



## INTRODUCTION

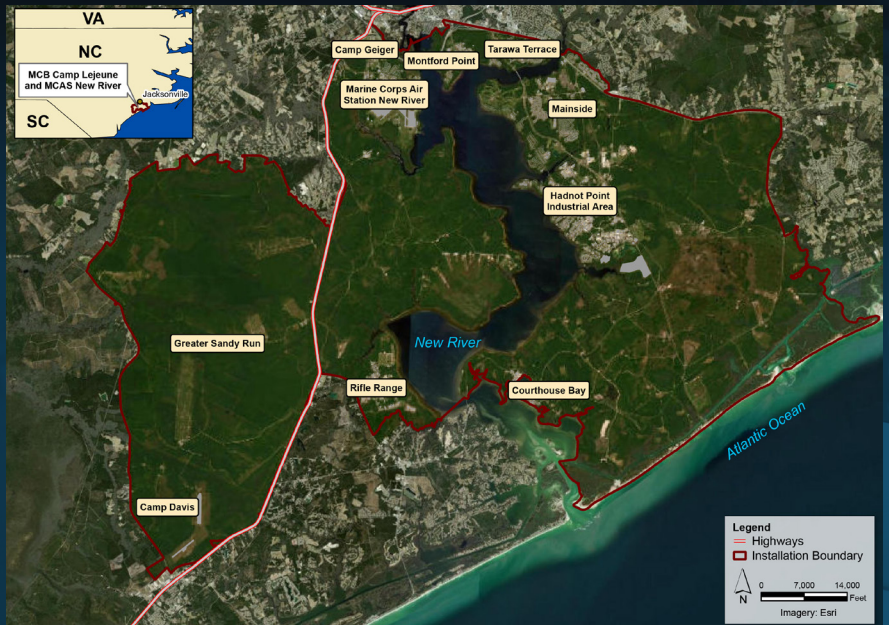
Marine Corps Base (MCB) Camp Lejeune was commissioned in 1941 with a mission that still holds true to this day: to maintain combat-ready warfighters for expeditionary deployment. MCB Camp Lejeune is a training base that promotes combat readiness of the operating forces and missions of other tenant commands by providing training venues, facilities, services, and support in order to be responsive to the needs of Marines, Sailors, and their families.

### ENVIRONMENTAL, GEOGRAPHICAL, AND REGIONAL SETTING

MCB Camp Lejeune covers more than 156,000 acres in the Atlantic coastal plain of southeastern North Carolina in Onslow County, adjacent to the City of Jacksonville. The Base consists of a diverse environmental setting including approximately 72,000 acres of upland forests, 49,000 acres of wetlands, 26,000 acres of water, and 7,500 acres of urban/developed land with elevations ranging from sea level to 70 feet above mean sea level. The Base boundary includes approximately 14 miles of beach along the Atlantic Ocean. Beach frontage consists of a barrier island system and is separated from the mainland by salt marshes, small bays, and the Atlantic Intracoastal Waterway. Several large, publicly owned tracts of land, including Croatan National Forest, Hoffman Forest, and Hammocks Beach State Park, are located within 15 miles of the Base. The remaining surrounding land uses are a mix of urban, suburban, small town, and agricultural, as Onslow County has grown and developed with MCB Camp Lejeune. Estuaries along the coast support commercial fishing, recreation, and tourism, and residential resort areas along the coast are important to the regional economy.

### COMMUNITY SETTING

MCB Camp Lejeune and the surrounding community are home to a large concentration of Marines and Sailors, with an active duty, dependent, retiree, and civilian employee population of approximately 120,000 people. MCB Camp Lejeune enjoys a close relationship with the Base community and neighboring civilian communities. Neighboring communities, cities, and towns include the City of Jacksonville, Verona, Holly Ridge, North Topsail Beach, Surf City, Piney Green, Sneads Ferry, and Swansboro.



MCB Camp Lejeune

## BACKGROUND

Historical operations, storage, and disposal practices at MCB Camp Lejeune resulted in environmental impacts to soil and groundwater. As a result, MCB Camp Lejeune has been actively engaged in environmental investigations and remediation programs since 1981. In 1989, the United States Environmental Protection Agency (USEPA) placed MCB Camp Lejeune on the National Priorities List (NPL). MCB Camp Lejeune is a leading Department of War (DoW) installation, operating at the forefront of environmental restoration programs. By maintaining collaborative relationships with regulatory agencies and the supportive local community, the team has made tremendous progress in investigating and cleaning up over 500 sites to-date under several environmental programs; including Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) that covers the Installation Restoration Program (IRP) and Military Munitions Response Program (MMRP), Resource, Conservation, and Recovery Act (RCRA), and the Underground Storage Tank (UST) program; with a goal to ensure continued protection of those living and working aboard MCB Camp Lejeune.

### ORGANIZATION, STAFFING, AND MANAGEMENT APPROACH

Base Environmental Management Division (EMD) leads the environmental compliance and restoration programs to manage 58 active sites. The Base is supported by technical, acquisition, and legal professionals across the Naval Facilities



Engineering Systems Command (NAVFAC) organization. Experienced Partnering Teams for the CERCLA (formed in the 1990s) and for the UST programs consist of representatives of MCB Camp Lejeune, NAVFAC, North Carolina Department of Environmental Quality (NCDEQ), and/or USEPA. The teams meet quarterly and are supported by multiple environmental consulting firms supporting the environmental investigations and cleanup process. By bringing these key parties together in regular, structured meetings to discuss and resolve issues, the Partnering Team promotes trust and cooperation that enables the remediation process to move forward more quickly than possible under traditional procedures.

During this achievement period, the team installed over 165 monitoring wells, collected over 2,000 environmental samples (soil, groundwater, surface water, sediment, pore water, sewer vapor, soil gas, indoor air, outdoor air), conducted munitions surface clearance over 50 acres, managed over 4,200 acres of land use controls, and maintained and monitored two vapor intrusion mitigation systems. Pilot studies and treatment remedies were conducted to expedite site cleanup. This resulted in treating over 256 million gallons of water through the groundwater extraction and treatment system at Site 82, treating over 200,000 gallons of water in the Site 93 subgrade biogeochemical reactor, operating the air sparging systems at Sites 35 (16,600 hours) and 89 (13,400 hours), injecting approximately 95,100 gallons of potassium permanganate and 2.6 million gallons of recirculation water in Zone 2 at Site 88, and injecting approximately 132,000 gallons of an emulsified vegetable oil solution in the biobarrier in Zone 3 at Site 88.

The team’s key successes under the CERCLA program during Fiscal Years 2024 and 2025 were:

- Planning for per- and polyfluoroalkyl substances (PFAS) Remedial Investigations, completing work plan documents for 10 sites and initiating field work. Through onsite treatment of nearly 7,750 gallons of PFAS-impacted aqueous waste generated during investigation, more than \$35,000 in cost avoidance has been realized.
- Reducing Volatile Organic Compound (VOC) concentrations in groundwater, allowing for two vapor intrusion mitigation systems to be changed from active to passive operation.

- Advancing six sites/projects through CERCLA phases, as documented by the finalization of the Basewide Preliminary Assessment for General Radioactive Material, the Site 96 Remedial Action Completion Report, the Site 9 VOC Site Inspection Report, the Site Unexploded Ordnance (UXO)-28 Feasibility Study, the Site UXO-29 Feasibility Study, and the Site UXO-30 Record of Decision (ROD).
- Finalizing the sixth Five Year Review, evaluating remedies at each Operating unit (OU) to determine whether they remain protective of human health and the environment in accordance with the requirements set forth in their RODs, and identifying issues that may prevent a particular remedy from functioning as designed. As a follow-up to issues identified during previous Five-Year Reviews, regulatory agencies evaluated remediation alternatives for Site 78 and established site-specific active remediation goals to optimize the preferred alternatives to balance capital cost and remediation time frame.
- Gaining team consensus on the abandonment of 58 monitoring wells no longer necessary for site investigations or long-term monitoring, reducing the Navy’s liability.
- Providing electronic tools annually to facilitate the Marine Corps and Navy’s management of environmental sites, including Geographic Information System (GIS) updates (environmental restoration site boundaries, munitions response site boundaries, contamination layers, sample locations, land use control boundaries, remediation features, and sensitive layers) and a comprehensive monitoring well database.

The team also made significant progress under the UST program including:

- Achieving final No Further Action from the North Carolina Department of Environmental Quality for four petroleum remediation sites (G-920, 1340 Transformer Release, 1711 Waste Oil Release, and Building 2603 Petroleum Release).
- Responding to six emergent sites (641, 2602, AS-146, AS-4208, HP-119, SAS-3503 Oil Water Separator).
- Removing five USTs at former gas station Building 1232 and conducted follow on groundwater sampling in support of petition for clean closure of the site.



- Excavating and disposing of approximately 88.22 tons of petroleum impacted soil (641, 1111, AS-146, AS-4208, FC-66, HP-119) in support of emergent sites and POL remediation.
- Continuing the reporting effort summarizing assessments at 26 historical UST removal sites to ensure no soil or groundwater impacts remain.
- Requesting No Further Action with Land Use Restrictions at Gottschalk Marina, which had an active remediation system resulting in cost-saving shut down of the system.
- Worked to improve land use restriction management by inspecting sites and documenting annually.
- The UST program supported operation of six remediation systems and continued addressing PFAS, including effluent treatment at sites AS-4141 and the Rapid Refueler, as well as groundwater sampling of remediation system effluent for PFAS, where applicable.
- Treating approximately 82,397 gallons of PFAS-impacted water at the PFAS water treatment facility located at AS-4141 to remove PFAS to below permitted levels prior to charging.
- Resurveying groundwater monitoring wells at five Environmental Restoration Navy sites (Rapid Refueler, Hadnot Point Fuel Farm, 820, TC-341, and PPV) to ensure data integrity, as well as improve the accuracy of long-term site management and decision-making tools.

**COMMUNITY AND STAKEHOLDER INVOLVEMENT**

The Base provides information regarding investigation and cleanup efforts to the public through the community relations program which includes a Community Involvement Plan, Restoration Advisory Board (RAB) (<https://www.lejeune.marines.mil/Offices-Staff/Environmental-Mgmt/Restoration-Advisory-Board/>), public meetings, Administrative Record (<https://go.usa.gov/xSdBH>), Information Repository file at the Onslow County Library, and public announcements. The first Community Involvement Plan was prepared for Camp Lejeune in 1990, following the Base’s inclusion on the NPL, and is updated every five years (with the last update initiated during the current achievement period).

The RAB was established in 1995, and meetings are held quarterly, are open to the public, and provide an information exchange among community members and the Partnering Team.

To maintain communication with stakeholders, the Base published success stories on digital media addressing timely topics such as PFAS investigations, the UXO-30 Proposed Plan and public meeting, land use control management, the remedy implementation at Site 88, and the commitment to innovative technologies.

**ENVIRONMENTAL RESTORATION AGREEMENTS AND PLANS**

This timeline shows the key environmental restoration agreements, dates of their preparation, and last revision.

**RELEVANT ENVIRONMENTAL RESTORATION DOCUMENTS**

The MCB Camp Lejeune team has been developing the investigation and remediation strategies for the IRP, MMRP, and RCRA Programs, working to develop solutions that support the mission of the Marine Corps, while meeting Navy metrics and regulatory requirements. During Fiscal Years 2024 and 2025, 75 work plans and reports were approved by the regulatory agencies and finalized and included the key tabulated documents.

- ★ 1984 RCRA Permit Issued
- ★ 1989 NPL
- ★ 1990 First Community Involvement Plan (CIP)
- ★ 1991 Federal Facility Agreement
- ★ 1992 First Site Management Plan (SMP)
- ★ 1999 First Five-Year Review
- ★ 2020 Latest CIP
- ★ 2020 Latest RCRA Permit Update Submitted
- ★ 2025 Latest Five-Year Review
- ★ 2025 Latest SMP

**Environmental Restoration Work Plans and Reports – Fiscal Years 2024–2025**

Program Management Documents and Schedules	6
Proposed Plans, Decision Documents, RODs, and post-ROD Documents	2
Long-Term Monitoring and Pilot Study Work Plans and Reports	30
Installation Restoration Program Investigations and Reports	13
Munitions Response Program Investigations and Reports	7
Emerging Contaminants	16
RCRA	1
<b>TOTAL</b>	<b>75</b>



## SUMMARY OF ACCOMPLISHMENTS

### ACCELERATED ENVIRONMENTAL CLEANUP:

Site 88 is the former dry-cleaning facility that operated from the 1970s to the mid-1980s. Tetrachloroethene (PCE) was released to the environment via an aboveground storage tank and migrated across the site through a compromised sewer line, resulting in a 51-acre groundwater plume. Because of distinct nature and extent, and hydrogeology variations along its flow pathway, the plume was divided into three treatment zones: 1) Zone 1, the initial source area, with relatively shallow impacts; 2) Zone 2, the downgradient plume, with impacts extending from 40 to 180 feet belowground surface (bgs); and 3) Zone 3, the distal plume end, with impacts between 40 and 60 ft bgs.

Dense non-aqueous phase liquid (DNAPL) was addressed by a soil mixing removal action in Zone 1; however, contaminant of concern (COC) concentrations in Zone 2 nearing 100 milligrams per liter suggested that DNAPL had migrated downgradient and reached the bottom of Zone 2. Enhanced reductive dechlorination was selected for Zones 1 and 3 to remediate lesser COC concentrations in groundwater. In situ chemical oxidation (ISCO) was selected for Zone 2, following multiple pilot studies that demonstrated its effectiveness for the DNAPL-level concentrations observed in this area. Active remediation goals (ARGs) were established to clearly define the transition between active treatment and monitored natural attenuation (MNA).

ISCO is being implemented in Zone 2 through injection and recirculation of sodium permanganate via ten vertically-nested horizontal directionally drilled (HDD) wells (ranging from 750 to 975 feet long) and eight vertical extraction wells set from 101 to 111 feet bgs. The innovative use of the ten HDD injection wells coupled with groundwater recirculation maximized the permanganate distribution while significantly minimizing the infrastructure as compared to a conventional vertical injection approach. The first round of injection and recirculation was conducted between May 2021 and June 2022. Approximately 1,872,000 pounds of sodium permanganate (4,404,100 gallons at a 2 percent weight solution) were injected via the HDD, then approximately 23,698,000 gallons of water, comprising extracted groundwater and supplemental potable water, were recirculated through the injection wells.

Performance monitoring results indicate that treatment is occurring as the total molar VOC concentration within the ISCO treatment zone has decreased by 87 percent since baseline. Since COC concentrations remain greater than ARGs, a second round of sodium permanganate injection and recirculation was initiated in FY 2025, during which approximately 95,100 gallons of potassium permanganate and 2.6 million gallons of recirculation water were injected into six of the ten injection wells (with the remainder falling outside of this achievement period).

Based on ERD and ISCO progress to date, it is expected that active remediation may be completed within 10 years of remedial action initiation allowing the Navy to shift to a cost-effective long-term monitoring program while remaining protective of base personnel.



**Site 88 Zone 2 potassium permanganate injection layout, including tanks to store permanganate solution and recirculation water and distribution piping connecting to the well heads.**

The Off-Base Surface Danger Zones (SDZs) were jointly used by MCB Camp Lejeune for artillery and airborne strafing and Marine Corps Air Station Cherry Point for rocket firing and bombing since 1945. Munitions used would have included small arms ammunition, aircraft rockets, mortars, projectiles, practice bombs, and up to 500-pound high-explosive bombs. Previous investigations within the site have identified and removed aircraft rocket warheads, aircraft illumination flares, 20mm projectile cartridges, and practice bombs. Therefore, it was established that the Off-Base SDZs may contain additional munitions and explosives of concern (MEC) due to historical training, and therefore, the area required additional investigation.



Because the Off-Base SDZs is difficult to access, conventional digital geophysical mapping (DGM) methods were considered logistically impractical, costly, and presented an explosives health and safety concern to field personnel. Therefore, the Navy developed an approach to conduct DGM within the remote area using an Inspired Flight (IF) 1200A drone tethered with a MagArrow II magnetometer to identify terrestrial and underwater metallic anomalies within the study area. This innovative method aligns with Executive Orders 14305 (Restoring American Airspace Sovereignty) and 14307 (Unleashing American Drone Dominance). The project also utilized another American-made drone (Skydio X10D) to monitor the primary drone and identify flight path hazards, such as flocks of birds and downed trees, as well as minimize potential incursions with local sightseers and commercial fisherman within the investigation area.

The IF1200A drone flew along transects and within total coverage grids at a speed of approximately 2 meters/second with the magnetometer at an altitude of approximately 1 meter above the ground or water surface using an onboard radar altimeter and a high-accuracy positional system. To ensure data quality, a geophysical system verification approach was applied, using twice-daily surveys of instrument verification strips and the placement of known metallic items within the study area.

Outside of technology demonstrations, aerial drone DGM for MR had not been previously utilized within this type of coastal environment or at this scale. Challenges encountered during the field effort included: troubleshooting components necessary to safely fly and map this dynamic environment; daily sediment deposition and erosion changes, making boat access difficult; sudden thunderstorms; significant intraday variations in wind speed and direction affecting flight conditions; and a hurricane that reshaped part of the site landscape.

This innovative solution allowed for a more efficient and safe execution of a remotely operated data collection mission and significantly reduced both costs and the potential for encountering MEC by field personnel compared to a traditional geophysical approach. Findings from the aerial DGM study will be used to identify and remove potential MEC and assess the explosive hazards within the Off-Base SDZs.



With the aerial drone in the distance, the pilot and geophysicist work from an established command center with real-time feedback to track progress.



The aerial drone equipped with a magnetometer to identify subsurface anomalies in an inaccessible area.

### PARTNERSHIPS ADDRESSING ENVIRONMENTAL RESTORATION ISSUES BETWEEN DOW AND OTHER ENTITIES

The Navy and Marine Corps, in partnership with EPA Region 4 and the NCDEQ, successfully completed the sixth CERCLA Five-Year Review (FYR). This review covered 23 OUs across 33 sites and evaluated remedies ranging from active treatment—such as groundwater extraction and treatment, in-situ bioremediation, and air sparging—to monitoring and land use controls. These actions addressed



contaminants in groundwater and soil, waste-in-place, and munitions. Additionally, investigations for PFAS are underway at 11 of the reviewed sites.

The Partnering Team’s long-standing history of collaboration and consensus-building during previous FYRs fostered trust and cooperation, which proved critical when navigating complex and evolving approaches to incorporating PFAS into the review process. By working closely with EPA and NCDEQ, the Navy avoided conflicting independent findings that could have undermined protectiveness determinations. The team ensured alignment with CERCLA processes and Navy/EPA guidance, delivering consistent and transparent protectiveness statements to the public. Furthermore, the Navy reaffirmed its commitment to advancing PFAS investigations, reinforcing stakeholder confidence.

**TANGIBLE RESULTS:**

- Achieved consensus among Navy, EPA, and NCDEQ on protectiveness statements for all 23 OUs.
- Documented outcomes: 15 OUs determined protective, 1 OU classified as “will be protective,” and 7 OUs with protectiveness deferred pending PFAS investigation results.
- Strengthened interagency collaboration, reducing potential delays and costs associated with conflicting determinations.
- Accelerated PFAS investigation efforts, positioning the Navy as a leader in addressing emerging contaminants.

This collaborative effort demonstrates how strategic partnerships can enhance effectiveness, reduce costs, and accelerate environmental restoration while addressing complex challenges such as PFAS contamination.

**REDUCING RISK TO HUMAN HEALTH AND THE ENVIRONMENT**

The MCB Camp Lejeune IR Partnering Team has worked together to efficiently conduct a Preliminary Assessment (PA) throughout MCB Camp Lejeune and MCAS New River. General Radioactive Materials (G-RAM) are present on Navy bases because military aircraft, ships, and equipment historically incorporated radioactive components, such as radioluminescent paints for gauges and controls, self-luminous markers, electron tubes, and counterweights, and has potential to be a contributor to cancer risks and environmental contamination. The PA aims to evaluate the potential for G-RAM and determine whether further action is warranted for the identified areas. In order to determine areas with potential for G-RAM, the Team conducted a thorough data review of available documents from the national archives, environmental restoration and navy program records, environmental data resources reports, and aerial photographs pertaining to the radiological and land use history of all Environmental Restoration, Navy (ER,N)-eligible areas at the Base. The Team also conducted interviews with site personnel and performed site reconnaissance to fill data gaps from the data review and identify evidence of G-RAM releases, current site conditions, and migration pathways.



The MCB Camp Lejeune IR Partnering Team, from left to right: Jennifer Tufts, Laarni Cooper, Laura Spung, Genevieve Ritter, Monica Fulkerson, Dan Hocket, Thomas Richard, Beth Hartzell, Kim Henderson, Ben Francisco, Joshua Hanks, Dylan Elks, and Matt Louth



The PA was completed in FY 2025; 450 areas at the Base were reviewed and 36 areas were identified with the potential for G-RAM. The PA identified radionuclides of potential concern (ROPC) at each of the 36 areas with potential for G-RAM and determined site media in which ROPCs would be present, including site soils and groundwater.

Of the 36 areas, the PA recommended 35 areas proceed to a Site Inspection (SI) to further evaluate the possible presence of G-RAM and one area proceed to a Remedial Investigation (RI) based on the previous identification of G-RAM at the site. The potential for human and ecological exposure to radioactive material will be assessed through the SI process as a result of this assessment. The UFP-SAP for the SI is currently being developed.



Back side of a dial classified as a G-RAM commodity found at Site 82.

*ELECTRICAL CONDUCTIVITY/HYDRAULIC PROFILING TOOL INVESTIGATION AT MCB CAMP LEJEUNE AND MCAS NEW RIVER*

An Electrical Conductivity/Hydrologic Profiling Tool (EC/HPT) investigation was conducted as part of remedial investigations for PFAS at MCB Camp Lejeune's and MCAS New River's Sites 9, 36, 43, 78, 86, 112, 113, 114, 115, 116, and 117. The purpose of this investigation was to better understand groundwater fate and transport mechanisms and to identify the optimal depth interval for well screens and isolation casings during the installation of groundwater monitoring wells within the Castle Hayne aquifer.

At each investigation location, qualified hydrogeological technicians advanced an EC/HPT probe to collect continuous data on formation permeability and lithology. The EC readings serve as a proxy for grain size, providing additional resolution of subsurface lithology, while the HPT component measures the pressure required to inject water into the surrounding soils, where lower pressure responses indicate more permeable intervals, and higher pressures reflect lower permeability intervals.

The site characterization information gathered from the EC/HPT logging allows for precise placement of surficial isolation casings into low permeability zones, preventing the possibility of chemicals in the upper aquifers migrating to lower aquifers during drilling. Results from this EC/HPT log will also be used in the development of potential remedial alternatives in the Feasibility Study phase of work and again during the Remedial Design to mitigate potential risks from exposure to PFAS.



EC/HPT probes were advanced using direct push technology drilling techniques to collect continuous data on formation permeability and lithology.