

## **Decision Summary**

### 1.0 Site Name, Location, and Description

The Rocky Mountain Arsenal (RMA) National Priorities List (NPL) site is comprised of two operable units,<sup>1</sup> On Post and Off Post. The On-Post Operable Unit is encompassed by the boundaries of RMA; it occupies 27 square miles in southern Adams County, approximately 8 miles northeast of Denver (Figure 1.0-1). Areas bordering RMA exhibit varied land use. To the north and east the land is primarily agricultural, except for Denver International Airport, around which a great deal of business and residential activity is ongoing or scheduled. The southern boundary is adjacent to the Denver residential, commercial, and industrial community of Montbello and to the former Stapleton International Airport, and the western boundary is adjacent to Commerce City, where land use is residential, commercial, and industrial.

Future land use for the On-Post Operable Unit is addressed in the **Federal Facility Agreement (FFA)**, which was signed by the U.S. Army (Army), U.S. Environmental Protection Agency (EPA), U.S. Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Fish and Wildlife Service (USFWS), U.S. Department of Justice, and Shell Oil Company (Shell) in 1989 (these entities are collectively referred to as the Organizations) pursuant to Section 120 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Among other provisions, the FFA states that it is a goal of the signatories to make significant portions of the site available for beneficial public use and requires the preservation of habitat to the extent required by the Endangered Species Act, Migratory Bird Treaty Act, and Bald Eagle Protection Act. In October 1992, in conjunction with the future goal of beneficial public use and in recognition of the unique urban wildlife resources provided by RMA, President George Bush signed the Rocky Mountain Arsenal National Wildlife Refuge Act, making RMA a national wildlife refuge following EPA certification that required response actions have been appropriately completed. Once the EPA Administrator declares the site protective, ownership of the site will be transferred to USFWS.

Restrictions on land use at RMA or access to RMA are agreed to by the Army, EPA, USFWS, Shell, and state of Colorado (Parties) and are included as part of this **Record of Decision (ROD)**. The Rocky Mountain Arsenal National Wildlife Refuge Act and the FFA restrict future land use, specify that the U.S. government shall retain ownership of RMA, and prohibit certain activities such as agriculture, use of on-post groundwater as a drinking source, and consumption of fish and game taken at RMA.

### 1.1 Environmental Setting

#### 1.1.1 Physiography

RMA is located at the western edge of the Colorado Plains, near the foothills of the Rocky Mountains. It occupies an area of rolling terrain characterized by grasslands, shrublands, wetlands, aquatic habitats, and extensive weedy areas, and it supports a variety of plant and wildlife species. The elevation above mean sea level ranges from 5,330 ft at the southeastern boundary to 5,130 ft at the northwestern boundary.

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<sup>1</sup> Items printed in bold face are included in the glossary.

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Regional surface drainage is toward the northwest into the South Platte River, which flows parallel to the northwest boundary of RMA and eventually joins the North Platte River in Nebraska. The land surface of RMA has largely been shaped by fluvial processes associated with the South Platte River and its tributaries. Wind-borne deposits cover the alluvial land surface in many areas, particularly in the southern and western portions of RMA.

### **1.1.2 Climate**

According to the National Climatic Data Center records for Denver, the mean maximum temperatures range from 43°F in January to 88°F in July; mean minimum temperatures range from 16°F in January to 59°F in July.

Annual precipitation averages approximately 15 inches (water equivalent). Average monthly precipitation is highest in May and lowest from December through February. The maximum precipitation events are heavy localized thunderstorms that occur during late spring and summer. Tornadoes and severe hailstorms may occur in association with intense thunderstorm activity. Snowfall normally occurs from September through May. The average annual snowfall is 58 inches. Average monthly snowfall is highest in March, when snow also tends to have the highest moisture content. Snow generally melts or sublimates rapidly at RMA and normally does not cover the ground for extended periods.

The prevailing wind is from the south. In summer, the strongest winds are associated with thunderstorms. In other seasons, the strongest winds are generally from the northwest quadrant and are downslope "chinook" winds. The annual mean wind speed at RMA is approximately 9 mph, and the maximum hourly wind speed ranges from approximately 33 mph to 38 mph. A maximum wind gust of approximately 70 mph has been recorded at RMA.

### **1.1.3 Existing Cultural Features**

Most military and industrial activities at RMA occurred in three areas: North Plants, South Plants, and the Rail Yard. Cultural features are generally associated with these areas. The primary roads at RMA form a grid that runs along the township section lines.

Structures at RMA include buildings, foundations, basements, tanks and tank farms, process and nonprocess equipment, pipelines, sewers, and other manmade items such as electrical substations. Most of these structures (53 percent) are located in the South Plants area. Two smaller groupings of structures occur in North Plants (12 percent) and in the Rail Yard (8 percent), and the rest (27 percent) occur as individual or small clusters throughout the site.

There are six former disposal basins at RMA. Basin A was originally developed as an unlined evaporative basin for disposal of aqueous waste from the production of mustard and lewisite. Basin B was used as a holding pond for overflow from Basin A. Basins C, D, and E were created from natural depressions to hold overflow aqueous wastes

from preexisting basins. Basin F, partially remediated under the Basin F Interim Response Action (IRA), was an asphalt-lined evaporation basin. Other disposal sites include the Army and Shell Trenches and sanitary landfills.

Three boundary groundwater containment systems, the North, Northwest, and Irondale systems (NBCS, NWBCS, and ICS, respectively), are present at RMA. These systems are designed to treat and to prevent the migration of groundwater contamination to off-post areas. Each system consists of an array of extraction wells, water treatment facilities, an array of injection wells, and, at the NBCS, recharge trenches.

There are also four internal groundwater treatment systems, the Motor Pool, Rail Yard, Basin F, and Basin A Neck IRA systems. Extraction wells in the Motor Pool and Rail Yard IRA systems pump water to the ICS for treatment prior to reinjection at the ICS. At the North of Basin F IRA, water is extracted and piped to the Basin A Neck IRA system for treatment. The Basin A Neck IRA is a pump-and-treat system that intercepts and treats contamination in groundwater as it moves northwest from Basin A. Water is reinjected at the Basin A Neck reinjection trenches.

### 1.1.4 Cultural Resources

Previous to Army operations at RMA, a patchwork of small irrigated farms occupied the southeastern and north-central portions of the site and larger dryland farms and ranches occupied the northeastern portion. Lakes in the southern portion are remnants of this agricultural past. Prior to 1850, the site was used by Native American tribes indigenous to the area, such as the Cheyenne and Arapaho.

The Army is in the process of completing cultural resource surveys that will identify structures or sites that may be protected under the National Historic Preservation Act (36 CFR 800) or the Archeological Resources Protection Act (16 USC Section 469 a-1). To determine the extent of historical and prehistorical resources existing on the current RMA site, several areas were investigated by different archeological teams. To bring all these studies together, as well as to close any information gaps, a complete RMA-wide surface sweep was conducted. A final report summarizing the results of this survey will be completed in summer 1996 prior to initiating on-post remedial actions. Native American sites and farmsteads at RMA were investigated.

No National Historic Register nominations have been made as a result of these activities, but two potentially eligible National Historic Districts were determined to exist, the North Plants manufacturing area and the South Plants manufacturing area. Due to their significant contribution in the Cold War, particularly the North Plants area, consultations were entered into with the Colorado State Historical Preservation Office (SHPO). Because contamination and Chemical Weapons Convention issues require the destruction of these potentially eligible districts, a Historic American Engineering Record of the districts is being prepared in advance of demolition, as is a video history of former residents and workers at RMA. Current projects in South and North Plants are carried out under an Interim Memorandum of Agreement between the Army, SHPO, and USFWS.

### 1.2 Geology

RMA is located within the Denver Basin, an asymmetrical depression approximately 300 miles long and 200 miles wide. The sedimentary rocks in the Denver Basin are more than 10,000 ft thick. Only the surficial soil, unconsolidated alluvium, and Denver Formation units are of interest for remedial actions at RMA.

Virtually all of RMA is covered with unconsolidated alluvial and windblown sediments that may locally reach thicknesses of 130 ft. Due to the nature of the alluvial deposition and erosion and the irregular bedrock surface on which the alluvium lies, there is little lateral continuity in the alluvial units, and the spatial relationships between them are complex. The thickest deposits of these alluvial sediments occur in paleochannels eroded into the underlying Denver Formation, which consists of sandstones, siltstones, and claystones. The paleochannels, which were incised in the bedrock surface and subsequently filled with alluvial deposits, influence regional groundwater flow and the direction and rate of movement of groundwater plumes at RMA. The major paleochannels on post, the First Creek and Irondale channels, direct regional groundwater flow to the north and north-northwest, respectively.

At RMA, the Denver Formation is exposed in only a few isolated outcrops. The unit ranges from approximately 200 to 500 ft in thickness, and is separated from the underlying Arapahoe Formation by a relatively impermeable claystone interval 30 to 50 ft thick. The Arapahoe Formation consists of 400 to 700 ft of interbedded conglomerate, sandstone, siltstone, and shale. The upper portion of the Arapahoe Formation consists predominately of 200 to 300 ft of blue to gray shale with some conglomerate and sandstone beds. The lower portion of the formation consists primarily of sand, gravel, and conglomerate and is a source zone for many water-supply wells in the area.

### 1.3 Hydrology

Flow of surface water at RMA occurs through a network of streams, lakes, and canals. Four principal drainage basins and three smaller subcatchments are recognized within RMA and include the First Creek, Irondale Gulch, Sand Creek, and Second Creek drainage basins and the Basins A and F and Sand Creek Lateral subcatchments.

Streamflow at RMA is highly variable. Seasonal variations in stream discharge are generally greater than average year-to-year variations and are strongly affected by the amount of urban runoff, released or diverted flow, and direct precipitation. Streams at RMA are generally intermittent, and highest flows tend to occur during spring runoff and during major storms. Water levels in the lakes are less variable than stream discharge and are regulated. Peak storage volumes usually occur in spring or early summer.

Groundwater flow occurring within the alluvium and the uppermost weathered portion of the Denver Formation has been designated as the unconfined flow system (UFS). Deeper water-bearing units within the Denver Formation, which are designated as the confined flow system (CFS), are separated from the UFS by low-permeability confining units. Depending on site-specific hydrological characteristics, varying degrees of hydraulic interchange are possible

between surface water and groundwater and between the UFS and CFS. In general, analytical and hydraulic data indicate little hydraulic interchange between the UFS and CFS.

The UFS includes saturated portions of the unconsolidated materials overlying the Denver Formation, the weathered upper portion of the Denver Formation, and, where the Denver Formation is missing near the South Platte River, the weathered upper portion of the Arapahoe Formation. The CFS includes the deeper portions of the Denver Formation and the underlying Arapahoe Formation. Water enters the UFS as infiltration of precipitation; seepage from lakes, reservoirs, streams, canals, and buried pipelines; flow from upgradient regional flow; and flow from the underlying CFS. Water is discharged from the UFS as seepage to lakes and streams, underflow to off-post areas north and west of RMA, and downward flow into the CFS. The UFS may gain or lose water at various locations and at different times of the year.

The CFS consists of strata within the Denver Formation collectively referred to as the Denver aquifer, where water residing in permeable sandstone or fractured lignite is confined above and below by relatively impermeable shale or claystone. Water enters the CFS primarily through regional updip flow and vertical flow from the overlying UFS. Water is discharged from the CFS by lateral flow into the UFS (where the strata are transmissive) or by leakage to the Arapahoe aquifer. The UFS is the principal migration route for groundwater contaminants at RMA. Some low-level contamination is present in isolated portions of the CFS, but the spread of contamination has been minimal due to the limited permeability and discontinuous nature of the water-bearing zones in the CFS. No contaminant migration pathway has been identified for the CFS and no production wells at RMA currently obtain water from the CFS.

#### **1.4 Biological Habitat**

RMA is situated within a temperate grassland region and is part of a broad transition zone between mountain and plains habitats. Tall-grass species are common in moist areas and short-grass species prevail in dry areas. On-post human activity has resulted in vegetation dominated by weedy species and early successional colonists typical for the region. Currently, 88 percent of the RMA land surface is vegetated. Of this total, 41 percent supports early successional plant communities and 19 percent supports crested wheatgrass, which was used in the 1930s and 1940s to stabilize land susceptible to erosion. The remaining 28 percent supports shrubland, patches of yucca, riparian woodlands, cattail marshes and other wetland types, locust and wild plum thickets, upland groves of deciduous trees, and ornamental plantings. Each of these varied plant groups provides potential wildlife habitat.

Regional wildlife is dominated by species of prairie, steppe, and savanna communities. The wildlife species inhabiting RMA are those found in similar habitats off post. RMA supports populations of deer, hawks, and eagles, as well as numerous other mammals, birds, and other animals. In contrast to surrounding urban areas where these species are hunted or are sensitive to human presence, RMA provides a relatively less disturbed habitat that is

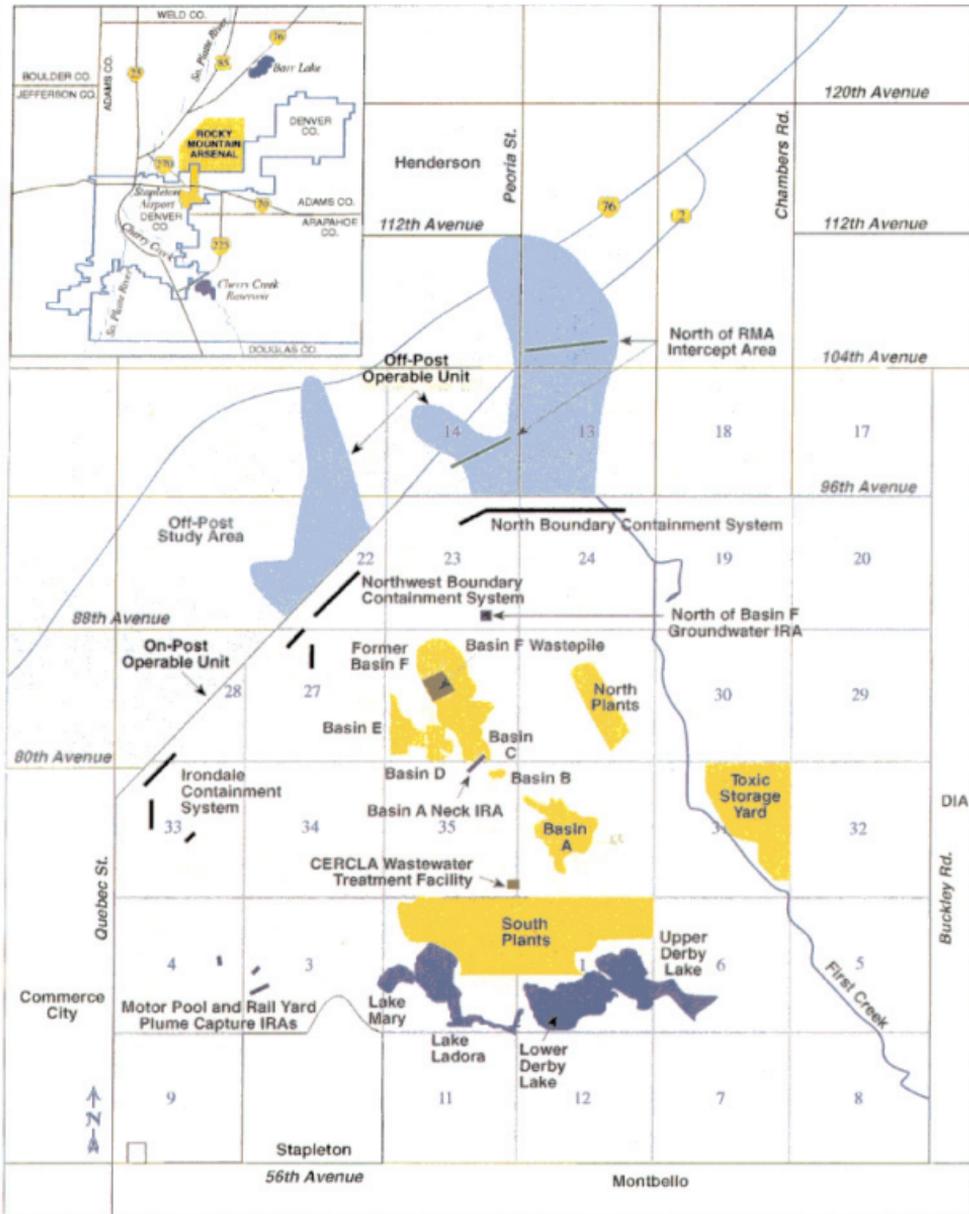
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attractive to wildlife. Its large acreage of diverse open habitats interspersed with lakes, small wooded areas, and a mixture of native grasses and tall weedy forbs, along with a lack of hunting pressure and disturbance, have contributed to an abundance of many wildlife species. The abundance and availability of prey species attracts avian and mammalian predators.

Twenty-six species of mammals have been observed at RMA, a number that includes all of the common mammals that inhabit the prairie grasslands of the Colorado Front Range. One hundred seventy-six species of birds have been observed at RMA, which is approximately 40 percent of all bird species recorded in the state of Colorado. The species richness of RMA birds is high relative to that of the region. At least two regionally rare or declining species (Cassin's sparrow and Brewer's sparrow) are relatively common breeding birds at RMA. Raptor population density and species diversity are comparable with those at other sites in the region. Winter raptor populations, particularly that of the bald eagle, are a primary attraction for the 20,000 to 30,000 visitors that come to RMA during this season.

Several species of reptiles and amphibians may be encountered in nearly every habitat type at RMA. Incidental observation has recorded 61 percent (or 17) of the 28 species of reptiles and amphibians that could potentially occur at RMA. The four lakes in the South Lakes area support aquatic communities, although aquatic insects appear to be largely absent.



**Legend**

20 Section (1 section = 640 acres or 1 square mile)

*Not to scale*

**Figure D-1**  
**RMA Operable Units**