3.0 PHYSICAL SETTING

3.1 Climate

Precipitation averages just over 10 inches annually at MCAS Miramar, generally associated with low intensity storms in winter and spring. Frosts are light and infrequent, with the growing season ranging from 345 to 360 days. Winds are usually gentle and come from the west, especially during summer afternoons. The average annual temperature is about 63 degrees Fahrenheit. The average daily high is 71 degrees, and the low averages 53 degrees. Weather patterns are dominated by a subtropical ridge with a shallow marine layer and pronounced low-level inversion and moderating effects of the California current off-shore. This Mediterranean climate creates a semi-arid condition, with warm, dry summers and mild winters. Weather data are available from the Marine Corps Meteorology and Oceanographic Command Detachment on MCAS Miramar and from the National Weather Service at Lindbergh Field, the commercial San Diego Airport.

Four climatic aspects affect erosion on the Station (Kellogg and Kellogg 1991):

temperature mildness (*i.e.*, warm summers, cool winters), which results in comparatively immature Station soils with a low tolerance to erosive forces;
Mediterranean semi-aridity (*i.e.*, Mediterranean precipitation pattern fosters high erosion rates because ground protection is least when precipitation peaks) (Kirkby 1980));
winter storm progression (*i.e.*, the amount of soil moisture before an intense storm); such storms create significant sheet and rill erosion unless the ground is dry enough to absorb water quickly); and
"fire weather" *(i.e.*, extremely dry, warm fall winds), which results in wildfires that create conditions conducive to extremely high soil loss during storms. Firebreaks[5] used to control wildfire damage are secondary erosion agents.

Hazardous fire conditions occur during fall when there are very dry, warm winds and vegetation is dry. High erosion rates can result when intense storms follow a fire. Fire is a natural component of the southern California landscape, thus, the vegetation at MCAS Miramar is adapted to occasional fires. However, the risk of large-scale, disastrous fire has increased with urbanization and past fire suppression policies.

3.2 Geology and Soils

More than three-quarters of MCAS Miramar soils are in the Redding series of shallow, cobbly, or gravelly loams that range from 2 to 50 percent slopes. Permeability is very slow due to a hardpan, and fertility is low. Erodibility of the Redding series is considered severe because of shallow depth to rock and, in some cases, steepness. Where these soils are more gently sloping, they form a hummocks topography known as "mima mounds," which harbor vernal pool habitat and associated Special Status Species.

Steep, eroded, gravelly, or cobbly terraces, consisting of the Poway group of non-marine sandstone and coarse cobbly "Stadium" conglomerate, dominate upland areas of East Miramar. The conglomerate is overlain by softer, more erodible tongues of marine, lagoonal, and non-marine sandstone called the Mission Valley Formation, which is then overlain by Pomerado conglomerate (Figure 3.2a) (Kennedy 1975). This area is highly dissected, with rugged divides, dendritic drainages, and V-shaped valleys (Figure 3.2b). Landslides are common along valley walls in clay-rich portions of Mission Valley and Friars formations.

[5] MCAS Miramar has converted its former firebreaks to fuelbreaks, which are less prone to significant erosion.

West Miramar encompasses gravelly marine terraces (mesas) of the Lindavista formation with areas of terrace escarpment and alluvium. It was formed under fluctuating estuarine and beach conditions with subsequent uplift (Kennedy 1975). In extreme western portions of MCAS Miramar are three soil types with small acreages but characteristics appropriate for raising irrigated crops… Chesterton fine sandy loam, Carlsbad gravelly loamy sand, and Altamont clay (Figure 3.2a).

3.2.1 Erosion Hazard Ratings

Almost all MCAS Miramar's soils are severely erodible, according to the Natural Resources Conservation Service, because of either steepness, shallow depth to rock, shallow depth to a hardpan, or excessive silt in surface texture composition. A 1991 survey (Kellogg and Kellogg) identified 287 historic and/or active erosion sites on the Station; about 50 of the sites were classified as active. A more recent survey (URS 2005) assessed, documented, and prioritized 98 active erosion sites on portions (areas accessible by service roads) of undeveloped areas on MCAS Miramar and provided recommendations for restoration of 18 priority sites. Soils within the 2005 survey area had moderately severe to severe erosion hazard ratings.

3.2.2 Topography

Elevations on MCAS Miramar range from just over 1,178 feet above mean sea level in the east to 240 feet in the west (Figure 3.2b). Gently sloping, eroded plateaus or mesas where flight line and air operations are located are cut by southwesterly draining canyons. These give rise to a series of marine wave-cut terraces, which, in turn, grade to the steep and dissected hills of Sycamore Canyon. The hummocky topography that includes an impervious subsurface layer supports vernal pool habitat in western and central areas of MCAS Miramar. It consists of alternating well-drained to moderately well drained mounds and poorly drained swales.

3.3 Hydrology and Watersheds

3.3.1 Watersheds

Local watersheds drain to the south or southwest (Figure 3.2b). Murphy, Elanus, Oak, Spring, Quail, Little Sycamore, West Sycamore, and Sycamore canyons drain into the San Diego River and then to the coast. San Clemente Canyon enters Rose Canyon and then Mission Bay. Carroll and Beeler canyons eventually drain into Soledad Valley and then proceed to the coast. Many of these watersheds wholly or partly originate on MCAS Miramar, the main exceptions being Sycamore and Beeler canyons. Most sub-basins are small, which contributes to a high sedimentation rate as particles have less opportunity for deposition before becoming part of a stream system.

3.3.2 Floodplains and Impoundments

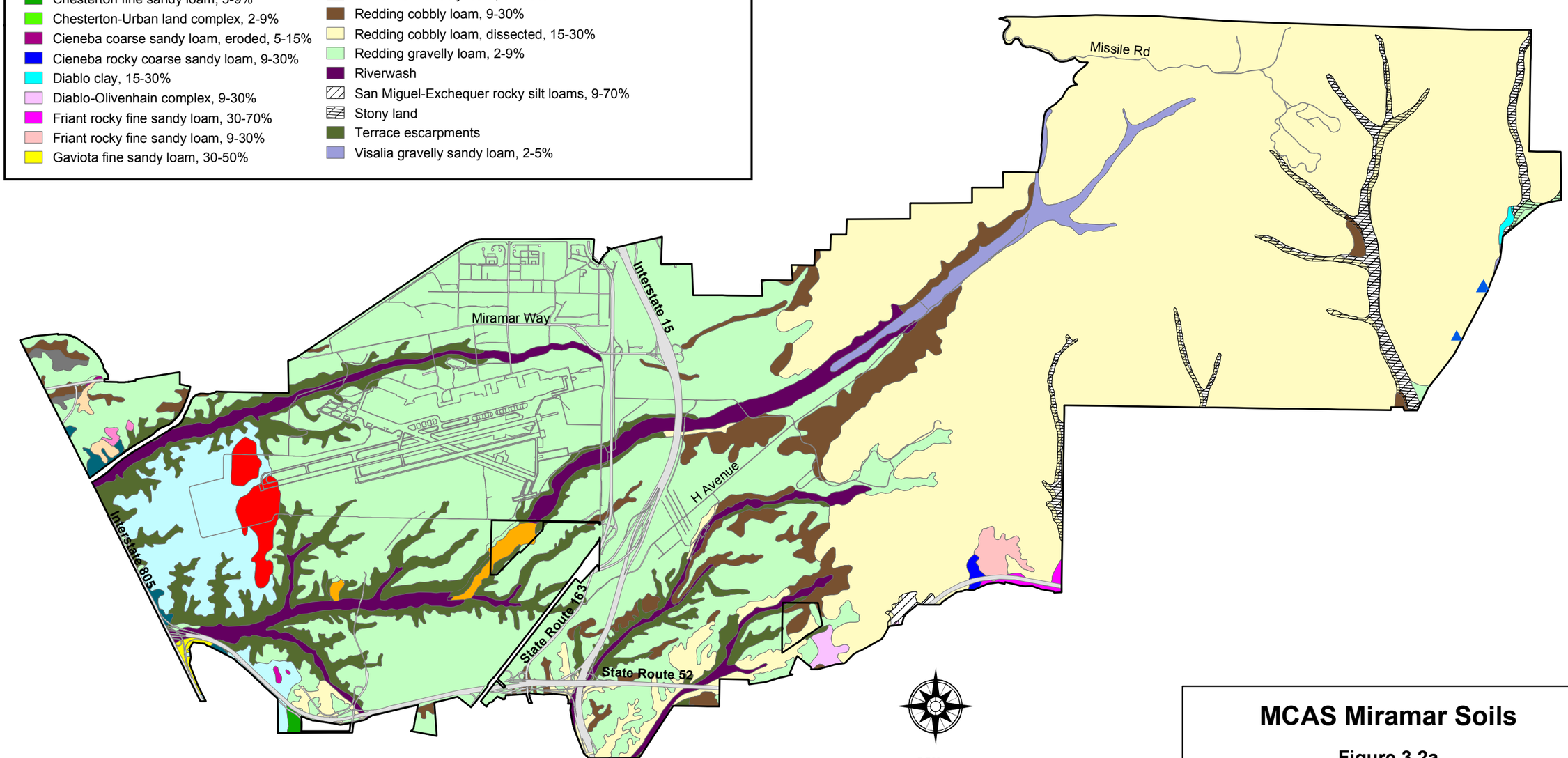
One-hundred-year return period floodplains have been completely mapped at a planning level scale for MCAS Miramar (Smith and Lichvar 2001). Areas of potential flooding are narrow because of canyon topography, but these narrow canyons have significant high-water flooding potential. Peak flows (2-year, 24-hour) for Rose Canyon were calculated at between 165 and 268 cubic feet per second (Woodward-Clyde 1986), and more than 14,000 cubic yards per year of sediment were estimated to be deposited into channels (confirmed by City of San Diego dredging records).

3.3.3 Sedimentation Effects on Water Quality

Streambank erosion problems along San Clemente and Rose canyons were identified in a sedimentation study commissioned by the City of San Diego (Woodward-Clyde 1986). Streambanks are typically 10-12 feet high but can be as high as 200 feet. Channel sides and bottoms are of cobble alluvium. Loose colluvial sand is common in canyon bottoms (Lloyd-Reilly 1987; Woodward-Clyde 1986).

Soil Type (% Slope)

- Altamont clay, 15-30%
- Altamont clay, 9-15%
- Carlsbad gravelly loam sand, 2-5%
- Chesterton fine sandy loam, 2-5%
- Chesterton fine sandy loam, 5-9%
- Chesterton-Urban land complex, 2-9%
- Cieneba coarse sandy loam, eroded, 5-15%
- Cieneba rocky coarse sandy loam, 9-30%
- Diablo clay, 15-30%
- Diablo-Olivenhain complex, 9-30%
- Friant rocky fine sandy loam, 30-70%
- Friant rocky fine sandy loam, 9-30%
- Gaviota fine sandy loam, 30-50%
- Gravel Pit
- Loamy alluvial land-Huerhuero complex, severely eroded, 9-50%
- Not listed as perennial or intermittent
- Olivenhain cobbly loam, 2-9%
- Olivenhain cobbly loam, 9-30%
- Ollivenhain cobbly loam, 30-50%
- Redding cobbly loam, 9-30%
- Redding cobbly loam, dissected, 15-30%
- Redding gravelly loam, 2-9%
- Riverwash
- San Miguel-Exchequer rocky silt loams, 9-70%
- Stony land
- Terrace escarpments
- Visalia gravelly sandy loam, 2-5%



Miles

0 0.5 1 2 3

This map is for planning purposes only. Some data may be incomplete, inaccurately positioned, and/or generalized.

MCAS Miramar Soils

Figure 3.2a

Source: USDA NRCS Soil Data, 2003

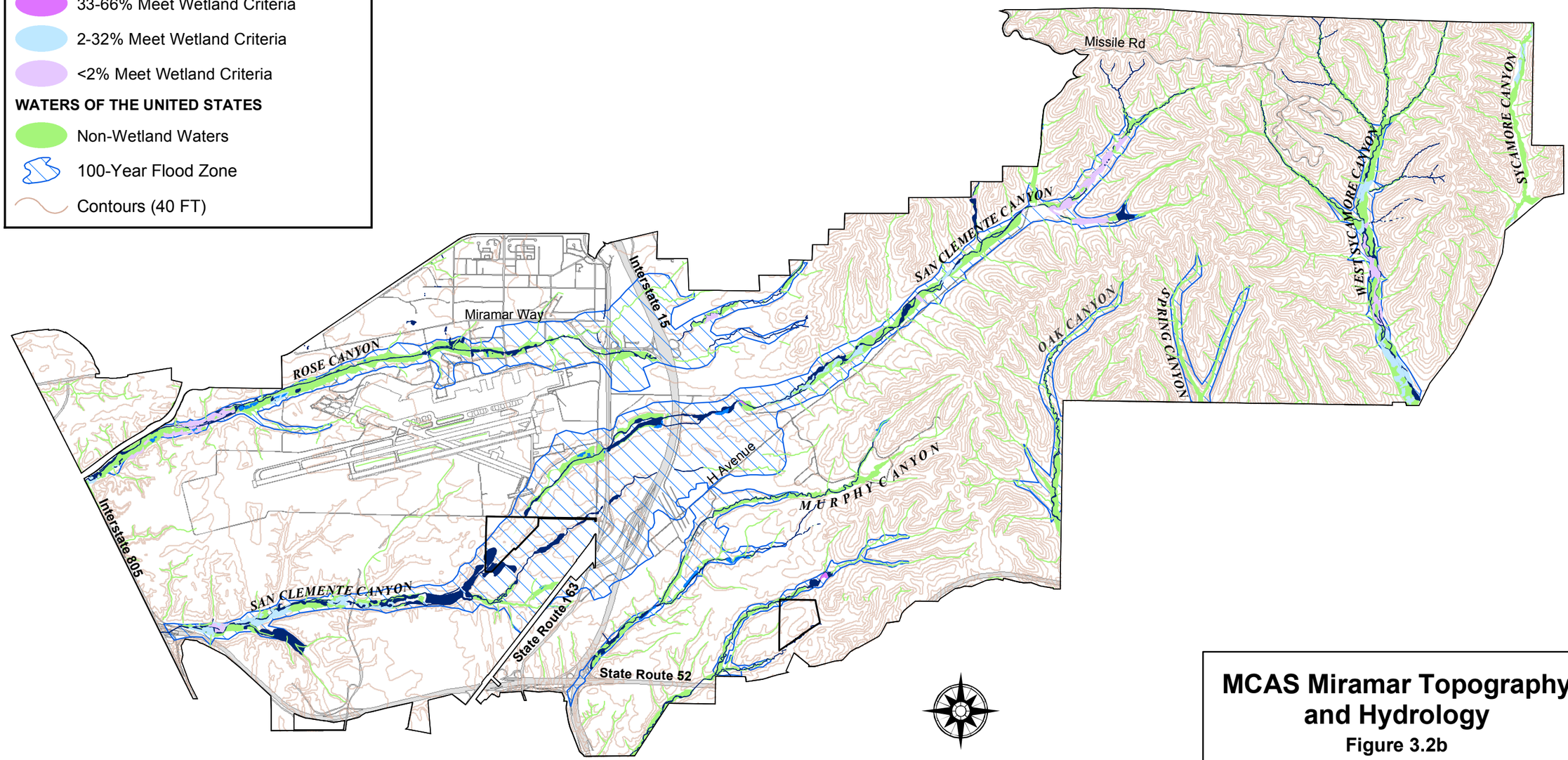
GeomorphIS *2010*

Possible Non-Vernal Pool Wetlands

- 100% Meet Wetland Criteria
- 67-99% Meet Wetland Criteria
- 33-66% Meet Wetland Criteria
- 2-32% Meet Wetland Criteria
- <2% Meet Wetland Criteria

WATERS OF THE UNITED STATES

- Non-Wetland Waters
- 100-Year Flood Zone
- Contours (40 FT)



Miles

0 0.5 1 2 3

MCAS Miramar Topography and Hydrology

Figure 3.2b

Sources: Contour Data - SANDAG/USGS/SDSU
Waters of the U.S. - Smith and Lichvar 2001

GeomorphIS *2010*

This map is for planning purposes only. Some data may be incomplete, inaccurately positioned, and/or generalized.

An earlier study (Tetratech, Inc. 1983) had concluded that Rose Canyon was a source of high concentrations of organically rich fine sediments draining into Mission Bay, aggravating the silting of the bay and degrading bottom sediments. In an aerial photo comparison of stream channel conditions in 1928 (when these lands were used for ranching) and 1991 (Kellogg and Kellogg 1991), most channels were found to be well-defined, flowing with water and full of sediment in 1928. By 1991 these areas were almost completely vegetated with no defined channel, probably due to bed aggradation. Section 7.3.1.1, subsection Soil Erosion and Revegetation has more detail on erosion on MCAS Miramar and programs to reduce its impacts.

Soil Erosion and Revegetation Restoration Projects have been programmed via Marine Corps Headquarters to address identified erosion sites Nine MCAS Miramar sites are in the process of mitigation.

3.4 Potentially Contaminated Sites and Areas Containing Munitions and Explosives of Concern

Areas of MCAS Miramar have been identified as sites where the disposal or discharge of hazardous wastes has resulted in potential environmental contamination. There are also sites where munitions and explosives of concern are potentially and/or confirmed to be present. Such sites potentially affect natural resources on the Station, primarily though the following issues: 1) concern about natural resources, particularly restoration work that could unexpectedly encounter contamination or unexploded munitions; 2) execution of a natural resource management action could further complicate a clean-up action; and 3) contamination could result in poor success with a natural resource management action.

3.4.1 Installation Restoration Program Sites

Sites where hazardous materials disposal or discharge may have resulted in contamination were identified under the Installation Restoration Program, which addresses the identification, investigation, research, and cleanup of contaminated sites. Of the 18 identified Installation Restoration Program sites on MCAS Miramar, 10 have been closed because cleanup action is unnecessary or removal has already been conducted. One site was transferred to the Military Munitions Response Program.

Of the remaining seven active Installation Restoration sites on MCAS Miramar, six are actively undergoing investigation:

- ***IR1 - Fuel Farm Operations Area*** (seven non-contiguous areas, including the existing fuel farm where waste petroleum, oils, lubricants, and tank bottom sludges were sprayed on vegetated areas and bare soil for weed and dust control during early 1940s-1975. In preparation for the construction of the new fuel farm, a hot spot Removal Action removed the soil identified to have the highest concentrations of Polychlorinated Biphenyls and Total Petroleum Hydrocarbons. Investigation and removal action for the balance of IR Site 1 began in FY09; completion is scheduled by FY 2011, after the existing fuel farm is closed);
- ***IR5 - Old San Clemente Canyon Disposal Site*** (1940s-1972 dump on south side of flight line that received refuse that included hazardous materials (*e.g.*, waste paints, pesticides, solvents, spent lead acid batteries);
- ***IR10 - Old Sycamore Canyon Atlas Missile Test Site*** (East Miramar site contaminated with polychlorinated biphenyl (ongoing assessment) and asbestos-containing material (abatement completed in 1997); a portion of this facility is used for an Explosive Ordnance Demolition range (Section 2.4.2, *Firing Ranges*).);
- ***IR15 - Supply Drum Storage Area*** (prior to 1992 used as the hazardous waste storage area where soil contamination resulted from spills associated with storage of waste fuels, solvent rags, and waste oils; a site investigation is scheduled for FY10.);

IR16 - K212 Boiler Plant Mercury Spill (adjacent to the K212 Boiler Plant where during a tank excavation, evidence was found of a mercury release, most likely from broken mercury manometers and leaking waste tanks; a site investigation is scheduled for FY10); and

IR18 - MCX Main Gas Station (old, leaking, underground fuel storage tanks that were removed in 1998 resulted in soil and groundwater contamination).

The other active site is considered low priority and is scheduled for a site investigation in the future. Additional information on these sites is available at http://www.miramar.usmc.mil/ems/environmental programs/installation restoration/default.htm.

3.4.2 Military Munitions Sites

The primary concern with munitions and explosives of concern is the risk to installation personnel and visitors associated with the potential presence of unexploded live ordnance (armed with exploding warhead). If disturbed, unexploded live ordnance can be deadly. Inert practice ordnance with unexploded signal cartridges is not as dangerous as unexploded live ordnance, but it is also dangerous.

The second concern is potential for environmental contamination. Hazardous constituents contained in munitions and explosives are usually consumed in a series of chemical reactions that occur upon detonation. Occasionally, munitions do not fully detonate or do not detonate at all. If these non-detonated munitions are not recovered and the munitions case is damaged or eventually corrodes, hazardous constituents could leach into the environment.

The Military Munitions Response Program was established to manage the environmental, health, and safety issues presented by unexploded ordnance, discarded military munitions, and munitions constituents. The program maintains an inventory of non-operational ranges that contain or are suspected to contain these items, prioritizes site cleanup with site-specific cost estimates to complete the response, and programs and budgets for such cleanup response actions.

Only non-operational ranges prior to 2002 are included in the Military Munitions Response Program. There are 12 of these sites on MCAS Miramar. Firing on some of these sites dates from 1917. Preliminary assessments of all 12 sites were completed in 2007. Military Munitions Response Program sites 2, 3 and 9 have received No Further Action Letters from the Department of Toxic Substances Control Department. Additional information on Military Munitions Response Program sites is available at http://www.miramar.usmc.mil/ems/environmental_ programs/mmrp/default.htm.

There are 79 old firing ranges, impact areas, and areas where ordnance may exist on MCAS Miramar. Eight ranges are south of the base; 12 of the ranges have been added to the Military Munitions Response Program. The location of the ranges, munitions, and explosives of concern that might be encountered are summarized in *Range Identification and Preliminary Range Assessment, Marine Corps Air Station Miramar* (U.S. Army Corps of Engineers, St. Louis District 2001).

East Miramar is treated as an active range complex; thus, the old Camp Elliott World War II artillery, mortar, and heavy machine gun ranges are not classified as non-operational. As such, they are not within the Military Munitions Response Program. However, natural resources activities within the Camp Elliott area have the potential to encounter unexploded ordnance.

Additional information pertaining to potentially contaminated sites and areas containing munitions and explosives of concern can be obtained by contacting the MCAS Miramar, Environmental Management Department, Engineering Division.