C ***ReferenceID:*** 234

Title: ***Sullivan capping, pump-treat bids near***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author Address:

Prepared For: Superfund Week

Date Published: December 13, 1996

Key Words and Phrases:

Reference Type: C ***ReferenceID:*** 286

Title: ***City of New Bedford May Need Subs For Millions in Work at Sullivan's Ledge***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author Address:

Prepared For: Superfund Week

Date Published: July 17, 1998

Key Words and Phrases:

Project Name ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

Reference Type: C ***ReferenceID:*** 309

Title: ***Sullivan's Ledge May Be Delisted As Technology Construction Ends***

Location: AEM

Category: Site Update

Prepared by/Author:

Preparer/Author Address:

Prepared For: Hazardous Waste/Superfund Week

Date Published: January 1, 2001

Key Words and Phrases:

Reference Type: E ***ReferenceID:*** 84

Title: ***Ecological Exposure Assessment of a PCB-Contaminated Wetland in Massachusetts***

Location: AEM

Category: Risk Assessment

Prepared by/Author: (1) Peter M. Boucher, (2) James T. Maughan Ph.D., and (3) Jane Downing

Preparer/Author Address: (1 and 2) Metcalf & Eddy, Inc.
Wakefield, MA
(3) US EPA Region I
Boston, MA

Prepared For: 1991 Superfund Conference

Date Published: December 1991

Key Words and Phrases:

Reference Type: L ***ReferenceID:*** 16

Title: ***Memo re: Sullivan's Ledge***

Location: AEM

Category: Site Update

Prepared by/Author: AEM, Inc.

Preparer/Author Address: Malvern, PA 19355

Prepared For: Internal file

Date Published: September 26, 1997

Key Words and Phrases:

Project Name ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

ReferenceID: 3

Reference Type:	S
Title:	***U.S. v. Cornell-Dubilier Electronics, Inc. et al. (D. Mass.); U.S. v. Coaters, Inc. et al. (D. Conn.)***
Location:	AEM
Category:	Legal
Prepared by/Author:	US EPA HQ
Preparer/Author Address:	
Prepared For:	Fy 1996 Enforcement and Compliance Assurance Accomplishments Report
Date Published:	May 1997
Key Words and Phrases:	Consent Decree for cost recovery

MODELING

Project Name: ***SULLIVAN'S LEDGE*** ***ProjectID:*** 01-05

Last Updated: 12/16/98

Modeling Performed: Flood flow and flood flow distribution models.

Modeling Objectives: To estimate flood flows and the spatial extent of flooding in Middle Marsh resulting from various design storms: the 1 month storm through the 100-year storm. Determining the extent of flooding in Middle Marsh was an important aspect of developing a meaningful and representative sampling program. The model results were used to identify areas in Middle Marsh that are likely to be inundated with flood flows from the Unnamed stream for various design storms to select sampling locations and to develop maps of areas of varying flood frequency."

Modeling Description: "TR-20 was used to estimate storm flow rates entering Middle Marsh by way of the Unnamed Stream at Hathaway Road for monitored storms and various design storms. The peak storm flow rates were then routed through Middle Marsh using HEC-2, a water surface profile model, to determine flood elevations throughout Middle Marsh."

Company Performing Modeling:

Modeling Status: Complete

Modeling Summary: "The contributing drainage area to the Unnamed Stream at Hathaway Road is approximately 345 acres. Field investigations were conducted to determine watershed characteristics such as land use, flow patterns, stream channel and flood plain characteristics, and presence of flow control structures. Based on information obtained from field investigations and review of plans, the drainage area was divided into four subdrainage areas in order to simulate the routing of flows through upstream reaches of the Unnamed Stream. Required input information such as drainage area size, runoff curve numbers and times of concentration for subdrainage areas were presented. Weighted average runoff curve numbers were determined from existing land uses for hydrologic soil group C and assuming average antecedent soil moisture conditions (II). Times of concentration were determined using the SCS Lag Method, taking into account flow paths through enclosed drainage systems where pertinent."

"The headwaters of the Unnamed Stream start at the outlet of a 60-inch diameter storm drain outfall located south of the SE on and off ramps for Routes 195 and 140. From this point the Unnamed Stream flows through six culverts before discharging to Middle Marsh. It was assumed based on the magnitude and locations of storm flow inputs to the Unnamed Stream and culvert characteristics that storm flows would pass relatively unimpeded through the four upstream culverts, while the twin 48-inch culverts under Hathaway Road and 72-inch culvert, located 60 feet upstream under the car wash driveway, may significantly control the passage of flows to Middle Marsh. To take into account the overall effect of these downstream controls, detailed routing of various flows through these culverts was accomplished using the HEC-2 model. The results of the model were used to develop a rating curve of elevation versus discharge and storage which was then used as input to the TR-20 model as a control structure."

"TR-20 was used to model the routing of flows through the upstream reaches of the Unnamed Stream. A schematic of the TR-20 model was used to predict flows discharging to Middle Marsh."

"Water surface profiles in Middle Marsh were calculated for flows predicted by TR-20 using the HEC-2 model. Required input information for HEC-2 includes cross-sectional data, reach length, and friction or roughness coefficients. The cross-sectional data were based on actual field surveys conducted in Middle Marsh and the golf course along the Unnamed Stream between Hathaway Road and the Conrail railroad embankment. The cross-sections were located at points where hydraulic control structures, such as culverts and weirs exist and where stream channel and floodplain characteristics change appreciably. Roughness coefficients were derived from literature values based on field observations of

channel and floodplain vegetation characteristics."

"As indicated on the final RI, flow monitoring of the Unnamed Stream was conducted at several of the surveyed cross-sections during the rainstorm of April 3-4, 1991. This rain event was a large storm in which 3.17 inches fell and resulted in significant overbank flooding in Middle Marsh. To test the accuracy of the models, observed peak flow levels at the six monitored stations were compared with the water surface elevations predicted by HEC-2. It was found that the simulated values were very close to the observed values, indicating the models are representative of actual conditions."

"The modeling effort was an integral part in understanding the wetland, hydrologic, and habitat functions of Middle Marsh, and in understanding the likely distribution of contamination in Middle Marsh which was not fully addressed in previous studies. The modeling results were primarily used as an aid in designing a "smart" sampling plan that would provide more detail on the most contaminated areas of the wetland rather than expending unneeded effort and funds on relatively uncontaminated areas. It should be noted that the remediation plan for Middle Marsh is based on the PCB sampling data and the ecological risk assessment, and not the results of the hydrologic and hydraulic models."