WILDLAND FIRE MANAGEMENT PLAN

SAN DIEGO NATIONAL WILDLIFE REFUGE COMPLEX

2004

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EXECUTIVE SUMMARY

When approved, this document will become the San Diego National Wildlife Refuge Complex (NWRC) Fire Management Plan. Major components include:

- updated policy for wildland fire suppression, hazardous fuels reduction, and pile burning at Tijuana Slough National Wildlife Refuge (NWR), San Diego NWR, San Diego Bay NWR, and Del Mar Mesa Vernal Pools Management Unit (VPMU).

- updated format in compliance with direction of the FWS Fire Management Handbook (Release Date 8/2002).

- establishment of suppression strategy guidance at all refuges and management units within the San Diego NWRC.

This plan establishes guidelines for pre-suppression, suppression, and post-suppression activities on the San Diego NWRC. Prescribed fire is not a management strategy at this time. Mechanical treatments will be used to treat hazardous fuels and maintain fuel-breaks. Disposal of mechanically treated fuels may include pile burning on-site. Wildland Fire Use will not be a management tool on these refuges due to natural resource and public values at risk and wildfire escape potential.

INTRODUCTION

This document establishes guidelines for the Fire Management Program on the San Diego NWRC. The San Diego NWRC includes Tijuana Slough NWR, San Diego Bay NWR, San Diego NWR, Seal Beach NWR, and the Del Mar Mesa VPMU (Figure 1). As of July, 2004, the Sweetwater Marsh NWR and South San Diego Bay Unit of the San Diego NWR were combined under the title of San Diego Bay NWR. South San Diego Bay and Sweetwater Marsh NWR are now considered units under this title. Several maps and other components of this plan may make reference to the old titles. All references could not be corrected for this version but will be in future editions. This name change and consolidation will not affect how this plan is implemented or how fires will be managed.

Tijuana Slough NWR, San Diego Bay NWR, San Diego NWR, and the Del Mar Mesa VPMU all have vegetation that under typical weather and fuel conditions could ignite and continue to burn until extinguished either naturally or through fire suppression activities. This plan will not cover Seal Beach NWR. Seal Beach NWR does have areas of low growing vegetation, which could ignite under very unusual conditions, but the resulting impacts would be minimal and the fire would not jeopardize public safety. Additionally, there is virtually no possibility of a wildland fire leaving the refuge boundaries. The Seal Beach Naval Weapons Station has a comprehensive fire management plan that addresses both fire protection and suppression activities. The Seal Beach Refuge Manager reviewed that plan for FWS environmental compliance. In January 2003, the California and Nevada Operations office approved an exemption from fire management planning for Seal Beach NWR (Appendix H); therefore, we will not discuss this refuge in subsequent chapters of this Fire Management Plan.

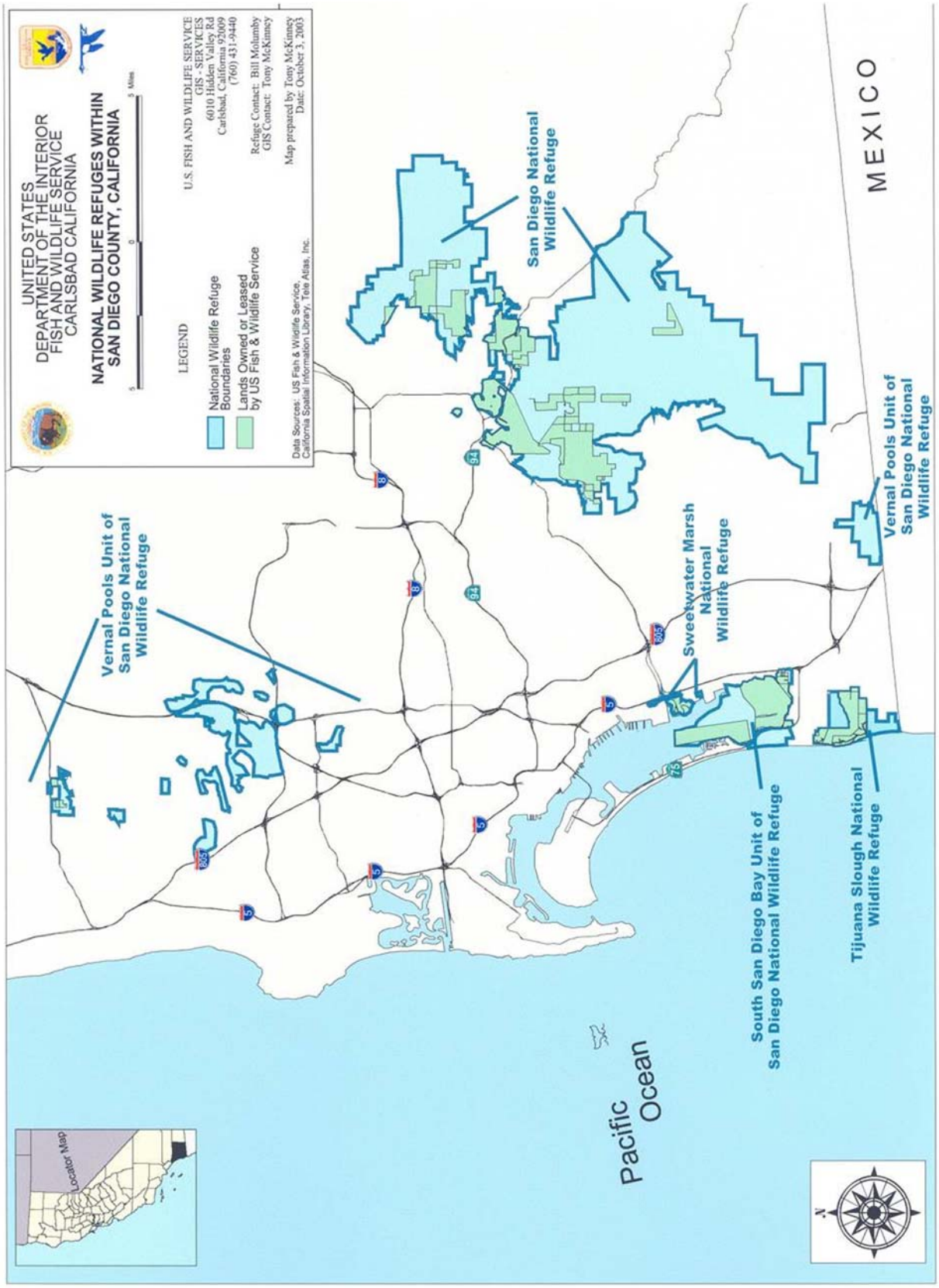
In July 2000, Tijuana Slough NWR completed a Comprehensive Management Plan (CMP). A Comprehensive Conservation Plan for San Diego Bay NWR is currently being prepared with an expected completion date of fall 2004. Management for the remaining refuges is found in either the establishment documents or subsequent environmental documents. CCP's for those refuges are scheduled for completion in 2007. This plan will meet the requirements of the National Environmental Protection Act (NEPA), the National Historic Preservation Act (NHPA), and the Endangered Species Act (ESA).

This plan also serves as an operational guide for managing the refuges' wildland fire and fuels management programs. It defines strategies needed to provide for public and firefighter safety as well as protect private property and facilities. It also provides strategies for maintaining and restoring important habitats of high natural resource value and critical habitats used by endangered species, given the current understanding of fire's relationship in these natural ecosystems. This plan was developed in compliance with an FWS requirement that refuges with burnable vegetation develop a fire management plan (620 DM 1).

Within the San Diego NWRC, wildland fire responsibilities are accomplished both by agency and cooperators with agency oversight. The Fish and Wildlife Service (FWS) wildland fire department located on the San Diego NWR provides pre-suppression, suppression and post suppression services for the Tijuana Slough NWR, Del Mar Mesa VPMU, San Diego Bay NWR. Mutual aid suppression assistance is provided on these refuges by local, state, and other federal fire departments. On the San Diego NWR, the FWS provides pre-suppression and post suppression services. The California Department of Forestry and Fire Protection (CDF) provides the suppression element under the statewide Direct Protection Area (DPA) agreement with assistance from the FWS. The Seal Beach Naval Weapons Fire Department provides all elements of the fire management program for Seal Beach NWR with assistance from FWS fire management. This fire management plan provides cooperators with the information and guidance necessary when performing fire suppression activities on these refuges and management units. It also provides direction to agency personnel and cooperators on fire suppression activities that may affect the natural plant communities, sensitive species, and cultural resources present within the San Diego NWRC, and how to minimize or avoid those impacts.

Four factors influence how wildland fire will be managed on the San Diego NWRC – flammable vegetative communities, high frequency of human caused fires, private property adjacent to refuge boundaries, and threatened & endangered species. First, chaparral and coastal sage scrub vegetation communities account for approximately 8,500 acres of the San Diego NWRC vegetation. This comprises roughly 75% of the total vegetation found on these refuges, excluding water and marshes. Second, based on the San Diego NWRC's fire records, the current fire frequency in this fuel type exceeds the natural fire regime of 35-100 years due to human-caused ignitions. Human-caused fires have accounted for 100% of all wildland fires on these refuges since inception. Thirdly, the areas surrounding the San Diego NWRC include hundreds of single-family homes and businesses either adjacent to, or within the approved acquisition boundaries of the refuges. These refuges fit the classic definition of wildland-urban interface situations. Thirteen of these communities (Table 4) are considered Communities at Risk and listed in the Federal Register. Bearing out this risk is that more than 700 homes located within the wildland-urban interface are destroyed in California annually (CDF 1996). Lastly, 21 species of threatened and endangered plants and animals (Table 1) are found on these refuges, along with 7 critical habitats (Appendix E). The potential for adverse effects to any one of these species is high due to the unusually high frequency of the current fire return interval. Adverse effects would include habitat loss or individual mortality. Therefore, all wildland fires will be suppressed using the appropriate management response as identified in this plan.

Figure 1. San Diego National Wildlife Refuge Complex and Management Units.



COMPLIANCE WITH USFWS POLICY

Operational plans for the various refuges and units of the San Diego NWRC have not been completed, with the exception of the Comprehensive Management Plan (CMP) for the Tijuana River Estuary that encompasses Tijuana Slough NWR (2000). A Comprehensive Conservation Plan (CCP) for San Diego Bay Unit is currently being prepared with an expected completion date of November 2004. The CCP for San Diego NWR is scheduled to begin in 2007. This Fire Management Plan will be reviewed and updated as those plans are completed and necessary revisions will be made.

Environmental Assessments (EAs) for the establishment of each refuge within the San Diego NWRC are completed. The Tijuana Slough, San Diego and San Diego Bay EAs identify the need for a Fire Management Plan and refer to the need for wildfire and vegetation management planning. In 2001, a Biological Evaluation was prepared for fuel break maintenance activities at San Diego NWR (Appendix D1) and submitted to the USFWS Carlsbad Field Office for consultation under Section 7 of the Endangered Species Act. The Carlsbad Field Office concluded that such activities are not likely to adversely affect any threatened or endangered species. In 2003, a Biological Evaluation was prepared for fire suppression and pile burning activities within the San Diego NWRC (Appendix D2) and submitted to the USFWS Carlsbad Field Office for consultation under Section 7 of the Endangered Species Act. The Carlsbad Field Office concurred that these activities also are not likely to adversely affect any threatened or endangered species.

U.S. Fish and Wildlife Service policy gives specific direction regarding fire management. Department of the Interior Manual 910 (USDI 1997) states the following regarding wildland fires:

> Wildfires may result in loss of life, have detrimental impacts upon natural resources, and damage to or destruction of man-made developments. However, the use of fire under carefully defined conditions is to be a valuable tool in wildland management. Therefore, all wildfires within the Department will be classified either as wildfire or as prescribed fires. Wildfires, whether on lands administered by the Department or adjacent thereto, which threaten life or man-made structures, or are determined to be a threat to the natural resources or the facilities under the Department's jurisdiction, will be considered emergencies and their suppression given priority over normal Departmental programs.
>
> Bureaus will give the highest priority to preventing the disaster fire – the situation in which a wildfire causes damage of such magnitude as to impact management objectives and/or socioeconomic conditions of an area. However, no wildfire situation, with the possible exception of a threat to human survival, requires the exposure of firefighters to life threatening situations. Within the framework of management objectives and plans, overall wildfire damage will be held to the minimum possible giving full consideration to (1) an aggressive fire prevention program, (2) the least expenditure of public funds for effective suppression, (3) the methods of suppression least damaging to resources and the environment, and (4) the integration of cooperative suppression actions by agencies of the Department among themselves or with other qualified suppression organizations.
>
> Prescribed fires may be used to achieve agency land or resource management objectives as defined in the fire management plans. Prescribed fires will be conducted only when the following conditions are met:
>
> a. Conducted by qualified personnel under written prescriptions.
> b. Monitored to assure they remain within prescription.
>
> Prescribed fires that exceed the limits of an approved prescribed fire plan will be reclassified as a wildfire. Once classified a wildfire, the fire will be suppressed and will not be returned to

prescribed fire status.

The authority for funding (normal fire year programming) and all emergency fire accounts is found in the following authorities:

Section 102 of the General Provisions of the Department of Interior's annual Appropriations Bill provides the authority under which appropriated monies can be expended or transferred to fund expenditures arising from the emergency prevention and suppression of wildland fire.

P.L. 101-121, Department of the Interior and Related Agencies Appropriation Act of 1990, established the funding mechanism for normal year expenditures of funds for fire management purposes.

31 US Code 665(E)(1)(B) provides the authority to exceed appropriations due to wildland fire management activities involving the safety of human life and protection of property.

Authorities for procurement and administrative activities necessary to support wildland fire suppression missions are contained in the Interagency Fire Business Management Handbook.

The Reciprocal Fire Protection Act of May 27, 1955 (42 U.S.C. 815a; 69Stat 66) provides Authorities to enter into agreements with other Federal bureaus and agencies, with state, county, and municipal governments, and with private companies, groups, corporations, and individuals regarding fire activities.

Authority for interagency agreements is found in Interagency Agreement between the Bureau of Land Management, Bureau of Indian Affairs, National Park Service, US Fish and Wildlife Service of the United States Department of the Interior and the Forest Service of the United States Department of Agriculture (1996).

Authorities for implementing this plan include the following:

- Protection Act of September 20, 1922 (42 Stat. 857; 16 U.S.C. 594).
- Economy Act of June 30, 1932.
- Reciprocal Fire Protection Act of May 7, 1955 (69 Stat. 66, 67; 42 U.S.C. 1856,1856 a & b).
- Disaster Relief Act of May 22, 1974 (88 Stat. 143; 42 U.S.C. 5121).
- Department of the Interior Appropriation Act. Section 102.
- National Wildlife Refuge System Administrative Act of 1966 as amended (80 Stat. 927; 16 U.S.C. 1601) 668dd-668ee).
- Federal Fire Prevention and Control Act of October 29, 1974 (88 Stat.1535; 15 U.S.C. 2201).
- Wildfire Suppression Assistance Act of 1989, (Pub. L. 100-428, as amended by Pub. L.101-11, April 7, 1989).
- Departmental Manual (Interior), Part 910 DM, Chapter 1, Wildland Fire Suppression Management (March 29, 1990).
- National Environmental Policy Act of 1969.
- Clean Air Act (42 United States (USO) 7401 et seq.).
- The National Wildlife Refuge Improvement Act
- Endangered Species Act of 1973.

FIRE MANAGEMENT OBJECTIVES

The objectives of this Fire Management Plan for the San Diego National Wildlife Refuge Complex are consistent with both the resource management objectives as defined in the goals of the National Wildlife Refuge System, which are:

- *To preserve, restore, and enhance in their natural ecosystems (when practicable) all species of animals and plants that are endangered or threatened with becoming endangered.*

- *To enhance and preserve habitats used by migratory birds.*

- *To preserve a natural diversity and abundance of fauna and flora on refuge lands.*

- *To provide an understanding and appreciation of fish and wildlife ecology and man's role in his environment, and to provide refuge visitors with high quality, safe, wholesome, and enjoyable recreational experiences oriented toward wildlife to the extent these activities are compatible with the purposes for which the refuge was established.*

And the San Diego National Wildlife Refuge Complex goals, which are:

- *To protect, restore and enhance native habitats to aid in the recovery of federally listed endangered and threatened species and to prevent the listing of additional species.*

- *To protect, manage and restore the rare coastal sage scrub, chaparral, riparian woodland, vernal pools, coastal dune and wetlands habitats representative of the biological diversity of the southwestern San Diego region.*

- *To create partnerships and provide leadership in coordinating the land management activities of Federal, Tribal, State and local governments and agencies and with academia, private conservation organizations, and citizens in support of the Multiple Species conservation Program preserve system.*

- *To provide breeding, migration, and wintering habitat for migratory birds with emphasis on seabird and shorebird breeding habitat and wintering waterfowl habitat.*

- *To provide safe and high quality opportunities for compatible wildlife dependent educational and recreational activities that foster public appreciation of the unique natural heritage of the San Diego region for the conservation of native coastal sage scrub, chaparral, grassland, vernal pool, and riparian communities, recovery of several endangered and threatened species, and the protection of biological diversity.*

The guiding principle of the fire management objectives of this plan will be to provide for firefighter and public safety as the primary consideration of every action. Goals of fire management on the San Diego NWRC are to:

- Implement pre-suppression, suppression, and post-suppression activities that maintain or enhance the current biological communities, and prevent adverse impacts on resources consistent with completing the fire protection mission.

- Enhance or restore native plant communities and benefit other resources of the biological

community that have been reduced in extent or degraded by human-caused factors, including increased fire frequency.

- Identify fire return intervals and identify effects upon various plant communities to assist in the development of future management actions, which may include prescribed burning. The goal is to restore optimal fire regimes for habitat and watershed management.

- Develop a program of Fire Prevention & Public Education to heighten awareness of fire issues for the surrounding communities.

- Manage Hazard Fuels to reduce the threat of severe wildland fire to communities at risk (WUI) and the environment.

- Protect life, property, and resources from wildland fire.

- Develop and implement a process to ensure the collection, analysis and application of high quality fire management information needed for sound management decisions.

Specific Fire Management Objectives are:

Suppression

FMU target individual wildland fire size:

- Coastal: 12 -34 acres annually with 97% success at all fire intensity levels (Table 14).
- Inland: 92-262 acres annually with 97% success at all fire intensity levels (Table 14).

Pre-suppression

FMU target fuels and wui protection measures:

- San Diego NWRC to complete all approved fuelbreak maintenance activities before June 1 annually.

DESCRIPTION OF SAN DIEGO NWRC

GENERAL REFUGE DESCRIPTIONS

Tijuana Slough National Wildlife Refuge

Home to many endangered birds and one endangered plant, this beautiful 1,072 acre wetland where the Tijuana River meets the sea is southern California's only coastal lagoon not bisected by roads and rail lines. 550 acres are comprised of U.S. Navy property but are managed as an overlay by the FWS. Tijuana Slough NWR is part of the larger Tijuana River National Estuarine Research Reserve. Reserve lands in total consist of 2,531 acres. More than 370 species of birds have been recorded on the refuge and in the adjacent river valley. The endangered California least tern (*Sterna antillarum browni*), Least bell's vireo (*Vireo bellii pusillus*), California brown pelican (*Pelecanus occidentalis californicus*), Light footed clapper rail (*Rallus longirostris levipes*) and an endangered plant, Salt marsh bird's beak (*Cordylanthus maritimus* ssp. *maritimus*), can all be found on the refuge. The Western Snowy Plover, a threatened species, is a year round resident and nests on refuge beaches. Tijuana Slough's habitats include open water, tidal salt marsh, beach dune, riparian, vernal pool and upland surrounded by residential neighborhoods.

San Diego Bay National Wildlife Refuge

The Sweetwater Marsh Unit of this Refuge was established in 1988 to conserve endangered and threatened fish, wildlife, and plant species. It is located on the eastern boundary of the San Diego Bay in the cities of Chula Vista and National City. Total refuge size is 316 acres, which includes tidal marsh and adjacent upland habitats. Dedicated in June of 1999, South San Diego Bay Unit was a management unit of San Diego NWR until the recent consolidation. The approved refuge acquisition boundary is 3,940 acres. With 90 to 100% of submerged lands, intertidal mudflats, and salt marshes eliminated in the north and central portions of the bay, San Diego Bay Refuge preserves and restores the remaining wetlands, mudflats, and eel grass beds to ensure that the bay's thousands of shorebirds and waterfowl migrating along the Pacific Flyway as well as its resident species will survive into the next century. The bay supports numerous endangered and threatened species of plants and animals and is a vital link to other wildlife areas. San Diego Bay NWR supports many of the same threatened and endangered species as Tijuana Slough NWR.

San Diego National Wildlife Refuge

This east county refuge was established in 1996 as part of the U.S. Fish and Wildlife Service’s contribution to the Multiple Species Conservation Plan (MSCP) of San Diego County. The MSCP is a program designed to conserve enough open space and habitat for species survival while enabling development to occur in areas outside of those protected through the plan. The acquisition boundary of the San Diego NWR encompasses 43,000 acres of mostly contiguous land. Of the 43,000 acres, approximately 7,652 acres are currently in USFWS ownership and 9,107 are under USFWS management (November 2003). The remaining land is either in private or other governmental ownership. There is a continuing effort to acquire and protect the remaining private lands within the acquisition boundary. The conservation and restoration of San Diego NWR's coastal sage scrub and chaparral habitats adds to the efforts of other inland preserves established to conserve and restore diminishing wildlife habitats. This inland refuge is home to such endangered species as the Least Bell's Vireo, Quino checkerspot butterfly, and Otay tarplant. It is also home to the threatened coastal California gnatcatcher and to many other sensitive species including the San Diego Horned Lizard.

Del Mar Mesa Vernal Pools Management Unit

The Del Mar Mesa VPMU consists of three parcels totaling 60 acres. These are unique and extremely rare wetland habitats, and have been described as an “endangered ecosystem” (USFWS 1997). This unit represents a portion of the protected vernal pools in San Diego County. Vernal pools are shallow seasonal wetlands with very specific hydrology and geomorphological characteristics. Vernal pools are an extremely scarce wetland type occurring only where certain soil conditions are present. In late

summer, fall and early winter, vernal pools appear as dry, dusty indentations mostly devoid of vegetation. In late winter and early spring, rains can cause a spectacular transformation. As these depressions fill with water, high numbers of endangered, rare and sensitive species of plants and animals appear in and around the pools, many of which can only be found in these systems. The endangered San Diego Fairy Shrimp (*Branchinecta sandiegonensis*) lies dormant in the pools' dusty crevices until the wet season fills the pools with water. Delicately hued plants also grow during this wet phase. They proceed to blossom, and then change once again as the water begins to evaporate in the spring. As the pools dry, blossoms of every color fill these seemingly insignificant indentations in the landscape. In summer, these temporary wetlands dry out completely until the cycle of life resumes with the onset of winter rains.

PHYSICAL RESOURCES

Major topographic features of the San Diego NWRC include portions of the lower Tijuana, Otay and Sweetwater River Valleys and the San Miguel Mountains. All three rivers are ephemeral, with the Otay and Sweetwater feeding municipal water reservoirs. Elevations range from sea level at the coastal refuges to approximately 2,565 feet at the peak of San Miguel Mountain which is located on San Diego NWR. Prominent peaks include those on San Miguel, Mother Miguel, and McGinty Mountains. No known earthquake faults run through the refuges. The La Nacion Fault Zone lies approximately 6 to 8 miles (10 to 28 kilometers) to the northwest and is considered to be potentially active. The Elsinore Fault is approximately 35 miles (56 kilometers) northeast of the planning area. A significant seismic event could occur from the active Rose Canyon Fault, which runs parallel to Interstate Highway 5 and continues on through downtown San Diego.

CLIMATE

Climate within the San Diego NWRC is identified as maritime Mediterranean. Characteristics include low rainfall, moderate temperatures, and low to moderate relative humidity. Most precipitation occurs from December through April, with an annual average of 10 to 12 inches, and comes in the form of rain. Snow fall at higher elevations is possible but not common. Winter temperatures rarely fall below freezing while summer temperatures range from lows of 55 degrees to highs of over 100 degrees in the inland valleys. Average relative humidity at the coast is between 40 and 60 percent, with inland valleys averaging 20 to 30 percent. Coastal fog is common during the late spring and early summer. Wind flows are typically up slope/onshore during the day and down slope/offshore at night. Winds are characterized by a moderately strong land and sea breeze cycle. Generally, the sea breeze condition occurs between late morning and late afternoon with an average direction from the west-southwest. Between late afternoon and early morning, a land breeze dominates the local wind pattern. These wind patterns are influenced by topography.

Southern California fire weather is influenced by the Pacific Ocean and its severity is dictated by the seasonal, migratory, subtropical high pressure cell in the eastern Pacific known as the "Pacific High." In the summer, this pressure center sets up off the northern Pacific coast and causes storms to track north of California. This high pressure cell maintains relatively mild to high temperatures, no precipitation, and low humidity in the San Diego area. Cold fronts are typically not a factor influencing fire weather in southern California as they are in most of the United States. As winter approaches, this high pressure cell moves south and permits storms to once again track into southern California and bring winter rains. Summer thunderstorms can develop over the eastern mountains due to monsoonal moisture flows from the south. These thunderstorms occasionally track west over refuge lands, producing summer showers. Lightning is a factor in east San Diego county and it occasionally occurs on refuge lands. Periods of above 100 degree temperatures, relative humidity below 10%, and increased weather instability occasionally occur during July, August and September when a second high pressure system may develop over the western U.S. These periods of "extreme" fire weather are predicted by the Riverside fire weather office. They can last 2 to 10 days and increase the rates of spread and fireline intensity significantly.

Fire danger relative to spread, energy release, ignition, and risk is calculated using the National Fire Danger Rating System (NFDRS) on a daily basis by accessing Remote Automated Weather Stations (RAWS) located throughout the county. There are 5 adjectives for describing the daily fire danger; low, moderate, high, very high, and extreme. The average daily fire weather for San Diego County is considered high (Appendix I). While coastal refuges experience mild temperatures and moderate relative humidity, the inland refuge lands do not benefit from the proximity of the ocean due to their distance inland. At these inland refuge lands, moderate burning conditions usually exist from around 10:00 a.m. until 1:00 p.m.. Peak fire danger hours are from 1:00 p.m. to 4:00 p.m. This period is typified by onshore winds of 10 to 15 mph, relative humidities of 10 to 20%, and temperatures of 80 to 90 degrees. Periods of lowest fire activity occur during the midnight to daybreak hours. Exceptions are inversions and "thermal belts," which are weather features that either create stability and lower fire activity during morning hours or continue fire activity during the night.

Significant fire weather events that are common during the fall months and coincide with the end of the summer drought are called Santa Ana winds. These wind events are similar to winds found in other parts of the country called by names such as "chinook, east, and mono" winds. They are foehn, or gradient winds. During these events, air flows from a high pressure area near the Four Corners areas of Colorado and Utah to a low pressure area off the southern California coast. This wind is funneled through passes and canyons, warming and drying by subsidence and compression as it spills off the inter-mountain plateau to the lower elevations of the pacific coast. During this event, wind direction and humidity are not affected by nightfall. Wind speed, however, will increase during downhill flows on lee sides of passes and canyons at night. Humidities below 10 percent and wind speeds in excess of 20 mph from the northeast are trademark features of this event, which usually lasts from 3 to 5 days.

CULTURAL RESOURCES

Tijuana Slough NWR - A limited number of historical and archaeological sites exist in the lower Tijuana River Valley. Local records document about 16 archaeological sites in the nearby Border highlands area and along the coastal shore. Sites identified indicate past use by San Dieguito, La Jolla, and Yuman groups (City of San Diego 1981). An early Spanish explorer observed a native village located in the valley in 1769, but the exact location of the village was not recorded.

San Diego NWR - Extensive archaeological surveys were conducted as part of the planning and approval process for the proposed Rancho San Diego development in 1987. This area is located in the San Diego National Wildlife Refuge. Archaeological surveys within the Rancho San Diego site document prehistoric use of the area by the Kumeyaay Tribe. Archaeological surveys have identified milling and flaking stations, possible lithic quarry, limited flake scatter sites and campsites. A major native American habitation site, the Kumeyaay village of Jamacha, is reportedly located near Jamacha Junction, where SR 54 and SR 94 meet (Ogden 1995). This location is partially within the acquisition boundary.

San Diego Bay NWR - At the southern end of the refuge, eight archaeological sites have been recorded on or near the refuge, two of which have been determined to be ineligible to the NRHP. Six of the sites are prehistoric and two sites contain both prehistoric and historic-period artifacts. Prior to ground disturbing activities within the Otay River floodplain portion of the unit, a cultural resource survey must be conducted for the area and any newly discovered sites, in addition to one previously recorded site, must be evaluated to determine eligibility to the NRHP. Additionally, two historic sites are present: the Coronado Railway is ineligible and the Salt Works is eligible. Four historic buildings are located outside of the unit boundaries along the urban interfaces. (USFWS 2002). At the northern end of the refuge, several surveys have been conducted which revealed both prehistoric and historic artifacts. Five archaeological sites have been recorded on or near the refuge and all five have been determined to be ineligible for listing on the National Register of Historic Places (NRHP). Three of the sites are prehistoric, one site contains both prehistoric and historic-period artifacts, and one site

contains only historic artifacts. The remains of the Coronado Railway have been determined to be ineligible to the NRHP. The site of the Hercules Gunpowder Plant on Gunpowder Point has not yet been fully surveyed, recorded or evaluated for eligibility to the NRHP. Six historic buildings are located outside the refuge boundaries along the urban interface. (USFWS 2002)

No known archaeological surveys have been conducted for the Del Mar Mesa VPMU or surrounding areas.

FISH & WILDLIFE

A rich tapestry of native plant and animal communities highlights the uniqueness of the San Diego region. San Diego County contains over 200 plant and animal species that are federally and/or state listed as endangered, threatened, or rare, proposed or candidates for listing, or otherwise considered sensitive (San Diego County 2002). The largest numbers of the Federally endangered least Bell's vireo and threatened coastal California gnatcatcher occur in San Diego County. Currently, 21 federally listed species of plants and animals, that are listed as endangered or threatened, occur on the San Diego NWRC. Included in that list are the coastal California gnatcatcher, least Bell's vireo, southwest willow flycatcher, light-footed clapper rail, California least tern, Quino checkerspot butterfly, San Diego fairy shrimp, Salt marsh birds-beak, and Otay tarplant (Table 1). Within the San Diego NWRC, approximately 28 distinct plant communities, as described by Holland (1986), are found. Of these, 20 are considered rare. Twelve major habitat types are considered sensitive. Five critical habitats have been identified within the San Diego NWRC (Figures 3a-3c in Appendix E).

The California Floristic Province, within which southern California plant and animal communities occur, has been described as one of the biodiversity hotspots of the world (Dobson 1997). San Diego's latitudinal location, its great variety of micro-habitats, its generally mild climate, and its location along the Pacific flyway have combined to give the region an extremely rich legacy of native organisms. This legacy is threatened by the immense immigration of humans to the area that spawned the growth of sprawling cities and landscape level changes that have largely occurred in the last century. San Diego County boasts one of the longest lists of plant and bird species of any county in the United States. It is also home to more endangered, threatened, and sensitive species than almost any area of comparable size in North America. This threatened legacy is the impetus behind the establishment of the San Diego National Wildlife Refuge Complex and other land conservation efforts in the region. This fire management plan is part of a much larger effort to conserve, preserve, restore, and manage this region's natural diversity, evolutionary legacy and quality of life.

Table 1. Threatened and Endangered Species at San Diego NWRC.

Species		**Federal Status***	**Refuge****			
Scientific Name	**Common Name**		**TS**	**SD**	**SB**	**VP**
Plants						
Acanthomintha ilicifolia	San Diego thornmint	T		X		
Ambrosia pumila	San Diego ambrosia	E		X		
Cordylanthus maritimus ssp. *maritimus*	Salt marsh bird's-beak	E	X		X	
Eryngium aristulatum var. *parishii*	San Diego button-celery	E		X		X
Deinandra conjugens	Otay tarplant	T(ch)		X		

Navarretia fossalis	Spreading navarretia	T		X		
Orcuttia californica	California orcutt grass	E		X		
Pogogyne abramsii	San Diego Mesa mint	E		X		X
Pogogyne nudiuscula	Otay Mesa mint	E		X		X
Crustaceans						
Branchinecta sandiegonensis	San Diego fairy shrimp	E(ch)	X	X		X
Butterflies/Moths						
Euphydryas editha quino	Quino checkerspot butterfly	E(ch)		X		
Amphibians						
Bufo californicus	Arroyo toad	E(ch)		X		
Reptiles						
Chelonia mydas	Pacific green turtle	E			X	
Birds						
Charadrius alexandrinus	Western snowy plover	T (ch)	X		X	
Empidonax traillii extimus	Southwest willow flycatcher	E	X	X		
Falco peregrinus anatum ***	American Peregrine falcon	E	X	X	X	
Pelecanus occidentalis californicus	California brown pelican	E	X		X	
Polioptila californica californica	Costal California gnatcatcher	E (ch)	X	X	X	
Rallus longirostris levipes	Light-footed clapper rail	E	X		X	
Sterna antillarum browni	California least tern	E	X		X	
Vireo bellii pusillus	Least bell's vireo	E(ch)	X	X	X	

* E = Endangered; T = Threatened; ch = Critical Habitat
** TS = Tijuana Slough NWR; SD = San Diego NWR; SB = San Diego Bay NWR; VP = Del Mar Mesa Vernal Pools Management Unit.
*** De-listed Taxon, monitor status

VEGETATION COMMUNITIES

Some plant communities are nearly extirpated in the San Diego region (Table 2). These losses have raised concern among local citizens and public officials for the conservation and protection of remaining native areas. Conservation of core biological resource areas include such plant communities as coastal sage scrub, vernal pools, salt marsh, riparian communities, wetlands, grasslands, Tecate cypress forests, and chaparral. Conservation of these and other plant communities is essential to conserving endangered species and preserving the region's biological diversity and environmental health.

Table 2. San Diego County Plant Communities.

Plant Community	**% of Original Area Remaining**
Vernal pools	2
Native perennial grassland	5
Maritime succulent scrub	10
Freshwater marsh	10
Coastal mixed chaparral	12
Southern maritime chaparral	18
Coastal sage scrub	28

City of San Diego and U.S. Fish and Wildlife Service 1997

Vegetation communities found on the four refuges and two management units range from submerged-intertidal to interior valley upland types. The range in elevation and distance from the coast associated with these refuges results in a broad range of vegetation communities. Table 3 provides a reference to the vegetation communities, general location, and approximate acreage. Figures 2a-2e display vegetation maps for each of the refuges and management units.

Coastal Salt Marsh

Coastal salt marshes are restricted to the upper intertidal zone of protected shallow bays, estuaries and lagoons (MacDonald 1988). Vegetation that typifies coastal salt marsh in southern California includes succulent plants such as pickleweed (*Salicornia virginica*), glasswort (*Salicornia subterminalis*) and batis (*Batis maritima*). The lower marsh consists of expanses of cordgrass (*Spartina foliosa)* that provides nesting and roosting habitat for the endangered Light-footed Clapper Rail *(Rallus longirostris levipes*). The upper marsh includes other more xeric associated species such as shoregrass (*Monanthachloe littoralis*), salt grass (*Distichlis spicata*), and the federally endangered plant salt-marsh bird's beak (*Cordylanthus maritimus maritimus*). Salt marsh is one of the most impacted vegetation associations in southern California. It is estimated that as much as 90% of this plant community has been lost to development. Recent estimates indicate that in San Diego Bay only about 15% of the original salt marsh remains from its historic occurrence during the 1800's. That remaining 15% is degraded by exotic species, contaminants, inputs, and altered hydrology. Coastal salt marsh areas in the San Diego Refuge Complex are frequently lacking in upland transition plant communities adequate to provide high tide refuge for endangered birds that live in the marshes. This plant community should ideally be comprised of coastal sage scrub or coastal succulent scrub plant associations. In San Diego's remaining salt marshes the upland transition plant community is dominated by exotic grasses, other exotic species, or urbanized areas. These disturbed plant communities and urban areas now typify the upland transition areas surrounding San Diego's

remaining salt marshes.

Table 3. Summary of Vegetation Communities, Locations, and Acres.

	Refuge /Location			
Vegetation Communities (Acres*)	**Tijuana Slough NWR**	**San Diego Bay NWR**	**San Diego NWR**	**Del Mar Mesa VPMU**
Saltwater Marsh	600	208	–	–
Grassland	9	10	210	–
Coastal Sage Scrub	31	1	4750	5
Chaparral	–	–	1550	73
Coastal Sage-Chaparral Scrub	–	–	2100	–
Mule Fat / Willow Scrub	–	–	5	–
Riparian Woodland	182	30	100	–
Oak Woodlands	–	–	60	–
Vernal Pools	1	–	1	3
Fallow Fields & Disturbed Habitat	87	102	200	–

* Approximate acreage based on historic vegetation mapping and interpolation.

Grasslands

Annual and perennial grasslands are generally characterized by a mixture of native and introduced grass species. They tend to occur on fine, clay like soils that become waterlogged after winter rains, and become very dry during the summer months. Prior to European settlement, southern California grasslands were dominated by native grasses (*Nassella Pulchara* and *N cernua*). Native grasslands have since been largely invaded by nonnative species and are now very rare (Holland 1986). Nearly 95% of San Diego County's historical native grassland acreage had been lost as of 1988 (Oberbauer and Vanderwier 1991). Most grasslands on the San Diego NWRC are dominated by nonnative species of bromes (*Bromus* spp.), oats (*Avena* spp.), mustards (*Brassica* spp.), and filaree (*Erodium* spp.). Non-native grassland is not considered a rare habitat type, but is considered an important habitat for raptor foraging. Areas dominated by exotic grasses may also be havens for rare plants. The largest expanses occur south of Otay River and the Proctor Valley area.

Coastal Sage Scrub

Coastal sage scrub is the most common native plant community within the San Diego National Wildlife Refuge. Coastal sage scrub consists predominantly of low growing, aromatic and generally soft leaved shrubs. During periods of dryness, including summer and extended drought, many of the shrubs will lose all their leaves only to regenerate them when rain returns. Characteristic plant species include coastal sagebrush (*Artemisia californica*) and flat-topped buckwheat (*Eriogonum fasciculatum*). As a subset of coastal age scrub, both Diegan and Riversidean coastal sage scrub are recognized (Holland 1998), and occur on the refuges. Diegan coastal sage scrub, in addition to

containing the plant species already mentioned, also contains laurel sumac (*Malosma laurina*) as a dominant species (*i.e.*, covers more horizontal area than other associated species) (Holland 1989). The fire history of the area often confuses the identification of the distribution of scrub types. That is, areas that currently appear to be Riversidean coastal sage scrub may actually be early successional stages of Diegan coastal sage scrub or chaparral.

Chaparral

Chaparral vegetation consists of a dense covering of multi-stemmed shrubs with small, leathery, evergreen leaves (sclerophyllous leaves). The structure, density, and high oil content in the foliage of mature chaparral stands provide conditions favorable for supporting very hot, intense wildfires. Many native species require fire for successful seed reproduction. Characteristic native species include chamise (*Adenostoma fasciculatum*), scrub oak (*Quercus berberidifolia*, *Q. dumosa*), California lilac (*Ceanothus tomentosus*), wart-stemmed ceanothus (*Ceanothus verrucosus*), toyon (*Heteromeles arbutifolia*), mountain mahogany (*Cercocarpus betuloides*), poison oak (*Toxicodendron diversilobum*), Yerba santa (*Eriodictyon crassifolia*), and mission manzanita (*Xylococcus bicolor*) (O'Leary *et al.* 1994, Hunsaker and Awbrey 1998).

Two chaparral subtypes, chamise chaparral and southern mixed chaparral, are found within San Diego NWRC boundary. Chamise chaparral is dominated by nearly monotypic stands of chamise. This subtype tends to occur on shallow, dry soils at lower elevations, on flat or gently-sloping surfaces, and in areas with frequent fires. Southern mixed chaparral is largely restricted to mesic topographic sites such as north-facing slopes and is considered to be a sensitive vegetation community by the CDFG (1998).

Coastal Sage -Chaparral Scrub

Coastal sage-chaparral scrub appears to be a post-fire successional community (Holland 1986). This plant community is characterized by shrub cover consisting of roughly equal amounts of chaparral and sage scrub species. Common species include chamise (*Adenostoma fasiculatum*), California sagebrush (*Artemisia californica*) , black sage (*Salvia mellifera*), flat-top buckwheat (*Eriogonum fasciculatum*), poison oak (*Toxicodendron diversilobum*), and other species characteristic of Diegan coastal sage scrub and chaparral communities. Coastal sage-chaparral scrub is considered to be a sensitive vegetation community by the USFWS & CDFG (1999), and the County of San Diego (1980).

Mulefat Scrub/Southern Willow Scrub

Mulefat scrub and southern willow scrub are early successional stages of riparian forests or riparian woodlands. Mulefat scrub consists of dense stands of mulefat (*Baccharis salicifolia*), a large perennial wood shrub. Southern willow scrub is dominated by dense stands of willows (*Salix* spp.). Seasonal flooding along rivers scours away mature riparian forests, leaving bare sand which is colonized by riparian scrub species. A healthy riverine system is composed of a mosaic of various stages of riparian scrub, riparian woodland, and riparian forest. Mulefat scrub and southern willow scrub are found along the Sweetwater and Otay rivers and smaller intermittent creeks within the San Diego NWRC.

Riparian Forest and Woodland

Riparian forests and woodland communities consist of well-developed mature tree canopies typically oriented along perennial or intermittent stream channels and flood plains. The canopy is characterized by mature willows (*Salix* spp.), cottonwoods (*Populus* spp.), and California sycamores (*Platanus racemosa*). The understory vegetation includes shrubs and herbaceous plants such as mulefat (*Baccharis salicifolia*), poison oak (*Toxicodendron diversilobum*), creek nettle (*Urtica holosericea*) and mugwart (*Artemesia douglasiana*). Riparian forests are characterized by denser vegetation and a more closed canopy than riparian woodlands. Riparian woodlands typically have a predominance of western sycamore. Riparian forest and woodlands occur primarily along major drainages, including Sweetwater River and Dulzura Creek.

Oak Woodland
Coast live oak woodlands occur largely on slopes of moist drainages or among large rock outcrops within the chaparral. This habitat type is characterized by a predominance of coast live oak (*Quercus agrifolia*) and often includes an understory of chamise and scrub oak. Several drainages support oak woodlands that are dominated by Engelmann oak (*Quercus engelmannii*), a rare species listed as sensitive by the California Native Plant Society.

Southern coast live oak riparian forests grow within the flood plains of major drainages in canyons and valleys on fine-grained alluvial soils. Although this habitat type is dominated by coast live oak, scattered Engelmann oaks can also be found here. Other tree species which may occur in this habitat type include California sycamore and Mexican elderberry (*Sambucus mexicana*). The understory is often composed of annual grasses, forbs, and shrubs such as poison oak, wild honeysuckle, scrub oak, white flowering current (*Ribes indecorum*), and toyon.

Vernal Pool
Vernal pools are small, ephemeral wetlands that are associated with clay soils. During the wet season rainwater pools in soil depressions that have an impermeable hardpan. Vernal pools in the San Diego region are associated with a variety of other floral environments such as CSS or grasslands. A number of specialized animals and plants that are specifically adapted to their environment inhabit the vernal pool communities. Organisms in vernal pools have a life history that is adapted to periodic inundation with water, saturated soils that are not immersed, and extended periods of dryness. Most plant species in vernal pools are therefore annuals and are also unique to the vernal pool ecosystem. Vernal pools are yet another habitat type that has been largely replaced by development. It is estimated that over 97% of former vernal pool habitat has been lost in San Diego County (USFWS, 1999). Kearny Mesa, Clairemont Mesa, San Diego State University, and many other communities and developed urban areas now exist in areas that were former vernal pool habitats. Vernal pools, because of their specific physical conditions, and because they are non-contiguous across the landscape, exhibit a high degree of endemism within pool complexes. This tendency combined with the degree of habitat loss of these pools has led to the vulnerability of many species that occur only within them. This includes such endangered species as the San Diego Mesa mint (*Pogogyne abramsii*), Otay Mesa mint (*P. nudiuscula*), button celery (*Eryngium aristulatum* var. *parishii*) and the San Diego & Riverside fairy shrimp (*Branchinecta sandiegonensis*), among others. Vernal pools are especially susceptible to vehicular damage, especially during wet periods. Vehicle tracks can alter the hydrology of the pools to the point where they will not retain enough water during the wet season to function as vernal pool ecosystems.

Fallow Fields & Disturbed Plant Communities
Fallow fields and disturbed plant communities occur throughout the San Diego NWRC, ranging in size from 50 inches in diameter to 5 acres. These sites have been disturbed through various uses prior to acquisition by the U.S. Fish & Wildlife Service. Specifically, these are areas where the native vegetation has been removed wholly or in part, and at times has had the organic soil layer either removed or compacted. Several of these areas were former wetlands that were diked and drained decades ago and mostly converted to agricultural use. Other areas were cleared by developers who then abandoned their projects. Several areas have been degraded due to off road vehicle activity which has compacted the soil and left it open to erosion. Sites are dominated by exotic species such as European grasses (*e.g.*, bromes), mustards (*Brassica* spp., *Hirschfeldia incana*), fennel (*Foreniculum vulgare*), and wild lettuces (*Lactuca* spp.). The more prolific species are annuals or short-lived perennials with high seed production and small, easily dispersed seeds. If disturbed sites are left to recover, they general undergo succession toward one or another of the more stable and less weedy community types such as coastal sage scrub or grass land. If soil disturbance has not been severe, recovery can be complete. Succession will always occur, but composition and density of species occupying disturbed areas is variable, especially without restoration or enhancement activities.

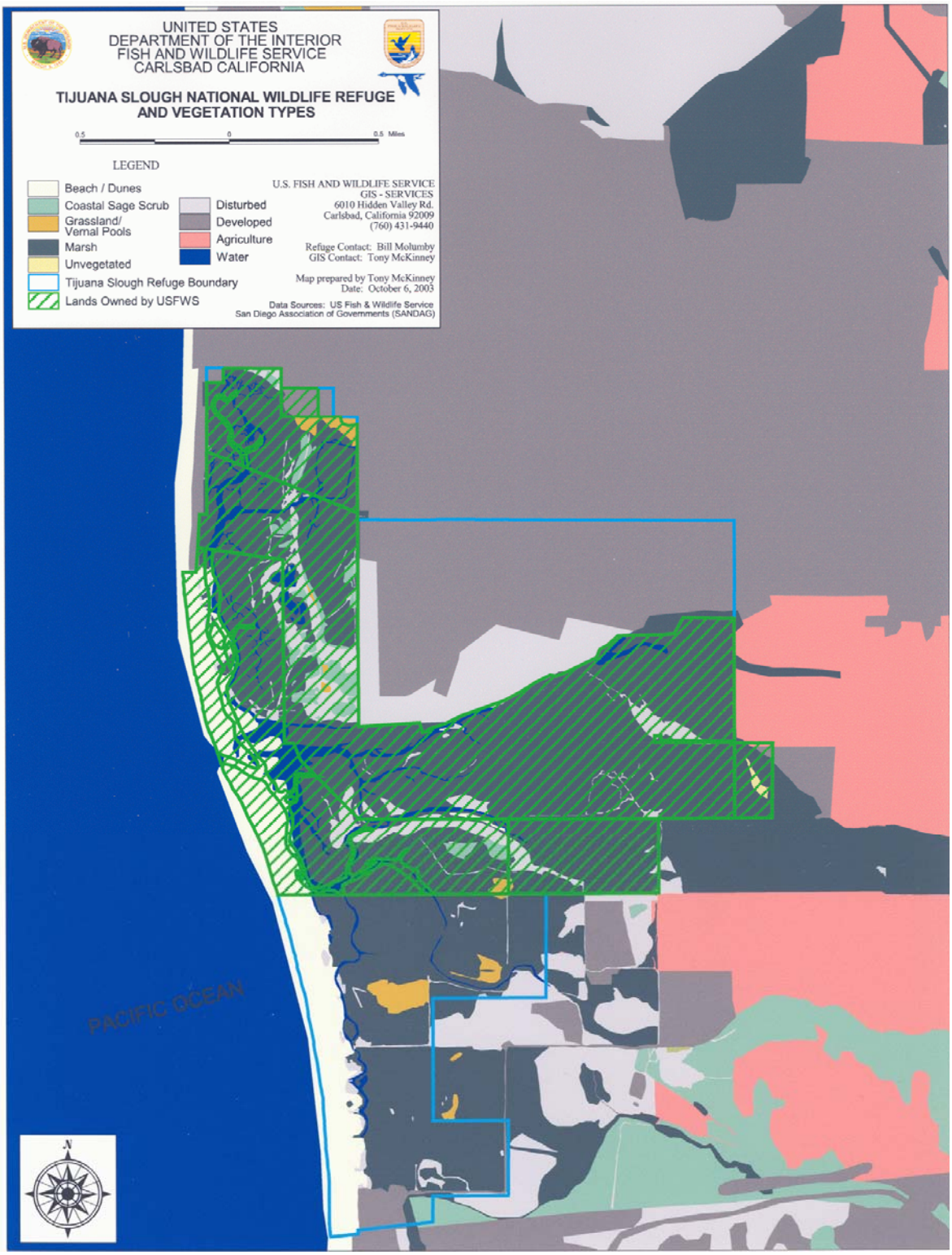


Figure 2a. Vegetation of Tijuana Slough NWR.

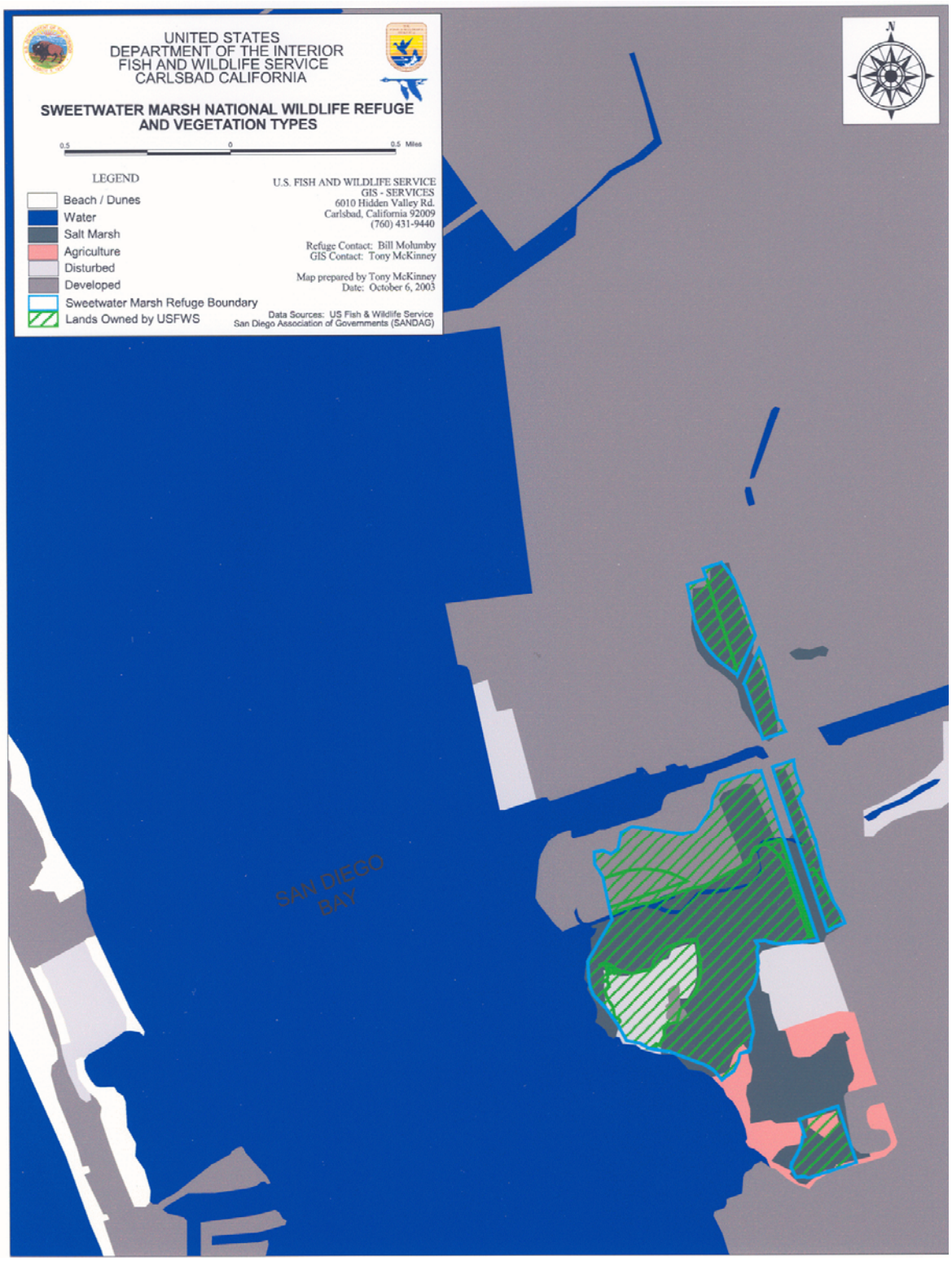


Figure 2b. Vegetation of Sweetwater Marsh Unit of San Diego Bay NWR.

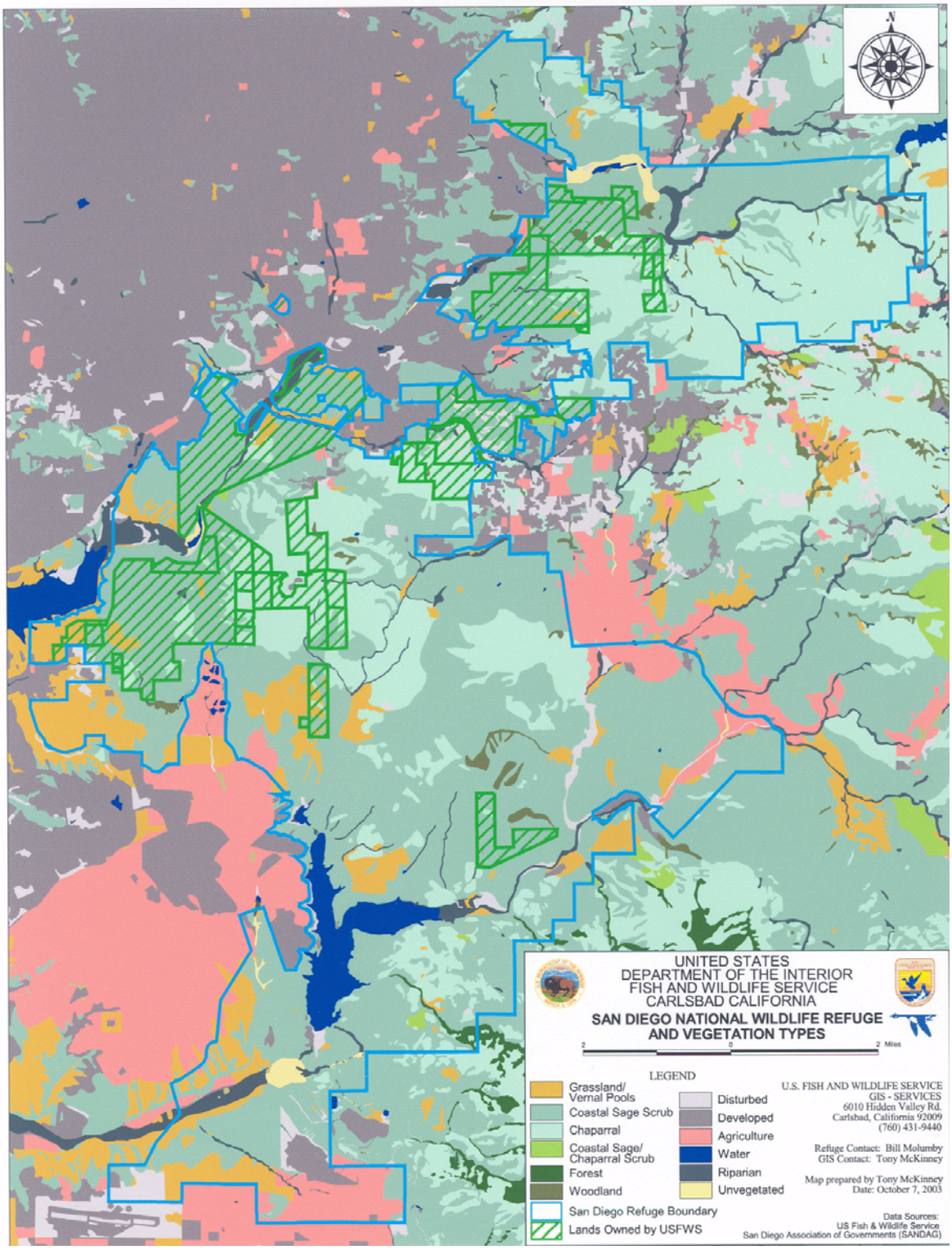


Figure 2c. Vegetation of San Diego NWR.

Figure 2d. Vegetation of the South San Diego Bay Unit of San Diego Bay NWR.

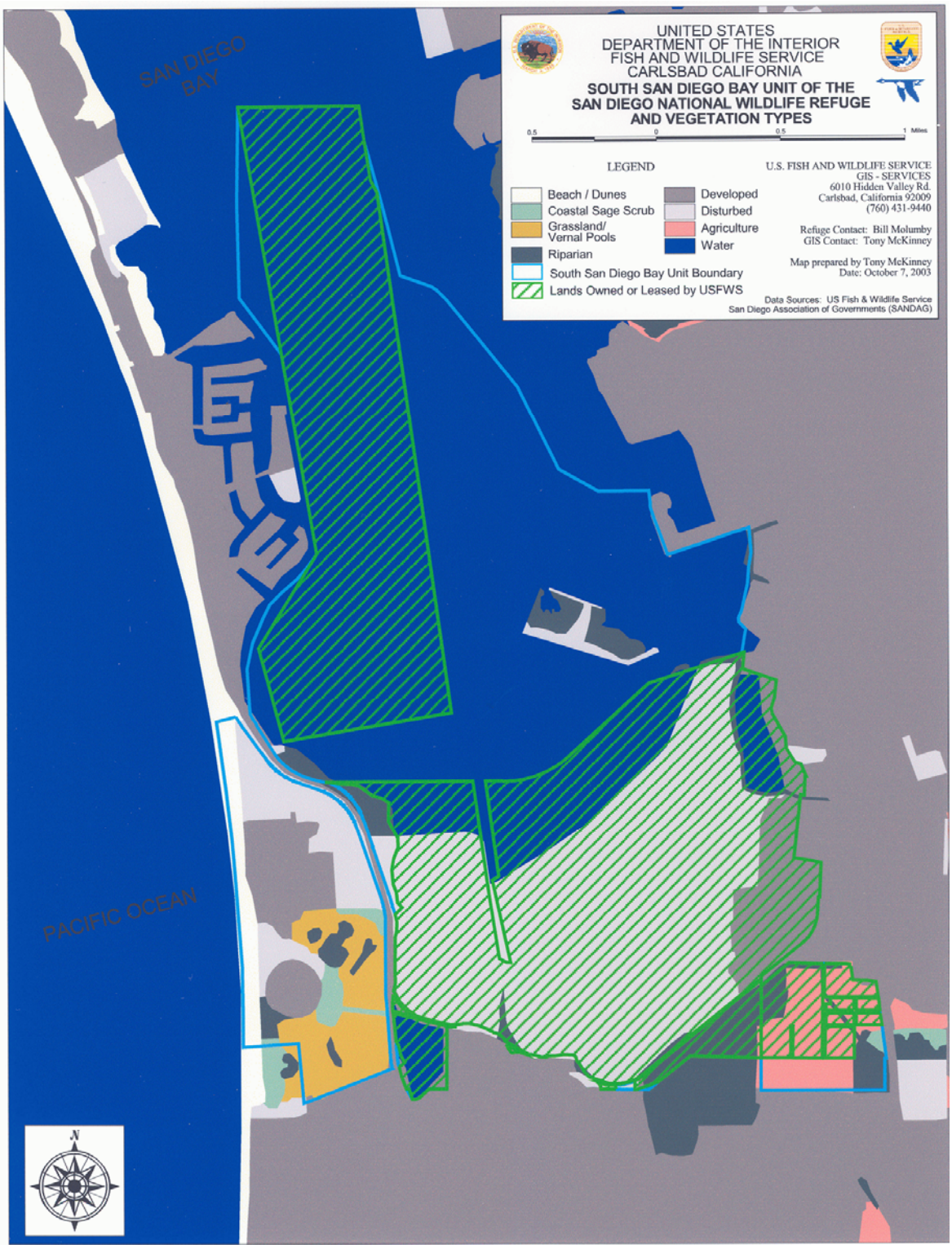
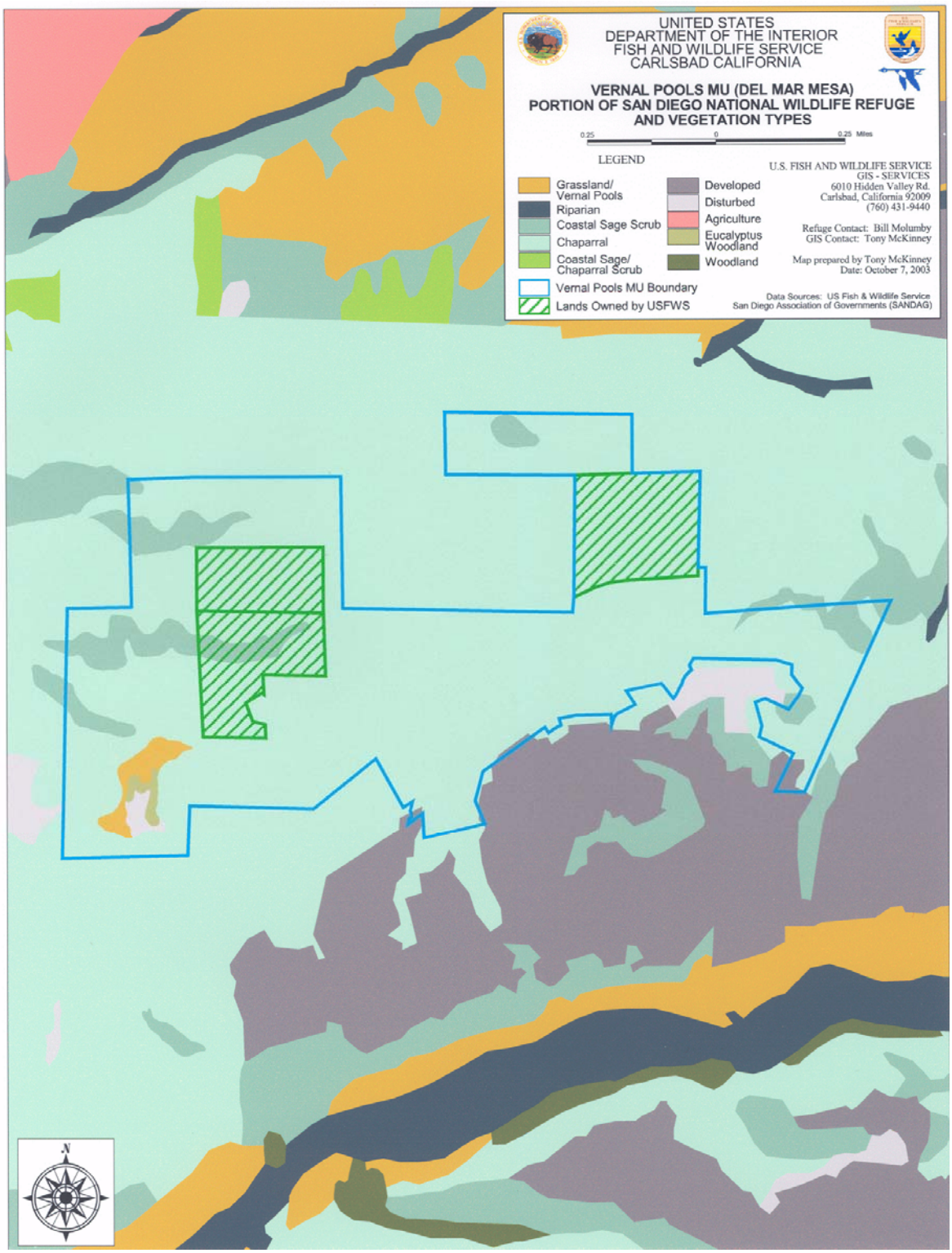


Figure 2e. Vegetation of the Del Mar Mesa Vernal Pools Management Unit.


UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
CARLSBAD CALIFORNIA
VERNAL POOLS MU (DEL MAR MESA)
PORTION OF SAN DIEGO NATIONAL WILDLIFE REFUGE
AND VEGETATION TYPES
0.25
0
0.25 Miles
LEGEND
Grassland/ Vernal Pools
Riparian
Coastal Sage Scrub
Chaparral
Coastal Sage/ Chaparral Scrub
Vernal Pools MU Boundary
Lands Owned by USFWS
Developed
Disturbed
Agriculture
Eucalyptus Woodland
Woodland
U.S. FISH AND WILDLIFE SERVICE
GIS - SERVICES
6010 Hidden Valley Rd.
Carlsbad, California 92009
(760) 431-9440
Refuge Contact: Bill Molumby
GIS Contact: Tony McKinney
Map prepared by Tony McKinney
Date: October 7, 2003
Data Sources: US Fish & Wildlife Service
San Diego Association of Governments (SANDAG)
N

AIR QUALITY

The San Diego NWRC is located within the San Diego Air Basin. This air basin is managed by the San Diego Air Pollution Control District (APCD). The San Diego APCD is one of 35 local air districts in California. The California Air Resources Board (CARB) is the regulatory agency responsible for air quality in the state. CARB develops and enforces state and federal air quality standards through the local air districts.

San Diego County experiences relatively good air quality with one pollutant of primary concern. Ozone, the chief component of smog, is the county's primary air pollution problem. Motor vehicles account for 60% of this pollutant's smog-forming emissions (oxides of nitrogen and reactive hydrocarbons). Both fuel and vehicle manufacturing guidelines are being implemented to bring this pollutant within federal and state standards. With the exception of ozone, San Diego County has met federal air quality standards for all criteria pollutants. Additionally, the county has met state air quality standards for all criteria pollutants except for ozone and inhalable particulates (PM10 & PM2.5). Both of these elements are the focus of current smoke regulations.

San Diego has not had a Stage I episode (very unhealthful air) since 1991. Air pollutants show a downward trend in all categories. A State Implementation Plan (SIP) was developed to meet and maintain federal ambient air quality standards (SDAPCD 2001).

Air quality as it relates to smoke from both wildland fire and prescribed fire has not been an issue of any degree within this air basin. This is due primarily to the fact that the typical on shore air flow moves smoke to the east and eventually into the Imperial Valley, where it readily dissipates. Concerns and complaints would and could arise when individual residents feel impacted from either source. Of course, the farther west one travels, the higher the residential density becomes, and with it a higher rate of concerns and complaints. The Air Quality/Smoke Management Section of this plan provides further discussion of the impacts smoke will have on air quality and how smoke will be managed.

FACILITIES AND INFRASTRUCTURE

Visitor centers exist at Tijuana Slough and San Diego Bay NWR's which operate six to seven days a week. Supporting offices, garages, shops, and wildlife rehabilitation facilities also exist at these locations. San Diego NWR maintains office space at a commercial office facility adjacent to refuge land and maintains several storage buildings on refuge land at San Miguel Ranch and Millar Ranch Road. The Del Mar Mesa VPMU do not have any associated refuge facilities. The San Diego NWRC headquarters office is co-located with the Ecological Services Field Office in Carlsbad, California.

The general area has a highly developed urban infrastructure which services each refuge and the surrounding communities. Road systems are abundant and of high quality. Most are state or county owned and maintained. Several major road corridors transect the county. Interstate 5 passes by the Del Mar Mesa VPMU as well as San Diego Bay and Tijuana Slough Refuges. Highway 94 bisects San Diego NWR from west to east. Paved city streets serve each refuge headquarters and provide access at many points. Utility lines border and transect refuges at several points. Water is supplied to each refuge through a municipal hydrant system, except in the undeveloped areas of the San Diego NWR (*i.e.*, Proctor Valley).

COMMUNITIES AT RISK

Besides the above government owned facilities, each refuge has a certain degree of interface with local communities. These communities have been listed in the National Registry as Communities at Risk from wildland fire. Table 4 displays those communities with their location relative to refuge lands. On Tijuana Slough NWR, San Diego NWR and the Del Mar Mesa VPMU, single family housing devolvements are situated immediately adjacent to the refuge boundary. Numerous businesses of varying types, from movie theaters, restaurants, and home improvement stores, to convenience

markets and gas stations are adjacent to, or within, the refuge boundary. Other non-Fish & Wildlife facilities exist in and around refuge lands. An electronic repeater site is situated at the top of Mt. Miguel. This multi-million dollar communication site, located in the middle of San Diego NWR, is used by private, public, and military sectors, and provides critical radio communication and television signals to greater San Diego County. At the San Diego Bay NWR, a private salt reclamation operation with associated buildings and facilities exists. A 40 KV line that supplies the electrical power to the greater San Diego area crosses both the San Diego NWR and the Del Mar Mesa VPMU.

Table 4. Communities at Risk

Coastal Fire Management Unit		**Inland Fire Management Unit**	
Tijuana Slough NWR	**San Diego Bay NWR**	**San Diego NWR**	**Del Mar Mesa VPU**
Imperial Beach	Chula Vista	Jamul	Del Mar
San Diego City	National City	Rancho San Diego	
	San Diego City	Chula Vista	
		Bonita	
		Crest	
		Granite Hills	
		Suncrest	
		Spring Valley	

Federal Register, August 17, 2001

WILDLAND FIRE MANAGEMENT SITUATION

HISTORIC ROLE OF FIRE

Fire is a natural part of the Mediterranean ecosystem (Mooney 1977) and has played a role in the development of San Diego County's upland ecosystems. Fire is part of the natural life cycle of native grasses as well as chaparral and hardwood ecosystems (Keeley 1982). The two ignition sources for wildfires in this area historically were lightning, occurring during mid-summer thunderstorms, and Native American burning associated with agriculture and hunting (Lewis 1973, Keeley 1982, Minnich 1983). Early Spanish explorers' accounts documented observing smoke from fires in the surrounding mountains as they entered San Diego Bay. The extent these two sources played in the development of the coastal and lower elevation ecosystems is not well understood.

There is a great deal of controversy over the definition of natural fire regimes in southern California plant communities (Keeley and Fotheringham 2000). Southern California plant communities have evolved in the presence of lightning caused fires (Keeley 1982), and may have been affected by fires intentionally lit by Native Americans, but to what extent is debatable (Dunn 1994). However, since the arrival of European settlements as early as the 1700's, changes began which have affected both the type and frequency of wildfires. The introduction of flammable exotic vegetation has impacted native vegetation (Keeley 2001; Minnich and Dezzani 1998). The increase in human-caused fires over the last 100 years has also drastically altered many of these landscapes (Keeley 1982). The result has been a type-conversion of vegetation stands from chaparral fuel types to grassland types by short-interval burning which benefits exotic vegetation (Brooks 1998). Organized suppression efforts began in response to the increase in fire frequency, which further changed the pattern of fire on the landscape (Dunn 1994). What we see today is a highly altered landscape and fire regime.

Within the San Diego NWRC, threatened and endangered species, as well as the plant communities in which they reside, are living in an altered fire environment. Some plant and animal species may suffer short term, if not long term, losses due to the short time intervals between wildfires (White 1995, Keeley 2001). Threatened and endangered species, such as the coastal California gnatcatcher, may suffer both short term and long term losses due to the direct and indirect effects of short-return interval wildfires (*e.g.*, shifts from shrubland to grassland community) (Stephenson and Calcarone 1999). Other species, such as the Quino checkerspot butterfly, may benefit from fire through openings created in the canopy of shrub stands. Another consideration is the wildland-urban interface (WUI). Estimated average losses due to the destruction of homes by wildland fires in California could exceed $150 million annually based on current trends (CDF 1996). Both human and natural values must be considered when addressing fire management objectives because of the potential for ecological, social, political, and economic impacts.

Pre-settlement Fires

In review of the study by Jon Keeley (1982) of the occurrence and distribution of lightning caused fires in California and specifically San Diego County, it can be assumed fires caused by lightning occurred prior to settlement. This is based on an analysis of fire records during the 1970 decade. When analyzed by elevation, less than 18% of these fires occurred under 3500' elevation. The two primary reasons for this are the lack of conditions necessary for the development of thunderheads and the way normal storms track in San Diego County. Thunderheads require moist air and some sort of mechanism to initiate development. In this county, the storm tracks favor a south to north course through the eastern deserts out of the Gulf of California. The mechanisms for development are both the rapid elevation change (Laguna Mountains, where elevations are over 5000') and the hot, unstable atmosphere of the east county. All refuges covered by this plan are under 2500' elevation, situated near the cooler coast. Lightning-caused fires at lower elevations in western San Diego County are uncommon. A review of the San Diego NWRC's fire history (Table 5) during the last 10 years reveals

no lightning-caused fires. Keeley (2001) further documented this phenomenon and stated " lightning ignited fires increase with distance from the coast with elevation." Another factor which must be considered when evaluating the effects of lightning-caused fires is size. Keeley (1982) reported that 95% of all lightning caused fires in the state are less than 0.1 hectares. This data is consistent with the Cleveland National Forest's fire records (Table 16, Appendix J) for lightning-caused fire size. In addition to the suppression efforts of organized fire personnel, San Diego County thunderstorms typically produce rainfall which also has a suppressing effect. In discussions with local firefighters, it is common to have difficulty finding lightning fires after they are reported since rain has nearly extinguished them. On the other hand, a holdover lightning fire may eventually reach the coast if it continued to smolder until the Santa Ana winds arrived several months later (Conrad and Weise 1998, Keeley 2001).

The history of fires attributed to Native Americans in southern California and specifically San Diego County is obscure, yet several points emerge from historical documents. There is very little evidence of widespread, routine maintenance burning by the Kumeyaay, Juaneno, Cupeno or Cahuilla tribes (Dunn 1994). Sampson (1944) concluded that in areas away from the coast, burning by Native Americans had little influence on chaparral distribution. When the Spaniards arrived in southern California (Drucker 1937), they found a hunting and gathering society of Indians who probably used fire only sparingly to increase hunting success. While local tribes did use fire, it was limited in size, duration, and location during the spring months (Lewis 1973).

The overall picture that emerges for San Diego County is a fire regime made up of small localized fires, punctuated by periodic massive fires (Keeley 2001, Dunn 1994). Fire return intervals varied between the coast and the inland mountains with 70 years or more for the interior sites and perhaps a century or more for the coastal areas (Minnich 1989, Minnich 1998, Conrad and Weise 1998). While severity and intensity are variable based on weather and site specifics, the greatest acreage burned was and still is in the fall months (Radke 1982, Keeley 2001).

Post-settlement Fire History

While southern California ecosystems have evolved over time to accommodate varying degrees of fire intensities and return intervals (Minnich 1983), recent history has shown changes in these ecosystems due to the arrival of Europeans (Dodge 1975). With the first settlements in San Diego County beginning in the 1700's, three factors occurred which brought about these changes – grazing, invasive exotic vegetation, and human caused fire. The introduction of cattle grazing altered natural fire spread by removing and changing the available fuel component (Baker 1989, Burchan 1982, Keeley 2001). Where fire once may have moved across native vegetation stands, it now stopped. It is also suggested that grazing provided opportunities for the invasion of exotic plant species. Invasive exotic annuals, specifically *Bromus* spp. and *Brassica* spp. invaded valley lowlands and hillsides (Minnich 1998). This provided abundant amounts of flammable vegetation. This new vegetation not only lengthened the fire season from late spring into early winter but also filled in naturally occurring gaps in the native vegetation stands where a fire may have previously stopped. The third factor, human caused fire, added a new ignition source which exceeded both the naturally occurring return and intensity levels. Human-caused fires in San Diego County in the past and present occur every month of the year, at all elevations and distances from the coast (Keeley 1982). Keeley (1982) found that during the decade of the 1970's , there was an average annual occurrence of 31 lighting fires burning 914 acres in San Diego County compared with 190 human-caused fires burning 2,803 acres during the same period. With these three factors came an increase in fire size, return frequency, and burning intensities (Dunn 1994; Conrad and Weise 1998).

Using historical fire records from the Cleveland National Forest (CNF) and California Department of Forestry (CDF) a GIS database has been developed dating back to 1910. The CNF mapped fires over

30 acres while the CDF mapped any fire over 300 acres. Figures 7a-7d (Appendix J) display the fire history for all fires on or near the San Diego NWRC during this period. We can see from this that very few large fires (over 300 acres) occurred on or near the coastal refuges, while a significant number occurred on or near the inland refuges and management units. Three factors can explain this. First, the types of vegetation and terrain inland are conducive to rapid fire spread. Second, fuel beds are considerably larger with fewer natural or manmade barriers which allow for larger fires. Third, the afternoon and evening coastal humidity has a suppressing effect on coastal wildfires while inland fires typically burn all night.

A review of fire causes on and adjacent to the San Diego NWRC shows that human-caused fires are by far the predominant type. They burn the most acres and reoccur more frequently than lightning-caused fires. An analysis of the Fish & Wildlife Service's wildland fire statistics for the period 1993 through 2002 reveals arson, illegal campfires and equipment use as the most significant causes of wildfires on and around the San Diego National Wildlife Refuges. Lightning-caused fires have not played any role in the fire ecology of the refuges during that same period (Table 5). A review of the CDF wildfire records for San Diego County from 1991 through 2000 demonstrates similar data (Table 15, Appendix J). The Cleveland National Forest occupies lands that are considered to be in the lightning belt of San Diego County. Statistical analysis of their fire records reveals a dramatic difference in the number of fires and acres burned in lightning versus human-caused fires. During the 2000 fire season, the Cleveland National Forest reported 9 lightning fires which burned 1.1 acres and 83 human-caused fires which burned 11,486.2 acres (Table 16, Appendix J). These records indicate that the modern wildland fire regime on and adjacent to the inland San Diego Refuges is potentially different from prehistoric and natural regimes.

Table 5. San Diego NWRC Wildland Fire History, 1993-2002.

	Coastal Fire Management Unit				**Inland Fire Management Unit**			
	Tijuana Slough		**San Diego Bay**		**San Diego**		**Del Mar Mesa**	
	Fires	**Acres**	**Fires**	**Acres**	**Fires**	**Acres**	**Fires**	**Acres**
Lightning	0	0	0	0	0	0	0	0
Campfire	9	9.5	0	0	17	31.3	0	0
Smoking	0	0	0	0	1	0	0	0
Debris	2	.5	0	0	8	1	0	0
Arson	5	80.6	4	8.3	22	101.1	0	0
Equipment	0	0	0	0	32	114.9	0	0
Children	1	.3	0	0	3	91.1	1	1
Miscellaneous	6	70	1	.1	59	185.2	0	0
TOTALS	23	160.9	5	8.4	142	524.6	1	1

The effects of fire management and specifically wildland fire suppression should be discussed. It has been offered by several researchers that fire management practices since the early 1900's have had a

significant impact on fire size and intensity in southern California (Minnich 1983, Radtke *et al.* 1982). These studies have tried to tie large disastrous fires during Santa Ana wind events with a fuel build-up from a successful suppression program. Minnich offered a comparison between Baja California, where organized fire suppression is nearly non-existent, to southern California's fire history with a highly developed suppression organization. His conclusion was that aggressive suppression of wildland fires should be replaced with an active prescribed burn program which would create a "fine grained mixture of age classes that precluded large catastrophic fires" (Keeley 2001). What wasn't recognized by this study was the difference in fire frequency, climates, fuel production, landscape, and land use between the two regions. When these factors were examined the biases for any difference became clear. Keeley and Fotheringham (2000) demonstrated through analysis of historical fire records that the contrary is true. Fire suppression in southern California has neither increased fire frequency, burned acreage, nor fire size. Large, catastrophic fires are more a result of coincidence between ignition and severe weather than available fuel (Schuster *et al.* 1997). Fire suppression is required just to maintain some semblance of the natural fire regime (Conrad and Weise 1998).

Prescribed Fire History

There has been no significant, documented prescribed burns conducted on any of the San Diego NWRC's refuges. However, pile burning has been conducted at San Diego NWR and San Diego Bay NWR throughout the years. These pile burns were limited in size and number. Historical records of CDF and local fire departments do not indicate any regular program of burning to either reduce hazard fuels or introduce fire into vegetation stands for ecological purposes. Recently, CDF has conducted several small scale (<100 acres) burns on CDF&G lands adjacent to San Diego NWR for habitat management. The need for conducting these types of prescribed burns is questionable since the high frequency of wildland fires already exceeds the natural fire regime interval in these ecosystems without the assistance of prescribed fire. This is largely due to the high number of human caused fires, whether they be accidental or arson-related. The San Diego County wildfire database reveals that wildfires over 300 acres in size have occurred annually for the past 90 years. These records show that nearly the entire county has burned at least once during that period and more specifically, 80% of San Diego NWR has burned at least once in the past 30 years. Aside from the need to remove hazard fuels in proximity to wildland urban interface zones, it is not yet understood what effects prescribed fire will have on the individual plant communities or animal species on these refuges. Through individual research projects, these effects will be documented and the appropriate goals and strategies developed.

In contrast to refuge lands, the Cleveland National Forest, and to a lesser extent CDF, each have well-established prescribed burning programs on lands they administer. These burn programs have focused on chamise and broadleaf chaparral stands, and the coniferous forest of the Cuyamaca and Laguna Mountains. These projects have taken place east of refuge lands at higher elevations. Both agencies have typically conducted prescribed burning during the winter and spring months. This time period is not necessarily chosen for biological reasons. It is chosen largely because during this time of year burns are easier to control and fire personnel are more available. The main goal of both programs has been hazard fuel reduction, management of grazing allotments, and deer herd management.

Fire Regime Condition Class

The Fire Regime Condition Class (FRCC) data base (Schmidt 2001) identifies the potential natural fuel type for southern California as chaparral, with a natural (historic) fire regime (NFR) of IV (35-100+ years, Stand Replacement Severity). It identifies the current fuel type as "other shrub", with a current fire regime (CFR) of III (35-100+ years, Mixed Severity). A FRCC of 2, or "moderate departure" from the NFR was assigned. It was acknowledged by the database developers that this model is coarse scale and requires validation and refinement for local use. That validation and refinement has not been completed in detail on the Refuges and Units of the San Diego NWRC, but a preliminary assessment has been made by the fire management staff based on fire history and current

fuel conditions which are of benefit when discussing fire management goals and strategies.

The NFR IV appears to be accurate for all refuges and units within the San Diego NWRC. This is based on research which was discussed in preceding sections of this plan. NFR IV, 35-100+ years, is accurate when looking for a baseline natural fire regime to use as a comparison. The CFR III is accurate for Tijuana Slough NWR, San Diego Bay NWR, but not for San Diego NWR and the Del Mar Mesa Unit. San Diego NWR and the Del Mar Mesa Unit should be classified as CFR II (0-35 years, Stand Replacement). This is based on historic fire records (Figure 7b, Table 6). Examining the FRCC for all refuges within the San Diego NWRC, a Condition Class of 2 is appropriate in some instances, but inaccurate in others. The refuges on the coast, Tijuana Slough NWR and northwestern San Diego Bay NWR are probably the closest to a condition class 1 of any of the refuges or units, with the exception of the eastern portions of both refuges. Both eastern portions should remain classified as 2, based on the altered NFR attributed to the introduction of non-native vegetation and increased human caused fires. To move these refuges to a Condition Class 1 requires continued protection from unwanted wildland fires in order to return to a NFR IV. The southern portion of San Diego Bay NWR meets the requirements for a Condition Class of 3 based on its highly altered ecosystem, a result of its conversion to farm land in the 1950's. Since then it has become fallow. A high level of mechanical restoration and fire protection are necessary to restore this land to Condition Class 1. San Diego NWR and the Del Mar Mesa Unit are Condition Class 2, due to the altered NFR. The affects of this change are seen in non-native species invasion, fuel type conversion, and habitat loss. To move this refuge and unit back to a Condition Class of 1 requires continued protection from unwanted wildland fires in order to return to a NFR IV.

Table 6. Fire Regime Condition Class

	Natural Fire Regime	Current Fire Regime	Fire Regime Condition Class
Tijuana Slough NWR western portion	IV, 35-100+ years, high severity	III, 35-100+ years, mixed severity	Class 1, within natural range
Tijuana Slough NWR eastern portion	IV, 35-100+ years, high severity	III, 35-100+ years, mixed severity	Class 2, moderately altered range
San Diego Bay NWR northwestern portion	IV, 35-100+ years, high severity	III, 35-100+ years, mixed severity	Class 1, within natural range
San Diego Bay NWR northeastern portion	IV, 35-100+ years, high severity	III, 35-100+ years, mixed severity	Class 2, moderately altered range
San Diego Bay NWR southern portion	IV, 35-100+ years, high severity	III, 35-100+ years, mixed severity	Class 3, highly altered range
San Diego NWR	IV, 35-100+ years, high severity	II, 0-35 years, high severity	Class 2, moderately altered range
Del Mar Mesa Unit	IV, 35-100+ years, high severity	II, 0-35 years, high severity	Class 2, moderately altered range

source:http//fire.org.frcc/FrccDefinitionsFinal.pdf

RESPONSIBILITIES

The San Diego National Wildlife Refuge Complex has a dedicated fire management organization consisting of a Zone Fire Management Officer (FMO), Assistant Fire Management Officer (AFMO), and two 4-person engine modules. The FMO works for the Project Leader of the San Diego NWRC with collateral fire management responsibilities to Project Leaders of the Hopper NWRC and Sonny Bono-Salton Sea NWRC. The FMO assists each Refuge Manager with fire management planning and implementation as it relates to their individual refuge. The Project Leader and Refuge Manager will assign fire management responsibilities as collateral duties to staff who possess appropriate training, experience, and incident qualifications to assist with emergency and pre-suppression tasks. Pre-suppression planning and projects are accomplished by fire management staff in accordance with national and regional fire management direction in coordination with Refuge Managers and their staff.

Project Leader

- Is responsible for implementation of all Fire Management activities within the San Diego NWRC and will ensure compliance with Department, Service, and refuge policies.
- Selects the appropriate management responses to wildland fire

.

Deputy Project Leader

- Coordinates San Diego NWRC programs to ensure personnel and equipment are made available and utilized for fire management activities including fire suppression, hazard fuels management, and rehabilitation.
- Ensures that the fire management program has access to Refuge and NWRC resources when needed.
- Ensures that Refuge Managers and NWRC Staff consider the fire management program during Refuge related planning and implementation.

Zone Fire Management Officer

- Is responsible for all fire related planning and implementation for the NWRC.
- Supervises all fire positions. Integrates biological refuge objectives into all fire management planning and implementation.
- Solicits program input from the RM and Biologist.
- Supervises prescribed fire planning.
- Coordinates fire related training.
- Works with cooperators to ensure adequate resources are available for fire operational needs.
- Determines when ecological and political triggers are reached for Wildland Fire Situation Analysis.
- Is responsible for implementation of this plan. This responsibility includes coordination and supervision of all prevention, pre-suppression, detection, wildfire, suppression, monitoring, and post-fire activities involving refuge lands.
- Is responsible for preparation of fire reports following the suppression of wildfires.
- Prepares an annual report detailing fire occurrence activities undertaken in each calendar year. This report will serve as a post-year's fire management activities review, as well as provide documentation for development of a comprehensive fire history record for the NWRC.
- Submits budget requests and monitors FIREBASE funds.
- Maintains records for all personnel involved in suppression and prescribed fire activities, detailing the individual's qualifications and certifications for such activities.
- Updates all fire qualifications for entry into the Fire Management Information System.
- Nominates personnel to receive fire-related training, as appropriate.
- Designates the person to serve as Incident Commander (IC) for initial attack purposes. The FMO may assume the position of IC at his/her discretion or designate other personnel to take

over that position at his/her discretion.

Assistant Fire Management Officer

- Is responsible for the planning and implementation of a program which collects information for the documentation, analysis, and prediction of fire behavior and effects.
- Implements and directs prescribed burns.
- Plans and conducts fuel management surveys to document the presence or absence of hazardous amounts of fuel.
- Is responsible for record keeping associated with prescribed burn planning, fire occurrence reporting, and fire weather.

Refuge Manager

- Acts as the primary Refuge Resource Management Specialist during fire management planning and operations.
- Ensures implementation of fire effects monitoring, drafts wildfire Rehabilitation Plans for the Deputy Project Leader, and is responsible for posting and enforcing fire restriction regulations.
- Conducts project planning and coordinates with fire staff.

Refuge Biologist

- Coordinates through Refuge Managers and the Deputy Project Leader to provide biological input for the fire program with the FMO or Assistant FMO.
- Assists FMO or Assistant FMO in design and implementation of fire effects monitoring.
- Participates, as requested, in fire suppression and rehabilitation.

Resource Advisor (RA)

The RA is a technical specialist appointed by the Agency Administrator. He/she reports to the IC or designee and provides guidance for natural and cultural resource protection from suppression operations. The RA provides input to the IC in the development of fire suppression strategies and tactics to minimize or mitigate the expected impacts of fire and fire suppression actions upon natural and cultural resources. The RA also provides input required for the development of rehabilitation plans. Resource Advisor responsibilities include (NWCG 1996):

- Provides analysis, information, and advice to fire managers for areas of concern, including:
  - Critical watersheds, riparian areas, fisheries, and water sources
  - Threatened or Endangered species
  - Prehistoric and historic archaeological sites and cultural landscapes
  - Fuelbreaks – locations and specifications
  - Urban interface impact – structures and improvements
  - Hazardous materials
- Assists the planning function in developing fire maps and identifying areas of concern
- Determines environmental restrictions commensurate with FMP resource protection in the fire area.
- Provides recommendations to fire management personnel and agency administrators for fire suppression rehabilitation needs.
- Documents potential and actual suppression/fire-related resource impacts and the rationale for protection of priority areas.
- Provides resource information to local initial attack ICs, dispatchers, or other fire personnel during pre-season training and planning meetings.

Supervisory Forestry Technician

- Is responsible for planning, coordinating, and directing preparedness activities including fire

training, physical fitness testing, Interagency Fire Qualification System (IFQS) data entry, and working with cooperative agencies as well as fire cache and equipment inventory, accountability, maintenance, and operation.

- Insures step-up plan is followed.
- Ensures fire management policies are observed.
- May propose hazard fuel projects.
- Assists the AFMO and the Biologist with fire effects monitoring.
- Helps prepare a Refuge fire prevention plan, and coordinates fire prevention with other employees.
- Maintains liaison with Zone FMO.
- Assists in updates of this Plan, maintains fire records, reviews fire reports (DI-1202) for accuracy, and enters fire reports into FMIS.
- Maintains engines in a state of readiness.

Fire Management/Suppression Personnel

- Consists of any other 9251 or 9263 funded personnel, whether permanent or seasonal, who meet the minimum standard set by the National Wildfire Coordinating Group (NWCG) for firefighters, have taken and passed the minimum classroom training, and meet required physical fitness standards.
- Undertakes fire management duties as assigned by their supervisor.
- Are responsible for their personal protective equipment and physical conditioning, qualifying annually with the work capacity test before April 15.

Incident Commander

Incident Commanders (Types I-V) use strategies and tactics as directed by the Project Leader and Wildland Fire Situation Analysis (WFSA) where applicable to implement selected objectives on a particular incident. A specific Limited Delegation of Authority (Appendix K) will be provided to the Incident Commander, depending on size and complexity, prior to assuming responsibility for an incident. Major duties of the Incident Commander are given in NWCG Fireline Handbook, including:

- Briefs subordinates, directs their actions and provides work tools
- Ensures that safety standards identified in the Fire Orders, the Watch Out Situations, and agency policies are followed at all times.
- Personally scouts and communicates with others to be knowledgeable of fire conditions, fire weather, tactical progress, safety concerns and hazards, condition of personnel, and needs for additional resources.
- Orders resources to implement the management objectives for the fire.
- Informs appropriate dispatch of current situation and expected needs.
- Coordinates mobilization and demobilization with dispatch and the FMO.
- Performs administrative duties; *i.e.*, approves work hours, completes fire reports for command period, maintains property accountability, provides or obtains medical treatment, and evaluates performance of subordinates.
- Assures aviation safety is maintained to the highest standards.

INITIAL ATTACK ENGINE MODULES

Initial attack (IA) engine modules will consist of a red-carded engine boss (ENGB), engine operator (ENOP) and 2 to 4 red-carded firefighters. The ENGB is the primary leadership required when responding to a fire with an engine module. Modules will be prepared and equipped with personal protective equipment and firefighting tools as needed. They will be dispatched with a day's supply of food and water in order to continue working for 24 hours without additional support. Initial attack modules are responsible for implementing refuge policy as the first agency resource to arrive on an

incident.

Employees participating in any wildland fire activities on Fish and Wildlife Service (FWS) or cooperator's lands must meet fitness requirements established in PMS 310-1.

INTERAGENCY OPERATIONS & AGREEMENTS

The San Diego NWRC fire management program operates in one of the most complex, yet well developed, interagency mutual aid regions of the country. A myriad of local, state, and federal wildland agencies request and dispatch suppression resources across jurisdictional boundaries regularly on wildland incidents. Each of the refuges within the San Diego NWRC rely on mutual aid assistance from one or more cooperating fire departments. These mutual aid responses are covered under either a memorandum of understanding or a cooperative fire protection agreement.

CDF is the primary cooperator, providing fire protection to San Diego NWR within their Direct Protection Area (DPA) of responsibility (see Direct Protection Area section). Other local fire departments provide mutual aid assistance to individual refuges under cooperative fire protection agreements. Those agreements are in various stages of development. Statewide agreements include The Local Government Fire Suppression Assistance to Forest Agencies (Appendix L). This agreement provides a means for federal agencies to obtain structure protection when local fire departments are unable to meet the demand. Federal agreements include the Interagency Agreement for Fire Management which involves four DOI agencies and the Forest Service. The Cleveland National Forest and the California Desert District of BLM provide assistance under this agreement (Appendix L). Table 10 displays all fire departments and their relationship to the San Diego NWRC's fire management program.

Dispatching services for the San Diego NWRC fire organization are provided by the Cleveland National Forest Emergency Command Center (CNF ECC) under a interagency agreement (Appendix L). The CNF ECC provides status of resources, local & national dispatching, weather information management, national incident reporting, and other support functions. The San Diego NWRC's fire organization works within both the National and California Interagency Mobilization Plans as administered through the CNF ECC. The CNF ECC coordinates, reports and mobilizes through the Southern California Geographic Area Coordination Center (South Ops) located in Riverside, California and the National Interagency Coordination Center (NICC) located in Boise, Idaho. Wildland suppression resources and overhead from the San Diego NWRC are dispatched locally and nationally under local and national mutual aid agreements.

All agreements are reviewed annually in joint meetings attended by each agency. Updates to protection areas, equipment availability, frequencies, and other pertinent information are exchanged and updated in the annual operating plans contained within each agreement. Each agreement has clauses for updating which must be agreed to by all parties. Individual department mutual aid agreements may be developed in the future to further clarify roles, responsibilities and financial obligations of each department.

PROTECTION OF SENSITIVE RESOURCES

One of the primary objectives of the San Diego NWRC Fire Management Program is to protect endangered species and their habitats from the effects of wildfire and collateral actions. Vegetation changes, habitat loss, invasive species, erosion, and illegal trails are some of the indirect products of the land management practices used prior to the establishment of these refuges. The current fire management program is being implemented to take these issues into consideration and provide the guidance each refuge requires for the protection and enhancement of those ecosystems.

In the **San Diego NWR,** major biological values are present in riparian habitats along the Sweetwater River and Dulzura Creek which provide critical habitat for the endangered least Bell's vireo (*Vireo belli pusillis*). Coastal sage scrub habitats in the San Miguel, Jamul, and San Ysidro mountains support core populations of the threatened coastal California gnatcatcher (*Polioptila californica*). Native habitats support 15 plant and animal species that are federally listed as endangered and threatened. The San Diego NWR lands also provide valuable open space and wildlife-oriented recreational and educational opportunities to the public. The Sweetwater River drainage supports one of the largest populations of least Bell's vireos in the United States . The San Diego NWR acquisition area is the largest contiguous block of native plant communities and habitats in southwestern San Diego County. Water quality in the Upper and Lower Otay and Sweetwater reservoirs needs to be protected. Critical habitat has been designated for the San Diego Fairy Shrimp, Quino checkerspot butterfly, Otay tarplant, California gnatcatcher, arroyo toad, and least Bell's vireo (Figure 3b, Appendix E).

In and/or adjacent to the **Del Mar Mesa VPMU**, several federally listed and otherwise sensitive species are found. These include endangered vernal pool species such as the San Diego Mesa mint (*Pogogyne abramsii*), San Diego button celery (*Eryngium aristulatum* var. *parishii*), and San Diego fairy shrimp (*Branchinecta sandiegonensis*). Critical habitat has been designated for the San Diego fairy shrimp (Figure 3c, Appendix E). In addition to the vernal pool species, other species occur in this general area, including Del Mar manzanita (*Arctostaphylos glandulosa* ssp. *crassifolia*), and willowy monardella (*Monardella linoides* ssp. *viminea*). Adjacent, non-vernal pool plant communities are also occupied by the threatened coastal California gnatcatcher (*Polioptila californica californica*). Other sensitive species that occur in this area include the orange-throated whiptail (*Cnemidophorus hyperthyrus beldingii*), San Diego horned lizard (*Phrynosoma coronatum blainvillei*) and San Diego barrel cactus (*Ferocactus viridescens*). On refuge lands the coastal California gnatcatcher, willowy monardella, southern mule deer, and San Diego barrel cactus have also been documented.

In the **Tijuana Slough NWR and San Diego Bay NWR**, diverse habitats support a corresponding variety of wildlife and fish. Over 370 species of birds have been documented in the south bay area. Federally endangered species that use the slough and San Diego bay for nesting or foraging include the California least tern (*Sterna antillarum browni*), light-footed clapper rail (*Rallus longirostris levipes*) and California brown pelican (*Pelecanus occidentalis*). Other sensitive or specially protected species present in the south bay area include the burrowing owl (*Athene cunicularia*), peregrine falcon (*Falco peregrinus*), northern harrier (*Circus cyaneus*), the State endangered Belding's savanna sparrow *(Passerculus sandwichensis beldingi*), the Federally endangered plant salt marsh bird's beak (*Cordylanthus maritimus maritimus*), the Federally endangered San Diego fairy shrimp and many other rare or sensitive species. Critical habitat for the least Bell's vireo is found throughout the riparian areas within the Tijuana River Valley including those riparian areas within the refuge. Critical habitat for the federally threatened western snowy plover (*Charadrius alexandrinus nivosis*) is found along the beachfront and back dune areas of the Reserve (Figure 3a, Appendix E).

Also found in the **San Diego Bay NWR** are salt pond dikes which support nesting western snowy plovers and colonies of Caspian terns (*Sterna caspia*) , Forster's terns (*S. forsteri*), California least terns, gull-billed terns (*S. nilotica vanrossemi*), royal terns (*S. maxima*), Belding's savanna sparrows and horned larks (*Eremophila alpestris*). The salt pond dikes also support one of two nesting colonies of elegant terns (*Sterna elegans*) in the United States and is also one of only three places in the western United States where black skimmers (*Rynchops niger*) nest. San Diego Bay is recognized as an important wintering area for at least 22 waterfowl species including surf scoter (*Melanitta perspicillata*), scaup (*Athya* sp.), and bufflehead (*Bucephala albeola*). In addition, a population of federally endangered eastern Pacific green sea turtles (*Chelonia midas*) use south San Diego Bay, the only area on the West Coast where turtles are known to congregate in winter. At least 69 fish species

have been identified in the South Bay including seven that provide recreational fishing opportunities. Notable species include the black croaker (*Cheilotrema saturnum*), California halibut (*Paralichthys californicus*), and diamond turbot (*Hypsopsetta guttulata*).

Sensitive Resource Protection Actions

Specific protection measures for pre-suppression, fire suppression, and post-suppression activities are detailed in Appendix U. All fire management projects and actions not covered under this plan require the appropriate level of environmental analysis and compliance review (*i.e.*, Section 7 consultation). Guidelines for emergency consultation during wildland fires are covered in the ESA Section 7 Consultation Handbook, Sections 8.1 & 8.2, and a modified consultation procedure is found in 50 CFR, Part 402, Section 402.05. The memo from former acting director Rogers and Secretary Norton's letter dated August 20, 2001 are included in Appendix F. Both the memo and letter explain the parameters, timing, and process for emergency consultation relative to wildland fire.

Cultural Resource Protection Actions

Impacts to archaeological resources by fire resources vary. The four basic sources of damage are (1) fire intensity, (2) duration of heat, (3) heat penetration into soil, and (4) suppression actions. Of the four, the most significant threat is from equipment during line construction for prescribed fires or wildfire holding actions.

If any previously unknown cultural resources are discovered during suppression or hazard fuel reduction actions, all ground disturbing operations will be halted and the Refuge Manager notified. The Regional Archaeologist and/or his/her staff will work with fire staff, Project Leaders, and Incident Commanders to ensure that cultural resources are protected from fire and fire management activities. The "Request For Cultural Resource Compliance" form (Appendix G) will be used to inform the Regional Archaeologist of impending activities, thereby meeting the regulations and directions governing the protection of cultural resources as outlined in Departmental Manual Part 519, National Historic Preservation Act (NHPA) of 1966, Code of Federal Regulations (36CFR800), the Archaeological Resources Protection Act of 1979, as amended, and the Archaeological and Historic Preservation Act of 1974. The NHPA Section 106 clearance will be followed for any fire management activity that may affect historic properties (cultural resources listed or eligible for listing on the National Register of Historic Places).

WILDLAND FIRE ACTIVITIES

Fire program management includes the operational activities necessary to reach the fire management goals and meet the operational objectives of the San Diego NWRC. Program management activities include planning, prevention, hazard fuel mitigation, preparedness, suppression, and rehabilitation.

Fire suppression strategies for the San Diego NWRC will place primary emphasis on a fire suppression program that is capable of applying appropriate wildland fire management strategies and tactics, before significant resource damage can occur. Due to the potential rapid rate of spread through the fuel types on the refuges, a wildland fire not only threatens refuge resources, but threatens property adjacent to the refuge as well. Resources such as critical habitat, threatened and endangered species, power lines, structures, and air quality may be at risk from wildland fires on or adjacent to the refuges.

It is the San Diego NWRC policy to control all wildland fires due to their potential for damaging resources such as critical habitat, and for the protection of property as well as the avoidance of potential liability from property loss and threats to human safety. This action meets national wildland fire management guidelines alternatives as discussed in the Federal Wildland Fire Policy (1995). **Wildland Fire use for resource benefit is not currently a management practice used within the San Diego NWRC due to the potential for escape and values at risk inside and adjacent to the refuge lands. A prescribed fire program will not be implemented until further research and environmental planning can be accomplished**. Full suppression of all wildland fires is the accepted management response of all fire departments on neighboring lands. Appropriate wildland fire management strategies and tactics will be used to keep wildland fires at the minimum acreage possible, commensurate with acceptable suppression impacts and safety standards.

FIRE MANAGEMENT STRATEGIES

When selecting fire management strategies, two important overriding issues guide the decision making process for the San Diego NWRC. The first is the presence of developed areas adjacent to refuge lands. All refuges within the San Diego NWRC are classified as wildland urban interface areas. Wildland urban interface areas are locations with man-made structures in close proximity to wildland fuels which are at risk from fire spread through those fuels. This includes situations where wildland fuels adjoin a community with an abrupt transition from the wildland to a high density development. Communities with low density structures intermingled with wildland fuels are another common example of urban wildland interface. Both examples are present within and next to the San Diego NWRC. The second issue is the presence of critical habitats and associated threatened and endangered species on these refuges that are at risk from wildfire and fire suppression activities. Other fire management considerations include air quality, watershed preservation, flammable fuels, fire return intervals, and severe weather events.

Specific strategies to implement the fire management objectives will be:

- **Wildland fires will be controlled using the appropriate management respsonse strategy.** Appropriate response strategy will be based on each refuge and management unit's fire risks and values threatened. Criteria used will be weather, fuels, values at risk, and fire potential. The typical response will be an aggressive initial attack with full control. Other alternatives include containment and confinement (Table 7). Selection criteria are based on public and firefighter safety, values at risk, fire return interval, and fire behavior.

- **Retardant, foam and/or mechanized equipment use will be permitted only with the approval of the Refuge Manager or Fire Management Officer, except when life and/or property are**

threatened. When control factors indicate the need for retardant, foam, and/or mechanized equipment, the Incident Commander will consult with the Refuge Manager or Fire Management Officer to evaluate the need and obtain technical guidance. In the event of an imminent threat to life and/or property, the incident commander will take appropriate actions using appropriate discretion. Guidelines for the use of retardant and foam are found in Appendix R. Procedures relating to Section 7 consultation for emergency situations will be followed.

- **Mechanical treatment of fuels to reduce fuel loads at strategic areas to protect values at risk**. By reducing fuel loads along strategic corridors, intensities are lowered which provides protection to values adjacent to refuge lands. These breaks in the fuel will also provide opportunities to stop a wildland fire before it can spread onto refuge lands. Consultation per Section 7 of the Endangered Species Act will be necessary for activities at all areas that are not covered under the existing Biological Evaluation for fuelbreaks (Appendix D1). Emphasis will be given to Communities at Risk (Table 4).

- **Maintain protection and mutual aid agreements with local, state and federal fire departments for the protection of the refuge(s)**. Where there is existing local fire protection, agreements will be developed for the initial and extended attack of fires on or threatening refuge lands. Mutual aid agreements will be developed to facilitate the exchange of resources between fire departments to augment suppression capabilities.

- **Rehabilitation of fire suppression activities and burned areas when appropriate**. All wildland fires on refuge lands will require a post assessment of the suppression action to determine the necessity for rehabilitation. An additional assessment will be made to determine the need for emergency stabilization, burned area rehabilitation, and cultural resource protection. Consultation per Section 7 of the Endangered Species Act may be necessary based on the post incident assessment.

Table 7. Fire Suppression Strategies.

STRATEGY	WHEN APPROPRIATE	TACTIC
Confine: To restrict the fire within determined boundaries established either prior to the fire or during the fire.	1. Wildfires on FWS owned lands which 2. When aggressive modes of attack will 3. Observed and forecasted fire weather 4. Safety concerns.	1. Holding at natural and man- 2. Burning out. 3. Observe and patrol. 4. Water drops
Contain: To take suppression action, as needed, which can reasonably be expected to check the spread of the fire under prevailing conditions.	1. Wildfires on FWS property with low 2. Wildfires burning on to Service lands 3. When direct attack is not safe. 4. To avoid excessive suppression	1. Use Minimum Impact 2. Direct and indirect line 3. Use of natural and man-made 4. Burning out. 5. Patrol and Mop-up of fire
Control: Aggressively suppress the fire using direct or indirect attack methods, holding the fire to the fewest acres burned as possible.	1. Wildfires that threaten life, property or sensitive resources. 2. Wildfires on Service property with 3. Observed and/or forecasted high to	1. Direct line construction. 2. Engines and Water Use. 3. Aerial retardant/foam. 4. Dozer lines. 5. Burning out and back fires. 6. Mop-up and extinguishment of

Fire management strategies relative to wildland fire suppression and hazard fuel reduction activities within the San Diego NWRC are consistent at each refuge (Table 8). Full suppression, mechanical fuels treatment, and pile burning are the only authorized actions offered by this plan.

Table 8. Fire Management Strategies.

Fire Management Strategies	Full Suppression	Wildland Fire Use	Prescribed Burning	Pile Burning	Mechanical Fuels Treatment
Tijuana Slough NWR	Yes	No	No	Yes	Yes
San Diego Bay NWR	Yes	No	No	Yes	Yes
San Diego NWR	Yes	No	No	Yes	Yes
Del Mar Mesa VPMU	Yes	No	No	Yes	Yes

Although resource impacts from suppression actions must always be considered in selecting a fire management strategy, resource benefit will not be the primary consideration. Appropriate consideration will be given to provide for firefighter safety, public safety, and protection of property and natural/cultural resources (Federal Wildland Fire Policy, 1995).

Critical protection areas, such as those known to be inhabited by populations of listed species, proposed & designated critical habitat, and wildland urban interface areas, will receive priority consideration in fire suppression planning efforts. In all cases, the primary concerns of fire suppression personnel shall be for firefighter and public safety.

Suppression strategies should be applied so that the equipment and tools used to meet the desired objectives are those that inflict the least amount of impact upon the natural and cultural resources. Minimum impact suppression strategies will be employed to protect all resources. Natural and

artificial barriers will be used as much as possible for containment. When necessary, fire line construction will be conducted in such a way as to minimize long-term impacts to resources. Vehicle access to normally closed areas of the refuge will be made using existing fire roads when possible. When off-road travel is determined to be necessary, the Refuge Manager or designee will be consulted (see "Pre-Attack Plan" and "Suppression Guidelines" sections).

PREPAREDNESS

Preparedness includes a list of activities accomplished at various times of the year which ensure that fire management activities, as directed by the fire management plan, can be carried out effectively and safely. Preparedness activities include: budget planning, equipment acquisition, equipment maintenance, dispatch planning (initial attack, extended, and expanded), fuelbreak maintenance, equipment inventory, personnel qualifications, and training. The preparedness objective is to have a prepared, equipped, and safe fire management organization to manage all fire situations within the San Diego NWRC. Appendix V displays a table of activities with due dates for accomplishment.

Annual fire preparedness is the responsibility of the Project Leader. Preparedness involves personnel training, equipment maintenance, cooperative agreement review and prevention actions. Implementation of the following areas of responsibility will be accomplished as situations dictate, but need to be evaluated annually prior to the fire season. The Zone Fire Management Officer is responsible for coordinating and assisting with technical and administrative implementation of this plan. Annual review of the San Diego NWRC "Emergency Incident Plan", mutual aid agreements, and operating plans with cooperators is identified in Appendix V. Changes to protection levels, emergency contacts, and procedures will be noted. Areas of concern such as roads and structural improvements, cultural and biological resources, and any operational changes which may affect fire operations should be reviewed.

Historical Weather Analysis

The San Diego NWRC uses the historic weather data from several Remote Automated Weather Stations (RAWS) as displayed in Table 9. These stations are located within the same Fire Danger Rating Areas as each refuge. Tijuana Slough NWR and San Diego Bay NWR use the Flores Canyon RAWS (045733). This weather station is operated by Camp Pendleton Fire Department. Flores Canyon is located at Latitude 35° 5' 47" by Longitude 119° 46' 22" at an elevation of 50 feet, 50 miles north of San Diego Bay NWR. The station has an historic weather database of 8 years. Both the RAWS and the refuges are located in Fire Danger Rating Area "610." The representative NFDRS fuel type used is "A," western annual grasses. The Flores weather station is the most representative for the area and should be used when preparing severity requests or preparing planning documents which require site weather information. Due to its distance from the refuges, its value in calculating daily site-specific fire danger is low. It is valuable in analyzing historic weather trends for the coastal refuges within the fire danger rating area and in the preparation of landscape scale fire weather forecasts. The San Diego NWR and Del Mar Mesa VPMU both use the Alpine RAWS (045701). This weather station is operated by the Cleveland National Forest. It is located at Latitude 35° 5' 47" by Longitude 119° 46' 22" at an elevation of 2500 feet, 15 miles east of San Diego NWR. The station has a historic weather database of 20 years. Both the RAWS and the refuges are located in Fire Danger Rating Area "630." The representative NFDRS fuel type used is "B," southern California Chaparral. Both stations are cataloged in the Weather Information Management System (WIMS) database.

Table 9. Weather Stations.

Refuge	RAWS Name	WIMS ID	Location/Owner	Forecast Zone

Tijuana Slough NWR San Diego Bay NWR	Los Flores	045733	Camp Pendleton MCB	610
San Diego NWR Del Mar Mesa VPMU	Alpine	045701	Cleveland National Forest	630

The fire season in San Diego County can begin as early as March and continue until December during drought years. Fire season is dictated by live fuel moisture in the herbaceous fuels and the cured state of the annual grasses. Other factors include the number of days since the last measurable rainfall, seasonal fire danger rating calculations, and probabilities using Fire Family Plus. An analysis of the historic Burning Index (BI) trend (Appendix I) shows a drop in the BI during the May and June months. This is due to increased inland heating which draws the cooler air mass offshore inland. The result is a fog layer which persists in coastal and inland valley areas during these months. As the Pacific high pressure cell builds, this condition dissipates.

A detailed historic weather analysis is provided in Appendix I. As we can see from this analysis, the average temperature and relative humidity over the course of the fire season is indicative of typical southern California weather patterns. A gradual warming and drying begins in April with a peak in August, then a drop off in October. Appendix I also displays the Keetch-Byram Drought Index which supports this drying trend through the summer.

Declaration of fire season in San Diego County is made by the CDF. All fire departments and land management agencies in the County acknowledge this declaration but may vary staffing based on their own calculations of fire danger and budgets. Weather features that dictate the beginning and end of fire season are predominantly the persistence of the "Pacific High," rainfall, live fuel moisture, and Santa Ana wind events. The servicing fire weather office (FWO) is the Riverside FWO, which publishes daily fire weather, weather alerts/watches, and spot weather forecasts for the County through the Southern Operations Emergency Command Center (SoOps)

The most accurate way of displaying the relationship of weather and fuels to the fire danger in southern California is through the Burning Index (BI). The representative fuel types found on these refuges are governed by live fuel moisture, relative humidity, and wind speed. The BI is calculated with significant weight to these factors. The BI is an estimate of the potential difficulty of containment of a wildland fire as it relates to the flame length at the head of the fire. The BI value is a function of the spread component (how fast the fire could spread) and the energy release component (how hot the fire could burn). The BI is scaled such that a BI value of 40 would indicate a predicted average flame length of 4 feet. Wildland fires that have flame lengths in excess of 4 feet are judged to be too hazardous for hand crews and engines to attack along the direct edge of the fire. The BI may also communicate the relative fire danger in a rating area. The 90th percentile is defined as the point at which 90 percent of all BI's are at or below this index for the time period calculated, and the same is true for the 97th percentile. The 90th and 97th percentile BIs for both representative RAWS are displayed in Appendix I. When overlaid with historic fire occurrence (Appendix I), a relationship with fire weather and fuel condition can assist with more accurate preparedness planning (See "Staffing Priority Levels" and "Dispatching" sections). Seasonal severity evaluation relies on a comparison between historic and existing weather and fuels data. The process for requesting severity funding is found in the FWS Fire Management Handbook and will rely upon the historic weather data from the RAWS identified for each refuge.

Fuel Moisture Sampling

A critical factor when describing the fire hazard of southern California fuels, specifically chaparral, is

fuel moisture content. Fuel moisture content controls the flammability of both live and dead fuels, and therefore plays a major role in the ignition, development, and spread of wildland fires. Moisture content is defined as the amount of water in a fuel sample relative to the dry weight of that sample, and is expressed as a percent (percent fuel moisture = (wet weight – dry weight) / dry weight)). Dead fuel moisture is estimated daily at RAWS sites using 10-hour fuel sticks (0.5 inch diameter), which are representative of the brush fuel model (chaparral) as it responds to daily fluctuations in relative humidity and air temperature. Live fuel moisture is only measured every two weeks, since its response to weather and the growing cycle is much slower. During the most active spring growing period, the moisture content of chaparral is more than 100% of its dry weight. As the season progresses, the plants' moisture content declines until late summer or early fall when it can be as low as 45% of the dry weight. Researchers have identified a critical fuel moisture level of 65% for chaparral; when fuel moisture falls below the critical level, chaparral begins to demonstrate high to extreme fire behavior characteristics such as high fireline intensity, high rates of spread, and resistance to control (Pyne *et al.* 1996, Rothermel *et al.* 1986).

The Poser Mountain fuel sample site on the Cleveland National Forest is the official San Diego County fuel moisture sampling location. Sampling has been performed at this site for over 20 years, which provides a reliable curve upon which to base seasonal and annual trends. Sampling consists of taking specimens of old growth (prior year) and new growth (current year) from a designated site. These samples are weighed, oven dried, and then re-weighed to calculate the percent moisture in the stems of the plant. The San Diego NWRC uses these calculations to communicate the overall county fire hazard, and as a base of comparison for refuge samples. Figure 6 (Appendix I) displays the Poser Mountain 20-year graph of both old and new growth average fuel moisture.

Fire Prevention

Fire prevention as a program requires elements of education, hazard mitigation, and enforcement to be effective. The initial step in fire prevention planning is analyzing if there is a wildfire problem, and if so who is responsible, what is the cause of the fires, where are the fires occurring, and when do they occur. There currently is no fire prevention plan for the San Diego NWRC. When the fire prevention plan is completed, it will be included in Appendix T.

In order to meet the fire prevention needs of the San Diego NWRC, the larger land base must be analyzed. This is due to the fact that these refuges are highly impacted by many external factors. The Wildland Urban Interface, off road vehicles, transient camps, illegal road access, high voltage lines, and arson are only a few of the factors which contribute to the wildfire prevention problem. While several fires have originated within refuge boundaries, 90% start on right of ways and neighboring lands. A review of fire history data from the area (Appendix J) reveals that the predominant causes of wildland fires in San Diego County are campfires, debris burning, equipment use, and arson. These are all cases in which a fire prevention program can effectively reduce starts.

An active fire prevention program both on and adjacent to the refuge is beneficial for the protection of the plant and animal communities that occur in this area. Part of that active program will be the collaborative effort with local fire departments to present a clear and unified message on fire prevention. The education element of the fire prevention program with these fire departments focuses on a reduction of human caused fires with emphasis on the protection of human life, private property, critical habitat, cultural resources, and other physical facilities. Visitor contacts, signing, bulletin board materials, handouts and interpretive programs may be utilized to increase visitor and neighbor awareness of fire hazard and protection. The refuge staff and volunteers will work with local elementary and secondary schools on education of the refuge values at risk and how students can play an active role in protecting the threatened and endangered species found there. Trained employees will educate the public about the beneficial effects of personal fire safety and hazard fuel reduction on

private property. They will place an emphasis on information regarding the potential severity of human-caused wildland fires and how to prevent them.

It is essential that all employees be well informed about fire prevention and the objectives of the San Diego NWRC fire management program. Implementation and enforcement of fire prevention regulations are the responsibility of every refuge employee. Refuge staff, volunteers and contractors shall be made aware of general fire restrictions during the fire season. Restrictions include ensuring all small engines have approved spark arresters, having a separate building and area for the storage of combustibles, and not using open flames or spark producing equipment during high fire danger. Furthermore, employees must be kept informed about changes in existing fire danger conditions throughout the fire season. Precautionary measures based on the activity levels are covered in the Fire Prevention Plan (will be included in Appendix T when completed). The daily activity level can be obtained from the Cleveland National Forest ECC during the fire season.

Fuelbreaks

Hazardous fuel mitigation is a critical fire prevention activity, as well as a pre-suppression protection measure for critical habitat and private property. Fire Departments in San Diego County require a minimum of 100-foot clearing of vegetation near any existing structures. New construction is evaluated by the County Fire Marshal on a case-by-case basis, with the potential for up to a 300-foot fuelbreak requirement when necessary. San Diego NWR maintains fuelbreaks which abut private lands. These are historic fuelbreaks that were adopted when the refuge was established. Appendix D1 identifies those fuelbreaks currently authorized for maintenance and timing requirements. Any new fuelbreaks require Section 7 consultation with the Carlsbad Ecological Services Field Office. Other fire preparedness activities may include brushing of the primary access road to refuge administrative sites to insure a safe entrance and exit route by the public and fire suppression equipment in the event of an emergency. See “Hazard Fuel Reduction” section.

Refuge Closures

During periods of extreme or prolonged fire danger, or other extreme local conditions which may threaten public safety or refuge lands, emergency restrictions regarding refuge operations or area closures may become necessary. Such restrictions, when imposed, should be consistent with those implemented by cooperators (*i.e.,* CDF , San Miguel Fire Department, etc.). The refuge may determine to implement an area closure independent of cooperators. There are no pre-determined area closures either on the refuge or adjoining cooperator jurisdictions. The Project Leader has the authority to implement an area closure for the refuge when fire danger is extreme and public safety is threatened (Appendix Q) Levels which should initiate consideration of area closures are BI’s in excess of the 97th percentile, large fires in the immediate area or threatening the refuge, initial attack resources committed to other fires, increases in arson activity, etc. A decision matrix for area closures can be found in the Fire Management Handbook, Section 3.1. Consultation and coordination with cooperating fire agencies and landowners are critical to implement a successful closure.

Staffing Priority Levels

Fire Danger calculations and adjectives are necessary for communicating the wildland fire ignition risk and growth potential on a given day, as well as for determining the precautions and restrictions when performing field work. Staffing levels are also tied to the daily and seasonal fire danger ratings in order to provide standards for initial attack response organization.

The Cleveland National Forest is responsible for collecting and publishing the current and predicted Burning Index (BI) and Adjective Ratings (AR) for the San Diego NWRC. The Adjective Rating translates the BI into a index relative to the fire danger rating area. Tijuana Slough NWR and San Diego Bay NWR are within Fire Danger Rating Area 600. San Diego NWR and the Del Mar Mesa

VPMU are in Area 630. The daily forecast, and predicted BI and AR are available at 1600 daily by contacting the Monte Vista Emergency Command Center. The daily and forecasted weather as well as the BI, AR, predicted BI, and predicated AR for the following day are announced on the forest dispatch frequency.

The San Diego NWRC will use the same staffing classes, BIs, and ARs that used by the Cleveland NF. The Cleveland NF, using Fire Family Plus calculations, has developed dispatch levels. These calculations are appropriate for the San Diego NWRC since fuels, topography, weather, and values at risk are comparable to the San Diego NWRC. The CDF uses a similar method in determining their staffing levels.

The Staffing Plan (Appendix P) identifies required and authorized actions for refuge resources based on calculated fire danger. Required actions are mandatory unless superceded by events outside of the control of management. Authorized actions may be implemented based on the perceived or anticipated need.

All severity augmentation on these refuges will be in the form of repositioning personnel and equipment to the refuges as the situation dictates. Coordination with the Cleveland NF will be necessary so as not to duplicate or otherwise commit resources unnecessarily. The Step-Up Staffing Plan will be referenced for determining needs and authorization of personnel, equipment, and funding. All severity actions will follow FWS Fire Management Handbook direction in Section 3.1, which gives guidance on when this type of action is warranted and the process for implementation.

Training

Departmental policy requires that all personnel engaged in suppression and prescribed fire duties meet the standards set by the National Wildfire Coordinating Group (NWCG). San Diego NWRC will conform strictly to the requirements of the wildland fire management qualification and certification system outlined in the NWCG publication "Wildland and Prescribed Fire Qualification System," PMS 310-1. The refuge will also follow additional requirements and guidelines found in the FWS Fire Management Handbook and Interagency Standards for Fire and Aviation Operations (Red Book).

The FMO is the refuge coordinator for all wildland fire training. The FMO will provide classroom and on the job training opportunities to facilitate career development, and augment the refuge, regional, and national firefighting, and prescribed program needs. The Project Leader/Refuge Manager and FMO will annually identify training needs for refuge staff. The FMO will obtain classroom-training slots and coordinate attendance. The FMO is responsible for verifying prerequisites and overseeing compliance in both the classroom and taskbook process. The supervisor will initiate specific task books for fire/refuge employees to document training assignments and aid in employee development. The FMO will be the certifying official on taskbooks after a review by the Project Leader. The Project Leader is responsible for signing Incident Qualification Cards (red cards).

Only red-carded firefighters will participate in fire suppression and prescribed burning programs. All other refuge staff should have a basic understanding of wildland fire safety, notification procedures and roles in the event of a wildfire. An Annual Wildland Fire Safety refresher course is a requirement for all red-carded refuge staff and should be attended by all employees with field duties. The refresher will follow guidelines as stated in the FWS Fire Management Handbook, section 1.5.1. Fire related training and qualification records for all refuge staff will be kept at the FMO office with a copy at the refuge office. All physical fitness testing, annual fire safety refresher training, and equipment & supply inspections will be completed prior to fire season. The Refuge Manager will ensure these tasks are accomplished annually (Appendix V). The Fire Management Information System (FMIS) will be used by the San Diego NWRC to track fire training and assignments, and to manage the qualification

process.

The San Diego NWRC supports the development of individual Incident Command System (ICS) overhead personnel from among qualified and experienced refuge staff for assignment to overhead teams at the local, regional, and national levels.

Supplies and Equipment
Preparedness measures for responding to wildland fires on or adjacent to the refuges require the stocking and maintenance of fire caches (Appendix W), establishment of fire hose boxes around refuge buildings, and mounting of fire extinguishers in buildings and vehicles. Fire tools will be maintained by the fire crew and inspected regularly by the Fire Management staff. The main fire cache is located on San Diego NWR at the Mt. Miguel Barn. The cache is stocked to re-compliment two type 3 engines with fire hose and hand tools. Additional stocking is based on a 10% inventory of both engines with crews and 10 supplemental firefighters. Vehicles, radios and specialized fire equipment are listed in Appendix W. Maintenance of equipment and supplies is the responsibility of the Engine Crew Supervisors.

Routine replacement of fire equipment and supplies is accomplished using the normal requisition and ordering process when an incident is not the cause of the expenditure. Fire replacement of normal unit strength inventories is obtained through similar procurement channels as well as through the Monte Vista Warehouse or the Southern California Logistics Center (SCLC). All fire replacement orders require the signature of a person authorized by the Project Leader to submit orders. The SCLC requires a letter annually identifying those persons authorized to submit fire replacement orders for the San Diego NWRC. Requests for additional personnel and equipment are made through the Cleveland NF (Monte Vista ECC) during incident mobilization.

Direct Protection Area
All wildland areas within the state of California are protected by either a local, state, or federal fire department/agency. These divisions are known as Direct Protection Areas (DPAs). DPAs in California are divided into three groups; Federal, State & Local Responsibility Areas (FRA, SRA, & LRA). In order to be more efficient, effective, and equitable, portions of the FRA are protected by CDF and portions of SRA are protected by a federal wildland agency. The California Wildfire Coordinating Group oversees management of the DPA review process which is performed every 5 years. The last review was accomplished in 1998. The FWS currently has DPA responsibility for Tijuana Slough NWR, San Diego Bay NWR, and Del Mar Mesa Unit. CDF has DPA responsibility for San Diego NWR.

A memorandum of understanding (MOU) is being developed to define the operating procedures within the CDF's DPA of the refuge. A cooperative fire protection agreement between the FWS and CDF is also being pursued which will define roles and responsibilities of both agencies on a statewide basis, tiering down to the local level as an operating plan, and replacing the local MOU.

Threat Zone
The threat zone is a area bordering the San Diego NWRC which could pose a threat if a fire were to occur there. Fires occurring in the threat zone receive the appropriate management response from both the responsible agency and those who feel threatened, e.g. FWS. The outer limits of threat zone boundaries generally follow roads and other natural or manmade fuelbreaks and mark a clear end to that threat zone. Threat zone widths are based on fuels conditions, geographic features, and typical weather conditions for that area. Both the Coastal and Inland Fire Management Units identify threat zone (figures 9a-9c) which range from one-quarter to one mile in width around both perimeters. It is within the San Diego NWRC's best interest to respond to any incidents occurring within this threat

zone and assess whether there is a threat, and if the response from the responsible agency is adequate to mitigate the hazard before it reaches FWS land. Fires occurring within the threat zone will require a fire report whether or not they actually burn FWS land.

Detection

Fires are typically reported by the public due to the road system, cell phones and public activity surrounding the refuges. The only special detection method identified is patrols, as outlined in the Staffing Plan (Appendix P). Patrols will be used during periods of extreme fire danger or significant fire activity. Patrols may be full time fire management staff, other refuge employees, or volunteers. Refuge staff will report fires using the steps outlined in the Emergency Incident Plan (Appendix N). Use of the 911 emergency notification system is the most appropriate and most practical when the exact location or responsibility area is not known. When the fire is known to be on refuge lands, the appropriate fire department or Emergency Communications Center should be called.

The Fire Management Plan does not discriminate between human-caused and lightning-caused fires for suppression purposes. However, detection shall include a determination of fire cause. Moreover, human-caused fires will require an investigation and report by law enforcement personnel. For serious human-caused fires, including those involving loss of life, a qualified arson investigator will be requested. During periods of extreme fire danger, arson activity, or fire activity, detection patrols may be authorized. The Staffing Plan (Appendix P) lists those levels where patrols are warranted in relation to the Burning Index. Detection patrols for other reasons are at the discretion of the FMO.

Communications

Fire Management owns both portable and mobile VHF and UHF radios (Appendix O). In addition to FWS frequencies, cooperating fire agencies have granted us permission to use their frequencies. Frequency use agreements have been signed with the Bureau of Land Management, U.S. Forest Service Region 5, California Department of Forestry, and County of San Diego (Appendix O). Authorized frequencies have been programmed in all fire and law enforcement radios (Appendix O). A dispatching agreement exists with the Cleveland N.F. (Appendix L) to facilitate routine and emergency operations. Reporting of all emergencies may be routed through this Emergency Command Center or the county's 911 system. All immediate emergency notifications and activations will use procedures outlined in the Emergency Incident Plan (Appendix N). During emergency fire operations, mutually agreed upon command and tactical channels will be used. Routine daily communications are provided by cellular phones which have been assigned to each San Diego NWRC employee.

Pre-Attack Plans

Table 10 displays a list of cooperators and their areas of responsibility. Dispatching levels with multiple resources are displayed in Tables 10 and 11. Suppression prescriptions have been developed for use on all refuges (Appendix U). These prescriptions include use of fire line standards and methods such as Minimum Impact Suppression Tactics. Maps of critical and sensitive habitat and known archeological sites are carried by all fire management staff and both fire engines. An agency representative will meet with the incident commander to provide a briefing on concerns and avoidance issues. Restrictions on the use of retardant and foam is provided in Appendix R. These restrictions may be overruled when there is a threat to life. There are no fire camp locations available on any of the refuges. A staging area exists on the San Diego NWR at the San Miguel Ranch. This staging area is limited to five wildland fire engines or two 20- person hand crews. There are no support facilities available for staging these resources at this location.

Table 10. Wildland and Structural Fire Protection Cooperators.

	CNF	CDF	RFPD	SMFD	SDFD	CVFD	CFPD	SRFD	IBFD	BFD

San Diego NWR	MA	DPA	MA/ SP	MA/ SP		MA/ SP	MA/ SP	MA		MA/ SP
Tijuana Slough NWR	MA								MA/ SP	
San Diego Bay NWR	MA				MA/ SP	MA/ SP			MA	
Del Mar Mesa VPMU	MA				MA/ SP					

DPA - Direct Protection Area responsibility.
MA - Mutual aid agreement to provide assistance on wildland fires.
SP - Structural protection responsibility for structures within the refuge boundary.

CNF - Cleveland National Forest; **CDF** - California Department of Forestry; **RFPD** - San Diego Rural Fire Protection District; **SMFD** - San Miguel Fire Department; **SDFD** - San Diego Fire Department; **CVFD** - Chula Vista Fire Department; **CFPD** - Crest Fire Protection District; **SRFD** - Sycuan Reservation Fire Department; **IBFD** - Imperial Beach Fire Department; **BFD** - Bonita Fire Department.

Structure and Facility Protection
All private and Service owned structures and facilities within and adjacent to San Diego NWRC lands are provided fire protection by individual local fire departments. This protection is based on local municipal charters. In the event a wildland fire occurs on or adjacent to one of the San Diego NWRC refuges and threatens structures or facilities, the responsible fire department will join in a unified command structure and assume those protection responsibilities. The Incident Commander will coordinate and order personnel and equipment to provide an adequate level of protection to those values. The level of protection will be dependent upon the location of the fire, fire behavior, and direction of spread. Table 10 displays the municipal fire departments with their respective structure protection responsibilities for the refuges and management units. Structure protection protocol and measures will be discussed at annual operating plan meetings with cooperating and protecting fire departments. This will be detailed in the operating plan. Specifics include:

- Refuge point of contact on wildland and structure fires.
- Updated structure and facility maps.
- Specific areas of concern.
- Protection coordination and responsibilities.

Pre-suppression protection measures for the San Diego NWRC structures and facilities include annual hazard fuel reduction as discussed in the “Prevention” and “Hazard Fuel Reduction” sections. Private landowners must also perform hazard fuel reduction measures, enforced by the local fire marshal, around their structures and facilities. The FWS has not been delegated hazard fuel reduction enforcement responsibilities by any of the local fire marshals for any private in-holdings.

Dispatching
The Cleveland National Forest Emergency Communication Center (ECC) dispatches Fish & Wildlife Service personnel and equipment under an interagency agreement (Appendix N). Upon the report of a wildland fire on Tijuana Slough NWR or San Diego Bay NWR, or within the threat zone of these refuges, the ECC will initiate a dispatch of resources according to the Fire Danger Adjective Rating (AR). The AR describes the current potential for a wildland fire to ignite and spread based on the BI and historic fire occurrence (See “Historic Weather Analysis” section). FWS engine(s) and chief

officer will respond according to the dispatch plan (Table 11). Concurrently, cooperating agencies will also respond based on mutual aid agreements and threat to their Direct Protection Areas (DPA). The amount of equipment and personnel despatched by these cooperators is determined by that agencies level of risk and assumed responsibility.

Table 11. U.S. Fish and Wildlife Service Dispatch Plan.

Adjective Rating		Engines	Helicopters	Air Attack	Air Tankers	Crews	Chief Officer
Low	Winter	1	0	0	0	0	1
High	Summer	2	*	*	*	*	1
Very High		2	*	*	*	*	1

* need determined by FWS chief officer based on location, cooperator response, and potential.

For fires occurring on or in the threat zone of the San Diego NWR where CDF has protection responsibility, CNF ECC will contact CDF ECC to coordinate the dispatch using FWS resources on Table 11. Concurrently CDF will initiate a dispatch of their resources. CDF uses a dispatch plan of increasing resource types and quantities as the Fire Danger increases. CDF has identified three levels of response based on the seasonal fire danger levels; low, high, and very high (Table 12). The FWS chief officer will meet with the CDF chief officer on scene to coordinate on the ground actions, strategies and resource orders. A unified command may be established based on location, threats, and potential as appropriate.

Table 12. California Department of Forestry Dispatch Plan.

Adjective Rating		Engines	Helicopters	Air Attack	Air Tankers	Crews	Dozer	Chief Officer
Low	Winter	1	0	0	0	0	0	0
High	Summer	5	1	1	1	2	1	1
Very High		10	1	1	2	4	2	2

For wildland fires occurring on the Del Mar Mesa VPMU, a similar scenario will develop with the San Diego City Fire Department (SDFD). The SDFD dispatch levels vary based on staffing and daily resource availability. They typically dispatch five structure and/or brush engines. Dispatching of aircraft, hand crews, and dozers is delayed until a size-up by the initial attack incident commander. All SDFD wildland resource orders for these resources are placed with CDF ECC. The FWS response will follow Table 11. The FWS chief officer will meet with the San Diego City FD chief officer to determine the incident commander and to coordinate on the ground actions, strategies and orders.

The FWS chief officer will notify the appropriate Refuge Manager and ask for a resource advisor to respond to all fires on or threatening refuge lands based on threat and potential. A FWS fire investigator should respond based on circumstances and responding agency ability to provide the appropriate level of investigation.

FIRE MANAGEMENT UNITS

The San Diego NWRC is located within the South Coast Fire Planning Unit (FPU) of California (figure 9a). Within this FPU the federal land management agencies have identified Fire Management Units (FMUs) for their respective management areas. FMU's are geographic areas which have common wildland fire management objectives and strategies, are manageable units from a wildland fire standpoint, and can be based on natural or manmade fuel breaks. It was also agreed to by all

federal agencies in California to respect agency boundaries. While FMU's are generally large, contiguous blocks of land, smaller, segregated management areas may be treated as a single FMU or they may be grouped into one combined FMU if they have commonalities. There are two FMU's within the San Diego NWRC, the Inland FMU and the Coastal FMU (figures 9b & 9c). These two FMU's use the grouping concept to cover several refuges and management units. These delineations were based on the biological, ecological, and fire management commonalities of each refuge.

Coastal Fire Management Unit

The Coastal FMU includes Tijuana Slough NWR and San Diego Bay NWR. Commonalities which distinguish this FMU includes the predominate animal species which are aquatic, with shore base birds and water fowl. The geographic description flat, located near the coast with elevation changes of 0 to 5 feet. The common fuel types are saltwater marsh, riparian forest, and some coastal sage scrub. The average annual wildland fire occurrence is 3 ignitions burning a total of 15 acres. Overall, this is a low severity FMU affected by the direct influence of the Pacific Ocean. This results in occasional wildland fires which do not normally pose a threat to either humans or the environment.

Inland Fire Management Unit

The Inland FMU includes San Diego NWR and Del Mar Mesa VPMU. Commonalities which distinguish this FMU are the predominate animal species of upland reptile, bird, and mammal. The geography is more pronounced, with elevations ranging from 250 to 2500 feet. The common fuel type is flammable, including annual grasses, chaparral, and coastal sage scrub. Average annual wildland fires are 14 per year with 140 acres burned per year. Overall, this is a FMU with a high fire occurrence with ignitions that can quickly spread to hundreds if not thousands of acres, threatening both the environment and human life and property.

Vegetation Communities

Vegetation communities for both FMU's are identified in the "Description of Refuges" section. These are general classifications of the vegetation communities that will be found on the San Diego NWRC. These communities include certain species of plants that are considered flammable and able to support combustion under normal weather and fuel conditions. These communities/species have the potential to be affected by fire on a regular basis. Several of the communities listed in the Coastal FMU do not pose a regular or seasonal threat to support combustion. Rare events might occur when these communities/species could burn (*e.g*., salt marsh, fresh water marsh, etc.). During those rare events, these fuels are of such a nature (fuel moisture, loading, arrangement, etc.) that intensities and rates of spread will not be sufficient to cause concerns. There may be effects though. Management action during those events will be to evaluate the fire behavior and potential, and then implement minimum suppression techniques. Post fire actions will be to evaluate both suppression and burn area rehabilitation needs (See "Rehabilitation and Restoration" section). It should also be noted that there are no NFDRS Fuel Type comparisons for those type of vegetation communities.

Fuel Types, Fuel Models, and Fire Behavior

Vegetation communities for each FMU have been grouped into representative fuel types for fire behavior description. Fuels are categorized as grass, brush, timber, or slash type. These fuel types have been mathematically modeled based on general fuel loading and death as described in *Aids to Determining Fuel Models for Estimating Fire Behavior* (Anderson 1982). There are thirteen fuel models available for fire behavior prediction (NFFL Fuel Models). As displayed in Table 13, several of the vegetation communities require two fuel models for the purpose of modeling. This is due to the presence of more than one fuel type within that community. Weather and individual fuel bed make-up can vary, which is why fire behavior (*e.g.*, rate of spread, intensity, etc.) can vary significantly in the same type of vegetation. For this reason, several of the vegetation communities may also have more than one fuel model assigned. A procedure is available for preforming those calculations based on

weighted values for two fuel models for fire behavior predictions. A qualified Fire Behavior Officer should perform these calculations. Figures 2a-2e display general fuel types on each of the refuges and management units. Table 13 provides a matrix of FMU, refuge, representative NFFL fuel models, and approximate acreage of within each FMU.

Fallow fields and disturbed habitats are not modeled due to either their lack of burnable vegetation or their insufficient horizontal continuity needed to sustain a ground fire. Those areas which do not fit this description would need to be modeled on a case by case basis.

Table 13. FMU Vegetation Communities and Corresponding NFFL Fuel Models.

Vegetation Community	Representative Fire Behavior Fuel Model	Approximate Acreage	Fire Management Units
Saltwater Marsh	**5**	880	Coastal
Grassland	**1**	19	Coastal
		210	Inland
Coastal Sage Scrub	**2**	32	Coastal
		4755	Inland
Coastal Sage/ Chaparral Scrub	**2,4**	2100	Inland
Chaparral	**4**	1626	Inland
Mule fat / Southern willow scrub	**4,6**	100	Inland
Riparian Forest and Woodland	**6,8**	195	Inland
		3	Coastal
Oak Woodland	**6,8**	60	Coastal
Vernal Pools	**1**	1	Coastal
		4	Inland
Fallow Fields & Disturbed habitat	**N/A**	194	Coastal
		200	Inland

NFFL Fuel Model 1
This model is representative of shorter annual and perennial grasses mixed with forbs and includes exotics which match that description. Fuels in this type are fine, very porous, continuous, open and exposed. The fuels in this model cure earliest of all fuels in the San Diego NWRC. Annual production and fuel loadings are in response to annual rainfall in the spring. Fuel loading can vary from two to four tons per acre. These fuels remain available to burn from when they cure during a dry period up until the following growing season's green up period. Wildland fire spread is very rapid with an average rate of spread of 78 chains per hour (1 chain = 66 ft) and flame lengths of 4 feet. These fuels are subject to very short drying period, one hour or less, and are rapidly affected by temperatures greater than 80 degrees Fahrenheit, relative humidity less than 20 percent, and wind at any temperature. Fires are usually controlled with hoselays. Retardant is effective but may burn through if grasses are matted.

NFFL Fuel Model 2
Fire spread is primarily through the fine herbaceous fuels, either curing or dead. Open shrub lands, pine or scrub oak stands that cover one-third to two-thirds of the area, and open pure stands of coastal sage scrub, may generally fit this model. These are surface fires where the herbaceous material, in addition to litter and downed stemwood from the open shrub contribute to the fire intensity. Total fuel loading is typically under 4 tons per acre. Fuel bed depth is less than 4 feet. Rates of spread average 35 chain per hour with 6 foot flame lengths. Short range spotting (*i.e.*, less than 1/8 mile) may occur with low humidity (< 20%) and moderate to high wind speeds (10-20 mph). Fire in this fuel is affected by humidity as with FM 1. Fires are usually controlled with hoselays. Foam and retardant are effective. Hoselays must be followed up with line construction.

NFFL Fuel Model 4
Fire intensity and fast spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuos secondary over story. Stands of mature shrubs 6 or more feet tall, such as those found in California mixed chaparral, are typical. Besides the flammable foliage over the brush, dead woody material of the shrub contributes to the fire intensity. A deep litter layer may also hamper suppression efforts. Fire brands (*i.e.*, burning embers lofted by the convection column) are actively produced by this type, resulting in high rates of spread. Spot fires have occurred up to a mile in advance of the main fire. Fuel loading can approach 30 tons per acre. Wildland fire spread is the same as NFFL Fuel Model 3, but more intense. These fuel types respond seasonally to live fuel moisture drying trends (Appendix I). Hoselays are effective at moderate intensities, but at higher burning conditions, retardant followed up with water drops and line construction is the only means of attacking these fires.

NFFL Fuel Model 5
This model type consists of saltwater marsh vegetation and adjacent uplands. Fuels are open and exposed. These surface fuels are made up of low growing shrubs and grasses. Fires are lower in intensity because surface fuel loads are light, shrubs are young and have little dead material, and the foliage contains minimal volatile material. Typically, shrubs are short, less than 2 feet, and densely cover an area. Young, green stands with no dead wood would qualify for this fuel model category. Wind is a factor in rate of spread, but typically the intensity and rate of spread are low enough to allow direct attack with hand tools. Spotting is not a problem.

NFFL Fuel Model 6
This is a brush model in which fire is carried through the shrub (crown) layer, where the foliage is more flammable than in Fuel Model 5, with moderate wind, greater than 8 miles per hour, at mid-flame height. Fire will drop to the ground at low wind speeds or at openings in the stand. Scrub oak, toyon, and other broad leaf chaparral are typical species that characterize this model. When fire is in

the crown, this fuel model produces fires that are characteristically high in intensity and difficult to control. Ground fires are easy to control but are often labor intensive due to the heavy duff layer and irregular burn pattern.

NFFL Fuel Model 8
This is a timber model where fires typically burn surface litter. Slow burning ground fires with low flame lengths are generally the case with this fuel model. Occasional "jackpots" of heavy fuel concentrations occur in this type. Fuel loading is approximately 7 tons per acre. Duff fuel loading can be up to 12 tons per acre. During periods of severe fire weather conditions involving high temperatures, low humidity, and high winds, the fire will burn into the crowns, which is not covered by this model. Fuel model 6 would be more representative under those conditions.

Fire Effects
The effects of fire on the environment within each FMU at the San Diego NWRC are complicated. Not only are the ecosystems home to a vast array of plants and animals, but the fire regime is under constant flux from ignition sources and suppression actions. The following is a general discussion of the first and second-order fire effects. These effects do not take into account suppression action effects. Mitigation of suppression action effects is covered in the "Protection of Sensitive Resources" section and Appendix U. Further information on fire effects is available online through the Fire Effects Information System (www.fs.fed.us/database/feis/welcome.htm).

Vegetation
Salt Marsh
Very little is known about the effects of fire on the salt marshes of San Diego County. It can be presumed that due to the low natural fire frequency of the coastal area, poor vertical and horizontal arrangement of the fuels, and the generally high moisture content, fire would be infrequent and not a significant concern. Because of the important role marshes play as sources of organic matter for estuarine food webs, high fire frequencies are not necessarily ideal for near-shore systems (Hacney and de la Crus 1978, Nyman and Chabreck 1995). Therefore, suppression of all fire occurring in a saltmarsh should be the goal. Conversely, more damage may be done in the suppression effort if indiscriminate tactics are used. A more complete discussion of salt marsh fire ecology can be found in Lynch (1941), Bendel (1974) Daiber (1974), Frost (1995), and Nyman and Chabreck (1995).

Grasslands
Fire readily destroys annual grasses and grass seeds on the surface; however, the increased insolation and nutrient flux at the soil surface following a fire promotes grass seed germination from the remaining seed bank in the soil (Hunsaker and Awbrey 1998). Perennial bunch grasses can be favored by low intensity fires. Low intensity burns, especially during the summer months, could function to remove thatch, fragment mature bunches into vigorous offspring plants, and enhance seed reproduction (Menke 1991). However, high intensity burns, especially during the spring and summer, reduces seed germination. A fire return interval of greater than 15 years has been found to be correlated with a dominance of annual grasses, whereas a shorter interval tends to lead to perennial bunch grass dominance (Kellogg and Kellogg 1991).

Diegan /Riversidian Coastal Sage Scrub
Many species of coastal sage scrub reproduce by both seed and stump sprouting following a fire occurrence (Dames and Moore 1998, Hunsaker and Awbrey 1998). California sagebrush stump sprouts especially after low intensity fires, black sage and monkey-flower reproduce by seed, and buckwheat, lemonade berry, and laurel sumac reproduce by both seed and sprouting (Hunsaker and Awbrey 1998). Following a fire, herbaceous species typically dominate the cover for the first few years. Although herbs remain common for several decades following a burn, shrub seedlings and

stump sprouts grow rapidly and begin to dominate the cover after a few years (Hanes 1971, Westman 1982, Malanson and O'leary 1982). While pre-fire floristic composition tends to be the best predictor of the post-fire vegetation community, a short fire return interval (*i.e.*, <5 years), often results in a shift in species composition to a greater representation of herb and grass species and a reduction in coastal sage scrub species (Malanson 1984, Zedler *et al.* 1983).

Chaparral

As with coastal sage scrub, herbaceous plants dominate the cover shortly after a stand-replacing fire occurs in chaparral, but stump-sprouting and seedling shrub species grow rapidly and become dominant within a few years. Chamise regenerates by seed and stump sprout vigorously following a low intensity fire. However, this regrowth of chamise often declines after a very hot, high intensity fire. Chamise also tends to form single-aged, monotypic stands following a fire (O'leary *et al.* 1994, Hunsaker and Awbrey 1998). Oak acorns are relatively flammable, but both species of scrub oak stump sprout vigorously following fire (Dames and Moore 1998, Hunsaker and Awbrey 1998). While frequent, low intensity burns favor chamise, California lilac is more dominant following intense burns. California lilac and wart-stemmed ceanothus do not stump sprout following a fire, but seed regeneration is often very vigorous following a very hot, intense burn (Keeley and Keeley 1987, Dames and Moore 1998, Hunsaker and Awbrey 1998). Yerba santa and mission manzanita both reseed and stump sprout following fires (O'leary *et al.* 1994, Hunsaker and Awbrey 1998). However, if fires occur too often, more than once every 30 to 50 years, the chaparral vegetation may be replaced with more weedy vegetation often comprised of non-native species.

Coastal Sage Scrub/Chaparral

Species composition varies or is transitional in this community, but individual dominant species would be expected to respond to fire as noted in the above sections for coastal sage scrub and chaparral communities, respectively.

Riparian Forest and Woodland

The response of riparian woodlands to fires has not been as well studied as other vegetation communities. However, many riparian trees and shrubs would be expected to stump sprout following a fire, including sycamore, oak, willow, poison oak, toyon, and mule fat (Davis *et al.* 1989, Barro *et al.* 1989). The generally moister conditions in riparian areas would also favor relatively fast growth and successful seed germination. The higher moisture content of the vegetation, and the valley bottom location of riparian areas, would also likely result in less intense and incomplete burns. Baccharis does not retain as much moisture during the summer as other riparian vegetation and will tend to carry a higher intensity fire where it occurs beneath a forest or woodland over story. On the Sweetwater River, infrequent flows or artificially interrupted/initiated flows will likely affect the woodlands' response to fire.

Mule Fat Scrub / Southern Willow Scrub

See discussion for riparian forests and woodlands.

Vernal Pools

Little is known about the response of vernal pool vegetation to wildfire. However, the generally moister conditions would be expected to result in incomplete or less intense fires, and would promote relatively rapid regeneration. Geophyte plant species would be expected to regenerate vegetatively following a burn. In general, vernal pool plant communities are expected to recover from a fire event, especially if it occurs when the pool is dry (Bauder and Wier 1991). However, vernal pools are vulnerable to suppression and prevention activities, especially when the soil is moist (Bauder and Wier 1991).

Fallow Fields & Disturbed Plant Communities
Generally, these sites will not burn due to the low fuel loading and poor continuity. If they do burn the pattern will be ragged and selective. There are isolated sites, particularly fallow fields, where invasive weeds dominate the site with sufficient fuel loading and continuity to sustain a ground fire. These sites may see nearly complete consumption of the above ground vegetation barring any suppression action. Burning may be a beneficial process in the restoration of these sites due to the removal of thatch, nitrogen replacement in soil, and possible removal of exotic plants. Disturbed sites would be expected to regenerate in a similar fashion as chaparral, coastal sage scrub, grasslands, etc., with continued competition from the exotic and invasive species.

Wildlife
Fire is frequently a nearly instantaneous shock to the ecological setting involved (Huff *et al.* 1984, Lyon *et al.* 1978). Some wildlife species are able to adapt to the rapid change in environment and some cannot (Lyon and Marzluff 1985, Parker *et al.* 1983, Rotenberry and Wiens 1978, Wecker 1964). The habitat for some species is greatly improved, while for others it may be degraded if not eliminated, and there will be endless variation in between (Beck and Vogl 1972, Bendell 1974, Evans 1988, McGee 1982, Wolf and Chapman 1987). Fire, both wild and prescribed is neither uniformly "good" nor "bad." Effects are differentially imposed on the resources effected.

Due to the variety of animal species present within both FMU and on these refuges, it would be difficult to detail how they are individually affected in this plan, since fire effects research is limited or non-existent. Of increased importance from both a regulatory and biological perspective are those species with critical habitat designation (Figures 3a-3c, Appendix E). Prescription guidelines on how these critical habitat areas will be managed during a wildfire is provided in Appendix U. Specific and updated guidance will be provided by the Resource Advisor (Biologist) on site during a wildland fire.

Soil
The effects of fire on the soil resource are induced by soil heating, by removal of the protective cover of vegetation such as litter and duff, or by the concentration of plant material substances in the soil. These effects are described in detail in Chandler *et al.* (1983), Wells *et al.* (1979), Wright and Bailey (1982), and others. Immediate effects may be changes to soil chemistry, biota, nutrients, and moisture. Indirect effects will be erosion potential and water quality and quantity. The effects of fire on soils, water, and watersheds are extremely variable. In some cases, such as accelerated erosion, the outcome is reasonably predictable and mitigation measures such as rapid re-vegetation are necessary. In other cases, such as changes in off-site water yield after a wildfire, the outcome is much less predictable because it appears to depend on site-specific characteristics and on unpredictable climatic events.

The hydrophobicity phenomenon is the most common concern in the chaparral soils of southern California. Hydrophobicity is the effect of soil becoming water repellent. Fire-induced hydrophobicity is usually only associated with high burn intensity areas and therefore not necessarily uniform throughout a burned area. Although not completely understood, the process by which hydrophobic soil layers form has been described in some detail by DeBano (1981). Organic compounds in litter, probably aliphatic hydrocarbons, are distilled during combustion, migrate into the soil profile, and condense on soil particles, forming a water repellent layer. The phenomena is most severe in dry, coarse textured (sandy) soils that are heated to 349 to 399°F (176 to 204°C). It is least severe in wet, fine textured soils, where temperatures remain below 349°F (176°C). It also appears that high temperatures, above 550°F (288°C), destroy the compounds. This data suggests that fires which heat soils to an intermediate range of temperature are more likely to cause the formation of a non-wettable layer than fires that only heat the surface of the soil, or those that cause deep penetration of high temperatures; and that certain plant communities, such as those containing chaparral species, are more likely to be affected. It is important to recognize that hydrophobicity occurs naturally, in the

absence of fire, on forest lands, shrub lands, grasslands, agricultural lands, and even golf greens around the world (DeBano 1969a, 1969b, 1981).

Air Quality

Smoke from wildland fires can expose individuals and populations to hazardous air pollutants. Concern is increasing over the risk to firefighters and the general public from exposure to toxins, irritants, and known carcinogens in smoke. The most likely effects of smoke on health are the aggravation of existing diseases or increased susceptibility to infection. Those most susceptible to exposure to air toxins include very young children and individuals with chronic lung disease or coronary heart disease. The effects of smoke on human health are discussed in detail in Sandberg and Dost (1990), Dost (1991), and the comprehensive study plan prepared by the USDA Forest Service and Johns Hopkins University (1989). Firefighters can be exposed to high levels of lung toxins such as aldehydes, acids, and particulates; to carcinogens such as polycyclic aromatic hydrocarbons, formaldehyde and benzene; and to carbon monoxide. These exposures may be at high levels for short periods, or at low levels for weeks at a time. The amounts of some hazardous components of smoke, such as formaldehyde and respirable particulate matter, are well correlated to the amount of carbon monoxide (Reinhardt 1989).

The National Ambient Air Quality Standards are a set of goals established by the Environmental Protection Agency for acceptable levels of six air pollutants that are potentially harmful to public health. These criteria pollutants are particulate matter, carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, and lead. Sulfur dioxide, nitrogen dioxide, ozone, and lead are not at sufficient levels in wildland fire smoke to be of concern. Particulate matter (PM10 & PM 2.5) and carbon monoxide will be produced by each wildland fire in amounts relative to fire behavior and fuel chemistry. Since both FMU's are located in close proximaty to urban developements smoke management will be a factor to consider. Each wildfire will dictate the air quality effect it will have on the environment and the appropriate health advisory. Quick initial attacks and mop-up will meet the immediate goal of limiting smoke production on most wildland fires. Those fires where confinement/containment is the strategy should consider the effect of smoke and document the decision rational and mitigation plan. .

Cultural Resources

The majority of cultural resources existing in each FMU on the San Diego NWRC are surface and sub-surface artifacts. It is difficult to accurately assess the effects of wildland fires on either of these locations. One important factor is the widely varying responses of vegetation and soils to fire within the same burn area. The amount of surface and subsurface heating depends upon the peak temperatures reached, and the duration of all phases of combustion. The amount of subsurface heating is a function of a number of variables, including soil moisture content and coarseness, amount and distribution of woody fuels, occurrence of duff layer or other accumulations of organic litter, weather conditions, and fuel and duff moisture content.

Experiments and observations conducted thus far indicate that cultural materials below the surface, unless directly exposed to a burning duff layer or burning underground roots, normally do not sustain significant damage, if any at all (Traylor 1981). The Cleveland National Forest found that many surface artifacts were damaged by a prescribed fire in chamise chaparral, but no subsurface artifacts were affected (Pidanick 1982). Measurements taken at the prescribed fire documented temperatures in excess of 800°F (427°C) at the ground surface, but only 100°F (38°C) at 5 centimeters (2 inches) below the surface. Obviously, the magnitude of fire effects on the soil and its contents is proportional to heat penetration. In conifer forests, temperatures of 200°F (93°C) have been recorded one/half inch (1.3 centimeters) deep in the soil, with duff layers considerably above that figure. Obviously, such heating depends on the thickness of the duff layer, duff moisture content, amount and moisture content of large diameter dead woody fuels, and the soil type and its moisture content. Given current knowledge of fire effects on cultural resources, it is apparent that fires involving larger fuel loads,

longer duration burns, and large total heat release pose significantly greater hazards to cultural resources than fires with short duration "cool" combustion temperatures.

Suppression Objectives
Based on the total burnable acreage, an annual Fire Management Suppression Objective was calculated using the NFR for each FMU. As has been previously stated, smoke impacts and the wildland urban interface play a significant role in managing fire within both FMU's. All wildland fires initially receive an aggressive suppression response based on these two factors. The intensity level is considered only when determining the amount and type of equipment (Table 11). Since most acreage in these FMU's is consumed in the higher intensity levels, individual intensity level suppression objectives will not be identified, except to say that the range of acres allows for a confinement or containment stragtey at the lower intensity levels.

Table 14. Suppression Objectives

	Burnable Acerage	**NFR**	**Suppression Objective**
Coastal FMU	1189	IV, 35-100 years, high severity	12-34 acres annually
Inland FMU	9190	IV, 35-100 years, high severity	92-262 acres annually

Suppression Strategy & Tactics
The suppression objective is met using a range of possible strategies and tactics from the initial attack to final control. To this end, all wildland fires will be suppressed in a safe and cost-effective manner using the appropriate management response with minimal resource damage. Concerns about values at risk and smoke impacts to local communities will be considered.

As displayed in Tables 10 and 11, typical initial attacks to both FMU's will include a mix of ground engines, crews, and aircraft resources. Adjustments to these dispatch levels may be made at the discretion of the duty officer based on local conditions or initial reports. All fires will be assessed by the first on-scene incident commander and attacked using the appropriate Fire Suppression Strategy (Table 7) and fire management prescription for that FMU (Appendix U). Since each refuge has several site specific issues dealing with threatened and endangered species, each refuge within the individual FMU's has a prescription. Minimum Impact Suppression Tactics will be employed when practical. The Incident Commander and Resource Advisor should discuss the use of roads and natural barriers to reduce fireline construction. Fireline and mop-up through riparian areas should consider long-term damage to vegetation. Unnecessary cutting and bucking should be replaced with alternative actions whenever possible (*e.g.*, extinguishing standing trees). Back-fires and burnout operations should consider head fire intensities and attempt to avoid scarifying the soil or running fire into riparian areas. Where wildland fires cross roads, the burned area adjacent to the road should be mopped up and dangerous snags felled.

In addition to the consultation with the Project Leader or his/her representative, a Resource Advisor should be assigned to the incident during initial attack to identify protection priorities and to begin identifying rehabilitation needs.

Individual mutual aid agreements with cooperators will serve as a delegation of authority to the initial attack Incident Commander to employ tactics they deem appropriate. The Incident Commander works for the Project Leader. The Refuge Manager or Fire Management Officer may represent the Project

Leader for the purpose of initiating delegation of authorities, signing WFSA's, and making strategic decisions. As a fire enters extended attack, a new delegation of authority may be necessary. The Project Leader and Fire Management Officer should evaluate this need based on prognosis, strategies & tactics, and complexity.

Suppression Response

A full suppression alternative was selected for both FMU's and requires a response strategy of either confinement, containment or control of all wildland fires (Table 7). The appropriate management response will follow prescriptions that have been developed to assist with the chosen strategy to protect the private property and the refuge from unnecessary damage (Appendix U). Heavy equipment use is restricted in certain areas due to cultural and wildlife concerns. Unless life or property is in eminent risk, consultation with the Refuge Manager or their representative is required prior to their use in those areas. At the Annual Operating Plan Review, issues of restrictions with maps of those areas will be discussed with cooperators. Changes and areas of concerns will be documented.

Guidance on retardant and foam use is provided in Appendix R. No retardant or foam shall be used on the coastal refuges or interior wetland areas. Chainsaws are allowed at all times without approval. Dozers require Refuge Manager or designate approval except when life and/or property are threatened. Dozers should stay on ridge lines and limit widths to one blade wide. Attempts should be made to stay on old dozer lines.

WILDLAND FIRE SITUATION ANALYSIS

For fires that cannot be contained in one burning period or that may have significant social, environmental or political consequences, a WFSA must be prepared. The purpose of a WFSA is to allow for a consideration of alternatives by which a wildfire may be managed. Several alternatives are analyzed and evaluated based on safety, economics, environmental concerns, and social issues. The Project Leader or acting, in conjunction with the FMO, will prepare the WFSA. Approval of the WFSA resides with the Project Leader (agency administrator) or designee, and is required to be reviewed or updated at every operational period or when there are significant changes affecting the current objectives.

A pre-attack WFSA with generic information will be reviewed and updated annually (Appendix M) to facilitate in the preparation during an incident. Important components to pre-identify are Objectives and Strategies. Objectives state how the incident will be controlled and where, *e.g.*:

- Keep fire north of Lyons Valley Road .
- Protect Mt. Miguel radio site.
- Keep fire east of Steel Canyon Drive.
- Keep fire south of Jamacha Road.
- Keep fire west of Jamul Drive.
- Protect all structures in the Mexican Canyon area.
- Protect cultural resource sites from suppression damage.
- Protect threatened and endangered species, *e.g.*, nest sites and host plants.
- Keep fire from entering private lands.

Strategies identify the method of obtaining those objectives, *e.g.*:

- Direct attack employing hand crews and dozers supported by hoselays, helicopters, and retardant.
- Combination of direct and indirect attack.. Direct attack using hand crews, tying into ridge lines and roads to contain fire.

AIRCRAFT OPERATIONS

All aircraft used for fire suppression purposes must be Office of Aircraft Services (OAS) or Forest Service approved. An OAS Aviation Policy Department Manual is available from OAS. As in all fire management activities, safety is a primary consideration. Qualified aviation personnel will be assigned to all flight operations. No refuge personnel will fly in any unapproved or unqualified aircraft. It is the responsibility of every employee to verify the certification of both the aircraft and pilot. When questions exist with either the equipment or pilot, the employee must decline participation. A flight plan must be on file at either the Helibase or servicing dispatch center. When in service, location checks are required every 15 minutes. A SAFECOM (aircraft safety incident report) should be filed with OAS when incidents occur which affect safety. SAFECOM forms and procedures for filing them are available from the refuge FMO.

Aircraft may be used in all phases of fire management operations with consideration given to values at risk and a fire's potential for adverse effects. Typically, the threat to life and property will be the deciding factor. When these threats are not a factor, resource values at risk and the potential for continued fire growth and resulting effects become deciding factors. Of concern are noise, retardant/foam, and pilot risk. Nesting season is of primary concern when considering limitations on any aircraft use. Otherwise, each incident must be evaluated on a case by case basis. Helicopters may be used for reconnaissance, bucket drops and transportation of personnel and equipment. Natural helispots and parking lots are readily available in most areas. Clearing for new helispots should be avoided where possible and require the Refuge Manager's approval unless there is a threat to life or property. Improved helispots will be rehabilitated following the fire. Further guidelines for the use of aircraft is found in Appendix U, Suppression Guidelines. Specific guidelines for the use of retardant and foam is contained in Appendix R.

REHABILITATION AND RESTORATION

There are three types of fire rehabilitation – Suppression, Burned Area, and Emergency Stabilization. Suppression rehabilitation restores and repairs property and resources from direct suppression activity damage (*e.g*, cut fences, dozer lines, and campsites). Burned area rehabilitation and emergency stabilization restores resources and property damaged or otherwise impacted from the fire itself (e.g., burned waterlines, lost habitat, denuded hillsides, etc.).

Suppression Rehabilitation

In the event of a wildland fire, rehabilitation of fire suppression damage should be accomplished immediately. An appropriate time is within 7 days after control of the fire, unless the Regional Fire Management Coordinator grants an extension. Funding for suppression rehabilitation comes from the specific fire cost account as established by the FMO. The Incident Commander, as agreed to by the Project Leader or Refuge Manager, will initiate suppression rehabilitation. Rehabilitation will be directed toward minimizing or eliminating the effects of the suppression effort and reducing the potential hazards caused by the fire. These actions may include:

- Backfill control lines, scarify, and seed*.
- Install water bars and construct drain dips on control lines to prevent erosion.
- Restore natural ground contours.
- Remove all flagging, equipment and litter.
- Completely restore camping areas and improved helispots.
- Revegetation to restore sensitive impacted areas due to suppression actions*.
- If revegetation or seeding is necessary, only locally procured seeds of native plant species will be used.

A written suppression rehabilitation plan may be appropriate on larger incidents. Contractors or equipment may be hired to accomplish specialized work.

Emergency Stabilization Versus Rehabilitation
Emergency stabilization is the use of appropriate emergency stabilization techniques in order to protect public safety and stabilize or prevent further degradation of cultural and natural resources inside the perimeter of the burned area and the downstream impact areas from erosion and invasion of undesirable species. Rehabilitation is the use of appropriate rehabilitation techniques to improve natural resources as stipulated in approved refuge management plans and the repair or replacement of minor facilities damaged by the fire.

Total "rehabilitation" of a burned area is not within the scope of the Emergency Rehabilitation funding. Emergency Rehabilitation funding can be used to begin the rehabilitation process if other funding is committed to continue the rehabilitation throughout the life of the project (beyond the initial three years of Emergency Rehabilitation funding). Major facilities are repaired or replaced through supplemental appropriations of other funding.

Burned Area Emergency Stabilization and Rehabilitation (ESR) Plan
The goal of the ESR Plan is to protect public safety and stabilize and prevent further degradation of natural and cultural resources, and to rehabilitate the stability, productivity, diversity, and ecological integrity of refuge lands after a wildland fire as described in approved refuge management plans. The ESR Plan is tiered to the refuge Comprehensive Conservation Plan (CCP), Habitat Management Plan (HMP), Fire Management Plan (FMP), and operations or step-down plans. Development of ESR Plan objectives is guided by resource management objectives, general management practices, and constraints identified in approved CCP, HMP, and/or supporting step-down plans.

If Burned Area Emergency Stabilization and Rehabilitation is required to reduce the effects of a wildland fire, then the refuge should request appropriate funding through the Burned Area Emergency Stabilization and Rehabilitation fund. The Service representative at the National Interagency Fire Center administers the ESR fund. A rehabilitation and restoration survey, plan, and request must be prepared and submitted according to agency guidelines. Smaller incidents may only need simple plans prepared by refuge staff. Larger incidents with extensive rehabilitation efforts should employ an ESR Team. An ESR Team is composed of personnel who specialize in key disciplines of resource management and are experts in ESR Plan preparation. A formal request for a ESR Team should be made in consultation with the Incident Management Team as soon as it appears damage may be significant. Instructions for ESR Team mobilization can be found in the National Wildfire Coordinating Group mobilization guide. Delays in making a request may hinder funding approval and magnify the damage. Once a ESR Team is employed, the Project Leader or their representative should provide guidance to the ESR team leader with expectations. The Project Leader, Biologist, and FMO will review all ESR Plans. The final plan will be submitted to the Region for review prior to submission to the Washington Office. Direction on ESR guidelines can be found in the Service Fire Management Handbook section 5.1.

REQUIRED REPORTING
The Incident Commander (FWS) will be responsible for documenting decisions and completing the fire report (*e.g.*, ICS-214, DI-1202). The FMO will be responsible for any additional required reports.

FIRE INVESTIGATION
All refuge employees will be aware of the need to protect the point of origin for fire cause determination. Protection will at the least include flagging the suspected ignition site and denying entry until an investigator arrives on scene. Initial attack forces will also attempt to keep the point of origin undisturbed from suppression activities and deny entry until a fire investigators arrives. Beside physical evidence, other critical information includes people observed leaving the area, tire tracks, witnesses, and suspicious activity. Prompt and efficient investigation of all suspicious fires will be

carried out by qualified wildland fire investigators. Refuge personnel should not question suspects or pursue the fire investigation unless they have a law enforcement commission.

All fire investigations should follow the guidelines outlined in 4.1-2 of the Fire Management Handbook (2000). On FWS DPA fires, a FWS fire investigator will lead the investigation, with coordination and sharing of information with local cooperators (e.g., SDFD). Fires which start off the Refuge and burn onto it, or into another agencies DPA, will be investigated by the agency responsible for the point of origin. A Fish and Wildlife Service Fire Investigator may be requested to assist with the investigation. If a Fish and Wildlife Investigator is not available, one may be requested through the CNF ECC. If the fire originated on the Refuge, the fire investigator will report directly to the Project Leader or his/her designate. All case reports, citations, and other pertinent documentation must meet with FWS guidelines. The FWS reserves the right to issue bills for collection for suppression costs and damage.

HAZARD FUEL MANAGEMENT

Hazard fuel is defined as "Excessive live or dead wildland fuel accumulations that increase the potential for uncharacteristically intense wildland fire and decrease the capability to protect life, property, and natural resources" (USDA 2002). Hazard fuel management reduces that risk and threat. It is both a fire prevention activity and a wildland fire protection measure. It is a prevention activity in that it removes fuel that may ignite and/or carry a source of ignition into the wildland. It is a protection measure in that it creates a "fuelbreak" which may stop a fire from further spread into the wildland or urban interface area.

HAZARD FUEL MANAGEMENT OBJECTIVES

The hazard fuel situation on the San Diego NWRC is associated with annual vegetation growth around structures and facilities at the various refuge headquarters, private in-holding facilities, and the wildland urban interface (WUI) along refuge boundaries. As discussed in the Introduction Section and the Facilities & Infrastructure Sections, the San Diego NWRC is at risk from wildland fires originating on the surrounding WUI, and the WUI is at risk from fires that are close to or on the refuge boundary. Communities at Risk (Table 4) will be given emphasis when proposing WUI projects. The objectives of the Hazard Fuel Management program on the San Diego NWRC are:

- reduce the hazard and risk to Service structures and facilities from an approaching wildland fire.
- reduce the risk of a fire originating at a service owned facility or land from spreading off-refuge.
- provide defensible space and safety to personnel at those facilities during a wildland fire.
- meet Federal, state and local fire hazard reduction ordinances.

HAZARD FUEL MANAGEMENT STRATEGIES

Strategies include mechanical treatment of the hazard fuels and debris disposal. Mechanical treatment is accomplished by hand cutting, mowing, and discing. The San Diego County Fire Hazard Reduction Ordinance requires a 30 foot clearing and/or mowing around structures of all vegetation and a 100 foot clearing and/or mowing of all vegetation to a height of 18 inches. Other measures include limbing of trees within proximity to structures of dead or overhanging branches. These activities must consider and be performed in accordance with guidelines as discussed in the "Protection of Sensitive Resources" Section of this plan.

Mitigation of WUI hazards is not only the problem of the San Diego NWRC, but of private property owners as well. Working with property owners and local fire departments to assure that mitigation efforts on refuge lands are extended onto private property will be key in meeting the intent and desired effect. Strategies will focus on partnering with property owners and local fire departments in identifying mutual areas of concern and developing projects which meet the hazard fuel reduction goals. The FMO and WUI coordinator will work collaboratively on project development.

Strategies for hazard fuel reduction will be:

- Maintain existing fuelbreaks to local fire department standards (Appendix D1)
- Chip or pile burn to dispose of vegetation debris which is identified as a risk.
- Identify resources at risk requiring hazard fuel reduction and mitigate threat.
- Prepare necessary NEPA documents and complete section 7 consultations on new projects
- Work with local fire protection agencies and communities to implement a fire safe community program.

PILE BURNING GUIDELINES

When planning to dispose of debris by pile burning, specific guidelines must be followed in order to provide for safety and reduce the escape potential. General guidelines for pile burning are the same as for prescribed burning. Service guidelines are found in the FWS Fire Management Handbook, Section 2. This section of the San Diego NWRC Fire Management Plan is written for the purpose of outlining the steps to take when conducting pile burning only. No prescribed burning of standing vegetation will be conducted. References to a burn plan and burn boss are only for the purpose of pile burning.

Pile burning will be used to dispose of cut vegetation resulting from refuge activities such as annual hazard fuel reduction around structures and on fuelbreaks. Limbs and branches of overhanging trees as well as brush will need to be trimmed back annually. At times trees may be blown down during storms which will require debris removal. The most economical and expedient method is through burning of the piled vegetation on site. Pile burning is typically rated as complexity level 3 due to the low risk of escape, limited control forces, and time of year conducted. Safety concerns are still present even at the low complexity level. Careful consideration must be given to smoke management, escape potential, and resource benefit when planning and rating the pile burn. The complexity of each pile burn would be evaluated using the NWCG Prescribed Fire Complexity Rating System Guide.

Pile Burn Plan

The Burn Boss will conduct a field reconnaissance of the proposed pile burn location with the Refuge Manager to discuss objectives, special concerns, and gather all necessary information to write the burn plan. After completing the reconnaissance, the Burn Boss will write the Pile Burn Plan.

All pile burning will have a Pile Burn Plan. The Pile Burn Plan is a site specific action plan describing the purpose, objectives, prescription, and operational procedures needed to prepare and safely conduct the burn. The project area, objectives, and constraints will be clearly outlined. No piles will be ignited unless all prescriptions of the plan are met. Fires not within those parameters will be suppressed. Pile Burn Plans will follow the format found in the FWS Fire Management Handbook , Section 2.2. Pile burning is considered a complexity level 3 burn and should use the plan format contained in Appendix X. Each burn plan will be reviewed by the Project Leader, Refuge Manager, Refuge Biologist, FMO/ AFMO, and Burn Boss. The Project Leader has the authority to approve the burn plan.

Additional planning requirements include air quality and smoke management guidelines. An application for Prescribed Burn Permit, Smoke Management Plan, and Burn Permit are required by the San Diego Air Pollution Control District. See the “Air Quality & Smoke Management” section for further details.

Pile Burning Strategies and Personnel

Execution of pile burning will only be performed by qualified personnel. Qualifications will be the same as those for prescribe burning, which are found in the NIIMS Wildland and Prescribe Fire Qualification System Guide. Pile burning requires a Type III Burn Boss. The Burn Boss will fill all required positions to conduct the burn with qualified personnel. All personnel listed in the burn plan must be available for the duration of the pile burn or it will not be initiated.

Weather and fuel moisture conditions must be monitored closely in the project area to determine when the prescription criteria are met. A belt weather kit may also be utilized to augment monitoring. Fuel moisture samples of 10-, 100-, and 1000-hour down and dead logs (where applicable) and of live plants may be monitored each week and fuel moisture content will be calculated to help determine when the prescription criteria are met.

The Pile Burn Plan requires the following items to be completed prior to ignition:

- contingency plan
- complexity analysis
- review and approval signatures
- go/no go checklist
- spot weather forecast

When pertinent prescription criteria are within the acceptable range, the Burn Boss will select an ignition date based on current and predicted weather forecasts. A thorough briefing will be given by the Burn Boss on the day of the burn and specific assignments and placement of personnel will be discussed. An updated spot weather forecast will be obtained on the day of ignition and all prescription elements will be re-checked to determine if they are still within the approved ranges. If all prescription elements are met, a test fire will be ignited to determine on-site fire behavior conditions as affected by current weather. If conditions are not satisfactory, the test fire will be suppressed and the burn will be rescheduled. If conditions are satisfactory, the burn will continue as planned.

For pile burning (complexity level 3 burns), a qualified Incident Commander Type III will be available within a one hour response in the event of an escape. If the burn pile escapes the predetermined burn area, all further ignition will be halted except as needed for suppression efforts. Suppression efforts will be initiated as discussed in the pre-burn briefing. The FMO will be notified immediately of any control actions on a prescribed burn. If the burn exceeds the initial suppression efforts, it will be declared a wildland fire and suppressed using guidelines established in the burn plan. A WFSA (Appendix M) will be completed and additional personnel and resources ordered as determined by the Incident Commander. If the fire continues to burn out of control, additional resources based on the contingency plan will be called from the local cooperating agencies via the servicing dispatch. A management overhead team may be requested to assume command of the fire if necessary. Each Pile Burn Plan will detail the contingency plan and identify resources for suppression. This plan will serve as the incident action plan during the initial attack phase of an escape.

Monitoring and Evaluation

During pile burns, monitoring can serve as a precursor to invoking suppression action by determining if the burn is in prescription, assessing its overall potential, and determining the effects of the pile burn. Pile burning does not usually require extensive monitoring. Weather, fire behavior, and smoke management are elements that require monitoring. The Burn Boss will assume responsibility for coordinating and implementing this section. Personnel may be assigned specific tasks such as weather monitoring to document these elements and keep the Burn Boss informed of conditions. Special situations or projects may dictate more extensive monitoring and evaluation.

Required Reports

All forms will be completed as outlined by the Pile Burn Plan. Accomplishments, costs, fire report (DI-1202), weather data, and first order fire effects monitoring are the responsibility of the Burn Boss. The Burn Boss may prepare a final report on the project for the Refuge Manager as requested. Information should include a narrative of the burn operation, a determination of whether or not objectives were met, weather and fire behavior data, number of work hours, and final cost of the burn.

AIR QUALITY / SMOKE MANAGEMENT GUIDELINES

The California Air Resources Board is the regulatory agency responsible for air quality in the state. California Air Basins are divided into air districts. San Diego NWR is within the San Diego County Air Pollution Control District (APCD). All air quality issues and regulatory information is administered through this office. See "Air Quality" discussion in the "Refuge Description" section.

The APCD must be consulted on all pile and prescribed burning on the Refuge. An Application for a Prescribed Burning Permit (Appendix Y) is to be submitted to the APCD prior to any burning which may produce significant smoke. Any project which is greater than 10 acres or produces more than 1 ton of particulate matter is considered a significant point source. The application will include a Smoke Management Plan. The Smoke Management Plan details the amount of smoke that may be produced, duration of burning, direction of drift, and Smoke Sensitive Areas (SSA) that are within the projected smoke trajectory. The plan must also include mitigation procedures in the event that the smoke impacts a SSA. The application must be submitted at least 30 days prior to a significant burn.

The Burn Permit must be on file prior to conducting a burn of any size or type. This permit is submitted to the local fire agency which has protection responsibility for the location of the burn. The Burn Permit details the date, duration, location, and amount of material to be burned. Also listed is the Burn Boss and contact phone numbers. The Zone FMO has the authority to write burn permits for Refuge projects. The Burn Permit must be kept on file with the Burn Plan.

Trend and outlook forecasts are issued by the APCD at 96 hours, 72 hours, and 48 hours prior to the burn day. Twenty-four hours prior to the burn day, a go/no-go decision forecast will be issued. This forecast states whether the following day will be a "burn day" or not. The burn day designation provides permission by the APCD to the burn boss to proceed with the burn, relative to smoke management concerns.

A Prescribed Fire Implementation Reporting System (PIFRS) report should be filed with the Monte Vista ECC prior to the burn in order to assist with Federal prescribed burning database information collection (Appendix Z). Notification of the local fire departments and the Monte Vista ECC on the day of the burn is necessary to prevent false alarm responses.

Currently the Agricultural Burning Guidelines for the State of California are being amended. Changes may occur in the coming years which may affect the quantity, method, and cost of prescribed burning. A tiered system based on acreage, tonnage, and smoke production will more than likely be the system used. Each tier will require varying degrees of reporting, notification, and monitoring. Administrative cost based on tonnage or acreage is also planned. The new amendments are scheduled to be implemented by April 1, 2003. As these changes become effective, amendments to this plan and individual burn plans may be necessary.

FIRE RESEARCH

Due to the diversity of threatened and endangered species found on the San Diego NWRC refuges and management units, and the lack of knowledge about the effects of fire on many of these species, research will be an integral part of the fire management program. The information received from this research will provide valuable fire management direction for the habitat management plans of these refuges and units. Specific to this fire management plan, research will play a significant role in tying the components of prevention, suppression, prescribed fire, and rehabilitation into a cohesive plan.

Fire research projects on San Diego NWRC refuges and units may be submitted from either external or internal sources provided there is coordination, consultation, and involvement by the appropriate refuge and fire management staff. Project proposals are to be submitted to the Refuge Manager who will convene a fire research project review team (PRT). The PRT will consist of the Refuge Manager, refuge biologist and a member of the fire management staff. Each project proposal will identify the project location, purpose, methodology, monitoring requirements, funding source(s), and special requirements. Fire research projects which are accepted by the PRT will then be forwarded to the Project Leader for approval. Research projects conducted on service lands require the appropriate level of NEPA documentation which will be the responsibility of the research project leader. In addition, consultation under Section 7 of the ESA and Section 106 of the NHPA will need to be completed if any federally listed or threatened and endangered species candidates exist in the project area.

Once a fire research project is approved, the research project leader will coordinate with the fire management staff who will assist with the planning, monitoring, and reporting requirements of the project. FWS guidelines for fire research will be used. These guidelines are described in the FWS Fuel and Fire Effects Monitoring Guide, which is available online at (http://fire.r9.fws.gov/ifcc/monitor/RefGuide/default.htm).

EMPLOYEE AND PUBLIC SAFETY

San Diego NWRC is dedicated to providing for the safety of each employee as well as visitors to the refuges. All of the refuges are open to the general public with the exception of Seal Beach NWR which is on an active military base. There is no visitor control system in place to document the number and location of visitors at the remaining refuges. The Tijuana Slough NWR and San Diego Bay NWR are relatively small, have designated trails, visitor centers, and flat terrain. Public information, cautionary signing, and the evacuation of visitors is relatively easy at these two refuges. The San Diego NWR presents the greatest difficulties in managing public safety. There are numerous entry points and illegal trails throughout the refuge. Also, surveys, research, and refuge maintenance projects place employees on the refuge during high fire danger periods. Situations could occur on the San Diego NWR where employees or public visitors are present on the refuge during a wildfire.

Public and employee safety will begin for all refuges by updating the Emergency Incident Plan (Appendix N) with phone numbers and information that could affect their safety in the event of a wildfire. During periods of high fire danger or fire activity, all employees and permittees to the affected refuge(s) will be briefed on fire safety and emergency procedures. Briefings will include use of any open flame or other ignition sources, the Emergency Incident Plan, and emergency procedures when engaged in field work. During high fire danger or fire activity in the area, public briefings and contacts will be made as well. In the event of a wildfire, the Incident Commander will authorize an air search of the fire area using either the air attack ship or the sheriff's ASTREA helicopter. The air attack ship can be contacted on the air to ground frequency assigned to the incident by ECC. If a Sheriff's helicopter is assigned for this purpose, contact will be made either on the same air to ground frequency or the San Diego County Law Enforcement Air Channel of the 800 MHz radio. The San Diego County Sheriff Department is responsible for search and rescue as well as evacuations. The Incident Commander will coordinate with the Sheriff's IC on any of these activities. The local fire department with medical aid responsibilities will assume charge of any first aid and transportation of victims. This process is activated through ECC as well.

There are no pre-determined area closures at any of the refuges, management units, or adjoining private lands. The Project Leader or Refuge Manager has the authority to implement an area closure for any refuge when fire danger is extreme and public safety is threatened (Appendix Q). Levels which should initiate consideration of area closures are BI's in excess of the 97th percentile, large fires in the immediate area or threatening the refuge, initial attack resources committed to other fires, increase in arson activity, etc. The Fire Management Handbook, Section 3.1 provides a decision matrix for determining refuge closures. Consultation and coordination with cooperating fire agencies and landowners is critical to implement a successful closure.

In the event of wildfire activity in the area, fire information and maps will be displayed at visitor information sites and at the refuge headquarters. Attempts to notify local landowners and residents adjacent to the refuge will be made during wildfires and when any prescribed burns are planned. If a fire information officer is available during an incident, the refuge will coordinate all press releases which could affect public safety. The fire information officer will also be used to assist with other public safety issues which the refuge staff identifies.

PUBLIC INFORMATION AND EDUCATION

Routine public information on fire safety and prevention will be handled by each refuge office. During fire season, visits to the field by refuge staff, volunteers, or the public should include a fire safety review or briefing by refuge staff. Specific points are outlined in the Public Safety section of this plan. Fire information brochures will be available to the public upon request at the each refuge office. Specific or detailed inquiries should be directed to the Zone FMO. Educational material or presentations are available upon request from the Zone FMO. Programs include Smokey Bear Fire Prevention, Wildfire Strikes Home, and Fire Prevention for Home Owners.

As outlined in the Public Safety section, emergency closures or restrictions may become necessary during periods of extreme or extended fire danger. If a closure is planned, appropriate media and local public notifications will be made by refuge staff. Coordination with the CDF, refuge law enforcement, and the sheriff's office is critical for a successful closure.

During fire emergencies, a fire information plan will be prepared by the incident management team and reviewed by the Refuge Manager. The process for press releases will be determined during team transitions. The Project Leader may retain approval authority for all press releases or delegate that to the incident commander. Coordination between the San Diego NWRC , cooperating agencies, and the incident information staff is critical to maintaining correct and timely internal and external information flow. All press releases will be coordinated through External Affairs, California/Nevada Operations Office.

FIRE CRITIQUES AND ANNUAL PLAN REVIEW

FIRE CRITIQUES

Fire critiques are an informal process to improve performance and prevent injury. Informal critiques should be conducted after all incidents where a FWS fire crew responds. Informal critiques should include the crew supervisor, fire crew members, and upper level management as the situation dictates. Cooperators can participate. The informal critique will discuss strategy & tactics, safety, interagency cooperation, and other issues that are identified in the discussion. There is no official form for these critiques, so plain paper with a heading of the incident name, date, complexity, names, and assignments will suffice. These critiques should be routed to the FMO. If there is a minor injury on the incident, formal documentation is required and the FMO will determine if a more extensive review of the incident is necessary based on FWS policy.

FIRE REVIEWS

Fire reviews are a formal process for improving safety and efficiency. The Fire Management Handbook, Section 3.6.1 describes the objectives, types, and responsibilities of formal reviews. Formal reviews may be requested by the Refuge Manager, Zone FMO, Project Leader, regional, or national offices.

ANNUAL FIRE SUMMARY REPORT

The FMO will be responsible for completing an annual fire summary report. The report will contain the number of fires by type, acres burned by fuel type, cost summary (projects and wildland fires), personnel utilized, and fire effects. This report will be provided to the Project Leader, Refuge Manager, and Regional Fire Management Coordinator.

ANNUAL FIRE MANAGEMENT PLAN REVIEW

The Fire Management Plan will be reviewed annually. Necessary updates or changes will be accomplished prior to the next fire season. Any additions, deletions, or changes will be reviewed by the Project Leader and Refuge Manager to determine if such alterations warrant a re-approval of the plan.

CONSULTATION AND COORDINATION

The following agencies, organizations and/or individuals were consulted in preparing this plan:

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APPENDICES

APPENDIX A: REFERENCES CITED

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APPENDIX B: DEFINITIONS

Agency administrator: The appropriate level manager having organizational responsibility for management of an administrative unit. May include Director, State Director, District Manager or Field Manager (BLM); Director, Regional director, or Project Leader (FWS); Director, Regional Director, Park Superintendent, or Unit Manager (NPS), or Director, Office of Trust Responsibility, Area Director, or Superintendent (BIA).

Appropriate management action: Specific actions taken to implement a management strategy.

Appropriate management response: Specific actions taken in response to a wildland fire to implement protection and fire use objectives.

Appropriate management strategy: A plan or direction selected by an agency administrator which guide wildland fire management actions intended to meet protection and fire use objectives.

Appropriate suppression: Selecting and implementing a prudent suppression option to avoid unacceptable impacts and provide for cost-effective action.

Burning index: A relative number related to the contribution that fire behavior makes to the amount of effort needed to contain a fire in a specified fuel type. Doubling that burn index indicates that twice the effort will be required to contain a fire in that fuel type as was previously required, providing all other parameters are held constant.

Class of fire: (as to size of wildland fires):
Class A - 3 acre or less.
Class B - more than 3 but less than 10 acres.
Class C - 10 acres to 100 acres.
Class D- 100 to 300 acres.
Class E - 300 to 1,000 acres.
Class F - 1,000 to 5,000 acres.
Class G- 5,000 acres or more.

Dead fuel: Fallen dead vegetation such as downed woody material, litter, duff and organic soils and dead upright vegetation such as cured grasses, forbs, and dead attached shrub stemwood.

Emergency fire rehabilitation/burned area emergency rehabilitation (EFR/BAER): Emergency actions taken during or after wildland fire to stabilize and prevent unacceptable resource degradation or to minimize threats to life or property resulting from the fire. The scope of EFR/BAER projects are unplanned and unpredictable requiring funding on short notice.

Energy release component (ERC): a number related to the available energy (btu) per unit area (square foot) within the flaming front at the head of a fire. It is generated by the national fire danger rating system, a computer model of fire weather and its effect on fuels. The erc incorporates thousand hour dead fuel moistures and live fuel moistures; day to day variations are caused by changes in the moisture content of the various fuel classes. The erc is derived from predictions of (1) the rate of heat release per unit area during flaming combustion and (2) the duration of flaming.
Extended attack: A fire on which initial attack forces are reinforced by additional forces.

Fire cycle: A fire return interval calculated using a negative exponential distribution, applied using current age-class structure on the landscape. It is the average stand age of a forest characterized using

the negative exponential distribution.

Fire frequency: A general term referring to the recurrence of fire in a given area over time. It is sometimes stated as number of fires per unit time in a designated area.

Fire suppression activity damage: The damage to lands, resources and facilities directly attributable to the fire suppression effort or activities, including: dozer lines, camps, and staging areas, facilities (fences, buildings, bridges, etc.), handlines and the roads.

Fire return interval (mean): The arithmetic average of all fire intervals in a given area over a given time period.

Fire effects: Any consequences to the vegetation or the environment resulting from fire, whether neutral, detrimental, or beneficial.

Fire intensity: The amount of heat produced by a fire. Usually compared by reference to the length of the flames.

Fire management: All activities related to the prudent management of people and equipment to prevent or suppress wildland fire and to use fire under prescribed conditions to achieve land and resource management objectives.

Fire management plan: A strategic plan that defines a program to manage wildland and prescribed fires and documents the fire management program in the approved land use plan. The plan is supplemented by operational procedures such as preparedness plans, preplanned dispatch plans, prescribed fire plans and prevention plans.

Fire prescription: A written direction for the use of fire to treat a specific piece of land, including limits and conditions of temperature, humidity, wind direction and speed, fuel moisture, soil moisture, etc., under which a fire will be allowed to burn, generally expressed as acceptable range of the various fire-related indices, and the limit of the area to be burned.

Firebreak: Any natural or construct barrier bladed to bare earth and used to segregate, stop, and control the spread of fire or provide a control line from which to work.

Fuels: Materials that are burned in a fire; primarily grass, surface litter, duff, logs, stumps, brush, foliage, and live trees.

Fuelbreak: Any natural or constructed barrier that includes mowed or modified vegetation which is used to segregate, stop, and control the spread of fire or provide a control line from which to work. Wide strips or blocks of land on which the native vegetation has been permanently modified so that fires burning into it can be more readily extinguished. It may or may not have a fireline constructed in it prior to fire occurrence.

Fuel loadings: Amount of burnable fuel on a site, usually given as tons/acre.

Fuel moisture content: This is expressed as a percent of fraction of oven dry weight of fuel. It is the most important fuel property controlling flammability.

Fuel type: An identifiable association of fuel elements of distinctive plant species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of

control under specified weather conditions.

Hazard fuels: Those vegetative fuels which, when ignited, threaten public safety, structures and facilities, cultural resources, natural resources, natural processes, or to permit the spread of wildland fires across administrative boundaries except as authorized by agreement.

Handline: A fireline built with hand tools.

Initial attack: An aggressive suppression action consistent with firefighter and public safety and values to be protected.

Incident: A human-caused or natural occurrence, such as a wildfire, that requires emergency service action to prevent or reduce the loss of life or damage to property or natural resources.

Intermix, or wildland intermix: Interspersing of developed land with wildland, where there are no easily discernible boundaries between the two systems. See *Wildland Urban Interface*.

Live fuels: Living plants. Especially important components include tree crowns, shrubs, grasses, forbs, and ferns.

Maintenance burn: A fire set by agency personnel to remove debris; i.e., leaves from drainage ditches or cuttings from tree pruning. Such a fire does not have a resource management objective.

Natural fire: A fire of natural origin, caused by lightning or volcanic activity.

NFDRS fuel model: One of 20 mathematical models used by the national fire danger rating system to predict fire danger. The models were developed by the us forest service and are general in nature rather than site specific.

NFFL fuel model: One of 13 mathematical models used to predict fire behavior within the conditions of their validity. The models were developed by us forest service personnel at the northern forest fire laboratory, Missoula, Montana.

Prescription: Measurable criteria which guide selection of appropriate management response and actions. Prescription criteria may include safety, public health, environmental, geographic, administrative, social, or legal considerations.

Prescribed fire: A fire ignited by agency personnel in accord with an approved plan and under prescribed conditions, designed to achieve measurable resource management objectives. Such a fire is designed to produce the intensities and rates of spread needed to achieve one or more planned benefits to natural resources as defined in objectives. Its purpose is to employ fire scientifically to realize maximize net benefits at minimum impact and acceptable cost. A written, approved prescribed fire plan must exist and NEPA requirements must be met prior to ignition. NEPA requirements can be met at the land use or fire management planning level.

Preparedness: Actions taken seasonally in preparation to suppress wildland fires, consisting of hiring and training personnel, making ready vehicles, equipment, and facilities, acquiring supplies, and updating agreements and contracts.

Presuppression: The term “presuppression” has been replaced by the term “preparedness” to match Policy and appropriation language.

Prevention: activities directed at reducing the number or the intensity of fires that occur, primarily by reducing the risk of human-caused fires.

Remote Automatic Weather Station (RAWS): An apparatus that automatically acquires, process, and stores local weather data for later transmission to the GOES Satellite, from which the data is re-transmitted to an earth receiving station for use in the National Fire Danger Rating System.

Rehabilitation: Actions to (1) limit the adverse effects of suppression on soils, watershed, or other values, or (2) mitigate adverse effects of a wildland fire on the vegetation-soil complex, watershed, and other damages.

Retardant: A chemical having a retarding action on fire.

Strategy: The science and art of command as applied to the overall planning and conduct of and incident which meets the stated goals.

Suppression: A management action intended to protect identified values from a fire, extinguish a fire, or alter a fire's direction of spread.

Tactics: Deploying and directing resources on an incident to meet objectives determined by strategy.

Unplanned ignition: A natural fire that is permitted to burn under specific conditions, in certain locations, to achieve defined resource objectives.

Wildfire: An unwanted wildland fire.

Wildland fire: Any non-structure fire, other than prescribed fire, that occurs in the wildland.

Wildland Fire Situation Analysis (WFSA): A decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economical, political, and resource management objectives as selection criteria.

Wildland Urban Interface (WUI): The geographical meeting point of two diverse systems, wildland and structures. At this interface, structures and vegetation are sufficiently close that a wildland fire could spread to structures or a structure fire ignite vegetation. See *intermix.*

Wildland/urban interface fire: A wildland fire that threatens or involves structures.

APPENDIX C: NEPA COMPLIANCE DOCUMENTATION

UNITED STATES FISH AND WILDLIFE SERVICE

SAN DIEGO NATIONAL WILDLIFE REFUGE COMPLEX
Tijuana Slough National Wildlife Refuge
San Diego National Wildlife Refuge
San Diego Bay National Wildlife Refuge
Del Mar Mesa Vernal Pools Management Unit

ENVIRONMENTAL ACTION STATEMENT FOR THE FIRE MANAGEMENT PLAN

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the proposed action of wildland fire suppression activities and debris pile burning:

Check One:

XX is a categorical exclusion as provided by 516 DM 2, Appendix 1and 516 DM 6, Appendix 1. No further NEPA documentation will therefore be made.

_____ is found not to have significant environmental effects as determined by the attached environmental assessment and finding of no significant impact.

_____ is found to have significant effects and, therefore, further consideration of this action will require a notice of intent to be published in the Federal Register announcing the decision to prepare an EIS.

_____ is not approved because of unacceptable environmental damage, or violation of Fish and Wildlife Service mandates, policy, regulations, or procedures.

_____ is an emergency action within the context of 40 CFR 1506.11. Only those actions necessary to control the immediate impacts of the emergency will be taken. Other related actions remain subject to NEPA review.

Other supporting documents (list):

Signature Approval:

_____ _____
Mendel Stewart, Project Leader Date