



## INVESTIGATION AREA H1 RESTORATION TEAM ACCOMPLISHMENTS AT THE FORMER MARE ISLAND NAVAL SHIPYARD, VALLEJO, CALIFORNIA

The environmental restoration team for the former Mare Island Naval Shipyard (MINS) achieved remedy-in-place (RIP) for a complex, 230-acre disposal area (landfill) known as Investigation Area H1 (IA-H1). Achieving RIP was complicated by IA-H1's geology as well as its location in an environmentally sensitive and politically active community. The IA-H1 Restoration Team employed transformational thinking to execute the landfill cap placement with ongoing time-critical removal actions occurring at five other installation restoration (IR) sites at MINS which ultimately resulted in substantial cost savings and avoidance of green house gas emissions. The transformation of a landfill into a recreation area, wildlife refuge and wildlife viewing platform was ultimately the pride of not only the IA-H1 Restoration team, but the contributing community members, regulators and contractors. Specific accomplishments include:

- Successful resolution of numerous remedy and geotechnical challenges encountered during remedy design
- Cost savings of \$42M and avoidance of green house gas (GHG) emissions (>9,000 tons of CO<sub>2</sub>) by consolidation of contaminated soil and debris from onsite and adjacent restoration sites to create the cap
- Incorporation of green remediation techniques in the design and implementation of the landfill cap (such as wetlands surface water replenishment from landfill cap runoff and onsite fuel storage, carpooling and use of local vendors)
- Successful partnering for the protection of the salt marsh harvest mouse, a State and Federally-listed Endangered Species, along with the improvement of 120 acres of existing wetlands and the successful creation of 8.7 acres additional wetlands
- Resolution of stakeholder issues and concerns for eco-receptors including creation of 4 miles of public access trails for wildlife and bay viewing with interpretative panels for public education of the environmental restoration process, local wildlife, and MINS history
- Successful outreach to nearby residences during development and implementation of cap
- Economic generation in the amount of \$20M for small and disadvantaged businesses in a local community which was severely impacted by base closure

### **Installation**

Former MINS, Vallejo, CA  
*Est.: 1854, Closed: 1996*

### **Nominee**

BRAC PMO, Naval Facilities  
Engineering Command  
Headquarters

### **Site Description**

IA H1; 230-acre Waste  
Disposal Area (Landfill)

### **Technology/Method**

Containment Area,  
Soil/Bentonite Slurry Wall,  
Groundwater Extraction,  
Geosynthetics-Soil Cover  
System, Wetland Mitigation

### **Contaminants**

Metals, PCBs, VOCs, PAHs,  
TPH, asbestos, discarded  
military munitions

### **Action Levels**

Human Health: (< 1E-5)  
Eco Risk: HQ = 3 (uplands)  
HQ = 1 (wetlands)

### **Planned Community Reuse**

Open space/Recreation

### **Restoration Team**

#### **Navy BRAC PMO Team**

Ms. Janet Lear  
Ms. Heather Wochnick  
Ms. Brooks Pauly  
Ms. Patricia McFadden  
Mr. Izzat Amadea

#### **Regulatory Lead**

Ms. Janet Naito,  
Department of Toxic  
Substances Control,  
Berkeley, CA

#### **Regulatory Partner**

Ms. Elizabeth Wells,  
San Francisco Regional  
Water Quality Control Board,  
Oakland, CA

#### **RAB Co-Chair**

Ms. Myrna Hayes

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## BRAC PMO NAVFAC and the Former Mare Island Naval Shipyard

The mission of the Department of the Navy (DON) Naval Facilities Engineering Command Base Realignment and Closure Program Management Office (BRAC PMO) is to expeditiously and cost effectively provide the services necessary to realign, close and dispose of DON BRAC properties. Such closures provide cost savings which can be reapplied to support DON and Department of Defense programs. The BRAC PMO prides itself on providing comprehensive environmental restoration and expedited property transfer actions to stimulate economic redevelopment at those installations where for many decades the community hosted the military mission.



Aerial view of the Mare Island Naval Shipyard

Mare Island Naval Shipyard (MINS) is located in Vallejo, California within Solano County in the northeastern portion of the San Francisco Bay area. It is bordered by San Pablo Bay to the west, the Carquinez Strait to the south, and Mare Island Strait (Napa River) to the east. Although originally a natural island, years of land reclamation by the DON through deposition of sediments from maintenance dredging of the Napa River created a peninsula and expanded the size of MINS from approximately 700 acres to over 5,000 acres, of which approximately 1,400 acres are developed.

The population of Vallejo is approximately 116,000 with a median household income of \$61,000. MINS played a major role in the economic development of Vallejo and surrounding communities, and was the largest employer in Vallejo and Solano County. At the height of its operations in 1989, MINS employed 15,000 persons on base, with an additional 12,000 ancillary jobs indirectly supporting the shipyard. 1993 data shows that approximately 83% of MINS employees lived within Solano or Napa counties. In 2008, the City of Vallejo was the first municipality in California history to declare bankruptcy.



IA-H1 Location and Land Subject to State Reversion

MINS was the first United States Naval installation on the West Coast, operating for 142 years from 1854 until its closure in 1996. Its primary mission was to build, maintain, and repair Navy ships and submarines. Over 500 ships were built at MINS, with an additional 1,200 repaired or overhauled. MINS was also home to an ordnance facility located at the southern end of the island that produced and stored munitions from 1857 to 1972. A large portion of MINS is subject to reversionary land interest that must revert to the State of California once the military mission has ceased.

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## Investigation Area H1 Background

Investigation Area H1 (IA-H1), identified in 1983 during the Initial Assessment Study, comprises 230-acres. The Navy managed solid wastes at IA-H1 generated from the base during the early 1940s until 1989. Waste oil was discharged into unlined oil sumps constructed within IA-H1 from the early 1940s until the late 1960s. IA-H1 also contained an industrial wastewater



IA-H1 and Surrounding Wetlands

treatment plant, sanitary sewage treatment plant, demolition debris disposal areas, lead battery disposal areas, and other miscellaneous disposal areas. Approximately 120 acres of the site contains non-tidal wetlands adjacent to or within disposal areas, which includes critical habitat for the Federal- and State-listed endangered salt marsh harvest mouse (SMHM).

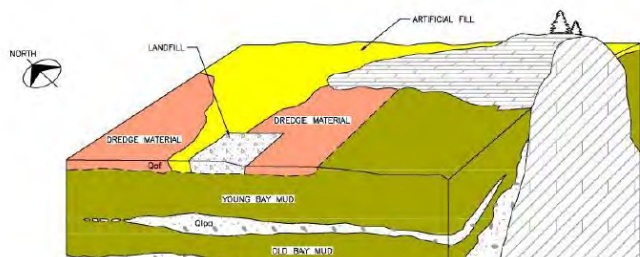
The Remedial Action Plan/Record of Decision/RCRA Closure Plan for IA-H1 was signed in 2006 and remedy-in-place was achieved in late 2010. A subarea of the site, which was most

impacted by historic waste disposal, is called the Containment Area. It is approximately 73 acres and located in the southwest corner of the site. The remedy included hot spot removals, construction of a Resource Conservation and Recovery Act (RCRA) and a non-RCRA multi-layer cap (requiring two different cap designs) over the Containment Area, a slurry wall and groundwater extraction trench around the Containment Area, wetland mitigation and 2-ft soil cover on surrounding areas, long-term monitoring and land use controls. The remedy reduces the risks to humans and the environment from the contaminants of concern (COCs) at the site. Remaining site closure documentation is nearly complete.

## Resolution of IA-H1 Design Challenges

The Team encountered and overcame numerous challenges during investigation and implementation of the IA-H1 environmental restoration. The IA-H1 landfill area is located on former mudflats of San Pablo Bay and required careful evaluation of geotechnical design parameters. The landfill waste materials are underlain by Young Bay Mud, Merritt Sand, and Old Bay Mud. The Young Bay Mud is soft and poses potential issues with settlement and stability of the cover system. Shear strength parameters for the site subsurface soils and import fill materials to be used for the cover system were determined via a combination of in-situ measurements (cone penetrometer testing) and laboratory testing (unconfined and tri-axial shear strength tests). To determine requirements for the landfill cover slope inclinations, drainage channel slopes, and material interfaces, the following evaluations were completed as part of the final design:

- Static global slope stability (circular and block failure surfaces)
- Assessment of seismic parameters



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- Seismic slope stability
- Dynamic deformation
- Veneer slope stability
- Settlement (primary and secondary consolidation)
- Bearing capacity analysis
- Surface water infiltration Surface water control system using 24-hr storm event software
- Erosion loss using Universal Soil Loss Equation (USLE)

### **Geologic Cross-Section IA-H1 Landfill Before Cap**

Rather than follow the typical CERCLA process, where remedial design occurs after the Record of Decision, the IA-H1 Restoration Team engaged the regulators early in the design process to establish the key geotechnical design parameters prior to preparing the remedial design document. This effort streamlined the preparation and approval of the final design.

### **Environmental Sustainability and Cost Savings to the Taxpayer**

Construction of the Containment Area (within the original landfill footprint) allowed similar contaminated materials to be consolidated from H1 (during hot spot removals) and five other Mare Island removal actions under the IA-H1 engineered cap. By using a localized containment area, the DON avoided an estimated 9,000 tons of carbon dioxide (CO<sub>2</sub>) emissions by eliminating trucking contaminated materials to off-site landfills. This practice also saved off-site landfill capacity and reduced risk by limiting the truck miles driven on public roads. In total, over 150,000 cubic yards of contaminated materials within IA-H1 and an additional 265,000 cubic yards from other MINS sites were consolidated within the Containment Area resulting in savings of over \$40M compared with offsite land disposal alternatives. The additional material consolidated from the removal actions outside IA-H1 required a revision to the cap design. All previous calculations for slope stability, settlement and materials analysis were modified and verified by the team and approved by the California Environmental Protection Agency Department of Toxic Substance Control (DTSC). The re-design and approval process was conducted with cooperation from DTSC as a parallel process with cap construction to accelerate the implementation schedule and save taxpayer dollars by not having to re-mobilize the contractor. Additional CO<sub>2</sub> emission savings of approximately 245 tons were realized by testing and using on-island dredge pond soil for the required clean, top two-foot cover instead of importing 250,000 tons of clean fill from off-site locations. The results of the chemical and geophysical testing were reviewed and approved by the DTSC prior to using the dredge pond soil as the engineered cap. This resulted in an additional savings of approximately \$2M.

The IA-H1 Containment Area includes a 7,300 linear foot soil-bentonite slurry wall surrounding it and a groundwater/leachate collection system to eliminate any lateral migration of contamination into the shallow groundwater zone. The cap design provided for gentle slopes of less than 10% to minimize the potential for soil erosion and future maintenance. Native grasses

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were utilized for re-vegetation of cover soil to eliminate the need for irrigation and to enhance habitat value.

The groundwater collection system was designed to utilize electrical line power rather than a fossil fuel-powered generator. The groundwater collection pumps are operated with compressed air and designed to automatically shut off at 120 psig and restart when the line pressure drops to 60 psig. This significantly reduces electricity usage, cost and CO<sub>2</sub> emissions to operate the compressor. An auto-dialer is used to notify personnel if a shutdown of the groundwater collection system occurs. Due to the limits of degraded waste within the landfill, it was determined not to be economically feasible to capture landfill gas and reuse it to power site operations or for commercial resale value. Instead wind turbines were utilized onsite as a safe and effective means to passively vent landfill gas.



Concrete Rip-Rap Surface Water Drainage to Wetlands

Other green remediation techniques implemented during field activities include crushing and re-using 100 tons of concrete as rip-rap to create surface water drainage features and enhance erosion control, in addition to, recycling of construction materials and debris including paper, plastics, and aluminum. On-site fuel storage was utilized to minimize vehicle fueling trips and workers carpooled to the site when practical. A “no- idling” policy was instituted for vehicles and heavy equipment, and local vendors were utilized to the maximum extent feasible to minimize delivery mileage.

### Endangered Species Protection and Partnering with the Regulators

Since the landfill closure in 1989, low-lying areas within the planned footprint of the IA-H1 Containment Area had developed into approximately 7-acres of low-grade wetlands containing pickleweed, which is the preferred habitat of the endangered SMHM (*Reithrodontomys raviventris*). These wetlands jeopardized acceptance of the preferred remedy of containment and capping, which required that the isolated wetlands be backfilled. The IA H1 Restoration Team successfully negotiated with the resource agencies to trap and relocate any recovered SMHM within the isolated wetlands prior to their removal. In addition, the Team negotiated an overall wetland compensatory mitigation ratio of only 1.15:1 (as opposed to 1.5:1) to replace the backfilled wetland area. After four years the 8.7 acres of created wetlands are exceeding the incremental goals for vegetation type and density.



Salt Marsh Harvest Mouse in Pickleweed

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The existing 120 acres of wetlands outside the cap were also preserved during the remedy implementation using stormwater best management practices and designated routes for heavy equipment to avoid the wetlands. The habitat value of the existing wetlands has been improved through a combination of contaminant removal, re-grading and the redirection of clean surface water runoff from the landfill soil cap to the existing and created non-tidal wetland areas. The runoff helps provide adequate hydrology to maintain the target plant species with minimal or no maintenance. In addition to supporting the SMHM, these wetlands are important because they lie along the Pacific Flyway, a major migratory bird pathway, which runs from Alaska to Patagonia.



Improved Wetlands

### Partnering with Stakeholders in a Redeveloping Community

After base closure the DON created two groups to facilitate the base transfer process: the BRAC Clean-up Team (BCT) and the Restoration Advisory Board (RAB). The BCT consists of members of the DON and regulatory agencies such as the DTSC, the Regional Water Quality Control Board (Water Board) and the United States Environmental Protection Agency (EPA). The purpose of the BCT is to streamline communications of technical issues during site remediation and closure. The BCT members are supported by other agencies such as the California Department of Fish and Game (Cal DFG), the United States Fish and Wildlife Service (USFWS) and the California Department of Public Health. The RAB consists of the BCT, the City of Vallejo, and members of the local community with the purpose of facilitating communication on the DON's remediation progress and to be a forum for community concerns and suggestions. The IA-H1 Restoration Team leads both of these forums and routinely presented IA-H1 status updates to the RAB and BCT. A key aspect of the IA-H1 Restoration Team success included engagement with regulatory and community stakeholders to facilitate early and frequent communication and gain acceptance of the DON's preferred remedial alternative to achieve protection of human health and the environment in a cost-effective and timely manner.

The concept of leaving waste in place is a controversial one. While the City and the BCT agreed with the remedy approach, the community was concerned and vocalized their issues through the RAB. After base closure, MINS was made accessible to the general public and ultimately became a popular destination for bird-watchers and others who enjoy the views of San Pablo Bay. Community members were concerned not only that the remedy construction might disturb the natural resources, but also that the final cap configuration would be unsightly and restrict the views of the Bay. The IA H1 Restoration Team used its risk communication strategy, and education of the RAB to turn the community from an adversary of the project into an ally. The San Pablo Bay hiking trail was installed as a requirement of the Final Remedial Action Plan.

IA-H1 now provides the trail head for the hiking trail. The 4-mile public access trail provides views of San Pablo Bay and the wildlife located in the non-tidal wetlands on the western side of

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MINS. The walking trail allows public viewing access from a protected and maintained area while reducing the public desire to go off trail. This has the dual benefit of increasing safety for human health and reducing risk of disturbance to the natural resources located with the non-tidal wetlands and former dredge ponds. The IA-H1 Restoration Team collaborated on interpretive panels that have been placed along the trail to educate the public on sensitive natural resources, potential munitions explosive hazards and MINS military history. Hikes on the trail are now a feature of annual MINS events like the Flyway Festival and the Mare Faire. The trail has been highlighted at these events as a new community jewel.

Additionally, the clean-up action was performed within half a mile of nearby residential redevelopment. This close proximity required careful execution of construction activities to minimize noise, dust emissions, or off-site migration of contaminants. Through consistent outreach to local residents using the RAB and close monitoring of field execution, no complaints were registered by the local residents.

### Small and local businesses benefitted from the remedy implementation

To maximize small business (SB) and small disadvantaged business (SDB) subcontracting opportunities several sources were used over the course of executing the remedial program at IA-H1. The DON acquired small business services through the DoD's Central Contractor Registration (CCR) website, Dynamic Small Business Search, Vallejo Chamber of Commerce, and the prime contractor's internal database of prequalified SB and SDBs. SBs and SDBs performed analytical services; surveying; drilling/soil boring; equipment rentals, material suppliers; electrical and mechanical services; import fill hauling; transportation and disposal services over the course of the project. Approximately two-thirds of subcontracted dollars were spent within a 50-mile radius of the site (a total of almost \$20 million), with the largest share of procured goods and services spent within Vallejo and the immediate vicinity.



\$20M Spent in Vallejo Community

### Additional IA-H1 Restoration Team Accomplishments

- Team Lead Remedial Project Manager received the BRAC/NAVFAC SW DRUM-E award for 2010 for work conducted on Mare Island
- The IA H-1 Contractor, Weston Solutions, Inc., has worked more than 280,000 hours on MINS with no recordable safety incidents and received multiple safety STAR awards for their fieldwork