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MCAS CHERRY POINT
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Proposed Plan

Operable Unit 14, Site 90

Marine Corps Air Station
Cherry Point, North Carolina

April 2009

1 Introduction

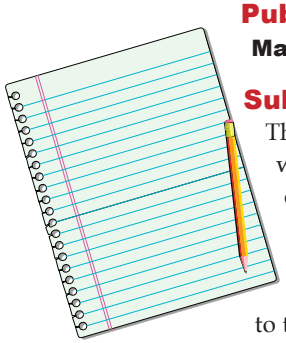
This **Proposed Plan** identifies the **Preferred Alternative** and provides the rationale for addressing environmental contamination in **groundwater** at **Operable Unit** 14 (OU14), Site 90 at Marine Corps Air Station (MCAS) Cherry Point. The Preferred Alternative is **Monitored Natural Attenuation (MNA)** and **Land Use Controls (LUCs)** for groundwater.

This document is issued by the U.S. Department of the Navy (Navy) [i.e., Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic and the MCAS Cherry Point Environmental Affairs Department (EAD)] and the **U.S. Environmental Protection Agency (USEPA)** Region 4, in consultation with the **North Carolina Department of Environment and Natural Resources (NCDENR)**. The Proposed Plan is submitted in order to fulfill the public participation requirements in Section 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)** and in Section 300.430(f)(2) of the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**.

The Navy and USEPA, in consultation with NCDENR, will make the final decision on the remedial approach for OU14, Site 90 after reviewing and considering all information submitted during the 45-day **public comment period**. Based on new information or public comments, the Preferred Alternative may be modified or another **remedial action** selected. Therefore, public comment on all of the alternatives presented is invited and encouraged. Information on how to participate in this decision-making process is presented in Section 10.

This Proposed Plan summarizes information that can be found in greater detail in the **Remedial Investigation (RI)** Report (December 2008), the **Feasibility Study (FS)** Report (April 2009), and other documents contained in the **Administrative Record** and Information Repository for MCAS Cherry Point (see Section 10 for access information). A glossary of key terms used in this document is attached; these key terms are identified in bold print the first time they appear.

Mark Your Calendar for the Public Comment Period



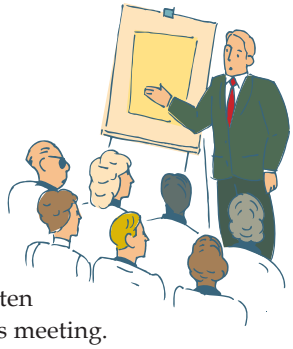
Public Comment Period
May 1 - June 15, 2009

Submit Written Comments
The Navy, USEPA, and NCDENR will accept written comments on the Proposed Plan during the public comment period. To submit comments or obtain further information, please refer to the insert page.

Attend the Public Meeting
May 21, 2009 at 6:00 p.m.

Haverlock Tourist and Event center
201 Tourist Center Drive
Haverlock, NC 28532

The Navy will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Feasibility Study. Verbal and written comments will also be accepted at this meeting.



Location of Information Repository

MCAS Cherry Point ERP Public web site: http://public.lantops-ir.org/sites/public/cherrypoint/; "Admin Records" link.
Havelock-Craven County Library
301 Cunningham Blvd
Havelock, NC 28532
Phone 252-447-7509

2 Site Background

2.1 Site Description and Background

MCAS Cherry Point is a 13,164-acre military installation located in southeastern Craven County, North Carolina, just north of the town of Havelock. The Air Station is bounded to the north by the Neuse River, to the east by Hancock Creek, to the south by North Carolina Highway 101, and by an irregular boundary approximately ¾-mile west of Slocum Creek (Figure 1). Commissioned in 1942, the mission of MCAS Cherry Point is to maintain and support facilities, services, and material of a Marine Aircraft Wing. The Air Station has facilities for training and support of the Fleet Marine Force Atlantic aviation units, and is designated as a primary aviation supply point. Surrounding areas include primarily commercial and residential development and public land (Croatan National Forest). In 1994, MCAS Cherry Point was placed on USEPA's **National Priorities List (NPL),** established under CERCLA §105(a) for sites contaminated by releases of hazardous substances.

OU14 is located in the west-central portion of the MCAS Cherry Point flight-line complex (Figure 1), and consists of a broad expanse of concrete tarmac, buildings, taxiways, and some grassy areas adjacent to Runway 14L (Figure 2). The portion of OU14 including and surrounding Building 130 is designated under the Navy's **Environmental Restoration Program (ERP)** as Site 90. Building 130 is a large aircraft hangar containing two large aircraft bays, storage rooms, and administrative offices. From Building 130, OU14 extends approximately 5,000 feet north-northwest to an unnamed stream adjacent to Runway 14L.

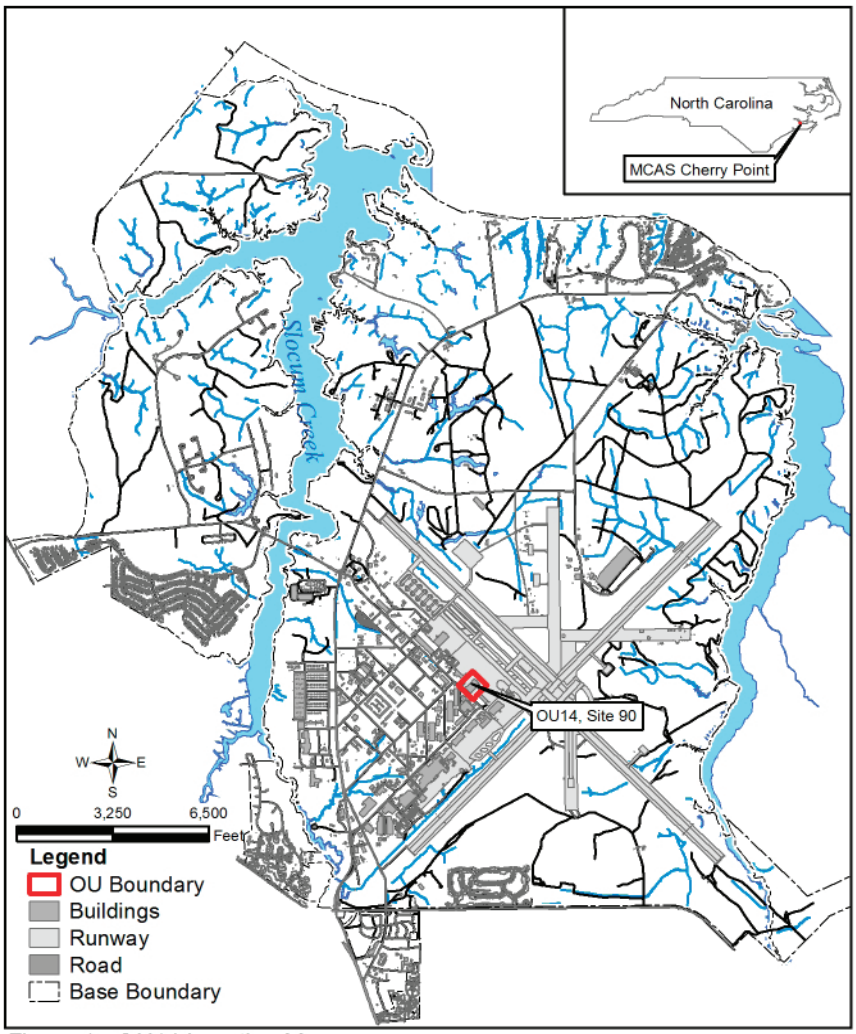


Figure 1 - OU14 Location Map

The Site 90 designation originated from the discovery in 2000 of **chlorinated volatile organic compound (CVOC)** contamination in groundwater near Building 130 during an investigation of the adjacent Operable Unit 1 (OU1), located a short distance to the southwest. Because of this discovery, a new ERP site (Site 90, Building 130 VOC-Contaminated Groundwater) was defined and assigned to a new operable unit designation, OU14.

There is no known documentation concerning the disposal, spill, or release of CVOCs at OU14. Potential historical release mechanisms for CVOCs at OU14 include infiltration through pavement cracks and leaks from drains, stormwater pipes, and industrial sewer pipes in and around aircraft maintenance and storage facilities. There are no known continuing sources of CVOC contamination. Based on evaluations performed during the RI, the most likely former CVOC source areas at OU14 include the following (see Figure 2 for locations):

1. Building 130 area (specifically the Building 130 Wash Rack)
2. The C-130 Wash Rack
3. Building 4075 area (which includes a former waste solvent underground storage tank [UST], a hazardous waste aboveground storage tank [AST], and a wash rack)
4. Former Refueling Station near Building 4495

The Building 130 Wash Rack is constructed of concrete and located on the southeast side of the building. It has been used to wash aircraft and related equipment since the early 1940s, and is currently used to flush aircraft fuel drop tanks with water. Rinse water at the wash rack drains to a diversionary catch basin (located near Sixth Avenue) that is connected to the industrial sewer system, which further drains to the Air Station's Industrial Wastewater Treatment Plant (IWTP). Portions of the industrial sewer system were reportedly constructed of clay pipe, which can crack and break with age. As a result, it is possible that solvents in rinse water from historical

practices at OU14 wash racks could have been released to the subsurface through leaking sewer pipes. The Air Station has continued to repair or upgrade older sections of the industrial sewer system.

Petroleum-related contamination in soil and groundwater associated with USTs and pipelines is widespread across OU14, but is not within the jurisdiction of the ERP. Instead, petroleum-related contamination is being addressed under the MCAS Cherry Point UST Program. Site features associated with UST Program investigations in the vicinity of OU14 are discussed briefly here because petroleum-related contamination is commingled with CVOC groundwater contamination across much of OU14. As will be discussed in Section 3, the presence of petroleum-related compounds likely facilitates the degradation of the CVOC contamination. In addition, UST Program remediation activities targeted at petroleum-related contamination are also reducing CVOC concentrations.

Most of the petroleum-related contamination at OU14 is associated with an extensive network of abandoned underground fuel pipelines consisting of several miles of piping connecting Tank Farm A to various buildings and aircraft refueling stations throughout OU14 (Figure 2). Several former USTs in the OU14 area represent other potential sources of petroleum-related contamination.

2.2 Summary of Previous Investigations

Several environmental investigations have been conducted at OU14, beginning in 1994. The following subsections briefly summarize the purpose and scope of investigations completed to date.

BRAC and UST Program Investigations (1994-2000)

Several soil and groundwater investigations were performed in and around OU14 in support of **Base Realignment and Closure (BRAC)** construction activities as well as for the MCAS Cherry Point UST Program.

A BRAC preconstruction sampling effort in 1994 revealed petroleum contamination in soil and groundwater in the vicinity of Building 130. No CVOCs were detected. The soil and groundwater data were used to perform a quantitative **human health risk assessment (HHRA)** for site workers. No unacceptable risks for exposure to these contaminants were identified.

UST Program investigations of the underground fuel lines throughout OU14 in 1995 and 1996 indicated the presence of petroleum-related contamination in soil and groundwater, as well as free-phase petroleum (also called **free product**) floating on the water table in some areas. CVOCs were also detected in groundwater in the vicinity

Figure 2 - OU14 Site Features

of the Building 130 Wash Rack and adjacent Building 3745. A Corrective Action Plan (CAP) was developed for the petroleum-related soil and groundwater contamination and free product near Building 130. The proposed remedial actions included automated free product recovery and remediation of petroleum-contaminated groundwater and soil using an **air sparge (AS)** and **soil vapor extraction (SVE)** system. The CAP also proposed a remedy of MNA for petroleum contaminants beyond the treatment areas. The remediation systems were installed in 2001 and the CAP activities are ongoing under the UST Program.

OU1 Remedial Investigation (TetraTech NUS, 2002)

In 2000, groundwater samples were collected within what is now OU14 as part of the RI for the adjacent Operable Unit 1 (OU1). The samples revealed the presence of CVOCs in groundwater near the Building 130 Wash Rack, which was thought to be unrelated to site activities in OU1. Subsequently, Building 130 and vicinity were designated as OU14, Site 90 and the OU14 RI was initiated in 2001.

OU14 Remedial Investigation (CH2M HILL, December 2008)

The majority of OU14 RI field activities were completed in three phases between 2002 and 2006. The objective of Phase I of the OU14 RI was to determine the preliminary extent of CVOC contamination in groundwater and soil using **direct-push technology (DPT)** sampling. During Phase I, a number of DPT groundwater samples were collected around and downgradient of Building 130 and analyzed for **volatile organic compounds (VOCs)**. Soil cores were also collected from the **unsaturated zone** and field-screened for the presence of VOCs and inspected visually for any indications of contamination such as staining. Elevated field screening readings and/or visual inspection indicated possible soil contamination at several locations. As a result, soil samples were collected from these locations and analyzed for VOCs.

The Phase I data indicated that CVOC groundwater contamination extended further downgradient (north-northwest) from Building 130 than anticipated. CVOCs detected in excess of regulatory standards included dichloroethanes (DCAs), dichlorethenes (DCEs), trichloroethene (TCE), and vinyl chloride (VC). A number of petroleum-related contaminants were also detected in excess of regulatory standards (e.g., benzene).

Phase II of the OU14 RI was subsequently performed to close data gaps identified during Phase I. During Phase II, 55 existing monitoring wells were sampled and analyzed for VOCs. The cumulative data from Phases I and II indicated the presence of CVOC contamination in groundwater, mostly adjacent to Building 130 and the Building 130 Wash Rack, but also in the vicinity of the C-130 Wash Rack and Building 4075.

Subsequently, a third investigation phase was performed to install and sample new monitoring wells, review potential preferential pathways for contaminant migration via utilities and utility bedding material, collect additional natural attenuation indicator parameter data to aid in the evaluation of the efficacy of natural biodegradation at OU14, and collect sediment and surface water samples from the unnamed stream. Data from all phases were used to perform a baseline HHRA, a screening-level **Ecological Risk Assessment (ERA)**, and an indoor air vapor intrusion screening evaluation (part of the HHRA).

The nature and extent of contamination at OU14 is summarized in Section 3. The potential risks to human health and the environment are summarized in Section 5. The RI report recommended that a FS be performed to evaluate remedial alternatives to address potential human health risks related to CVOC contamination in groundwater at OU14. As stated earlier, petroleum-related contamination in and around OU14 is being addressed separately by the MCAS Cherry Point UST Program.

Feasibility Study (CH2M HILL, April 2009)

An FS was performed to develop and evaluate remedial alternatives to mitigate potential human health risks associated with CVOC contamination in groundwater. Each remedial alternative was evaluated with respect to the **nine evaluation criteria** provided in the NCP. The alternatives were then compared to one another with respect to their evaluation under the NCP criteria.

3 Site Characteristics

3.1 Site Topography

The topography at OU14 is relatively flat, with a gentle slope to the north. The surface elevation averages approximately 25 feet above mean sea level. Surrounding several buildings and hangars, the vast majority of OU14 is paved in concrete or asphalt; some small "islands" of grass are present adjacent to Runway 14L. The unnamed stream paralleling the southern side of Runway 14L receives surface water drainage from portions of OU14 before crossing under the runway and eventually joining Mill Creek to the north.

3.2 Hydrogeology

The hydrogeologic setting at OU14 consists of a water table aquifer (**Surficial Aquifer**) and several deeper aquifers with intervening **confining units** (in descending order, the Yorktown, Pungo River, and Castle Hayne Aquifers). Investigation activities at OU14 have been performed in the top two aquifers beneath MCAS

Cherry Point, the Surficial and Yorktown Aquifers. CVOC contamination in groundwater has been found to be limited to the Surficial Aquifer.

The Surficial Aquifer was subdivided into two different groundwater zones for evaluation purposes during the RI, due to the relative thickness of the aquifer (approximately 40 feet) and because there are some differences in aquifer properties between the top and bottom of the aquifer. The *Upper* Surficial Aquifer refers to the top half of the Surficial Aquifer, from the water table (typically encountered at approximately 12 feet below the ground surface) to a depth of 25 to 30 feet below the ground surface. The *Lower* Surficial Aquifer refers to the bottom half of the Surficial Aquifer, from a depth of approximately 30 feet below the ground surface to the bottom of the aquifer (top of the Yorktown Confining Unit) at a depth of 50 to 60 feet below the ground surface.

The Surficial Aquifer beneath OU14 is composed of **unconsolidated** sands that are fine to medium in grain size, with varying percentages of silts and clays. The Upper Surficial Aquifer generally consists of finer-grained materials relative to the Lower Surficial Aquifer. However, the Upper and Lower Surficial Aquifers are not separated by any confining unit and are in direct hydraulic communication.

The horizontal directions of groundwater flow within the Upper and Lower Surficial Aquifers at OU14 are consistent with the topographic slope, and are generally toward the north-northwest and north towards Mill Creek. The vertical hydraulic gradient between the Surficial Aquifer and the underlying Yorktown Aquifer was found to be directed downward at OU14. Based on data collected during the RI, the average horizontal groundwater flow velocity in the Surficial Aquifer is estimated to be between 25 and 30 feet per year.

3.3. Nature and Extent of Contamination

Soil

The results of the RI showed no indication of the presence of CVOC contamination in OU14 soil that represented a human health risk or that could serve as a continuing source for CVOC contamination in groundwater. Relative to petroleum compounds, very few CVOCs were detected in soil at OU14. During RI sampling activities, CVOCs were found at concentrations exceeding one or more regulatory standards in only one sample collected in 2002. An additional sample was collected at this same location and depth in 2008, and no CVOCs were detected above regulatory standards. The MCAS Cherry Point UST Program subsequently installed a SVE well to remediate petroleum-related contamination in soil at this location. Any residual CVOC contamination in the vicinity would also be remediated by the SVE well.

Groundwater

Figure 3 shows the extent of CVOC contamination in Surficial Aquifer groundwater at OU14 based on the results of the RI. The CVOC contamination is found in several "plumes" of contamination, in which CVOCs have emanated from apparent source areas and have migrated in the directions of groundwater flow. No CVOCs were found in the underlying Yorktown Aquifer.

In the Upper Surficial Aquifer, the delineated CVOC plumes appear to have originated from the Building 130 area, including the Building 130 Wash Rack, the C-130 Wash Rack, and the Building 4075 area. In the Lower Surficial Aquifer, the CVOC plumes are consistent with inferred source areas in and around Building 130 and the associated wash rack, as well as the Former Refueling Station near Building 4495.

Based on the suspected timeframe of the releases of CVOCs at OU14 (as many as 60 or more years ago) and the specific CVOC compounds currently present in OU14 groundwater, the various CVOC plumes can be characterized as TCE plumes that have undergone significant **biodegradation** and natural attenuation for many years. TCE is biodegraded primarily by naturally-occurring, dechlorinating bacteria via a process called **reductive dechlorination** under **anaerobic** conditions in the aquifer. Naturally-occurring organic matter (including petroleum-related contamination in the case of OU14) in the aquifer provides carbon and energy to the bacteria, which produce hydrogen as part of their metabolic process. The chlorine atoms in the TCE are sequentially replaced by hydrogen, forming more-reduced CVOCs. As this type of dechlorination proceeds, TCE is degraded in a step-wise fashion as successive chlorine atoms are replaced by hydrogen, producing several intermediate "daughter products" of TCE (e.g., DCE and vinyl chloride) until all of the chlorine atoms are removed and only the harmless end product ethene remains. The CVOC plumes at OU14 are characterized by relatively low detected concentrations of TCE in conjunction with the widespread presence of TCE daughter products such as 1,2-DCE and vinyl chloride.

The CVOC plumes in the Upper Surficial Aquifer were found to contain TCE above the **North Carolina Groundwater Quality Standard (NCGWQS)** of 2.8 micrograms per liter (µg/L) at 6 monitoring well locations, with a maximum concentration of 180 µg/L found in monitoring well 56GW02 (located immediately downgradient of Building 4075). Other CVOCs found in excess of their respective NCGWQS in the Upper Surficial Aquifer included TCE biodegradation daughter products cis-1,2-DCE (maximum detected concentration of 30 µg/L at well 56GW02; NCGWQS is 70 µg/L) and vinyl chloride (maximum detected concentration of 28 µg/L at well 72GW04, located southeast of Building 130; NCGWQS is 0.015 µg/L).

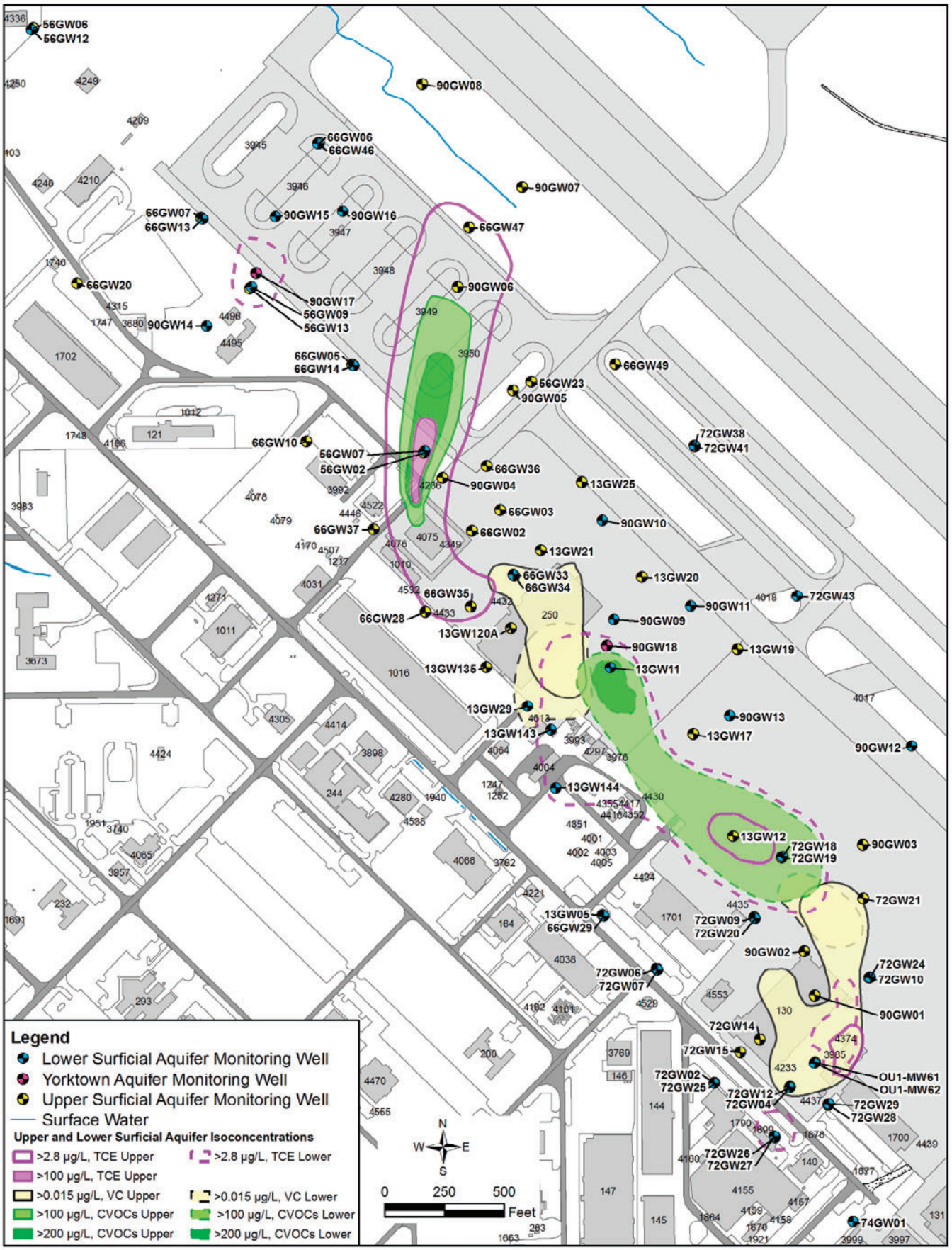


Figure 3 - TCE, Vinyl Chloride, and Total CVOCs; Upper and Lower Surficial Aquifers

All of the CVOCs detected in the Upper Surficial Aquifer were also detected in the Lower Surficial Aquifer. TCE and cis-1,2-DCE were the most frequently detected CVOCs in both portions of the Surficial Aquifer. The highest concentrations of TCE in the Lower Surficial Aquifer occurred at monitoring well 72GW19 (19 µg/L), located downgradient of Building 130, and 56GW09 (15 µg/L), located between the Former Fueling Station and the heavy fuel pits. The highest concentrations of cis-1,2-DCE (maximum concentration of 180 µg/L) in the Lower Surficial Aquifer were located downgradient of Building 130 and in the vicinity of the C-130 Wash Rack. Vinyl chloride was detected at a maximum concentration of 2.3 µg/L, in monitoring well 13GW29, located directly downgradient of the C-130 Wash Rack.

Numerous petroleum-related compounds, including benzene, were found to be widespread in both the Upper and Lower Surficial Aquifers at OU14. These constituents are being addressed by the MCAS Cherry Point UST Program, and are reported to have originated from potential source areas that include Tank Farm A, leaking underground fuel lines and USTs, the Former Refueling Station near Building 4495, and the heavy fuel pits. Petroleum free product is also widespread in many of these areas. Several UST Program remediation systems are currently active at OU14 to remove free product and treat petroleum-related contamination in soil and groundwater. The petroleum-related compounds throughout OU14 groundwater likely serve as a carbon source (energy) for the naturally-occurring dechlorinating bacteria, facilitating the biodegradation of the CVOCs via reductive dechlorination.

The naturally-occurring inorganic constituents arsenic, iron, and manganese were detected in Surficial Aquifer groundwater at concentrations exceeding their respective NCGWQS, but at concentrations that were generally consistent with the range of natural background conditions at MCAS Cherry Point. Because these constituents were only detected sporadically above background concentrations in several monitoring wells, the OU14 RI report concluded that there was not sufficient evidence of a CERCLA release related to these constituents from historic or current site operations.

Further evidence of natural biodegradation of CVOCs at OU14 was obtained during the RI through the analyses of selected groundwater samples for several natural attenuation evaluation parameters and analytes, including pH, oxidation-reduction potential (ORP), total organic carbon (TOC), dissolved oxygen, nitrate/nitrite, iron II/III, and sulfate/sulfide. These data were used to further evaluate whether biodegradation of the CVOCs in groundwater is occurring naturally under anaerobic conditions at OU14. The results supported the conclusion that sufficient to ideal conditions were present in the Surficial Aquifer at OU14 for anaerobic biodegradation.

The OU14 RI report concluded that the CVOC plumes have stabilized, meaning that they are not continuing to increase either in areal extent or in overall magnitude of concentration. CVOCs in groundwater migrating toward the unnamed stream attenuate to concentrations below their respective NCGWQS before groundwater reaches and discharges into the stream. Further evaluation in the RI indicated that the TCE, cis-1,2-DCE, vinyl chloride, and other CVOCs found in upgradient areas of OU14 will not reach the unnamed stream at concentrations above regulatory standards due to biodegradation and other natural attenuation mechanisms.

Surface Water and Sediment

Co-located surface water and sediment samples were collected during the RI from the unnamed stream located just south of Runway 14L (Figure 2). This stream receives groundwater discharge from the upper part of the Surficial Aquifer. No VOCs were detected in the sediment samples. Surface water sample data indicated trace concentrations of the CVOCs TCE, 1,1-DCE, and cis-1,2-DCE and three non-chlorinated VOCs (benzene, cyclohexane, and bromoform), but the concentrations of all CVOCs and non-chlorinated VOCs were below regulatory standards.

4 Scope and Role of Response Action

OU14 is one of several ERP operable units addressed under CERCLA at MCAS Cherry Point. The remediation of the groundwater at OU14 is a discrete and incremental step in the overall remedial process for MCAS Cherry Point. The role of the Preferred Alternative presented in this Proposed Plan is to address contaminated groundwater at OU14. The specific objectives of the Preferred Alternative are termed **remedial action objectives (RAOs)**. The RAOs for OU14 are listed in Section 6. This is the final remedial action for OU14, Site 90, and does not include or affect any other operable units or sites at the Air Station.

5 Summary of Site Risks

A summary of the HHRA and ERA conducted for OU14 during the RI is included in the following subsections and in Table 1. The RI report provides a more detailed analysis and evaluation. The RI report concluded that the only media with contamination posing potentially unacceptable risks to human health or the environment at OU14 were groundwater and indoor air vapor, as described below.

TABLE 1, OU14 RISK ASSESSMENT RESULTS

Medium	Potential Human Health Risk	Potential Ecological Risk
Soil	Not Evaluated*	Not Evaluated**
Groundwater	Unacceptable	Not Applicable
Surface Water	Acceptable	Acceptable
Sediment	Acceptable	Acceptable
Indoor Air Vapor***	Unacceptable	Not Applicable

* There are no CVOC exceedances of regulatory standards in soil (see Section 5.1).

** There is no viable ecological soil habitat at OU14 because it is almost completely covered by concrete and structures.

*** The HHRA included a vapor intrusion screening evaluation.

5.1 Human Health Risk Assessment

An HHRA was completed for OU14 for exposure to groundwater, surface water, and sediment. The HHRA also included a vapor intrusion screening evaluation component to evaluate impacts from VOCs in the groundwater on indoor air. CVOC contamination was limited in soil and there are no exposure pathways to soil at OU14 (potential source areas are covered by buildings and concrete). Therefore, risk due to exposure to soil was not calculated in the HHRA. Instead, potential risk from exposure to CVOCs in soil was conservatively performed by identifying exceedances of NC **Soil Screening Levels (SSLs)** for the protection of groundwater. No CVOC concentrations exceeded the NC SSLs. Therefore, no CVOCs were identified as **chemicals of concern (COCs)** in soil at OU14.

The HHRA quantifies and evaluates the "baseline" risk to current and potential future receptors (adults and children). This is an estimate of the likelihood of health problems that may occur, above one's normal likelihood, if no action is taken at the site. Health risks are based on a conservative estimate of the potential **cancer risk** or the potential to cause other health effects not related to cancer (**non-cancer risk**) due to exposure to chemicals in each media. The HHRA evaluated exposure to all chemicals and substances present in the site media, whether they are naturally-occurring or from a CERCLA or UST Program release.

The OU14 HHRA and the vapor intrusion screening evaluated risks for the following exposure scenarios:

- Surficial Aquifer groundwater for future residents and construction workers.
- Surface water and sediment for current/future industrial workers and adult and adolescent trespassers/visitors.
- Indoor air for current/future industrial workers and future residents.

The HHRA results indicated that there are no cancer risks or non-cancer hazards above acceptable ranges from exposure to surface water or sediment. Potential risks were identified for exposure to Surficial Aquifer groundwater by a future adult resident, future child resident, and lifetime resident. The primary risk-drivers were arsenic, iron, manganese, benzene, and vinyl chloride. However, arsenic, iron, and manganese were excluded as COCs for the FS because they are naturally-occurring constituents that were found at concentrations generally consistent with background conditions at MCAS Cherry Point, and because they are not related to historical contaminant releases that are regulated under CERCLA. Benzene was also not retained as a COC because it is a petroleum compound that is being addressed by the MCAS Cherry Point UST Program. The list of COCs that were retained for inclusion in the FS is presented in Section 6.

Although unacceptable risk to potential future residents through exposure to Surficial Aquifer groundwater was identified in the HHRA, this exposure scenario is unlikely to occur. OU14 is an active flightline area at MCAS Cherry Point, and there are no plans or likely future plans to change the industrial land use to residential. In addition, even if the area where to become residential, human exposure to groundwater from the Surficial Aquifer is unlikely. Drinking water supplies in this area are typically derived from a depth greater than 190 feet below the ground surface, from aquifers several "layers" down that are separated from each other by clay confining units that restrict the downward migration of contaminants. In addition, the concentrations of three naturally occurring inorganic constituents that were found to be risk drivers in the OU14 HHRA (arsenic, iron, and manganese) are typically found at elevated concentrations in the Surficial Aquifer in the Coastal Plain of North Carolina and surrounding states. As a result, Surficial Aquifer groundwater quality is typically poor due to natural conditions for use as a potable water resource, and is generally only used for small-scale irrigation.

The vapor intrusion evaluation results showed no indication of the need to mitigate vapor issues resulting from CVOCs for existing buildings under current industrial exposure scenarios. Conservative estimates of indoor air concentrations were calculated using the Surficial Aquifer groundwater data and compared to regulatory standards. The results indicated a need for further evaluation of the vapor intrusion pathway in the event that new buildings are constructed or if existing

structures are changed significantly. Therefore, indoor air vapor issues will be considered in the future, if necessary, prior to new building construction or major building modifications. In addition, the selected remedy will also indirectly address vapor issues, as the VOCs present in groundwater are remediated, thus reducing the potential for vapor intrusion impacts.

What is Human Health Risk and How is it Calculated?

A human health risk assessment estimates the "baseline risk." This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. To estimate the baseline risk at a site, the Navy performs the following four-step process:

Step 1: Analyze Contamination

Step 2: Estimate Exposure

Step 3: Assess Potential Health Dangers

Step 4: Characterize Site Risk

In **Step 1**, the Navy looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help the Navy to determine which contaminants are most likely to pose the greatest threat to human health.

In **Step 2**, the Navy considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency (how often) and length of exposure. Using this information, the Navy calculates a "**reasonable maximum exposure**" (RME) scenario that portrays the highest level of human exposure that could reasonably be expected to occur.

In **Step 3**, the Navy uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. The Navy considers two types of risk: cancer and (2) non-cancer. The likelihood of any kind of cancer resulting from a contaminated site is generally expressed as an upper-bound probability, for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer case may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than normally would be expected to from all other causes. For non-cancer health effects, the Navy calculates a "**hazard index**." The hazard index represents the ratio between the "reference dose," the dosage at which no adverse health effects are expected to occur, and the RME (see Step 2), the estimated maximum exposure level for a given category of individuals coming into contact with contaminants at the site. The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which noncancer health effects are no longer predicted to occur.

In **Step 4**, the Navy determines whether site risks are great enough to cause health problems for people at or near the site. The results of the three previous steps are combined, evaluated, and summarized. The Navy adds up the potential risks from the individual contaminants and exposure pathways and calculates a total site risk.

5.2 Ecological Risk Assessment

A screening-level ERA was conducted for the unnamed stream at OU14, and included the evaluation of the environmental setting, chemical fate and transport, ecotoxicity and potential ecological receptors, and complete exposure pathways. Potentially complete exposure pathways were identified for lower trophic-level aquatic receptor populations (e.g., aquatic plants, fish, and macro-invertebrates).

Potential risks to ecological receptors from exposure to all detected contaminants were calculated using conservative exposure assumptions. The ERA concluded that ecological risks are negligible and no further ecological investigation or risk analysis is warranted for the unnamed stream at OU14.

5.3 North Carolina Groundwater Quality Standards

North Carolina requires chemical concentrations in groundwater to meet the NCGWQS for the protection of human health. Therefore, in addition to constituents determined to be COCs as a result of the risk analyses performed during the OU14 HHRA, all detected organic compounds in OU14 groundwater that exceeded their respective NCGWQS in at least one sample were retained as COCs to be considered in the FS.

It is the Navy's current judgment, in partnership with USEPA and NCDENR, that the Preferred Alternative identified in this Proposed Plan is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

6 Remedial Action Objectives

Remedial action objectives (RAOs) are statements that define the extent to which sites require cleanup to protect human health and the environment. The RAOs reflect the COCs, exposure routes and receptors, and acceptable contaminant concentrations for each impacted medium at OU14. The RAOs for OU14 are as follows:

Surficial Aquifer Groundwater

- Prevent human exposure to Surficial Aquifer groundwater containing COCs above cleanup levels.
- Reduce exceedances of COCs to cleanup levels.
- Achieve suitability of OU14 groundwater for

unlimited use with a reasonable approach and within a reasonable timeframe.

- Prevent migration or discharge of COCs in the Surficial Aquifer groundwater to sediment and surface water in the unnamed stream at levels that would cause unacceptable risks to human or ecological receptors.

Indoor Air Vapors

- Prevent unacceptable risks to human receptors from exposure to indoor air vapors resulting from subsurface COCs.

Specific remediation goals (cleanup levels) to meet the RAOs are listed in Table 2.

TABLE 2: REMEDIATION GOALS, OU14, SITE 90

Chemical of Concern	Groundwater Remediation Goal (µg/L)
Bromomethane	21.1
Chloromethane	2.6
Cis-1,2-Dichloroethene (cis-1,2-DCE)	70
1,1-Dichloroethane (1,1-DCA)	70
1,2-Dichloroethane (1,2-DCA)	0.38
Methylene Chloride	4.6
Tetrachloroethene (PCE)	0.7
Trichloroethene (TCE)	2.8
Vinyl Chloride	0.015

7 Summary of Remedial Alternatives

The OU14 FS was conducted in accordance with USEPA guidance (*Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*, Interim Final, October 1988; and *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, July 2000). A preliminary screening of response actions and remedial technologies was completed to refine the potential components of remedial alternatives to be evaluated in the FS. Following the preliminary screening, five remedial alternatives were developed for detailed evaluation, and are summarized in this section. Alternative 3, Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs), is recommended as the Preferred Alternative.

Each alternative, with the exception of the no-action alternative, was developed to meet the RAOs. Consistent with the NCP, a no action alternative was evaluated as a baseline for the comparative analysis.

A more-detailed description of the screening and development of response actions, technologies, and developed remedial alternatives is presented in the FS. Table 3 provides the major components, details, and cost of each remedial alternative identified for OU14.

8 Evaluation of Remedial Alternatives

The five remedial alternatives presented in Section 7 were evaluated against the first seven of the nine criteria identified in the NCP. The two remaining criteria will be considered after the public comment period for this Proposed Plan.

8.1 The NCP Evaluation Criteria

The NCP outlines the approach for comparing remedial alternatives. Evaluation of the alternatives uses nine evaluation criteria (see glossary for a detailed description of each). These consist of "threshold", "primary balancing", and "modifying" criteria. To be considered for selection as the Preferred Alternative, a remedial alternative must first meet the following two threshold criteria:

- Overall protection of human health and the environment
- Compliance with **Applicable or Relevant and Appropriate Requirements (ARARs)**

The primary balancing criteria, which are technical criteria based on environmental protection, cost, and engineering feasibility, are then considered to determine which alternative provides the best combination of attributes. The primary balancing criteria are:

- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume through treatment
- Implementability
- Short-term effectiveness
- Cost

Finally, upon receipt of public comments on this Proposed Plan, the Preferred Alternative is evaluated further against two modifying criteria:

- Acceptance by the State
- Acceptance by the community

8.2 Relative Evaluation of Alternatives

The comparative analysis of alternatives with respect to the first seven evaluation criteria is summarized below. The OU14 FS provides a more-detailed discussion of the evaluation. Table 4 provides a relative ranking of the alternatives.

TABLE 3 - REMEDIAL ALTERNATIVES

Alternative	Components	Details	Cost
1. No Action *No action for COCs in groundwater and no restriction on activities.*	-Existing groundwater	-No action -Natural attenuation would reduce chemical concentrations over time, but no monitoring of groundwater conditions is conducted	No cost
2. Land Use Controls (LUCs) *Prevents human exposure to COCs in groundwater and indoor air vapor by placing restrictions on land use (including underlying aquifer resources).*	-LUCs	-LUCs to restrict access to Surficial Aquifer groundwater within potentially contaminated areas until the remediation goals are achieved -LUCs to ensure that the potential for vapor intrusion is evaluated during new building construction or the modification of existing structures within potentially contaminated areas	Capital Cost: $11,000 Present Value of Future, Annual Operations and Maintenance (O&M) Costs: $695,000 **Total Present-Worth Cost: $706,000** Discount Rate: 2.7% Assumed timeframe: 100 years
3. Monitored Natural Attenuation (MNA) and LUCs *Groundwater monitoring to assess COC concentrations until remediation goals have been met via natural attenuation processes. Also includes LUCs.*	-Biodegradation and other natural attenuation mechanisms to remove COCs from groundwater -Periodic groundwater sampling -LUCs	-Installation of additional monitoring wells and periodic groundwater monitoring for COCs and natural attenuation parameters until the remediation goals are achieved -LUCs to restrict access to Surficial Aquifer groundwater within potentially contaminated areas until the remediation goals are achieved (see Figure 4 for LUC boundaries) -LUCs to ensure that the potential for vapor intrusion is evaluated during new building construction or the modification of existing structures within potentially contaminated areas	Capital Cost: $413,000 Present Value of Future, Annual O&M Costs: $1,663,000 **Total Present-Worth Cost: $2,076,000** Discount Rate: 2.7% Assumed timeframe: 100 years
4. Biosparge, MNA, and LUCs *Injection of air into the groundwater to stimulate the biodegradation of COCs and to strip COCs out of the groundwater. Also incorporates MNA and LUCs.*	-Biosparge system to enhance biodegradation and remove COCs from groundwater -Periodic groundwater sampling -LUCs	-Installation of biosparge system to inject air into groundwater in the areas with the highest COC concentrations via a network of horizontal wells to induce mass transfer (volatilization) of COCs from groundwater and to enhance biodegradation (see Alternative 4 conceptual layout in Figure 5). MNA would be employed to address the remaining areas of groundwater contamination. -Installation of additional monitoring wells and periodic groundwater monitoring for COCs and natural attenuation parameters until the remediation goals are achieved -LUCs to restrict access to Surficial Aquifer groundwater within potentially contaminated areas until the remediation goals are achieved (see Figure 4 for LUC boundaries) -LUCs to ensure that the potential for vapor intrusion is evaluated during new building construction or the modification of existing structures within potentially contaminated areas	Capital Cost: $1,792,000 Present Value of Future, Annual O&M Costs: $3,284,000 **Total Present-Worth Cost: $5,076,000** Discount Rate: 2.7% Assumed timeframe: 40 years
5. Enhanced Reductive Dechlorination (ERD), MNA and LUCs *Injection of an organic substrate into the groundwater to stimulate the biodegradation of COCs. Also incorporates MNA and LUCs.*	-Multiple injections of an organic substrate into groundwater to enhance biodegradation -Periodic groundwater sampling -LUCs	-Installation of a network of vertical injection wells. Multiple injections of an organic substrate (serves as energy for naturally-occurring bacteria) into groundwater in the areas with the highest contaminant concentrations to enhance biodegradation (see Alternative 5 conceptual layout in Figure 6). MNA would be employed to address the remaining areas of groundwater contamination. -Installation of additional monitoring wells and periodic groundwater monitoring for COCs and natural attenuation parameters until the remediation goals are achieved -LUCs to restrict access to Surficial Aquifer groundwater within potentially contaminated areas until the remediation goals are achieved (see Figure 4 for LUC boundaries) -LUCs to ensure that the potential for vapor intrusion is evaluated during new building construction or the modification of existing structures within potentially contaminated areas	Capital Cost: $2,225,000 Present Value of Future, Annual O&M Costs: $3,982,000 **Total Present-Worth Cost: $6,207,000** Discount Rate: 2.7% Assumed timeframe: 60 years

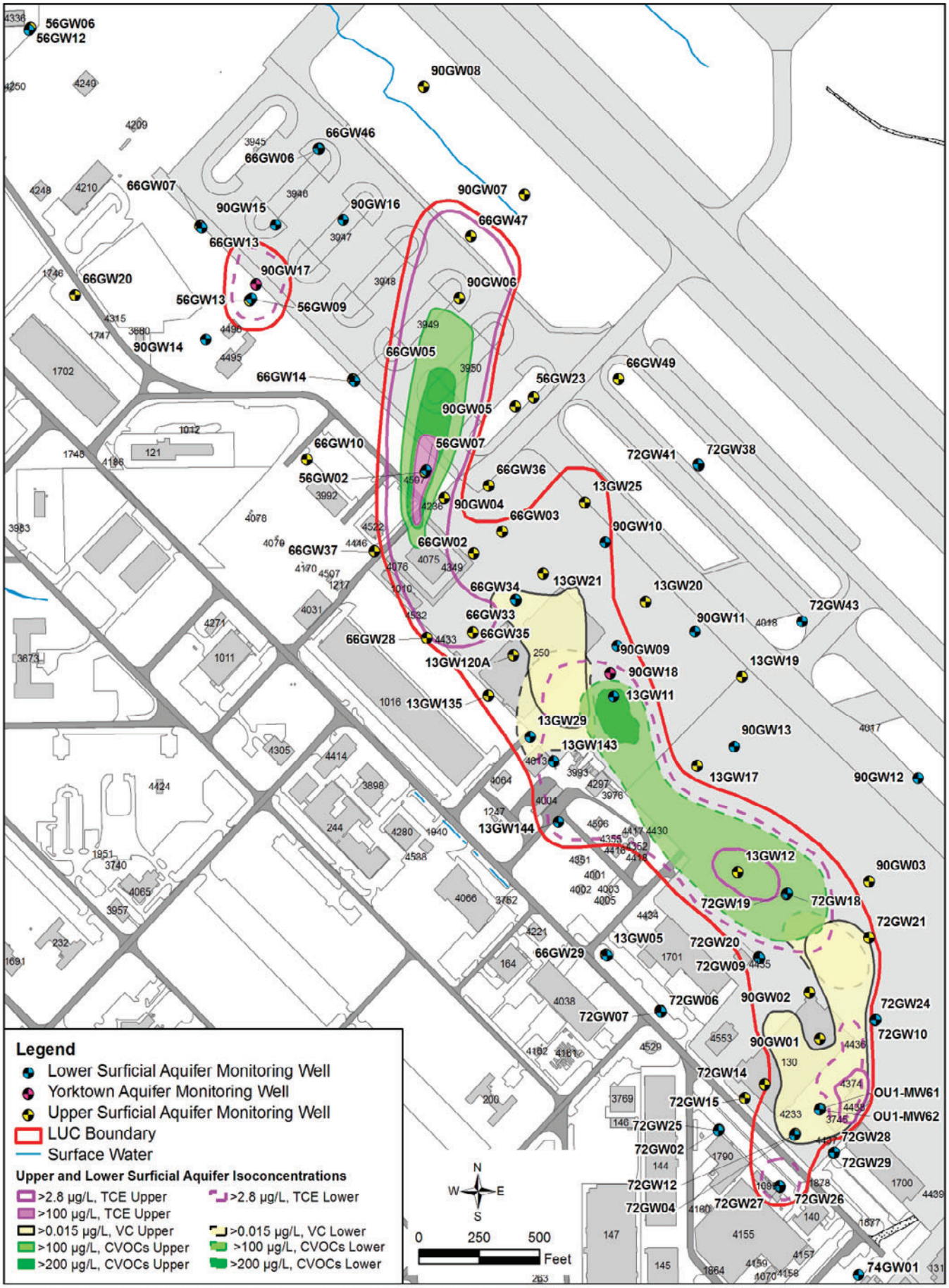


Figure 4 - Land Use Control (LUC) Boundaries for Alternatives 3, 4, and 5

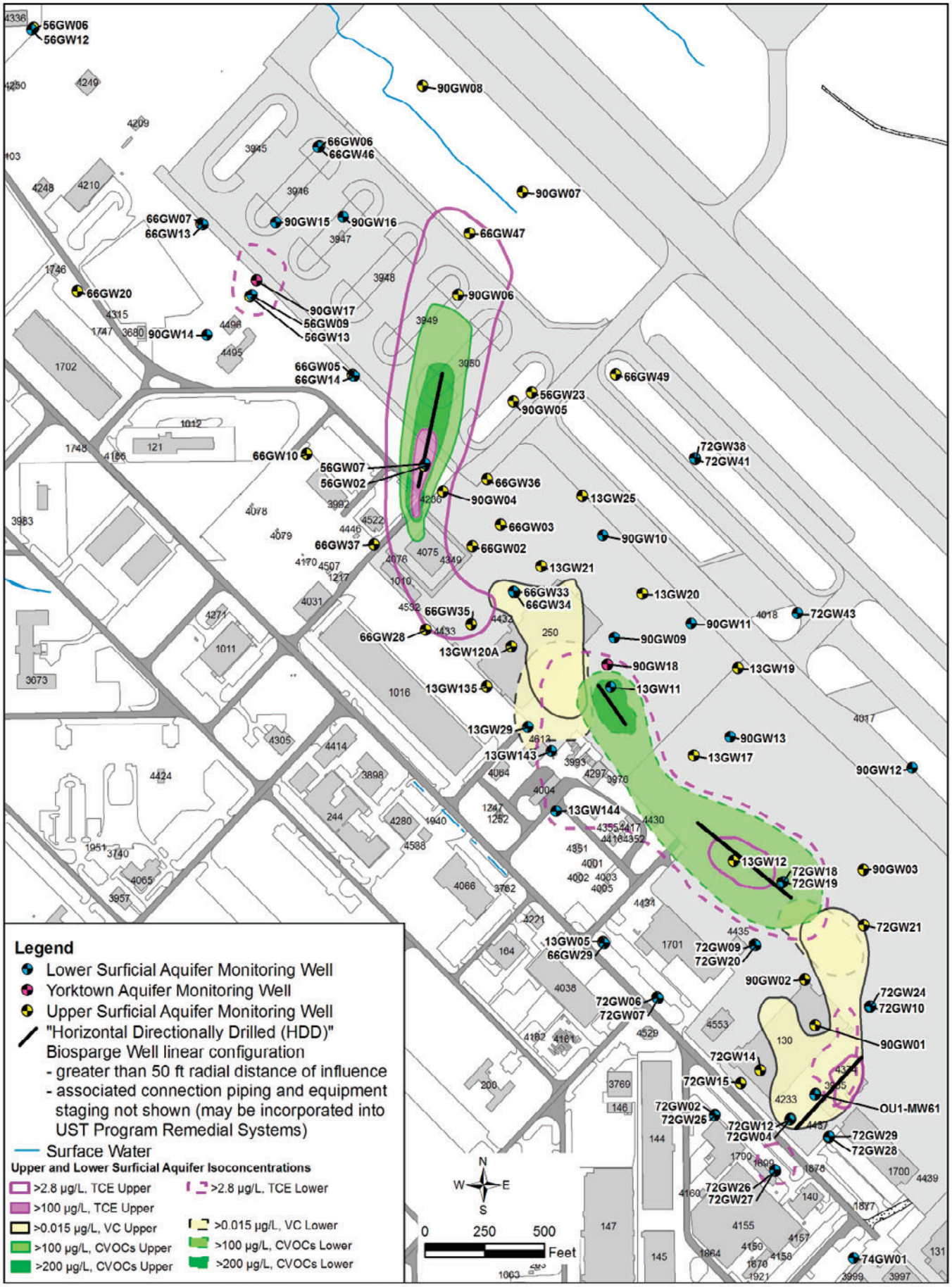


Figure 5: Alternative 4 - Biosparge Conceptual Layout

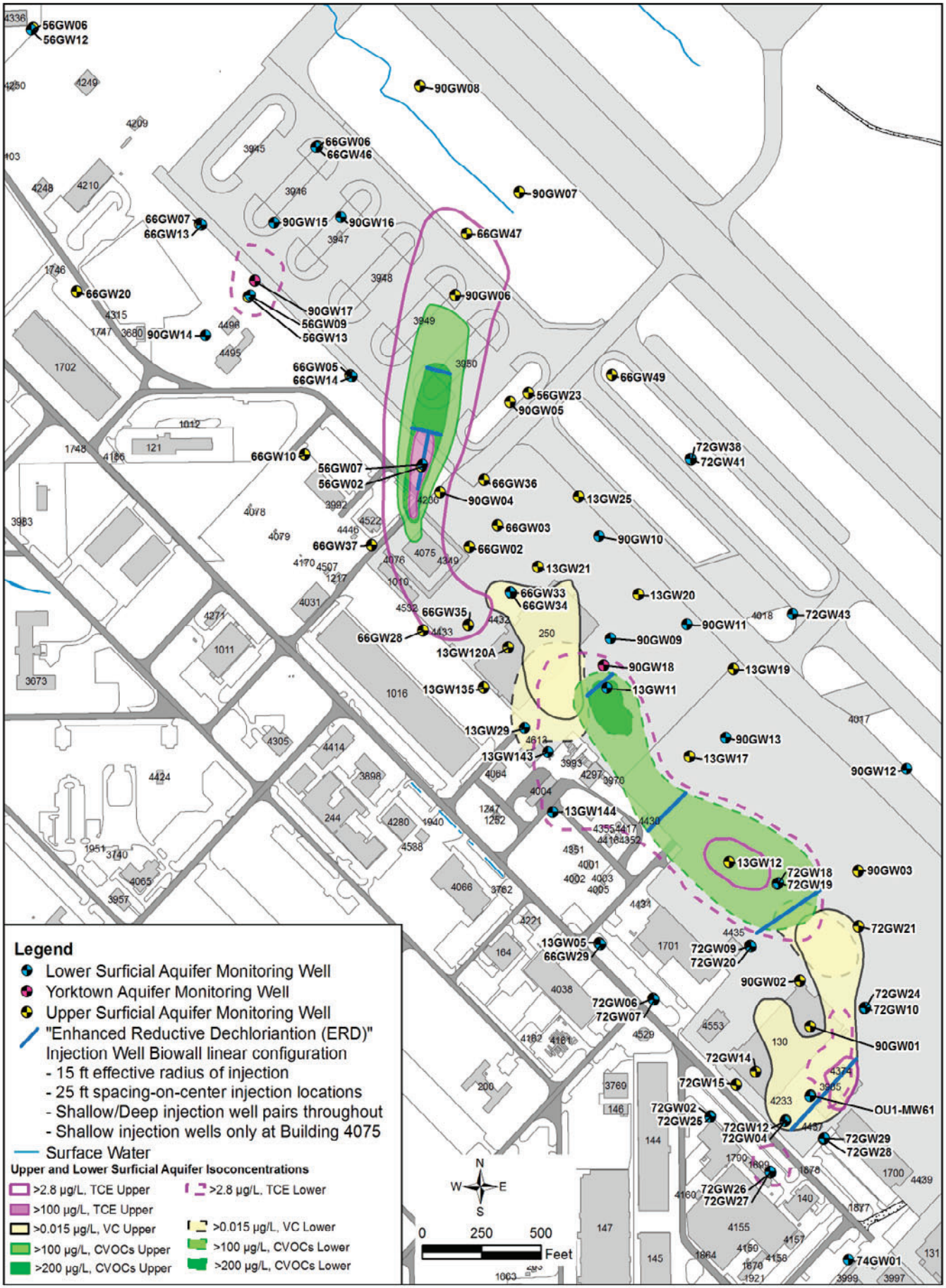


Figure 6: Alternative 5 - ERD Injection Well Biowall Conceptual Layout

Threshold Criteria

Overall Protection of Human Health and the Environment. Alternative 1 (No Action) does not protect human health and the environment because potential exposure to COCs is not limited. Alternative 2 (LUCs) does not achieve RAOs because it lacks a monitoring component to determine progress toward remediation goals.

Alternative 3 (MNA and LUCs), Alternative 4 (Biosparge, MNA, and LUCs), and Alternative 5 (ERD, MNA, and LUCs) are all protective of human health and the environment because potential exposure pathways to COCs in groundwater and indoor air vapors are restricted by LUCs while the remaining RAOs are achieved over time via MNA (Alternative 3) or a combination of active treatment and MNA (Alternatives 4 and 5). The LUCs proposed in alternative 2 are the same as those included in all other alternatives except Alternative 1 (No Action).

Compliance with ARARs. There are three types of ARARs: chemical-specific, location-specific, and action-specific. Alternative 1 does not comply with ARARs since no remedial action is taken. Alternative 2 does not comply with chemical-specific ARARs due to the lack of monitoring to assess COC concentrations and the spatial extent of contamination over time.

Alternatives 3, 4, and 5 all comply with ARARs. The RI for OU14 concluded that the CVOC plumes have stabilized and that, even without treatment, no COCs will discharge in groundwater to the unnamed stream at concentrations above any applicable chemical-specific ARARs and TBCs.

Since Alternatives 1 and 2 do not meet the two threshold criteria, they were subsequently eliminated from consideration as the Preferred Alternative, and will not be discussed further in this Proposed Plan.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Alternatives 3, 4, and 5 are all expected to be effective and permanent remedies to achieve RAOs. Permanent risk reduction would be achieved by all alternatives over relatively long periods of time (estimated to range from 40 to 100 years) as COCs attenuate to concentrations below the remediation goals. Alternative 3 requires the least amount of long-term monitoring (LTM) and operation and maintenance (O&M) activities. Alternatives 4 and 5 both require similar LTM and O&M activities as Alternative 3, but also include technology-specific LTM and O&M. Alternative 4 requires the greatest amount of O&M activities relative to the other alternatives, because the biosparge system includes equipment and controls that require power, protection from the elements, and periodic adjustment and repair. Alternative 5 involves three substrate injection events, maintenance of a series of injection wells, and LTM to maintain optimal conditions in the aquifer for ERD.

Reduction in Toxicity, Mobility, or Volume through Treatment. Alternatives 3, 4, and 5 would all effectively reduce the toxicity, mobility and volume of COCs in groundwater through natural attenuation processes, including dispersion, diffusion, volatilization, and biodegradation. Alternatives 4 and 5 add further treatment of areas within the CVOC plumes that contain the highest concentrations of COCs in an attempt to reduce the timeframe required to achieve RAOs. Alternative 4 promotes the volatilization and biodegradation of COCs in these areas via biosparging, while Alternative 5 promotes biodegradation via ERD.

TABLE 4 – RELATIVE RANKING OF REMEDIAL ALTERNATIVES

CERCLA Criteria	Remedial Alternatives				
	1. No Action	2. LUCs	3. MNA and LUCs	4. Biosparge, MNA, and LUCs	5. ERD, MNA, and LUCs
Threshold Criteria					
Overall Protection of Human Health and the Environment	0	2.5	4.5	5	5
Compliance with ARARs	0	1	5	5	5
Balancing Criteria					
Long-Term Effectiveness and Permanence	0	3	4	3.5	3.5
Reduction in Toxicity, Mobility or Volume through Treatment	0	1	4	5	5
Short-Term Effectiveness	2	2	3.5	4	4
Implementability	5	5	5	2	2.5
Present-Worth Cost	5 ($0)	5 ($706,000)	4 ($2,076,000)	2 ($5,076,000)	1 ($6,207,000)
OVERALL RANK	1.7	2.8	4.3	3.8	3.7

Ranking: Scores range from 0 to 5, with 0 being the least favorable and 5 being the most favorable.

Short-Term Effectiveness. Alternatives 3, 4, and 5 all protect human health and the environment in both the short and long term. Alternative 3 is conservatively estimated to require 100 years for groundwater COC concentrations to fully reach remediation goals throughout the site; however, this estimate does not take into account the potential for petroleum contamination commingled with the CVOC plumes to facilitate the biodegradation of the COCs, nor the potential for existing UST Program AS/SVE systems at OU14 to reduce CVOC concentrations. The active treatments employed with Alternatives 4 and 5 in certain areas of the plumes are estimated to reduce the timeframe to achieve RAOs to 40 and 60 years, respectively.

There are negligible risks to the community associated with the implementation of Alternatives 3, 4, and 5. All of the alternatives would require the use of standard engineering and safety controls to protect site workers during the remedial action, particularly for drilling, well installation, O&M, and LTM activities. However, Alternatives 4 and 5, each having more substantial implementation and O&M requirements, inherently have an increased potential risk to site workers.

Implementability. Alternative 3 is easily implementable, and the required services and materials are widely available. The installation of additional monitoring wells for the LTM network and the periodic sampling activities are similar between Alternatives 3, 4, and 5, but Alternatives 4 and 5 involve considerably more drilling and well installation activities.

Alternative 4 is the most technically challenging of all of the alternatives with respect to construction and O&M and has the most significant implementability challenges and concerns. The installation of horizontal biosparge wells can be performed by many environmental drillers and would minimize the substantial challenges associated with avoiding underground utilities. However, the trenching for conveyance piping, power requirements for operation, and housing and maintenance of equipment all present substantial challenges relative to Alternatives 3 and 5. There are several implementability concerns and challenges associated with Alternative 4: (1) This alternative poses a significantly greater potential for disruptions to flightline and other military operations relative to Alternative 3; (2) Subsurface air injection, even under low-flow conditions, will increase the risk of indoor air vapor intrusion issues in buildings from CVOCs as well as from petroleum contamination and free product near the areas of injection or via utility conduits to buildings near the areas of injection. If deemed necessary during system design or system startup activities, passive or active vapor mitigation systems could be installed depending on the occupancy of potentially affected buildings; and (3) Temporary groundwater mounding may occur during and immediately after system startup, impacting groundwater flow directions and potentially disrupting existing UST Program petroleum free product extraction systems currently in place at OU14.

The technology employed in Alternative 5 is relatively easy to implement and the required services and materials are widely available. However, multiple substrate injections would be required, and the installation of the considerable number of vertical injection wells and the injection activities would create significant challenges to mitigate related to avoiding underground utilities and the potential for disruptions to flightline and other military operations. An implementability concern associated with Alternative 5 involves potential impacts from existing UST Program AS and SVE remediation systems at OU14. These systems might impede the enhancement of anaerobic conditions in portions of the site and impede ideal ERD conditions due to the injection of air (contains oxygen) into the aquifer.

Cost. Alternative 3 is the least-cost alternative, with an estimated **present-worth cost** of $2,076,000 associated with installing additional monitoring wells, conducting LTM for the MNA remedy, and for maintenance of LUCs. Alternatives 4 and 5 both include similar costs for LTM and LUCs, but for a shorter timeframe. Alternatives 4 and 5 require considerably higher implementation and O&M costs than Alternative 3. The estimated present-worth costs of Alternatives 4 and 5 are $5,076,000 and $6,207,000, respectively.

Modifying Criteria

State Acceptance. State involvement has been continual throughout the CERCLA process for OU14 and the NCDENR supports the Preferred Alternative. However, their final concurrence will be provided following the review of all comments received during the public comment period.

Community Acceptance. Community acceptance will be evaluated after the public comment period for the Proposed Plan, and public comments will be addressed and documented in the forthcoming **Record of Decision (ROD)** for OU14.

9 Preferred Alternative

The Preferred Alternative for OU14, Site 90 is Alternative 3, MNA and LUCs. Based on the evaluation of the data and information currently available, the Navy believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria.

While all of the viable alternatives will require a long timeframe to achieve RAOs (at least 40 years), it is

acknowledged that the Preferred Alternative represents the longest timeframe of the various alternatives to achieve remediation goals (estimated to be 100 years). However, there are several factors that support the Preferred Alternative as the least disruptive, easiest to implement, and most cost-effective of the various alternatives, while remaining fully protective of human health and the environment. These factors include:

- The estimated timeframe for the Preferred Alternative to achieve RAOs does not account for the beneficial influence of petroleum compounds commingled with the CVOC contamination. The ability of these compounds to serve as an energy source to naturally-occurring, dechlorinating bacteria should accelerate biodegradation and shorten the timeframe to achieve remediation goals. In addition, the presence of existing UST Program remediation systems at OU14 to treat petroleum contamination has a beneficial impact by reducing CVOC concentrations.

- The LUCs included as part of Alternative 3 eliminate potential exposure pathways to COCs in Surficial Aquifer groundwater by prohibiting Surficial Aquifer groundwater use/exposure and by evaluating potential vapor intrusion issues for future buildings or building modifications until remediation goals have been achieved.

- The results of the OU14 RI indicate that the CVOC plumes at OU14 have stabilized due to natural attenuation processes since the contaminant releases occurred decades ago. The findings also indicate that COCs in groundwater will not reach the unnamed stream at concentrations above remediation goals.

- There are implementability concerns associated with Alternatives 4 and 5, most significantly the potential for remedial activities in the heart of an active flightline area to be disruptive of military operations. Alternative 4 would also increase the risk of indoor air vapor intrusion issues from both CVOC and petroleum contamination, and might also be temporarily disruptive to ongoing remediation efforts to recover petroleum free product. Alternative 5 is based on the enhancement of anaerobic conditions for biodegradation, which have the potential to be disrupted by existing UST Program AS/SVE systems that involve the injection of air into groundwater.

- The HHRA and ERA for OU14 indicated no unacceptable risks to current receptors. The only unacceptable human health risks were to hypothetical future residents from exposure to Surficial Aquifer groundwater. However, as explained in Section 5.1, residential land use and use of the Surficial Aquifer as a potable water source at OU14 are not likely to occur.

The Preferred Alternative is expected to achieve RAOs while remaining fully protective of human health and the environment and eliminating exposure pathways to the COCs in Surficial Aquifer groundwater. The Navy has concluded that the longer relative timeframe required to achieve remediation goals under Alternative 3 (MNA and LUCs) is acceptable considering the significant potential disruptions to flightline and other military operations and the substantial additional implementation costs associated with Alternatives 4 and 5.

The Preferred Alternative includes long-term groundwater monitoring to monitor the effectiveness of the natural attenuation process in reducing the COC concentrations to achieve the remediation goals. In addition, LUCS including, but not limited to, land use restrictions in the Base Master Plan process and the filing of a Notice of Contaminated Site per North Carolina General Statutes 143B-279.9 and 143B-279.10, will be implemented to prevent exposure to the residual contamination at OU14 that exceeds the remediation goals. LUCs will be developed during the remedial design phase following approval of the ROD for OU14. The LUCs will be implemented and maintained by the Navy and MCAS Cherry Point until the concentrations of hazardous substances in the groundwater are at such levels to allow for unrestricted use and unlimited exposure. The LUC performance objectives include:

- Prohibiting all uses of groundwater from the Surficial Aquifer within the LUC boundaries (Figure 4), including but not limited to, human consumption, dewatering, irrigation, heating/cooling and industrial processes, unless prior written approval is obtained from the Navy, MCAS Cherry Point, EPA and NCDENR.
- Prohibiting unauthorized intrusive activities below the water table within the LUC boundaries.
- Evaluating the potential for vapor intrusion impacts from new building construction or the modification of existing structures within the LUC boundaries.
- Maintaining the integrity of any existing or future monitoring or remediation system at the site.

Since hazardous substances will remain at the site above levels that allow for unlimited exposure and unrestricted use, the Navy will review the final remedial action no less than every five (5) years after initiation of the remedial action per CERCLA Section 121(c) and the NCP at 40 CFR 300.430(f)(4)(ii). If results of the five-year reviews reveal that remedy integrity is compromised and protection of human health is insufficient, then alternative remedial actions would be evaluated by the parties and implemented by the Navy.

The Navy and the USEPA expect the Preferred Alternative to meet the following statutory requirements of CERCLA Section 121(b): (1) be protective of human

health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element. The NCDENR has reviewed the Proposed Plan and supports the Preferred Alternative. However, its final concurrence will be provided following review of all comments received during the public comment period. Based on new information or public comments, the Preferred Alternative may be modified or another remedial action selected. Therefore, public comment is invited and encouraged. Information on how to participate in this decision-making process is presented in Section 10.

10 Community Participation

Community participation at MCAS Cherry Point includes a Restoration Advisory Board (RAB), public meetings, a public information repository, newsletters and fact sheets, public notices, and an ERP web site. The Community Involvement Plan for MCAS Cherry Point provides detailed information on community participation for the ERP. The RAB was formed in December 1995 and consists of community members and representatives of the USEPA, NCDENR, NAVFAC Mid-Atlantic, and MCAS Cherry Point. RAB meetings are usually held quarterly and are open to the public to provide an opportunity for comments and questions. The investigations conducted at OU14, the findings, and potential remedial approaches have been presented and discussed at multiple RAB meetings.

If individuals have any questions or comments about OU14 they may call or write one of the following contacts:

Ms. Janice Nielsen, Code OPNCEV
NAVFAC Mid-Atlantic
LRA, Building C, NC IPT
9742 Maryland Avenue
Norfolk, VA 23511-3095
(757) 322-8339

Ms. Gena Townsend
US Environmental Protection Agency, Region 4
Superfund Division
Atlanta Federal Center
61 Forsyth St.
Atlanta, GA 30303
(404) 562-8538

Mr. George Lane
NC Department of Environment and Natural Resources
Superfund Section
401 Oberlin Rd., Suite 150
Raleigh, NC 27605
(919) 508-8462

The public comment period for the Proposed Plan provides an opportunity for input regarding the remedy selection process for OU14. The public comment period will be from May 1 to June 15, 2009, and a public meeting will be held on May 21, 2009 at 6:00 PM at the Havelock Tourist and Event Center. All interested parties are encouraged to attend the public meeting to learn more about the remedial alternatives developed and evaluated for OU14. The meeting will provide an additional opportunity to submit comments on the Proposed Plan. A public notice will be published in area newspapers announcing the availability of the Proposed Plan and the public comment period. In addition, a public notice will also be published in area newspapers announcing the date, time, and location of the public meeting.

Public input is a key element in the decision-making process. The public is strongly encouraged to use the comment period to relay any questions and concerns about OU14, the remedial alternatives that have been evaluated, and the Preferred Alternative. Written comments must be postmarked no later than June 15, 2009. The back page of this Proposed Plan may be used to provide written comments. Simply remove the page, fold, and add postage. However, use of this form is not required.

The Navy, USEPA, and NCDENR, in consideration of comments or new information, may modify the Preferred Alternative or select another alternative. If the changes are deemed substantial, additional public comment may be solicited. If not, the Navy and USEPA will prepare and sign the ROD with NCDENR's concurrence. The Navy will detail the selected remedial alternative for the site within the ROD and will summarize and respond to comments in a responsiveness summary to be included as part of the ROD.

The Community Involvement Plan and technical reports supporting the remedial decision making process for OU14 are available for download by the public via the MCAS Cherry Point ERP Public web site: http://public.lantops-ir.org/sites/public/cherrypoint/. These and other MCAS Cherry Point Administrative Record documents can be accessed by clicking on the "Admin Records" link at the top of the web site home page. If a computer and internet access is not available from home, access to the MCAS Cherry Point ERP Public web site may be obtained at the following location:

Havelock-Craven County Library
301 Cunningham Blvd
Havelock, NC 28532
Phone 252-447-7509

Glossary

Administrative Record: A compilation of documents and information for CERCLA sites that is made available to the public for review.

Aerobic: A process that requires the presence of oxygen.

Air Sparge (AS): A remediation technology in which air is injected into groundwater to remove volatile organic compounds (VOCs). As the injected air rises toward the surface through pore spaces in the aquifer, VOCs in the groundwater volatilize into the air, thereby reducing groundwater VOC concentrations.

Anaerobic: A process that occurs in the absence of oxygen.

Applicable or Relevant and Appropriate Requirements (ARARs): "Applicable" requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. "Relevant and appropriate" requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be either "applicable" or "relevant and appropriate."

Base Realignment and Closure (BRAC): Refers to policy, procedures, authorities, and responsibilities for closing or realigning military installations across the Department of Defense. Includes related environmental restoration activities.

Biodegradation: The transformation or reduction in concentration of a chemical by naturally occurring microorganisms (e.g., bacteria).

Cancer Risk: Cancer risks are expressed as a number reflecting the increased chance that a person will develop cancer if exposed to chemicals or substances. For example, USEPA's acceptable risk range for Superfund hazardous waste sites is 1×10^{-4} to 1×10^{-6}, meaning there is 1 additional chance in 10,000 (1×10^{-4}) to 1 additional chance in 1 million (1×10^{-6}) that a person will develop cancer if exposed to contaminants at a site that is not remediated.

Chemical of Concern (COC): A contaminant that contributes significant risk to an exposure pathway for a receptor.

Chlorinated Volatile Organic Compound (CVOC): Volatile organic compounds (VOCs) are organic compounds (i.e, they contain carbon) that readily evaporate, or volatilize. Chlorinated VOCs are VOCs in which chlorine atoms substitute for one or more hydrogen atoms in the compound's structure (e.g., trichloroethene, 1,1,1-trichloromethane, etc.). CVOCs are a common component of solvents for grease removal and dry cleaning, and are commonly toxic in nature.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): A Federal law passed in 1980 (42 U.S.C. §§ 9601 to 9675), commonly referred to as the "Superfund" Program, that regulates and provides for cleanup and emergency response in connection with numerous existing, inactive hazardous waste disposal sites that endanger public health and safety or the environment. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986.

Confining unit: A subsurface geologic layer, usually with a high clay content, that is located between aquifer units and restricts the upward or downward transmission of pressure and groundwater flow due to its relatively low permeability.

Direct-Push Technology (DPT): An investigation technique in which a probe or sampling tool is driven into the subsurface via the application of downward pressure. Soil and groundwater samples can be collected via DPT. Unlike conventional drilling techniques, no subsurface materials ("drill cuttings") are brought to the surface as the probe advances.

Ecological Risk Assessment (ERA): An evaluation of the risk posed to ecological receptors (i.e., plants and animals) if remedial activities are not performed at the site.

Environmental Restoration Program (ERP): A program established in 1984 to identify, investigate, and cleanup contamination on Department of Defense properties.

Feasibility Study (FS): An analysis in which the data collected during the Remedial Investigation (RI) are used to develop and evaluate a list of potential remediation alternatives. A detailed technical evaluation is performed on each remedial alternative that considers the nine evaluation criteria (see "nine evaluation criteria" below) specified by EPA guidance.

Free product: Generally a fuel, solvent, or liquid organic material that exists as a separate liquid phase. Petroleum-related free product is generally lighter than water, and if it infiltrates the subsurface and encounters groundwater, typically floats on the surface of the water table.

General Response Action (GRA): A broad category of potential remediation approaches as opposed to specific remediation technologies. Examples include institutional controls, monitoring, containment, treatment, and removal.

Groundwater: The supply of freshwater beneath the Earth's surface that occurs in the pore spaces between soil grains or within fractures in geologic formations that are fully saturated.

Human Health Risk Assessment (HHRA): A qualitative and quantitative evaluation of the risk posed to human health by the presence of specific pollutants. Elements include: identification of the hazardous substances present in the environmental media; assessment of exposure and exposure pathways; assessment of the toxicity of the site's hazardous substances; and characterization of human health risks.

Land Use Controls (LUCs): Institutional or administrative controls that are imposed to prevent human exposure to contaminants. Examples include restrictions to prohibit non-industrial land use, intrusive activities, or the extraction of groundwater for potable use.

Monitored Natural Attenuation (MNA): Natural attenuation refers to natural processes, without human intervention, in which contaminant concentrations are reduced by physical, chemical, and biological processes. Examples include diffusion, dispersion, retardation, and biodegradation. MNA is a remedial approach in which natural attenuation is coupled with a program of regular sampling or monitoring to assess the progress of contaminant reduction.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The Federal regulations (Code of Federal Regulations [CFR], Volume 40, Page 300 [40 CFR 300]) that guide determination of the sites to be corrected under both the Superfund (CERCLA) program and the program to prevent or control spills into surface waters or elsewhere.

National Priorities List (NPL): A list developed by USEPA of uncontrolled hazardous substance release sites in the United States that are considered priorities for long-term remedial evaluation and response.

Natural Attenuation: Refers to natural processes, without human intervention, in which contaminant concentrations are reduced by physical, chemical, and biological processes. Examples include diffusion, dispersion, retardation, and biodegradation.

Nine Evaluation Criteria: The criteria specified in the NCP for evaluating remedial alternatives in Feasibility Studies. These consist of:

- Overall Protection of Human Health and the Environment - Addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
- Compliance with ARARs - Addresses whether a remedy will meet all of the Applicable or Relevant and Appropriate Standards (ARARs) of other Federal and State environmental laws and/or justifies a waiver of the requirements.
- Long-Term Effectiveness and Permanence - Addresses the expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time.
- Reduction of Toxicity, Mobility, and Volume through Treatment - The anticipated performance of the treatment technologies a remedy may employ.
- Short-Term Effectiveness - Considers the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period of a remedy.
- Implementability - Evaluates the technical and administrative feasibility of a remedy, including the availability of materials and services needed for implementation.
- Cost - The estimated capital, operation and maintenance (O&M), and present-worth costs of each potential remedy.
- State Acceptance - Considers the State regulatory agency's comments on the Proposed Plan.
- Community Acceptance – Addresses public comments and concerns related to the alternatives described in the Proposed Plan. The specific responses to the public comments are addressed in the Responsiveness Summary section of the Record of Decision (ROD).

Non-Cancer Risk: Non-cancer hazards (or risk) are expressed as a quotient that compares the existing level of exposure to the acceptable level of exposure. There is a level of exposure (the reference dose) below which it is unlikely for even a sensitive population to experience adverse health effects. USEPA's threshold level for non-cancer risk at Superfund sites is 1, meaning that if the exposure exceeds the threshold, there may be a concern for potential non-cancer effects.

North Carolina Department of Environment and Natural Resources (NCDENR): The State agency responsible for administration and enforcement of

environmental regulations in North Carolina.

North Carolina Groundwater Quality Standard (NCGWQS): The groundwater quality standards for existing or potential groundwater sources of drinking water supply for humans (Class GA), as specified in North Carolina Administrative Code (NCAC) Title 15A, Subchapter 2L, Section .0200. They are often referred to as "2L standards", and are maximum allowable groundwater contaminant concentrations resulting from any discharge of pollutants to the land or waters of the State.

North Carolina Soil Screening Levels (NC SSLs): Calculated soil contaminant concentrations for the protection of the groundwaters of North Carolina. They reflect the levels for each chemical above which the potential exists for the contaminant to migrate through the soil and contaminate groundwater The SSLs are calculated by multiplying the North Carolina Groundwater Quality Standards by soil contaminant fate and transport factors.

Operable Unit (OU): Consists of one or more potentially contaminated sites that have been grouped together due to their proximity to each other or due to similarity of contamination.

Preferred Alternative: With respect to the nine criteria specified in the NCP for evaluating remedial alternatives, the Preferred Alternative is the proposed remedy that meets the threshold criteria and is deemed to provide the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria.

Present-worth cost: Total cost of the remedial action, discounted to the value of current dollars. The present-worth cost includes upfront capital costs required to implement the remedial action, as well as the present value costs of future long-term operations, maintenance, and monitoring.

Proposed Plan: A document that presents the preferred remedial alternative and requests public input regarding its proposed selection.

Public Comment Period: The time allowed for the members of a potentially affected community to express views and concerns regarding an action proposed to be taken by USEPA, such as a rulemaking, permit, or Superfund-remedy selection.

Record of Decision (ROD): A legal document that describes the cleanup action or remedy selected for a site, the basis for choosing that remedy, and public comments that were considered regarding the selected remedy.

Reductive dechlorination: The biodegradation process in which one or more chlorine atoms in a chemical are replaced by hydrogen or hydroxide ions via anaerobic bacteria. When all of the chlorine atoms have been replaced, the end product is harmless.

Remedial Action: A cleanup method proposed or selected to address contaminants at a site.

Remedial Action Objectives (RAOs): Site-specific objectives that describe what the remedial actions are expected to accomplish. They specify the contaminants and media of interest, exposure pathways, and remediation goals, and are used to develop a range of remedial alternatives.

Remedial Investigation (RI): A study in support of the selection of a remedy at a site where hazardous substances have been released. The RI identifies the nature and extent of contamination and analyzes human health and ecological risk associated with the contamination.

Soil Vapor Extraction (SVE): A remedial technology that creates a vacuum (negative pressure) to extract volatile contaminants from soil.

Surficial Aquifer: An aquifer is a saturated, permeable geologic formation that is capable of yielding water in usable quantities via a well. The Surficial Aquifer is the uppermost aquifer in the Coastal Plain of North Carolina, where MCAS Cherry Point is located. The surficial aquifer is unconfined, meaning that its upper surface is the water table rather than a confining unit.

To-be-considered (TBC) criteria: Non-promulgated regulatory criteria, advisories, guidance, and proposed standards that have been issued by the Federal or State government that are not legally binding and do not have the legal status of ARARs. However, TBC criteria may be useful for developing remedial alternatives and for determining the necessary level of cleanup for the protection of human health and the environment. Examples include EPA Drinking Water Health Advisories, Reference Doses, and Cancer Slope Factors.

Unconsolidated: Sediments that are loosely arranged and not cemented together.

United States Environmental Protection Agency (USEPA): The Federal agency responsible for administration and enforcement of CERCLA (and other Federal environmental statutes and regulations).

Unsaturated zone: Sometimes referred to as the "vadose" zone, the geologic material that occurs above the water table, in which the pore spaces are only partially filled with water.

Volatile Organic Compounds (VOCs): Organic compounds (i.e, they contain carbon) that readily evaporate, or volatilize

Notes

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