ENVIRONMENTAL STEWARDSHIP PLAN
FOR THE CONSTRUCTION, OPERATION, AND MAINTENANCE OF TACTICAL INFRASTRUCTURE
U.S. Border Patrol El Centro Sector, California

U.S. Department of Homeland Security
U.S. Customs and Border Protection
U.S. Border Patrol

May 2008

COVER SHEET

ENVIRONMENTAL STEWARDSHIP PLAN
FOR THE CONSTRUCTION, OPERATION, AND MAINTENANCE
OF TACTICAL INFRASTRUCTURE
U.S. BORDER PATROL EL CENTRO SECTOR, CALIFORNIA

Responsible Agencies: U.S. Department of Homeland Security (DHS), U.S. Customs and Border Protection (CBP), U.S. Border Patrol (USBP).

Coordinating Agencies: Bureau of Land Management (BLM), El Centro Field Office; U.S. Army Corps of Engineers (USACE)-Los Angeles District; U.S. Fish and Wildlife Service (USFWS); and the United States Section, International Boundary and Water Commission (USIBWC).

Affected Location: U.S./Mexico international border in Imperial County, California.

Project Description: The Project includes the construction, operation, and maintenance of tactical infrastructure to include primary pedestrian and vehicle fence, lighting, and associated patrol and access roads along approximately 44.6 miles of the U.S./Mexico international border within the USBP El Centro Sector, California. The Project will be implemented in six discrete sections. Individual sections will range from approximately 2.4 to 19.3 miles in length.

Report Designation: Environmental Stewardship Plan (ESP).

Abstract: CBP plans to construct, operate, and maintain approximately 44.6 miles of tactical infrastructure, including three discrete sections of primary pedestrian fence, lighting, and patrol roads; one section of primary vehicle fence and patrol roads; one of primary pedestrian fence and patrol roads, one section of lighting; and access roads along the U.S./Mexico international border in the USBP El Centro Sector, California. Individual sections will range from approximately 2.4 to 19.3 miles in length. The tactical infrastructure will encroach on multiple privately owned land parcels and public lands managed by the BLM.

This ESP analyzes and documents environmental consequences associated with the Project.

The public may obtain information concerning the status and progress of the Project and the ESP via the project Web site at *www.BorderFencePlanning.com*; by emailing *information@BorderFencePlanning.com*; or by written request to Loren Flossman, Program Manager, SBI Tactical Infrastructure, 1300 Pennsylvania Ave, NW, Washington, DC 20229, Tel: (877) 752-0420, Fax: (703) 752-7754.

ENVIRONMENTAL STEWARDSHIP PLAN
FOR THE
CONSTRUCTION, OPERATION, AND MAINTENANCE OF TACTICAL INFRASTRUCTURE U.S. BORDER PATROL EL CENTRO SECTOR, CALIFORNIA

U.S. Department of Homeland Security
U.S. Customs and Border Protection
U.S. Border Patrol

MAY 2008

This document printed on paper that contains at least 30 percent postconsumer fiber.

EXECUTIVE SUMMARY

BACKGROUND

On April 1, 2008, the Secretary of the U.S. Department of Homeland Security (DHS), pursuant to his authority under Section 102(c) of Illegal Immigration Reform and Immigrant Responsibility Act (IIRIRA) of 1996, as amended, exercised his authority to waive certain environmental and other laws in order to ensure the expeditious construction of tactical infrastructure along the U.S./Mexico Border. The tactical infrastructure described in this Environmental Stewardship Plan (ESP) is covered by the Secretary's April 1, 2008, waiver (see **Appendix A**). Although the Secretary's waiver means that CBP no longer has any specific legal obligations under the laws that are included in the waiver, the Secretary committed DHS to continue to protect valuable natural and cultural resources. CBP strongly supports the Secretary's commitment to responsible environmental stewardship. To that end, CBP has prepared the following ESP, which analyzes the potential environmental impacts associated with construction of tactical infrastructure in the USBP's El Centro Sector. The ESP also discusses CBP's plans as to how it can mitigate potential environmental impacts. The ESP will guide CBP's efforts going forward.

As it moves forward with the project described in this ESP, U.S. Customs and Border Protection (CBP) will continue to work in a collaborative manner with local government, state and Federal land managers, and the interested public to identify environmentally sensitive resources and develop appropriate best management practices (BMPs) to avoid or minimize adverse impacts resulting from the installation of tactical infrastructure.

Goals and Objectives of the Project

The Project will provide USBP agents with the tools necessary to strengthen their control of the U.S. border between ports of entry (POEs) in the USBP El Centro Sector. The Project will help to deter illegal entries within the USBP El Centro Sector by improving enforcement efficiency, thus preventing terrorists and terrorist weapons, illegal aliens, drugs, and other cross border violators and contraband from entering the United States, while providing a safer work environment for USBP agents. The U.S. Border Patrol (USBP) El Centro Sector has identified six discrete areas along the border that experience high levels of illegal entry. Illegal entry activity typically occurs in areas that are remote and not easily accessed by USBP agents, near POEs where concentrated populations might live on either side of the border, or in locations that have quick access to U.S. transportation routes.

The Project is being carried out pursuant to Section 102 of IIRIRA, 8 U.S.C. § 1103 note. In Section 102(b) of IIRIRA, Congress called for the installation of fencing, barriers, roads, lighting, cameras, and sensors on not less than 700 miles of the southwestern border. This total includes certain priority miles of fencing that are to be completed by December of 2008. Section 102(b) further specifies that these priority miles are to be constructed in areas where it would be practical and effective in deterring smugglers and aliens attempting to gain illegal entry into the United States.

Public Outreach and Coordination

CBP notified relevant Federal, state, and local agencies of the Project and requested input on environmental concerns they might have regarding the Project. CBP has coordinated with the U.S. Environmental Protection Agency (USEPA); U.S. Fish and Wildlife Service (USFWS); State Historic Preservation Office (SHPO); and other Federal, state, and local agencies. A Draft Environmental Assessment (EA) was prepared, copies were mailed to interested parties, it was posted on a public Web site, and a 30-day public review and comment period was announced. A public open house was advertised and held at the Imperial Valley Expo in Imperial, California, on January 9, 2008. The open house was attended by 4 people. Although the Secretary issued the waiver, CBP has continued to work in a collaborative manner with agencies and has considered and incorporated agency and public comments into this ESP. CBP responses to public comments on the Draft EA will also be provided on the *www.BorderFencePlanning.com* Web site

Description of the Project

CBP plans to construct, operate, and maintain approximately 44.6 miles of tactical infrastructure in six discrete sections along the U.S./Mexico international border near Calexico, in the USBP El Centro Sector, Imperial County, California. Three sections will consist of primary pedestrian fence, lighting, access and patrol roads; one section will consist of primary vehicle fence, access and patrol roads; one section will consist of primary pedestrian fence, access and patrol roads; and one section will consist of lighting. The tactical infrastructure will be constructed in areas of the border that are not currently fenced. Locations are based on the USBP El Centro Sector's assessment of local operational requirements where such infrastructure will assist USBP agents in reducing illegal cross-border activities. Congress appropriated funds for this project in CBP's fiscal year (FY) 2007 and 2008 Border Security Fencing, Infrastructure, and Technology Appropriations (Public Law [P.L.] 109-295; P.L. 110-161). Individual sections will range from approximately 2.4 to 19.3 miles in length.

Environmental Impacts, Mitigation, and Best Management Practices

Table ES-1 provides an overview of potential environmental impacts by specific resource areas. **Chapters 2** through **11** of this ESP address these impacts in more detail.

CBP followed specially developed design criteria to reduce adverse environmental impacts and will implement mitigation measures to the extent practicable to further reduce or offset adverse environmental impacts without compromising operational requirements. Design criteria to reduce adverse environmental impacts include selecting a route that will minimize impacts, consulting with Federal and state agencies and other stakeholders to avoid or minimize adverse environmental impacts, and developing appropriate Best Management Practices (BMPs) to protect natural and cultural resources. Potential effects, including physical disturbance and construction of solid barriers on wetlands, riparian areas, streambeds, and floodplains, will be avoided or mitigated whenever possible. BMPs will include implementation of a Construction Mitigation and Restoration (CM&R) Plan, Spill Prevention Control and Countermeasure (SPCC) Plan, Storm Water Pollution Prevention Plan (SWPPP), Environmental Protection Plans (EPPs), Dust Control Plan, Fire Prevention and Suppression Plan, and Unanticipated Discovery Plan.

CBP will enter into a programmatic mitigation agreement with DOI and fund a mitigation pool for adverse impacts that cannot be avoided.

Table ES-1. Summary of Environmental Impacts, Mitigation, and BMPs

Resource Area	Effects of the Project	Best Management Practices/Mitigation
Air Quality	Emissions will result in major short-term adverse impacts.	BMPs to reduce dust and control PM_{10} emissions. Construction equipment will be kept in good operating condition to minimize exhaust Construction speed limits will not exceed 35 miles per hour.
Noise	Noise from construction equipment and increased traffic will result in short-term moderate adverse impacts.	Mufflers and properly working construction equipment will be used to reduce noise. Generators will have baffle boxes, mufflers, or other noise abatement capabilities. Blasting mats will be used to minimize noise and debris.

Resource Area	Effects of the Project	Best Management Practices/Mitigation
Land Use and Visual Resources	Land use changes and incompatibilities will result in long-term minor adverse and beneficial impacts. Visual interruption will result in short- and long-term minor to major adverse impacts.	None required.
Geology and Soils	Grading and contouring will result in short- and long-term minor adverse impacts.	Construction related vehicles will remain on established or existing roads as much as possible and areas with highly erodible soils will be avoided when possible. Gravel or topsoil would be obtained from developed or previously used sources. Where grading is necessary, surface soils will be stockpiled and replaced following construction.
Water Use and Quality		
Hydrology and Groundwater	Grading and contouring will result in short-term minor adverse impacts. Increase in storm water will result in short-term negligible adverse effects on groundwater.	Equipment maintenance, staging, laydown, or fuel dispensing will occur upland to prevent runoff. Project Storm Water Pollution Prevention Plan (SWPPP) will be developed and implemented.
Surface Waters and Waters of the United States	Increased impervious surface and runoff potential will result in short-term minor adverse impacts on wetlands. Washes, wetlands, and other waters of the U.S. will be adversely impacted by construction.	Construction activities will stop during heavy rains. All fuels, oils, and solvents will be collected and stored. Stream crossings will not be located at bends to protect channel stability. Equipment maintenance, staging, laydown, or fuel dispensing will occur upland to prevent runoff. SWPPP will be developed and implemented Fence types will allow conveyance of water.

Resource Area	Effects of the Project	Best Management Practices/Mitigation
Floodplains	Construction activities will result in negligible adverse impacts.	Fence maintenance will include removing any accumulated debris on the fence after a rain event to avoid potential future flooding.
Biological Resources		
Vegetation Resources	Disturbance and clearing will result in short- and long-term minor adverse impacts.	Construction equipment will be cleaned to minimize spread of non-native species. Removal of brush in Federally protected areas will be limited to smallest amount possible. Invasive plants that appear on project area will be removed. Fill material, if required, will be weed-free to the maximum extent practicable.
Wildlife and Aquatic Resources	Habitat conversion and fragmentation will result in short- and long-term moderate adverse impacts.	Ground disturbance during migratory bird nesting season will require migratory bird nest survey and possible removal and relocation. To prevent entrapment of wildlife all excavated holes or trenches will either be covered or provided with wildlife escape ramps. All vertical poles and posts that are hollow will be covered to prevent entrapment and discourage roosting. General BMPs will avoid and reduce impacts on wildlife and aquatic resources (see **Appendix E**).

Resource Area	Effects of the Project	Best Management Practices/Mitigation
Threatened and Endangered Species	Loss of potential habitat, fragmentation, and elevated noise will result in short- and long-term minor adverse impacts.	General BMPs, BMPs for peninsular bighorn sheep, and BMPs for peirson's milk-vetch (see **Chapter 7.3.3** and **Appendix E**) and BMPs for Flat Tailed-Horned Lizard (FTHL) (see **Chapter7.3.3**).
Cultural Resources	No impacts will be expected.	None required.
Socioeconomics, Environmental Justice, and Protection of Children	Construction activities, increased employment, and new income will have direct and indirect short-term minor beneficial impacts. Deterrence of cross-border violators will result in direct beneficial effects on safety. No adverse impacts are expected.	None required.
Hazardous Materials and Wastes	Waste generation and use of hazardous materials and wastes will result in short-term negligible adverse impacts will be expected.	All waste materials and other discarded materials will be removed from the project area as quickly as possible. Equipment maintenance, staging, laydown, or fuel dispensing will occur upland to prevent runoff.

ENVIRONMENTAL STEWARDSHIP PLAN FOR THE CONSTRUCTION, OPERATION, AND MAINTENANCE OF TACTICAL INFRASTRUCTURE U.S. BORDER PATROL EL CENTRO, CALIFORNIA

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

APPENDICES

FIGURES

TABLES

1. GENERAL PROJECT DESCRIPTION

1.1 INTRODUCTION TO THE ENVIRONMENTAL STEWARDSHIP PLAN

On April 1, 2008, the Secretary of the U.S. Department of Homeland Security (DHS), pursuant to his authority under Section 102(c) of Illegal Immigration Reform and Immigrant Responsibility Act (IIRIRA), exercised his authority to waive certain environmental and other laws in order to ensure the expeditious construction of tactical infrastructure along the U.S./Mexico Border. The tactical infrastructure described in this Environmental Stewardship Plan (ESP) is covered by the Secretary's April 1, 2008, waiver (73 Federal Register [FR] 65, pp. 18293-24, **Appendix A**). Although the Secretary's waiver means that U.S. Customs and Border Protection (CBP) no longer has any specific legal obligations under the laws that are included in the waiver, the Secretary committed DHS to continue to protect valuable natural and cultural resources. CBP strongly supports the Secretary's commitment to responsible environmental stewardship. To that end, CBP has prepared the following ESP, which analyzes the potential environmental impacts associated with construction of tactical infrastructure in the USBP's El Centro Sector. The ESP also discusses CBP's plans as to how it can mitigate potential environmental impacts. The ESP will guide CBP's efforts going forward.

As it moves forward with the project described in this ESP, CBP will continue to work in a collaborative manner with local government, state and Federal land managers, and the interested public to identify environmentally sensitive resources and develop appropriate best management practices (BMPs) to avoid or minimize adverse impacts resulting from the installation of tactical infrastructure.

This ESP is divided in to 13 chapters plus appendices. The first chapter presents a detailed description of the Project. Subsequent chapters present information on the resources present, and evaluate the direct, indirect, and cumulative effects of the Project. The ESP also describes measures CBP has identified—in consultation with Federal, state and local agencies—to avoid, minimize, or mitigate impacts to the environment, whenever possible. The following resource areas are presented in this ESP: air quality; noise; land use and visual resources; geological resources and soils; water use and quality; biological resources (i.e., vegetation, wildlife and aquatic species, special status species); cultural resources; socioeconomics; hazardous materials and wastes. Some environmental resources were not included in this ESP because they were not relevant to the analysis. These potential resource areas include utilities and infrastructure (omitted because the Project will not impact any utilities or similar infrastructure), roadways and traffic (omitted because the Project will not be accessible from public roadways), sustainability (omitted because the Project will use minimal amounts of resources during construction and maintenance), and human health and safety (omitted because construction workers will be subject to

Occupational Safety and Health Administration (OSHA) standards and the Project will not introduce new or unusual safety risks).

Appendix A presents the Secretary's published waiver pursuant to IIRIRA. **Appendix B** provides information on primary pedestrian and vehicle fence designs. **Appendix C** provides air quality emissions calculations. **Appendix D** presents the Biological Survey Report and **Appendix E** presents the Biological Resources Plan.

CBP will follow specially developed design criteria to reduce adverse environmental impacts and will implement mitigation measures to further reduce or offset adverse environmental impacts to the extent possible. Design criteria to reduce adverse environmental impacts include avoiding physical disturbance and construction of solid barriers in wetlands/riparian areas and streambeds. Consultation with Federal and state agencies and other stakeholders will augment efforts to avoid or minimize adverse environmental impacts. And developing appropriate BMPs to protect natural and cultural resources will be utilized to the extent possible. BMPs will include implementation of a Construction Mitigation and Restoration (CM&R) Plan; Spill Prevention Control and Countermeasures (SPCC) Plan; Dust Control Plan; and Unanticipated Discovery Plan for Cultural Resources.

1.2 USBP BACKGROUND

The mission of CBP is to prevent terrorists and terrorist weapons from entering the United States, while also facilitating the flow of legitimate trade and travel. In supporting CBP's mission, USBP is charged with establishing and maintaining effective control of the borders of the United States. USBP's mission strategy consists of five main objectives:

- Establish substantial probability of apprehending terrorists and their weapons as they attempt to enter illegally between the Ports of Entry (POEs)
- Deter illegal entries through improved enforcement
- Detect, apprehend, and deter smugglers of humans, drugs, and other contraband
- Leverage "smart border" technology to multiply the effect of enforcement personnel
- Reduce crime in border communities and consequently improve quality of life and economic vitality of targeted areas.

USBP has nine administrative sectors along the U.S./Mexico international border. Each sector is responsible for implementing an optimal combination of personnel, technology, and infrastructure appropriate to its operational requirements. The USBP El Centro Sector is responsible for Imperial and Riverside counties in

California. The areas affected by the Project include the southernmost portion of Imperial County. Within the USBP El Centro Sector, areas for tactical infrastructure improvements have been identified that will help the Sector gain more effective control of the border and significantly contribute to USBP's priority mission of homeland security.

1.3 GOALS AND OBJECTIVES OF THE PROJECT

The goal of the project is to increase border security within the USBP El Centro Sector with an ultimate objective of reducing illegal cross-border activity. The project further meets the objectives of the Congressional direction in the Fiscal Year (FY) 2007 DHS Appropriations Act (Public Law [P.L.] 109-295), Border Security Fencing, Infrastructure, and Technology appropriation to install fencing, infrastructure, and technology along the border.

The USBP El Centro Sector identified six distinct areas along the border that experience high levels of illegal cross-border activity. This activity occurs in remote areas and in areas that are not easily accessed by USBP agents, near POEs where concentrated populations might live on either side of the border, or in locations that have quick access to U.S. transportation routes.

1.4 DESCRIPTION OF THE PROJECT

CBP plans to construct, operate, and maintain approximately 44.6 miles of tactical infrastructure in six discrete sections along the U.S./Mexico international border near Calexico, in the USBP El Centro Sector, Imperial County, California. Three sections will consist of primary pedestrian fence, lighting, access and patrol roads; one section will consist of primary vehicle fence, access and patrol roads; one section will consist of primary pedestrian fence, access and patrol roads; and one section will consist of lighting. These six sections of tactical infrastructure are designated as Sections B-1, B-2, B-3 (lighting only)[1], B-4, B-5A, and B-5B. **Table 1-1** presents general information for each of the six sections. **Figure 1-1** illustrates the location of the tactical infrastructure within the El Centro Sector.

The tactical infrastructure will be constructed in areas of the border that are not currently fenced. Locations are based on the USBP El Centro Sector's assessment of local operational requirements where such infrastructure will assist USBP agents in reducing illegal cross-border activities. Individual sections will range from approximately 2.4 to 19.3 miles in length.

[1] In January 2004, USBP approved construction of approximately 5 miles of pedestrian fence along the U.S./Mexico international border starting approximately 2 miles west of the Calexico POE. In August 2007, USBP approved the installation of an additional 2.62 miles of pedestrian fence. These 7.62 miles of fence sections are designated as Section B-3 in this ESP.

Table 1-1. Tactical Infrastructure for USBP El Centro Sector

Section Number	Associated USBP Station	General Location	Land Ownership	Type of Tactical Infrastructure	Length of New Fence Section
B-1	El Centro	West of Pinto	Public: Bureau of Land Management (BLM)-managed	Primary vehicle fence, patrol road, access roads	11.3 miles
B-2	El Centro	Monument 224 to West of Calexico	Public: BLM-managed	Primary pedestrian fence, lighting, patrol road, access roads	2.4 miles
B-3	Calexico	West of Calexico	Public: BLM-managed	Lighting (7.4 miles)	N/A
B-4	Calexico	East of Calexico	Public: BLM- and Bureau of Reclamation-managed	Primary pedestrian fence, lighting, patrol road, access roads	8.6 miles
B-5A	Calexico	East of Calexico	Public: BLM- and Bureau of Reclamation-managed	Primary pedestrian fence, lighting, patrol road, access roads	19.3 miles
B-5B	Calexico	East of Calexico to Monument 210	Public: BLM-managed	Primary pedestrian fence, patrol road, access roads	3.0 miles
				Total	**44.6 miles**

Notes:
Lighting will be spaced approximately 50 yards apart.
NA = Not Applicable

Design criteria that have been established based on USBP operational needs require that, at a minimum, any primary pedestrian fencing must meet the following requirements:

- Built 15 to 18 feet high and extend below ground
- Capable of withstanding a crash of a 10,000-pound (gross weight) vehicle traveling at 40 miles per hour

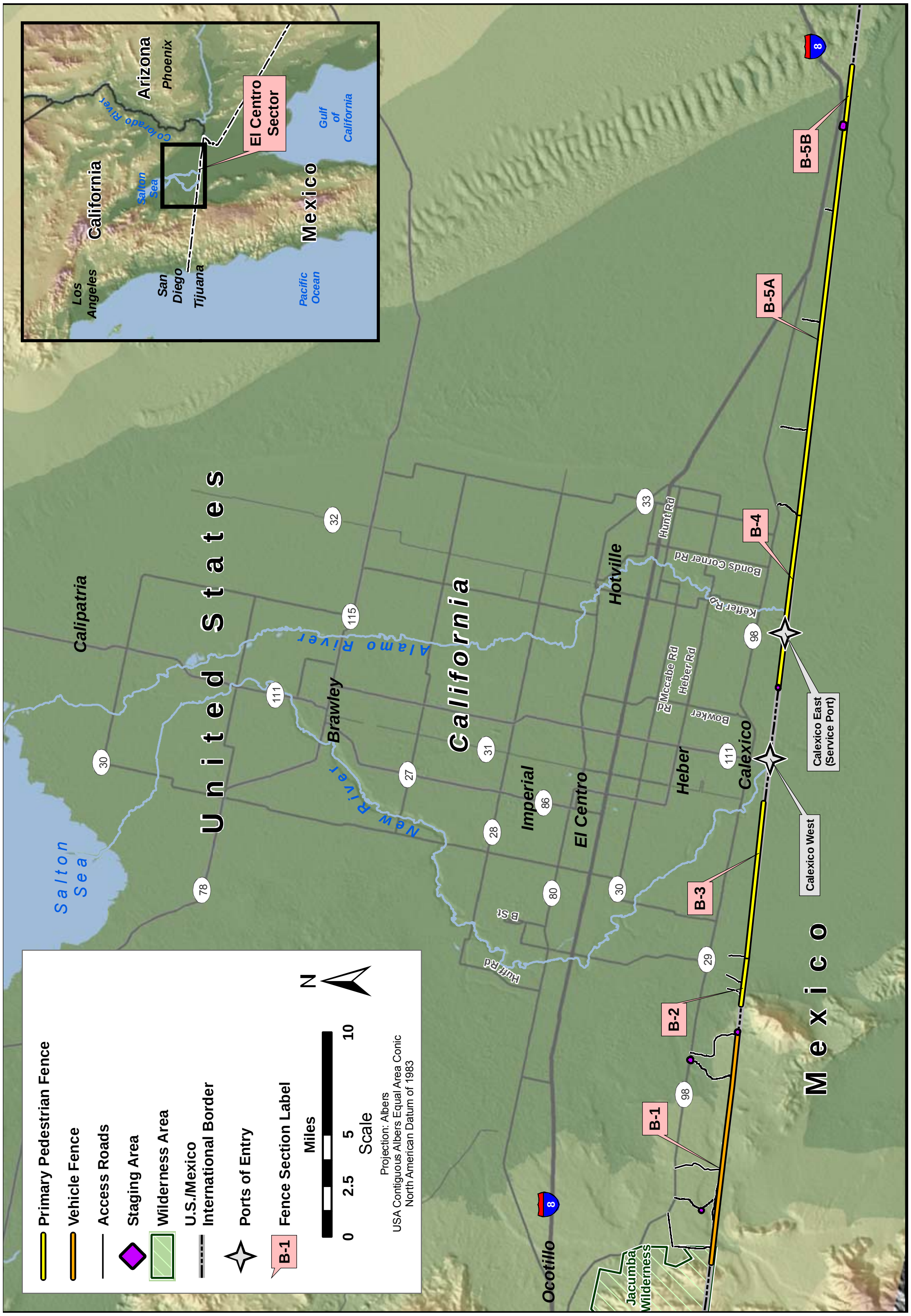


Figure 1-1. Locations of Tactical Infrastructure

- Capable of withstanding vandalism, cutting, or various types of penetration
- Semi-transparent, as dictated by operational need
- Designed to survive extreme climate changes
- Designed to reduce or minimize impacts on small animal movements
- Engineered not to impede the natural flow of surface water
- Aesthetically pleasing to the extent possible.

In addition, the United States Section, International Boundary and Water Commission (USIBWC) has design criteria for tactical infrastructure to avoid adverse impact on floodplains, levees, and flood control operations (IBWC 2007). Fence in Section B5-B has been designed for dune conditions. Examples of primary pedestrian and vehicle fence are included in **Appendix B.**

The tactical infrastructure will be installed approximately 3 feet north of the U.S./Mexico international border within the Roosevelt Reservation.[2] The tactical infrastructure will be constructed around International Boundary and Water Commission (IBWC) monuments and locked gates will be installed at each monument to allow for access to the monuments. The tactical infrastructure will impact an approximate 60-foot-wide corridor along each fence section. **Figure 1-2** shows a schematic of the typical temporary and permanent impact area for tactical infrastructure. This corridor will include fences, patrol roads, and lighting; and construction staging areas. In some locations such as near the Calexico East POE, construction will include removal of spoils and berm material to provide a clear line of site between the patrol road and the fence. Access roads will be a maximum of 30 feet wide (total disturbance). Vegetation will be cleared and grading and placement of aggregate will occur where needed. The area that will be permanently impacted by construction of tactical infrastructure along all six sections will total approximately 324 acres. Impacts on jurisdictional waters of the United States, including wetlands, will be mitigated.

Construction, operation, and maintenance of tactical infrastructure will increase border security in the USBP El Centro Sector and may result in a change to illegal cross-border traffic patterns.

[2] In 1907, President Roosevelt reserved from entry and set apart as a public reservation all public lands within 60 feet of the international boundary between the United States and Mexico within the State of California and the Territories of Arizona and New Mexico. Known as the “Roosevelt Reservation,” this land withdrawal was found “necessary for the public welfare ... as a protection against the smuggling of goods.” The proclamation excepted from the reservation all lands, which, as of its date, were (1) embraced in any legal entry; (2) covered by any lawful filing, selection, or rights of way duly recorded in the proper U.S. Land Office; (3) validly settled pursuant to law; or (4) within any withdrawal or reservation for any use or purpose inconsistent with its purposes (CRS 2006).

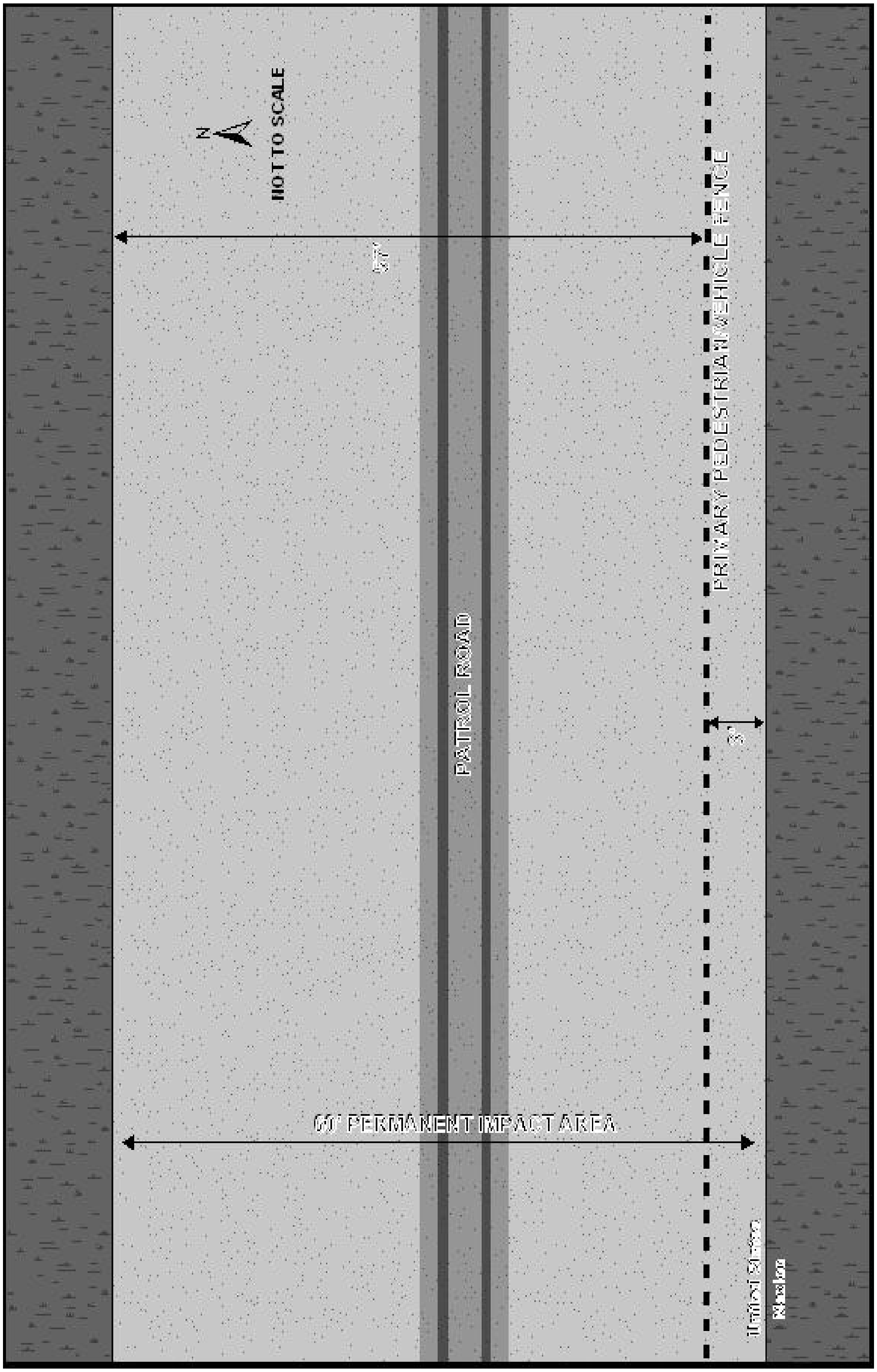


Figure 1-2. Schematic of Project Impact Areas

However, changes to illegal cross-border traffic patterns result from a myriad of factors in addition to USBP operations and therefore are considered unpredictable and beyond the scope of this ESP.

Wherever possible, existing roads and previously disturbed areas will be used for construction access and staging areas. Any necessary aggregate or fill material will be clean material obtained by construction contractors from commercially available sources that will not pose an adverse impact on biological or cultural resources.

Fence maintenance will either be performed by USBP El Centro Sector personnel or contracted personnel. The fences will be made from non-reflective steel. No painting will be required. Fence maintenance will include removing any accumulated debris on the fence after a rain event to avoid potential future flooding. Sand that builds up against the fence and brush will also be removed as needed. Brush removal could include mowing, removal of small trees and application of herbicide if needed. During normal patrols, Sector personnel will observe the condition of the fence. Any destruction or breaches of the fence will be repaired, as needed.

Construction of other tactical infrastructure might be required in the future as mission and operational requirements are continually reassessed. To the extent that other current and future actions are known, they are discussed in **Chapter 11**, Related Projects and Potential Effects.

1.5 PUBLIC OUTREACH AND COORDINATION

CBP notified relevant Federal, state, and local agencies of the Project and requested input on potential environmental concerns such parties might have regarding the Project. CBP has coordinated with the U.S. Environmental Protection Agency (USEPA); U.S. Fish and Wildlife Service (USFWS); State Historic Preservation Office (SHPO); and other Federal, state, and local agencies.

Along some of the fence sections the tactical infrastructure will follow rights-of-way (ROWs) administered, maintained, or used by the USIBWC. The IBWC is an international body composed of a U.S. Section and a Mexican Section, each headed by an Engineer-Commissioner appointed by its respective president. Each Section is administered independently of the other. The USIBWC is a Federal government agency headquartered in El Paso, Texas, and operates under the foreign policy guidance of the Department of State (IBWC 2007). The USIBWC will provide access and ROWs to construct tactical infrastructure within the El Centro Sector. The USIBWC will also ensure that design and placement of the tactical infrastructure does not impact flood control process and does not violate treaty obligations between the United States and Mexico.

A Draft Environmental Assessment (EA) was prepared, copies were mailed to interested parties, it was posted on a public Web site, and a 30-day public review and comment period was announced. A public open house was advertised and held at the Imperial Valley Expo in Imperial, California, on January 9, 2008. The open house was attended by 4 people. Although the Secretary issued the waiver, CBP has continued to work in a collaborative manner with agencies and has considered and incorporated agency and public comments into this ESP. CBP responses to public comments on the Draft EA will also be provided on the *www.BorderFencePlanning.com* Web site.

1.6 BMPS AND MITIGATION PLAN

CBP applied various design criteria to reduce adverse environmental impacts associated with the Project, including selecting a route that will avoid or minimize effects on environmental and cultural resources. Nonetheless, CBP has determined that construction, operation, and maintenance of tactical infrastructure in USBP El Centro Sector will result in adverse environmental impacts. These impacts will be most adverse during construction. Mitigation resources that are available during implementation of the Project include:

- BMPs will be used to avoid, minimize, or mitigate impacts on biological resources.
- CBP will implement a CM&R Plan; SPCC Plan; Blasting Specifications, Dust Control Plan; Fire Prevention and Suppression Plan; and Unanticipated Discovery Plan for Cultural Resources to protect natural and cultural resources and residential areas during construction and operation of the Project.
- CBP will consult with the USFWS, the California Department of Fish and Game (CDFG), California SHPO, Native American tribes, and others to identify appropriate mitigation measures.
- An environmental inspection and Mitigation and Monitoring Plan will be prepared to ensure compliance by contractors with all mitigation measures.

THIS PAGE INTENTIONALLY LEFT BLANK

2. AIR QUALITY

2.1 DEFINITION OF THE RESOURCE

Although the Secretary's waiver means that CBP no longer has any specific obligation under the Clean Air Act (CAA), the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines associated with the CAA as the basis for evaluating potential environmental impacts and developing appropriate mitigations for air quality.

The air quality in a given region or area is measured by the concentration of various pollutants in the atmosphere. The measurements of these "criteria pollutants" in ambient air are expressed in units of parts per million (ppm), micrograms per cubic meter ($\mu g/m^3$), or milligrams per cubic meter (mg/m^3).

While issuance of the waiver eliminated the requirement for CBP to comply with the CAA, the applicable thresholds and standards have been used to evaluate the potential impacts on air quality. The CAA directed USEPA to develop National Ambient Air Quality Standards (NAAQS) for pollutants that have been determined to affect human health and the environment. NAAQS are currently established for six criteria air pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter (including particulates equal to or less than 10 microns in diameter [PM_{10}] and particulates equal to or less than 2.5 microns in diameter [$PM_{2.5}$]), and lead (Pb). The primary NAAQS are ambient air quality standards to protect the public health; secondary NAAQS specify levels of air quality to protect the public welfare such as effects on vegetation, crops, wildlife, economic values, and visibility.

States designate any area that does not meet the national primary or secondary ambient air quality standard for a criteria pollutant as a nonattainment area. For O_3, each designated nonattainment area is classified as marginal, moderate, serious, severe, or extreme, based on ambient O_3 concentrations. The Cal/EPA, California Air Resources Board (CARB) has delegated responsibility for implementation of the Federal CAA and California CAA to local air pollution control agencies.

The State of California adopted the NAAQS and promulgated additional State Ambient Air Quality Standards (SAAQS) for criteria pollutants. The California standards are more stringent than the Federal primary standards. **Table 2-1** presents the primary and secondary USEPA NAAQS and SAAQS.

Table 2-1. National and State Ambient Air Quality Standards

Pollutant	Averaging Time	California Standard	National Standard	
		Concentration	Primary	Secondary
O_3	1 Hours [c]	0.09 ppm (180 μg/m^3)	----	Same as Primary Standard
	8 Hours [b]	0.070 ppm (137 μg/m^3)	0.08 ppm (157 μg/m^3)	
PM_{10}	24 Hours [a]	50 μg/m^3	150 μg/m^3	Same as Primary Standard
	Annual Arithmetic Mean [d]	20 μg/m^3	----	
$PM_{2.5}$	24 Hours [f]	No separate State Standard	35 μg/m^3	Same as Primary Standard
	Annual Arithmetic Mean [e]	12 μg/m^3	15 μg/m^3	
CO	8 Hours [a]	9.0 ppm (10 mg/m^3)	9.0 ppm (10 mg/m^3)	None
	1 Hour [a]	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	
NO_2	Annual Arithmetic Mean	0.030 ppm (56 μg/m^3)	0.053 ppm (100 μg/m^3)	Same as Primary Standard
	1 Hour	0.18 ppm (338 μg/m^3)	----	
SO_2	Annual Arithmetic Mean	----	0.030 ppm (80 μg/m^3)	----
	24 Hours [a]	0.04 ppm (105 μg/m^3)	0.14 ppm (365 μg/m^3)	----
	3 Hours [a]	----	----	0.5 ppm (1,300 μg/m^3)
	1 Hour	0.25 ppm (655 μg/m^3)	----	
Pb	30 Day Average	1.5 μg/m^3	----	----
	Calendar Year	----	1.5 μg/m^3	Same as Primary Standard
Visibility Reducing Particles	8 Hours	Extinction coefficient of 0.23 per kilometer visibility of 10 miles or more due to particles when relative humidity is less than 70 percent	No Federal Standards	
Sulfates	24 Hours	25 μg/m^3	No Federal Standards	

Pollutant	Averaging Time	California Standard	National Standard	
		Concentration	Primary	Secondary
Hydrogen Sulfide	1 Hour	0.03 ppm (42 μg/m^3)	No Federal Standards	
Vinyl Chloride	24 Hours	0.01 ppm (26 μg/m^3)	No Federal Standards	

Sources: USEPA 2006a and CARB 2007a

Notes: Parenthetical values are approximate equivalent concentrations.

[a] Not to be exceeded more than once per year.

[b] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

[c] (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1. (b) As of June 15, 2005, USEPA revoked the 1-hour ozone standard in all areas except the 14 8-hour ozone nonattainment Early Action Compact Areas.

[d] To attain this standard, the expected annual arithmetic mean PM_{10} concentration at each monitor within an area must not exceed 50 μg/m^3.

[e] To attain this standard, the 3-year average of the annual arithmetic mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 μg/m^3.

[f] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 μg/m^3.

These programs are detailed in State Implementation Plans (SIPs), which are required to be developed by each state or local regulatory agency and approved by USEPA. A SIP is a compilation of regulations, strategies, schedules, and enforcement actions designed to move the state into compliance with all NAAQS. Any changes to the compliance schedule or plan (e.g., new regulations, emissions budgets, controls) must be incorporated into the SIP and approved by USEPA. USEPA has delegated the authority for ensuring compliance with the NAAQS to the CARB.

USEPA classifies the air quality in an air quality control region (AQCR), or in subareas of an AQCR, according to whether the concentrations of criteria pollutants in ambient air exceed the NAAQS. All areas within each AQCR are Therefore designated as either “attainment,” “nonattainment,” “maintenance,” or “unclassified” for each of the six criteria pollutants. Attainment means that the air quality within an AQCR is better than the NAAQS, nonattainment indicates that criteria pollutant levels exceed NAAQS, maintenance indicates that an area was previously designated nonattainment but is now attainment, and unclassified means that there is not enough information to appropriately classify an AQCR, so the area is considered attainment.

Many chemical compounds found in the Earth’s atmosphere act as “greenhouse gases.” These gases allow sunlight to enter the atmosphere freely. When sunlight strikes the Earth’s surface, some of it is reflected back towards space as infrared radiation (heat). Greenhouse gases absorb this infrared radiation and trap the heat in the atmosphere. Over time, the trapped heat results in the phenomenon of global warming.

In April 2007, the U.S. Supreme Court declared that carbon dioxide (CO_2) and other greenhouse gases are air pollutants under the CAA. The Court declared that the USEPA has the authority to regulate emissions from new cars and trucks under the CAA.

Many gases exhibit these “greenhouse” properties. The sources of the majority of greenhouse gases come mostly from natural sources but are also contributed to by human activity.

2.2 AFFECTED ENVIRONMENT

The Project is within Imperial County, California, within the Southeast Desert Air Quality Control Region (SDAQCR). The SDAQCR is composed of Imperial County, and portions of Kern, Los Angeles, Riverside, and San Bernardino counties, California. Imperial County is within a Federal marginal and state moderate nonattainment area for 8-hour O_3, Federal serious and state nonattainment area for PM_{10}, and is in attainment/unclassified for all other criteria pollutants. Although O_3 is considered a criteria air pollutant and is measurable in the atmosphere, it is not often considered a regulated air pollutant when calculating emissions because O_3 is typically not emitted directly from most emissions sources. Ozone is formed in the atmosphere by photochemical reactions involving sunlight and previously emitted pollutants or “O_3 precursors.” These O_3 precursors consist primarily of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) that are directly emitted from a wide range of emissions sources. For this reason, regulatory agencies attempt to limit atmospheric O_3 concentrations by controlling VOC pollutants (also identified as reactive organic gases) and NO_2.

The Project is within the Imperial County Air Pollution Control District (ICAPCD). The ICAPCD has established air pollution control regulations in California Code of Regulations (CCR) Titles 13 and 17. The ICAPCD has also promulgated rules regulating the emissions of toxic substances which are defined as those chemicals listed in California Health and Safety Code, Division 26 Air Resources, Part 2 State Air Resources Board, Chapter 3.5 Toxic Air Contaminants plus any other air pollutant that is considered a health hazard, as defined by the Occupational Safety and Health Administration (OSHA).

2.3 DIRECT AND INDIRECT EFFECTS OF THE PROJECT

The Federal *de minimis* threshold emissions rates were established by USEPA in the General Conformity Rule to focus analysis requirements on those Federal actions with the potential to substantially affect air quality. **Table 2-2** presents these thresholds, by regulated pollutant. These *de minimis* thresholds are similar, in most cases, to the definitions for major stationary sources of criteria and precursors to criteria pollutants under the CAA's New Source Review Program (CAA Title I). As shown in **Table 2-2**, *de minimis* thresholds vary depending on the severity of the nonattainment area classification.

Table 2-2. Conformity *de minimis* Emissions Thresholds

Pollutant	Status	Classification	***de minimis* Limit (tpy)**
O_3 (measured as NO_x or VOCs)	Nonattainment	Extreme Severe Serious Moderate/marginal (inside ozone transport region) All others	10 25 50 50 (VOCs)/100 (NO_x) 100
	Maintenance	Inside ozone transport region Outside ozone transport region	50 (VOCs)/100 (NO_x) 100
CO	Nonattainment/ maintenance	All	100
PM_{10}	Nonattainment/ maintenance	Serious Moderate Not Applicable	70 100 100
$PM_{2.5}$ (measured directly, as SO_2, or as NO_x)	Nonattainment/ maintenance	All	100
SO_2	Nonattainment/ maintenance	All	100
NO_x	Nonattainment/ maintenance	All	100

Source: 40 Code of Federal Regulations (CFR) 93.153

Imperial County is within a Federal marginal and state moderate nonattainment area for 8-hour O_3 and a Federal serious and state nonattainment area for PM_{10}, and is in attainment/unclassified for all other criteria pollutants. Regulated pollutant emissions from the Project will not contribute to or affect local or regional attainment status with the NAAQS.

Construction Projects. The Project will generate air pollutant emissions from the construction projects and the operation of generators to supply power to construction equipment. Minor, short-term adverse effects will be expected with implementation of dust control measures.

The construction projects will generate total suspended particulate and PM_{10} emissions as fugitive dust from ground-disturbing activities (e.g., minor grading and trenching, removal of spoils and berm) and from combustion of fuels in construction equipment. Fugitive dust emissions will be greatest during the initial site-preparation activities and will vary from day to day depending on the construction phase, level of activity, and prevailing weather conditions. The quantity of uncontrolled fugitive dust emissions from a construction site is proportional to the area of land being worked and the level of construction activity. Estimated ground disturbance associated with the Project will total approximately 324 acres and will occur in stages as sections are constructed. CBP will develop a Dust Control Plan and implement best available control measures for PM_{10} during construction and earthmoving activities.

Construction operations will also result in emissions of criteria pollutants as combustion products from construction equipment. These emissions will be of a temporary nature. For purposes of this analysis, the project duration and affected project site area that will be disturbed was used to estimate fugitive dust and all other criteria pollutant emissions. The construction emissions presented in **Table 2-3** include the estimated annual construction PM_{10} emissions associated with the Project.

Table 2-3. Total Construction Emissions Estimates

Description	NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
Construction Emissions	4.0	0.2	1.5	0.01	67.1	10.0
Generator Emissions	19.1	1.6	4.1	1.3	1.3	1.3
Total Project Emissions	**23.1**	**1.8**	**5.6**	**1.3**	**68.5**	**11.3**
Federal *de minimis* Threshold	100	100	NA	NA	70	NA
SDAQCR Regional Emissions	69,491	57,494	398,793	937	59,518	21,073
Percent of SDAQCR Regional Emissions	**0.026%**	**0.003%**	**0.002%**	**0.023%**	**0.115%**	**0.054%**

Source: USEPA 2007b

Appendix C contains the detailed spreadsheets for calculation of air emissions. These emissions will produce elevated short-term PM_{10} ambient air concentrations. However, the effects will be temporary, and will fall off rapidly with distance from the construction sites. Construction emissions resulting from the Project will not exceed the *de minimis* threshold limits and will not exceed 10 percent of the regional air emissions values. Specific information describing the types of construction equipment required for a specific task, the hours the equipment is operated, and the operating conditions vary widely from project to project. For purposes of analysis, these parameters were estimated using established methodologies for construction and experience with similar types of construction projects. Combustion by-product emissions from construction equipment exhausts were estimated using USEPA's NONROAD Model emissions factors for construction equipment. As with fugitive dust emissions, combustion emissions will produce slightly elevated air pollutant concentrations. Early phases of construction projects involve heavier diesel equipment and earthmoving, resulting in higher NO_x and PM_{10} emissions. Later phases of construction projects involve more light gasoline equipment and surface coating, resulting in more CO and VOC emissions. However, the effects will be temporary, fall off rapidly with distance from the construction site, and will not result in any long-term effects.

The Project is projected to require six diesel-powered generators to power construction equipment. These generators are estimated to be approximately 75 horsepower each and operated approximately 8 hours per day for 190 working days. Operational emissions associated with the Project are shown in **Table 2-2**. The emissions factors and estimates were generated based on guidance provided in USEPA AP-42, Volume I, *Stationary Internal Combustion Sources*.

Operations and Maintenance Activities. The Project will generate air pollutant emissions from the continuation of operations and increased maintenance activities along the Project corridor. Minor, long-term adverse effects will be expected from increased maintenance. The estimated air emissions from long-term vehicle operations and maintenance activities are shown in **Table 2-4**.

Table 2-4. Total Operations and Maintenance Vehicle Emissions Estimates from the Project

NO_x (tpy)	VOC (tpy)	CO (tpy)	SO_2 (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)
2.2	0.3	2.0	0.002	0.08	0.07

Current USBP El Centro Sector operations include using techniques, such as sign cutting (i.e., searching for signs of disturbances in natural conditions) and tire dragging (i.e., dragging a tire behind a vehicle to make the ground smooth), which involve driving vehicles on unpaved roads or routes. The USBP El Centro Sector has an ICAPCD-approved Fugitive Dust Control Plan. For the most part, operations will be essentially the same under the Project. However, after construction is completed, USBP El Centro Sector will begin on-road patrols along Sections B-1, B-2, B-4, B-5A, and B-5B. The Project could result in an overall decrease in ground disturbance because border patrol agents will patrol more frequently along the new stabilized roads. The vehicles used for surveillance of the existing border area, such as Section B-3, are currently generating criteria pollutants and will not introduce new pollutant sources. The

Project is not expected to increase off-road border patrol operations or increase fugitive dust emissions; therefore, operations are expected to have a negligible contribution to criteria pollutant emissions.

The construction of new tactical infrastructure will increase infrastructure maintenance activities within the USBP El Centro Sector. It is anticipated that future maintenance will primarily consist of welding and fence section replacements, as needed. In addition some maintenance activities will require the use of a fork lift to clear sand as needed from fencing. Maintenance activities will result in criteria pollutant air emissions well below the *de minimis* thresholds and will have a negligible contribution to the overall air quality in the SDAQCR, as shown in **Table 2-3** (USEPA 2007b). Minor long-term adverse impacts on air quality will be expected.

Greenhouse Gases. The Project will result in short-term CO_2 emissions from the operation of construction vehicles and generators. Operation of construction vehicles will result in an estimated 474 tons of CO_2, and operation of generators will result in an estimated 710 tons of CO_2. Therefore, short-term greenhouse gas emissions associated with construction activities will total approximately 1,184 tons of CO_2.

The USBP El Centro Sector currently patrols along Sections B-1, B-2, B-4, B-5A, and B-5B. The vehicles used for surveillance and patrol of the existing border areas, such as at Section B-3, are currently generating CO_2; therefore, no net increase of CO_2 emissions will be expected. Maintenance of tactical infrastructure will increase under the Project, which could result in CO_2 emissions of approximately 248 tpy.

The USEPA has estimated that the total greenhouse emissions for California were 427 million metric tons of CO_2 equivalent (MMTCE) in 1990 (CARB 2007b). Of this, an estimated 3.3 MMTCE are associated with the SDAQCR region. The short-term CO_2 emissions associated with construction (1,184 tons) represent less than 0.0003 percent of the estimated California CO_2 inventory and 0.03 percent of the estimated SDAQCR CO_2 inventory. Long-term increases in CO_2 emissions will result from maintenance activities (248 tpy) representing negligible fractions of the estimated California and SDAQCR CO_2 inventories. The Project will be expected to have a negligible contribution to CO_2 and greenhouse gases.

Summary. As shown in **Tables 2-3** and **2-4**, emissions from the Project will not exceed the *de minimis* thresholds for the SDAQCR and will also be less than 10 percent of the emissions inventory for SDAQCR (USEPA 2007b). Minor adverse impacts on local air quality will be anticipated from implementation of the Project.

3. NOISE

3.1 DEFINITION OF THE RESOURCE

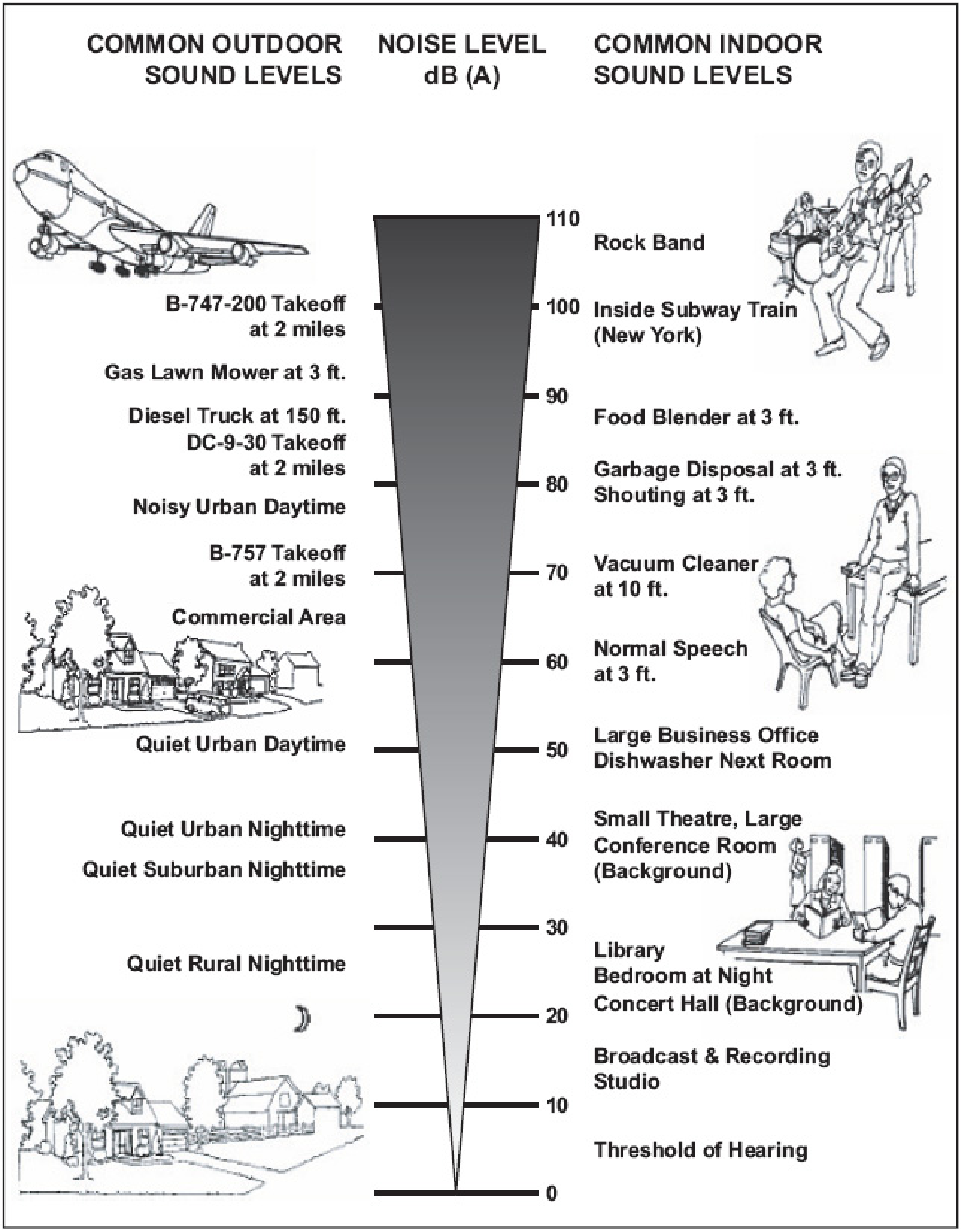
Although the Secretary's waiver means that CBP no longer has any specific legal obligations for the tactical infrastructure segments addressed in this ESP, the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines for evaluating environmental impacts and mitigations on noise resources.

Noise and sound share the same physical aspects, but noise is considered a disturbance while sound is defined as an auditory effect. Sound is defined as a particular auditory effect produced by a given source, for example the sound resulting from rain hitting a metal roof. Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise annoying. Sound or noise (depending on one's perception) can be intermittent or continuous, steady or impulsive, and can involve any number of sources and frequencies. It can be readily identifiable or generally nondescript. Human response to increased sound levels varies according to the source type, characteristics of the sound source, distance between source and receptor, receptor sensitivity, and time of day. How an individual responds to the sound source will determine if the sound is viewed as music to one's ears or an annoying noise. Affected receptors are specific (e.g., schools, churches, or hospitals) or broad (e.g., nature preserves or designated districts) in which occasional or persistent sensitivity to noise above ambient levels exists.

Sound is measured with instruments that record instantaneous sound levels in decibels. A-weighted decibels (dBA) are sound level measurements used to characterize sound levels that can be sensed by the human ear. "A-weighted" denotes the adjustment of the frequency content of a sound-producing event to represent the way in which the average human ear responds to the audible event. Construction-, vehicle-, and aircraft-related noise levels are analyzed using dBA.

Noise levels in residential areas vary depending on the housing density, location, and surrounding use. As shown in **Figure 3-1**, a quiet urban area in the daytime is about 50 dBA, which increases to 65 dBA for a commercial area, and 80 dBA for a noisy urban daytime area.

Construction Sound Levels. Building construction, modification, and demolition work can cause an increase in sound that is well above the ambient level. A variety of sounds come from graders, pavers, trucks, welders, and other work processes. **Table 3-1** lists noise levels associated with common types of construction equipment that are likely to be used under the Project. Additionally,



Source: Landrum & Brown 2002

Figure 3-1. Common Sound Levels

Table 3-1. Predicted Noise Levels for Construction Equipment

Construction Category and Equipment	Predicted Noise Level at 50 feet (dBA)
Clearing and Grading	
Bulldozer	80
Grader	80–93
Truck	83–94
Roller	73–75
Excavation	
Backhoe	72–93
Jackhammer	81–98
Building Construction	
Concrete mixer	74–88
Welding generator	71–82
Pile driver	91–105
Crane	75–87
Paver	86–88

Source: USEPA 1971

the fence will be constructed using pile driving. Noise levels from pile-driving equipment have been measured at range of 91 dBA to 101 dBA (USEPA 1971). In general, construction equipment usually exceeds the ambient sound levels by 20 to 25 dBA in an urban environment and up to 30 to 35 dBA in a quiet suburban area. Pile driving will exceed ambient sound levels by approximately 25 to 35 dBA in an urban environment and 35 to 45 dBA in a quiet suburban area.

3.2 AFFECTED ENVIRONMENT

The Project construction corridor is adjacent to both urban/mixed use areas and rural/undeveloped areas. The areas north of the U.S./Mexico international border are largely rural/undeveloped areas. The most prominent sources of noise in these areas will be from vehicle traffic and agricultural equipment. Expected daytime noise levels in these areas will be approximately 50 dBA or less. The closest populations on the U.S. side of the construction corridor are several unidentified buildings approximately 400 feet north of the construction corridor. The areas south of the western end of the construction corridor, in Mexicali, Mexico, are urban/mixed use areas. The city of Mexicali, Mexico, has a population of approximately 1 million. The most prominent sources of noise in this area will be from vehicle traffic and local industry. Expected daytime noise levels in these areas could range from 60 dBA to 80 dBA. The closest populations in Mexicali, Mexico, are approximately 50 feet from the construction corridor. Moving east along the construction corridor, once outside of the city of Mexicali, Mexico, the areas are largely rural/undeveloped. The most prominent sources of noise in these areas will be from vehicle traffic and agricultural equipment. Expected daytime noise levels in these areas will be approximately 50 dBA or less.

3.3 DIRECT AND INDIRECT EFFECTS OF THE PROJECT

Short-term, moderate, adverse effects on local populations in Mexicali, Mexico, and short-term, minor adverse effects on local U.S. populations will result from noise associated with construction activities. The effect on local populations in Mexicali, Mexico, will be greater than populations in the United States because of the size of the population and its proximity to the construction corridor.

Noise from construction activities varies depending on the type of construction being done, the area that the project will occur in, and the distance from the source. To predict how construction activities will impact adjacent populations, the cumulative noise for several pieces of equipment (generator set, industrial saw, and welder) (see **Table 3-1**) and pile driving was estimated. Pile driving will be the dominant source of noise associated with the Project. To estimate the worst-case scenario, the higher noise level for pile driving was used (101 dBA). Under the Project, the cumulative noise from all construction equipment and pile driving was estimated to be 101 dBA at 50 feet from construction activities.

The residents closest to the construction in Mexicali, Mexico, will be approximately 50 feet south of the construction corridor. The residents closest in the United States will be approximately 400 feet north of the construction corridor. Populations in Mexico will experience noise levels of approximately 101 dBA from construction, including pile driving. Populations in the United States will experience noise levels of approximately 83 dBA. Implementation of the Project will have localized, short-term, minor and moderate, adverse effects on the acoustical environment from the use of heavy equipment and pile driving during construction activities. Pile driving, which will be the dominant source of noise, will be an intermittent noise during construction. Noise impacts from increased traffic due to construction vehicles will also be temporary in nature.

Long-term, negligible, adverse effects on the acoustical environment will continue as a result of existing patrols. Patrols consist of a single vehicle driving along the border on the U.S. side.

4. LAND USE AND VISUAL RESOURCES

4.1 LAND USE

4.1.1 Definition of the Resource

Although the Secretary's waiver means that CBP no longer has any specific legal obligations for the tactical infrastructure segments addressed in this ESP, the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines for evaluating environmental impacts on land use.

The term “land use” refers to real property classifications that indicate either natural conditions or the types of human activity occurring on a parcel. In many cases, land use descriptions are codified in local zoning laws. There is, however, no nationally recognized convention or uniform terminology for describing land use categories. As a result, the meanings of various land use descriptions, “labels,” and definitions vary among jurisdictions.

Two main objectives of land use planning are to ensure orderly growth and compatible uses among adjacent property parcels or areas. Tools supporting land use planning include master plans/management plans and zoning regulations. Land use constraints due to sound are described in **Chapter 3.**

4.1.2 Affected Environment

Land uses in and adjacent to the construction corridor, as categorized by Imperial County, include General Agriculture, Heavy Agriculture, Government Special Use, and BLM Land. General Agriculture Zones are areas that are suitable and intended primarily for agricultural-related compatible uses. Heavy Agricultural Zones are areas suitable for agriculture that prevent the encroachment of incompatible uses onto and within agricultural lands and prohibit the premature conversion of such lands to nonagricultural uses. This land use category is intended to promote the heaviest of agricultural uses in the most suitable land areas of Imperial County. Facilities which are necessary or advantageous to the general welfare of the community are permitted in both the General Agriculture and Heavy Agriculture Zones.

Government Special Public Use Zones are areas for the construction, development, and operation of governmental facilities and special public facilities, such as security facilities, jails, solid and hazardous wastes facilities, and other similar special public benefit uses (IDCP 1998).

The remainder of the land is managed by the BLM El Centro Field Office under the California Desert Conservation Act (BLM undated). The eastern end of the construction corridor ends at the Imperial Sand Dunes Recreation Area, which is also managed by the BLM.

4.1.3 Direct and Indirect Effects of the Project

Long-term, minor, adverse and beneficial direct and indirect effects on land use will occur as a result of the Project. Direct effects will occur in areas characterized as General Agriculture and Heavy Agriculture Zones because small areas will be permanently converted to Government Special Use Zones. These areas are currently near the U.S./Mexico international border and it is likely that the land use change will not result in the loss of agricultural lands. The Project will have no direct effect on the Government Special Use land use category.

Long-term, minor, adverse direct effects on land use will occur on BLM-managed lands in the area of the Project. It is the mission of the BLM to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations. The Project will occur in a rural area that is managed by BLM, including an area near the Imperial Sand Dunes Recreation Area at the eastern end of the construction corridor. However, these areas are remote areas along the U.S./Mexico international border. The Project will not result in a loss of BLM-managed lands. Therefore, the effects will be minor.

Indirect beneficial effects could occur as a result of decreased illegal cross-border activities within the areas adjacent to the Project.

4.2 VISUAL RESOURCES

4.2.1 Definition of the Resource

Although the Secretary's waiver means that CBP no longer has any specific legal obligations for the tactical infrastructure segments addressed in this ESP, the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines for evaluating environmental impacts on visual resources.

Visual resources include both natural and man-made features that influence the visual appeal of an area for residents and visitors. Visual resources can be defined as the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features).

In order to meet its responsibility to maintain the scenic values of public lands, BLM has developed a Visual Resource Management (VRM) system based on human perceptions and expectations in the context of the existing landscape. Different levels of scenic values require different levels of management. Determining how an area should be managed first requires an assessment of the area's scenic values. For management purposes, BLM has developed Visual Resource Classes.

Class I Objective. The objective of these classes is to preserve the existing character of the landscape. This class provides for natural ecological changes but also allows very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II Objective. The objective of these classes is to preserve the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities are allowed, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. New projects can be approved if they blend in with the existing surroundings and don't attract attention.

Class III Objective. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities might attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. New projects can be approved that are not large scale, dominating features.

Class IV Objective. The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities can dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements of predominant natural features (BLM 1986a).

4.2.2 Affected Environment

As listed in **Table 1-1**, the majority of the Project will be on Federal lands managed by BLM. Currently, the BLM El Centro Field Office does not have specific Visual Resource Classes for the project corridor. VRM classifications are developed in BLM resource management plans and the existing plans do not include the applicable classifications for the project corridor. BLM lands in the project corridor are managed according the California Desert Conservation Area as Multiple-Use Class L and Class I which are generally consistent with VRM Classes II and IV respectively. Section B-1 and BLM lands along Sections B-2 and B-4 fall into Multiple-Use Class L, which according to VRM Class II, can be seen, but should not attract attention of the casual observer. The level of change to the landscape should be low and changes should repeat the basic elements found in the natural features of the landscape in form, line, color and texture. Section B-5B falls into the Class I or "Intensive Use" meaning its purpose is to provide for concentrated use of lands and resources to meet human needs. Reasonable protection will be provided for sensitive natural and cultural values (BLM 2007a).

4.2.3 Direct and Indirect Effects of the Project

Degree of Contrast Criteria. To properly assess the contrasts between the existing conditions and the Project, it is necessary to break each down into the basic features (i.e., landform/water, vegetation, and structures) and basic elements (i.e., form, line, color, and texture) so that the specific features and elements that cause contrast can be accurately identified.

General criteria and factors used when rating the degree of contrast are as follows:

- *None:* The element contrast is not visible or perceived.
- *Weak:* The element contrast can be seen but does not attract attention.
- *Moderate:* The element contrast begins to attract attention and dominate the characteristic landscape.
- *Strong:* The element contrast demands attention, cannot be overlooked, and is dominant in the landscape.

When applying the contrast criteria, the following factors are considered:

1. *Distance*. The contrast created by a Project usually is less as viewing distance increases.
2. *Angle of Observation*. The apparent size of a Project is directly related to the angle between the viewer's line-of-sight and the slope upon which the Project is to take place. As this angle nears 90 degrees (vertical and horizontal), the maximum area is viewable.
3. *Length of Time the Project Is In View*. If the viewer can only view the Project for a short period of time, the contrast might not be of great concern. If the Project can be viewed for a long period of time, the contrast could be very high.
4. *Relative Size or Scale*. The contrast created by the Project is directly related to its size and scale as compared to the immediate surroundings.
5. *Season of Use.* Contrast ratings should consider the physical conditions that exist during the heaviest or most critical visitor-use season, such as snow cover and tree defoliation during the winter, leaf color in the fall, and lush vegetation and flowering in the spring.
6. *Light Conditions*. The amount of contrast could be substantially affected by the light conditions. The direction and angle of light can affect color intensity, reflection, shadow, form, texture, and many other visual aspects

of the landscape. Light conditions during heavy periods must be a consideration in contrast ratings.

7. *Recovery Time*. The amount of time required for successful revegetation should be considered. Few projects meet the VRM objectives during construction activities. Recovery usually takes several years and goes through several phrases (e.g., bare ground to grasses, to shrubs, to trees).
8. *Spatial Relationships*. The spatial relationship within a landscape is a major factor in determining the degree of contrast.
9. *Atmospheric Conditions*. The visibility of a Project due to atmospheric conditions such as air pollution or natural haze should be considered.
10. *Motion*. Movements such as waterfalls, vehicles, or plumes draw attention to a Project (BLM 1986b).

The construction activity associated with the Project will result in both temporary and permanent moderate contrasts to Visual Resources. BLM lands along Sections B-1, B-2, and B-4 fall into Multiple-Use Class L, which according to VRM Class II, may be seen, but should not attract attention of the casual observer. The level of change to the landscape should be low and changes should repeat the basic elements found in the natural features of the landscape in form, line, color and texture. Primary pedestrian fence along Sections B-2 and B-4 will be a moderate to strong contrast for viewers near the fence. However, public viewing is limited in this area because of low visitation frequency and limited line of sight from other locations. Primary pedestrian fence in Section B–5B will be consistent with intensive use associated with VRM Class I. Primary vehicle fence along Sections B-1 will be a weak contrast for viewers near the fence.

THIS PAGE INTENTIONALLY LEFT BLANK.

5. GEOLOGY AND SOILS

5.1 DEFINITION OF THE RESOURCE

Although the Secretary's waiver means that CBP no longer has any specific legal obligations for the tactical infrastructure segments addressed in this ESP, the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines for evaluating environmental impacts and mitigations on geological and soils resources.

Geology and soils resources include the surface and subsurface materials of the earth. Within a given physiographic province, these resources typically are described in terms of topography, soils, geology, minerals, and paleontology, where applicable.

Topography is defined as the relative positions and elevations of the natural or human-made features of an area that describe the configuration of its surface. Regional topography is influenced by many factors, including human activity, seismic activity of the underlying geologic material, climatic conditions, and erosion. Information describing topography typically encompasses surface elevations, slope, and physiographic features (i.e., mountains, ravines, hills, plains, deltas, or depressions).

Site-specific geological resources typically consist of surface and subsurface materials and their inherent properties. Principal factors influencing the ability of geologic resources to support structural development are seismic properties (i.e., potential for subsurface shifting, faulting, or crustal disturbance), topography, and soil stability.

Soils are the unconsolidated materials overlying bedrock or other parent material. They develop from the weathering processes of mineral and organic materials and are typically described in terms of landscape position, slope, and physical and chemical characteristics. Soil types differ in structure, elasticity, strength, shrink-swell potential, drainage characteristics, and erosion potential, which can affect their ability to support certain applications or uses. In appropriate cases, soil properties must be examined for compatibility with particular construction activities or types of land use.

Prime and unique farmland is protected under the Farmland Protection Policy Act (FPPA) of 1981. Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses. Unique farmland is defined as land other than prime farmland that is used for the production of specific high-value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of a specific crop when treated and managed according to acceptable farming methods. Soil qualities, growing season, and moisture supply are needed for a well-managed soil to produce a sustained high yield of crops in an economic manner. The land could be cropland, pasture, rangeland, or other land, but not urban built-up land or water. The intent of the FPPA is to minimize the extent that Federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses. The act also ensures that Federal programs are administered in a manner that, to the extent practicable, will be compatible with private, state, and local government programs and policies to protect farmland.

The FPPA and Natural Resources Conservation Service (NRCS) pertain to activities on prime and unique farmland, as well as farmland of statewide and local importance (see 7 CFR Part 658, 5 July 1984). Determination of whether an area is considered prime or unique farmland and potential impacts associated with a project is based on preparation of the Farmland Conversion Impact Rating Form AD-1006 for areas where prime farmland soils occur and by applying criteria established at Section 658.5 of the FPPA (7 CFR 658).

5.2 AFFECTED ENVIRONMENT

Physiography and Topography. The USBP El Centro Sector is in the southwestern corner of the Basin and Range physiographic province which is characterized by linear north and south trending valleys and normal fault-block mountain ranges resulting from extension of the Earth's crust. The topographic profile of the USBP El Centro Sector is characterized by gently rolling lands with a few steep slopes. Elevations in the USBP El Centro Sector range from about 15 to 65 feet above mean sea level (MSL) along the western section of the fence and about 145 to 200 feet above MSL along the eastern section of the fence (TopoZone.com 2007).

Geology. The USBP El Centro Sector is within the Salton Trough, a structural and topographic depression that lies within the Basin and Range physiographic province. The Salton Trough which is an extension of the East Pacific Rise, emerges from a 1,000-mile-long trough occupied by the Gulf of California and continues northward to Palm Springs. Underlying the Salton Trough are thousands of feet of marine and nonmarine sediments (Morton 1977, Hunt 1974). The depth to basement rock ranges from 11,000 to 15,400 feet, though metamorphism of sedimentary deposits is known to occur at depths as shallow as 4,000 feet as a result of high heat flows associated with crustal spreading. High heat flows also give rise to geothermal steam; several "known geothermal resources areas" have been delineated by the U.S. Geological Survey (USGS) in the Imperial Valley (Morton 1977).

Soils. The soils of the USBP El Centro Sector are all well-drained to some extent, have varying permeability, and occur on 0–2 percent slopes with the exception of the Badland soil map unit (30–75 percent slopes). Twelve soil map units were identified in the USBP El Centro Sector. The soil map units at the site are all classified as nonhydric soils (USDA-NRCS 2007a). Hydric soils are soils that are saturated, flooded, or ponded for long enough during the growing season to develop anaerobic (oxygen-deficient) conditions in their upper part. The presence of hydric soil is one of the three criteria (along with hydrophytic vegetation and wetland hydrology) used to determine that an area is a wetland based on the U.S. Army Corps of Engineers (USACE) *Wetlands Delineation Manual*, Technical Report Y-87-1 (USACE 1987). The soils in the area of the American canal extension have been previously disturbed with canal development and associated activities.

The properties of soils identified in the USBP El Centro Sector are described in **Table 5-1.**

5.3 DIRECT AND INDIRECT EFFECTS OF THE PROJECT

Physiography and Topography. Short- and long-term, minor, adverse impacts on the natural topography of the USBP El Centro Sector could occur as a result of implementing the Project. Minor grading, contouring, and trenching associated with the installation of the fence, patrol roads, access roads, and utilities for lights and other tactical infrastructure will impact approximately 324 acres and could alter the existing topography. The project sites will be regarded and contoured following tactical infrastructure installation. This will minimize modifications to existing flood-flow characteristics.

Geology. Short- and long-term, negligible adverse impacts on geologic resources could occur at locations where bedrock is at the surface and blasting will be necessary to grade for fence placement or patrol and access road development. Geologic resources could affect the placement of the fence or patrol and access roads due to the occurrence of bedrock at the surface, or as a result of structural instability. In most cases, it is expected that project design and engineering practices could be implemented to mitigate geologic limitations to site development.

Soils. Short-term, minor, direct, adverse impacts on soils in the USBP El Centro Sector will be expected as a result of implementing the Project. Soil disturbance and compaction due to grading, contouring, and trenching associated with the installation of the fence, patrol roads, access roads, and utilities for lights and other tactical infrastructure will impact approximately 324 acres. However, much of the soils in the area of the All-American Canal extension have been disturbed, therefore reducing the amount of potential impact to undisturbed soils. Soils displaced by fence construction will be properly stockpiled to prevent erosion and

Table 5-1. Properties of the Soil Types Found Throughout the Project Corridor

Name	Type	Slope	Drainage	Hydric	Farmland Importance	Properties
Badland	N/A	30–75 percent	N/A	N/A	N/A	Alluvium derived from mixed sources.
Holtville	Silty clay, wet	0–2 percent	Moderately Well-Drained	No	Prime	Found on basin floors. Permeability is slow.
Imperial	Silty clay, wet	0–2 percent	Moderately Well-Drained	No	Statewide	Found on basin floors. Permeability is very slow.
Imperial-Glenbar	Silty clay loam, wet	0–2 percent	Moderately Well-Drained	No	Statewide	Found on basin floors. Permeability is moderately to very slow.
Indio-Vint Complex	N/A	0–2 percent	Well-Drained	No	Prime	Found on basin floors. Permeability is moderate to moderately rapid.
Meloland	Very fine sandy loam, wet	0–2 percent	Moderately Well-Drained	No	Prime	Found on basin floors. Permeability is slow.
Meloland and Holtville	Loam	0–2 percent	Moderately Well-Drained	No	Prime	Found on basin floors. Permeability is slow.
Rositas	Fine sand	0–2 percent	Somewhat Excessively Drained	No	Statewide	Found on basin floors. Permeability is rapid.
Rositas	Loamy fine sand	0–2 percent	Somewhat Excessively Drained	No	Statewide	Found on basin floors. Permeability is rapid.

Name	Type	Slope	Drainage	Hydric	Farmland Importance	Properties
Superstition	Loamy fine sand	0–2 percent	Somewhat Excessively Drained	No	Prime	Found on basin floors. Permeability is rapid.
Vint	Loamy very fine sand, wet	0–2 percent	Moderately Well-Drained	No	Prime	Found on basin floors. Permeability is moderately rapid.
Vint and Indio	Very fine sandy loams, wet	0–2 percent	Moderately Well-Drained	No	Prime	Found on basin floors. Permeability is moderate to moderately rapid.

Source: USDA-NRCS 2007a
Notes:
No = Not listed as a hydric soil for Imperial County, CA
Yes = Listed as a hydric soil for Imperial County, CA
N/A = Not applicable.

sedimentation and excess soils will be disposed of properly if not utilized during regrading and recontouring activities following installation of the fence. In areas where soils have not been previously disturbed by development of the All-American Canal and associated activities; minor adverse effects on natural soil structure and soil organisms will be expected.

CBP will require the construction contractor to prepare a Storm Water Pollution Prevention Plan (SWPPP) with BMPs, sediment and erosion control plans, and other environmental protection plans for the Project. Increased soil erosion due to the construction activities will be minimized with the implementation of BMPs. Implementing these BMPs will minimize soil erosion impacts in areas of steep slopes, especially in the areas covered by the Badland soil map unit. This map unit is commonly found on 30–75 percent slopes, though the area where this soil type was mapped does not exhibit especially steep topographic relief (TopoZone.com 2007, USDA-NRCS 2007a). Soil disturbance on steep slopes has the potential to result in excessive erosion due to instability of the disturbed soils and high runoff energy and velocity. Adverse effects associated with sediments that could potentially be transported from construction sites and deposited in the All-American Canal and Alamo River will be minimized as a result of implementation of the BMPs. Construction activities expected to directly impact the existing soils as a result of grading, excavating, placement of fill, compaction, and mixing or augmentation necessary to prepare the sites for development of the fence sections and patrol roads and associated utility lines will also be avoided by the proper implementation of the BMPs. Due to the arid climate of the region, wind erosion could potentially impact disturbed soils in areas where vegetation has been removed. However, following construction activities, the areas disturbed will be revegetated with native species to the maximum extent practicable to reestablish native plant communities and help stabilize soils.

Additional soil disturbance could occur during and following construction. Compaction and erosion of soil will be expected as a result of patrol operations from possible off-road pursuit that could decrease vegetation cover and soil permeability.

The Holtsville silty clay (0–2 percent slopes), Indio-Vint complex (0–2 percent slopes), Meloland very fine sandy loam (0–2 percent slopes), Meloland very fine sandy loam (0–2 percent slopes), Meloland and Holtville loams (0–2 percent slopes), Superstition loamy fine sand (0–2 percent slopes), Vint loamy very fine sand (0–2 percent slopes), and Vint and Indio very fine sandy loams (0–2 percent slopes) are designated as prime farmland soils. None of the areas in the impact corridor is being used for agricultural purposes. The corridor necessary for fence and patrol road development will be linear and limited in extent; therefore, any impacts as a result of the Project to these areas will be considered negligible to minor.

Imperial silty clay (0–2 percent slopes), Imperial-Glenbar silty clay loam (0–2 percent slopes), Rositas fine sand (0–2 percent slopes), and Rositas loamy fine sand (0–2 percent slopes) are designated as farmland soils of statewide importance. None of the areas in the fence corridor on the U.S. side of the border is being used for agricultural purposes. The corridor necessary for border fence and patrol road development will be linear and limited in extent, therefore any impacts as a result of the Project to these areas will be considered negligible to minor.

6. WATER USE AND QUALITY

6.1 HYDROLOGY AND GROUNDWATER

6.1.1 Definition of the Resource

Although the Secretary's waiver means that CBP no longer has any specific obligation under the Clean Water Act (CWA), the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines associated with the CWA as the basis for evaluating potential environmental impacts and developing appropriate mitigations for hydrology and groundwater.

Hydrology consists of the redistribution of water through the processes of evapotranspiration, surface runoff, and subsurface flow. Hydrology results primarily from temperature and total precipitation that determine evapotranspiration rates, topography which determines rate and direction of surface flow, and soil properties that determine rate of subsurface flow and recharge to the groundwater reservoir. Groundwater consists of subsurface hydrologic resources. It is an essential resource that functions to recharge surface water and is used for drinking, irrigation, and industrial processes. Groundwater typically can be described in terms of depth from the surface, aquifer or well capacity, water quality, recharge rate, and surrounding geologic formations.

6.1.2 Affected Environment

***Hydrology*.** The Alamo River, All-American Canal, and Pinto Wash occur in the project corridor, which is in the Salton Sea watershed. The drainage of the project corridor in general flows from south-to-north to the Salton Sea. Substantial quantities of surface water are diverted from the Alamo River to meet agricultural demands in California and Mexico. Most of the water diverted in the Alamo River is returned as treated, partially treated, or untreated wastewater that eventually flows back into the Salton Sea. Overall, the project corridor is located on an extensive plain of arid desert that is gently undulating. The climate is continental desert, is of extreme aridity, and results in high air and soil temperatures. There are typically no summer rains and the average annual precipitation in the area is approximately 2.6 inches. The evaporation rate during the summer season is very high, even more so due to light to moderate winds. Plants in the area are widely dispersed and provide negligible groundcover (Bailey 1995). Reduced groundcover along with steep slopes due to local topography can lead to heavy runoff and high erosion potential during precipitation events. Specifically, the area of the project corridor that contains Badland soil map units, commonly found on 30–75 percent slopes, will be most vulnerable, though the area where this soil type was mapped by does not exhibit especially steep topographic relief (TopoZone.com 2007, USDA-NRCS 2007a).

Groundwater. The USBP El Centro Sector is in the Imperial Valley Groundwater Basin which has a total surface area of 1,200,000 acres. The basin lies within the southern part of the Colorado Desert Hydrologic Region, south of the Salton Sea. The Sand Hills form the eastern boundary and the impermeable rocks of the Fish Creek and Coyote Mountains form the western boundary. The Salton Sea, the discharge point for groundwater in the basin, forms the northern boundary. The physical groundwater basin extends across the border into Baja California where it underlies a contiguous part of the Mexicali Valley. Major hydrologic features include the New and Alamo rivers, which flow north towards the Salton Sea. The rivers were formed in the mid to late 1800s when the Colorado River occasionally escaped the normal channel and flowed northward towards the present day Salton Sea. The All-American Canal (three branches) and the Coachella Canal also cross over the basin (CADWR 2003).

The Imperial Valley Groundwater Basin has two major aquifers, separated at depth by a semi-permeable aquitard that averages 60 feet in thickness and reaches a maximum thickness of 280 feet. The aquifers consist mostly of alluvial deposits of late Tertiary and Quaternary age. Average thickness of the upper aquifer is 200 feet with a maximum thickness of 450 feet. The lower aquifer averages 380 feet in thickness with a maximum thickness of 1,500 feet. As much as 80 feet of fine-grained, low permeability prehistoric lake deposits have accumulated on the nearly flat valley floor and cause locally confined aquifer conditions. The basin could have saturated sedimentary deposits as thick as 20,000 feet (CADWR 2003).

The San Andreas, Algodones, and Imperial faults are present within the Imperial Valley Groundwater Basin, but data on whether these faults control groundwater movement are lacking. The only known barriers to groundwater flow are the lake deposits of clay that obstruct downward seepage of surface waters in the central and western part of the basin. Recharge is primarily from irrigation return. Other recharge sources are deep percolation of rainfall and surface runoff, underflow into the basin, and seepage from unlined canals which traverse the valley. The basin might have saturated sedimentary deposits as thick as 20,000 feet. The total storage capacity for this basin is estimated to be 14,000,000 acre-feet. In general, groundwater beneath the basin is unusable for domestic and irrigation purposes without treatment because of high total dissolved solids concentrations. Groundwater in areas of the basin has higher than recommended levels of fluoride and boron (CADWR 2003).

6.1.3 Direct and Indirect Effects of the Project

Hydrology. Short- and long-term negligible adverse impacts on the hydrology of the Alamo River will be expected to occur as a result of grading and contouring in the project corridor. Grading and contouring will be expected to alter the topography and remove vegetation on a small portion of Section B-4 within the floodplain of the Alamo River, which could in turn increase erosion potential and increase runoff during heavy precipitation events. Revegetating the area with native vegetation following construction along with other BMPs to abate runoff and wind erosion could reduce the impacts of erosion and runoff. Additionally, the small increase in impervious surface within the floodplain will result in negligible increases in the quantity and velocity of storm water flows to the Alamo River. BMPs will be developed as part of the SWPPPs to manage storm water both during and after construction. Therefore, effects will be expected to be negligible.

Groundwater. Short-term, minor, direct, adverse construction-related impacts on groundwater resources will also be expected. During construction, water will be required for pouring concrete, watering of road and ground surfaces for dust suppression during construction, and for washing construction vehicles. Water use for construction will be temporary (approximately 9 months), and the volume of water used for construction will be minor when compared to the amount used annually in the area for municipal, agricultural, and industrial purposes. Water not lost to evaporation from watering of surfaces during construction will potentially contribute to aquifer recharge through downward seepage.

The potential for short-term negligible adverse effects on groundwater related to an increase in storm water runoff will also occur. Implementation of storm water and spill prevention BMPs developed consistent with the SWPPPs and other applicable plans and regulations will minimize potential runoff or spill-related impacts on groundwater quality during construction.

6.2 SURFACE WATERS AND WATERS OF THE UNITED STATES

6.2.1 Definition of the Resource

Although the Secretary’s waiver means that CBP no longer has any specific obligation under the CWA, the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines associated with the CWA as the basis for evaluating potential environmental impacts and developing appropriate mitigations for surface waters and waters of the United States.

Surface water resources generally consist of wetlands, lakes, rivers, and streams. Surface water is important for its contributions to the economic, ecological, recreational, and human health of a community or locale.

Waters of the United States are defined within the CWA, as amended, and jurisdiction is addressed by the USEPA and the USACE. These agencies assert jurisdiction over (1) traditional navigable waters, (2) wetlands adjacent to navigable waters, (3) nonnavigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-around or have continuous flow at least seasonally (e.g., typically 3 months), and (4) wetlands that directly abut such tributaries (USDOJ 2007).

Wetlands and riparian habitats represent some of the most ecologically important and rare vegetation communities on desert landscapes. They provide keystone habitat for a wide array of plant and animal species including resident and migrating birds, amphibian and fish species, mammals, and insects. Vegetation production and diversity are usually very high in and around these mesic to aquatic sites, with many plant species adapted only to these unique environments. In addition, wetlands and riparian zones provide a variety of hydrologic functions vital to ecosystem integrity. These include water filtration of sediment, groundwater recharge, and nutrient/chemical capture (USFS 1995). Development and conversion of wetlands and riparian zones affects wildlife diversity, carrying capacity, and hydrologic regime. Changes to and removal of wetlands can cause effects that are proportionally greater than elsewhere in an ecosystem (Graber 1996).

Wetlands have been defined by agencies responsible for their management. The term “wetland” used herein, is defined using USACE conventions. The USACE has jurisdiction to protect wetlands under Section 404 of the CWA using the following definition:

> . . . areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3[b]). Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands have three diagnostic characteristics that include: (1) over 50 percent of the dominant species present must be classified as obligate, facultative wetland, or facultative, (2) the soils must be classified as hydric, and (3) the area is either permanently or seasonally inundated, or saturated to the surface at some time during the growing season of the prevalent vegetation (USACE 1987).

Wetlands are protected as a subset of “the waters of the United States” under Section 404 of the CWA. The term “waters of the United States” has a broad meaning under the CWA and incorporates deepwater aquatic habitats and special aquatic habitats (including wetlands).

6.2.2 Affected Environment

Surface Water

The Alamo River, All-American Canal, and Pinto Wash which all three occur in the project corridor, are in the Salton Sea watershed, which is bordered on the northwest by the San Gorgonio Mountains, on the west by the San Jacinto and Santa Rosa Mountains and the Peninsular Range, and on the east by the Little San Bernardino and Chocolate Mountains. On the south the watershed includes the Imperial and Mexicali Valleys through which the Alamo and New Rivers flow from Mexico (USBR 2001). The Salton Sea is California's largest lake with a surface area of 243,718 acres (381 square miles) and a surface elevation of 229 feet below sea level (SSA 1997, IID 2005). Its average depth is 31 feet and its maximum depth is 51 feet. It is a federally designated repository to receive and store agricultural, surface, and subsurface drainage waters from the Imperial and Coachella valleys (IID 2005). The annual inflow is estimated at approximately 1,300,000 acre-feet of water carrying approximately 4,000,000 tons of dissolved salt. Salinity within the Salton Sea is approximately 46,000 parts per million (ppm), compared to ocean waters, which average approximately 35,000 ppm (USBR 2001, IID 2005). High salinity levels, when combined with nutrients from agricultural return flows that cause eutrophic conditions, have reduced the wildlife habitat and recreational values of the Salton Sea.

The Alamo River begins as a small stream near the U.S./Mexico international border near and perpendicular to the All-American Canal. The river flows under the canal via a box culvert in Section B-4, then flows northward approximately 60 miles to its discharge point into the Salton Sea. Flows consist of a high percentage of irrigation runoff or wastewater. Daily mean flows over a 40-year period ranged from 45 to 1,140 cubic feet per second (ft^3/s) (LeBlanc et al. 2004). The flow is initially formed and sustained by return irrigation water from the Mexicali Valley where approximately 700,000 acre-feet of pumped groundwater and 1.5 million acre-feet of New Alamo Canal water diverted from the Colorado River at Morales Dam is used to irrigate crops annually (USBR 2005). Pumping of groundwater for irrigation from thick sand and gravel aquifers of the eastern portion of the Mexicali Valley began during the 1950s. Presently, approximately 300,000 acres of irrigated farmland occur in this region of Mexico.

Scrub shrub wetlands are present on the banks of the Alamo River adjacent to the project corridor in Mexico. The wetlands are supported by surface flows and seepage into the groundwater table associated with the Alamo River. The wetlands are characterized primarily by stands of arrow weed (*Pluchea sericea*), short shrubs, and common reed (*Arundo donax*), a tall grass. Tamarisk or salt-cedar (*Tamarix ramosissima*), an invasive shrub, has also become established on Alamo River wetland margins.

Alamo River water was sampled at the international boundary and analyzed for various parameters in the early 2000s (LeBlanc et al. 2004). Suspended sediment concentration was determined from a point sample and bottom sediment sampling was conducted by compositing five grab samples. At Harris Road, downstream from the international border, the Alamo River discharge was 440 ft^3/s. The water temperature at this site was 19.1 degrees Celsius (°C), specific conductivity measured 2,660 microsiemens per centimeter (cm), and the dissolved oxygen was 9.8 ppm. The composition of suspended solids in Alamo

River water at the international border measured 53 percent fines and 47 percent sand and the concentration of suspended solids measured 27 ppm.

During 2003, the dissolved concentrations of current-use pesticides were analyzed at the Alamo River international boundary site (LeBlanc et al. 2004). Eptam was detected at a concentration of 28.7 nanograms per liter (ng/L). Eptam (carbamothioic acid, dipropyl-, S-ethyl ester) is an herbicide used to control annual grasses and forbs and some perennial forbs in agricultural fields (Spectrum undated). It is released directly into the environment through its application on agricultural fields and can be transported by water to rivers and lakes. Both microbial degradation and volatilization to the atmosphere reduce the amount of herbicide potentially transported by water.

Organic carbon was determined to be 14 percent in suspended sediments and 0.2 percent in bed sediments where the Alamo River flows across the international boundary (LeBlanc et al. 2004). Fines at this site ranged from 53 percent in suspended sediments to 9 percent in bed sediments. Pesticide concentration measured 40.5 nanograms per gram (ng/g) of p,p'–dichlorodiphenyl-dichloroethylene (DDE) in the suspended sediments and 6.2 ng/g of p,p'–DDE in the bed sediments. DDE enters the environment as a breakdown product of DDT (dichlorodiphenyltrichloroethane), a pesticide once widely used to control insects in agriculture and insect disease vectors (ATSDR 2002). DDE builds up in the tissues of plants and in the fatty tissues of fish, birds, and mammals; it does not dissolve easily in water.

All-American Canal. The All-American Canal flows generally from east to west across Sections B-3 and B-4 in the project corridor. The Imperial Irrigation District covers a management area of approximately 1,061,637 acres and provides agricultural and domestic/industrial water via the All-American Canal to irrigate approximately 433,226 acres of farmland in the Imperial Valley (USBR 2001, IID 2005). The All-American Canal was authorized by the Boulder Canyon Project Act (P.L. 70-642), constructed during the 1930s, and delivered water by the 1940s (USBR 2005). It is apportioned to deliver 3,100,000 acre-feet of water annually to the Imperial Irrigation District agricultural service area. Its diversion capacity is 15,155 ft^3/s, the water depth is 21 feet, and the average bottom width is 160 feet (Stene undated). Electricity is also generated in the Imperial Irrigation District system by directing canal flows through electric utility plant turbines located at (1) Brawley, (2) Coachella, (3) Double Weir, (4) Drop 1, (5) Drop 2, (6) Drop 3, (7) Drop 4, (8) Drop 5, (9) East Highline, (10) El Centro, (11) Pilot Knob, (12) Rockwood, and (13) Turnip (EIA 2000).

In the Imperial Valley, only surface water from the All-American Canal is applied to agricultural fields. Water is distributed via a network of canals and ditches to irrigate fields where a portion is consumed by plants, while the remainder percolates through the soil and is captured by tile drains at about 6 to 10 feet deep. This unused water contains dissolved salts and agricultural chemicals and is discharged directly to the Alamo and New rivers which flow to the Salton Sea.

Further north, the unused water is discharged directly from field drains into the Salton Sea (USBR 2001).

Of the 2,519,078 acre-feet of water transported during 2005 by the Imperial Irrigation District via diversion at the Imperial Dam, 97 percent was used for irrigation (433,321 acres) and 3 percent was used for residential and industrial applications. Imperial Valley irrigated agriculture is a $1,286,066,000 industry entirely dependent on Colorado River water (IID 2005). The most important crops grown in terms of acres planted and irrigated are alfalfa (*Medicago sativa*), Bermuda grass (*Cynodon dactylon*), Sudan grass (*Sorghum* spp.), wheat (*Triticum* spp.), lettuce (*Lactuca* spp.), sugar beets (*Beta* spp.), carrots (*Daucus* spp.), Klein grass (*Panicum coloratum*), broccoli (*Brassica* spp.), onions (*allium*), and cotton (*Gossypium* spp.). Water delivered to the Imperial Valley for agriculture in 2005 totaled 2,465,013 acre-feet. Conservation savings of water using canal lining, reservoirs, lateral interceptors, 12-hour deliveries, system automation and non-leak gates, and irrigation water management totaled 101,940 acre-feet (IID 2005).

In 2003, the Imperial Irrigation District entered into a package of decisions and agreements known collectively as the Quantification Settlement Agreement and Related Agreements, which include long-term transfer of water to the San Diego County Water Authority and the Coachella Valley Water District (IID 2007). By 2026, the Imperial Irrigation District must conserve and transfer 303,000 acre-feet of Colorado River water annually, approximately 10 percent of the total annual diversion. Transferred water is to be generated through efficiency conservation, which includes both improvements in the Imperial Irrigation District's delivery system and improvements in on-farm irrigation practices.

The All-American Canal surface flows can be a dangerous barrier for cross-border violators and they represent somewhat of an "attractive nuisance" in that flowing water within this desert environment is unusual. The canal system is posted on both sides of the border with danger signs warning of the deep, fast-flowing water and with "No Trespassing" signs.

Pinto Wash. The Pinto Wash, which crosses Section B-1, drains into the United States towards the northeast and is mapped as a 100-year floodplain by Federal Emergency Management Agency (FEMA) on Flood Insurance Rate Maps (FIRMs). Pinto Wash is normally dry and is subject to flash flooding when torrential rainstorms occur in the drainage area. There are no vegetated wetlands associated with Pinto Wash in the project corridor; rather it supports sparse tall shrubs of creosotebush, honey mesquite, and ironwood.

Wetland Riparian Areas and Other Waters of the United States. Based on preliminary site assessments, vegetated wetland and riparian habitats occur in and in proximity to the eastern one-fourth of Section B-2 and in Section B-4 and are supported by surface flows and underground seepage from the Alamo River, the All-American Canal, and an irrigation ditch in Section B-2. Perennial surface water flows only occur in the Alamo River and the All-American Canal.

Pinto Wash, and tributaries to the wash in Section B-1, and a few disturbed washes within an abandoned gravel pit on the western end of Section B-2 convey ephemeral flows in response to storm events.

Wetland and riparian habitats and vegetation stands sampled in the field during the preliminary site assessment are discussed in this section and are also presented as plant associations in **Chapter 7.1**. Several trees of Fremont cottonwood (*Populus fremontii*), Goodding willow (*Salix gooddingii*), Athel tamarisk (*Tamarix aphylla*), and date palms (*Phoenix dactylifera*) were observed in proximity to the project corridor in Sections B-2 and B-4 mostly in Mexico. Individual wetland plant species named in this report were provided a wetland indicator code appropriate for California (USDA-NRCS 2007b), as described in **Table 6-1**.

Vegetation alliances and plant associations (NatureServe 2007) that have been identified within proximity to the project corridor include aquatic bed, herbaceous graminoids, and shrublands, as follows:

- Spiral Ditchgrass (*Ruppia cirrhosa*), Beaked Ditchgrass (*Ruppia* □*asserin*) Permanently Flooded Herbaceous Vegetation
- Common Reed Temporarily Flooded Herbaceous Alliance
- Bermuda Grass Herbaceous Alliance
- Arrow Weed Seasonally Flooded Shrubland
- Salt-cedar species Semi-natural Temporarily Flooded Shrubland Alliance.

Aquatic Wetlands. Submerged beds of ditchgrass and water milfoil (Myriophyllum spicatum), which are both types of obligate wetland (OBL) plants occur within the All-American Canal along its south bank. The beds are dense, up to 100 percent cover, submerged to within 0.25 meters (m) of the water surface, and provide habitat for many aquatic insects and small fish. Regionally, this wetland type occurs in systems with saline soils and in areas of low precipitation; it has very specific water chemistry requirements (NatureServe 2007).

Herbaceous Wetlands and Riparian Types. The tall grass, common reed (FACW) and the short grass, Bermuda grass (FAC) have become established on the banks of the All-American Canal, in the ditch between the canal bank and the berm that demarcates the international border, and in the irrigation ditch in Section B-2.

Table 6-1. Wetland Indicator Status

Wetland Species Type	Indicator Code	Definition of Indicator Code
Obligate Wetland	OBL	Occurs almost always (estimated probability 99%), under natural conditions, in wetlands.
Facultative Wetland	FACW	Usually occurs in wetlands (estimated probability 67%–99%), but occasionally found in nonwetlands.
Facultative	FAC	Equally likely to occur in wetlands or nonwetlands (estimated probability 34%–66%).
Facultative Upland	FACU	Usually occurs in nonwetlands (estimated probability 67%–99%), but occasionally found in wetlands (estimated probability 1%–33%).
Obligate Upland	UPL	Occurs in wetlands in another region, but occurs almost always (estimated probability 99%), under natural conditions, in nonwetlands in the regions specified. If a species does not occur in wetlands in any region, it is not on the National List.
No Agreement	NA	The regional panel was not able to reach a unanimous decision on this species.
No Indicator	NI	Insufficient information was available to determine an indicator status.
No Occurrence	NO	The species does not occur in that region.
---	FAC modifiers: +, -, *	(+) indicates a frequency toward the higher end of the category (more frequently found in wetlands). (-) indicates a frequency toward the lower end of the category (less frequently found in wetlands). (*) identifies tentative assignments based on limited information from which to determine the indicator status.

Source: USDA-NRCS 2007b

Common reed also occurs along both banks of the Alamo River south of the international border in Mexico. The forb alkali mallow (*Malvella leprosa*) (FAC*) occurs as one small stand between the canal bank and the international border berm of Section B-4.

Common reed is a tallgrass that has colonized reaches of the canal and ditch banks where it is sometimes codominant with the short shrub arrow weed (FACW). At a few canal-bank sites, common reed stands also support small patches of the graminoid, broad-leafed cattail (*Typha latifolia*) (OBL). In proximity to Section B-4, common reed stands are the second most common vegetation type in terms of area occupied, next to more extensive stands of arrow weed. The stands are usually monotypic; however, patches of Bermuda grass or heliotrope (*Heliotropium* sp.) could occasionally occur along the margins of the tall grass. Stands are dense (up to 80 percent cover on the more mesic canal bank) to moderate in terms of cover (up to 45 percent) in the drier landscape of the adjacent ditch. It is likely that common reed became established on the permanently saturated canal banks (above ordinary high water) historically, then spread vegetatively under the canal bank road into the adjacent ditch via deep, stout rhizomes. It is unclear whether the principal water source currently is the permanently saturated canal bank or if the common reed plants within the ditch have independently established groundwater contact. Soil investigations within the ditch indicate that saturation does not occur in close proximity to the surface in these areas.

Bermuda grass is a nonnative/introduced shortgrass that has become established in the ditch between the canal bank and the international border berm and along the ditch in Section B-2. Two moderately large stands with up to 15 percent cover occur just west of the Alamo River, where they occupy the canal bank and ditch up to the berm on the international border. These stands possibly became established due to transfer of soil containing seeds or rhizomes, directly from seed blown onto the site which sprouted during a moist period, or plants on the moist soil of the canal banks that spread under the canal bank road into the adjacent ditch via rhizomes. Within the Imperial Irrigation District, Bermuda grass/hay is the second most commonly irrigated agricultural crop in terms of acreage.

Scrub-Shrub Wetland and Riparian Types. The native short (1–3 meters tall) shrub arrow weed and the nonnative, invasive tall (2–6 meters tall) shrub tamarisk or salt-cedar (FAC) represent the most common woody species within Section B-4. They occur on the banks of the All-American Canal and Alamo River and occupy the ditch and berms between the canal and the international border. Together, they provide the most common cover in the project corridor. West of the Alamo River, shrub stands are almost entirely composed of arrow weed. East of the Alamo River, stands of tamarisk become more common, but they typically support an understory of arrow weed.

Arrow weed short shrubs from 1–3 meters tall line the entire north bank of the All-American Canal and most of the south bank, providing up to 80 percent cover and sometimes more in this mesic habitat. On the south canal bank, arrow weed shrubs are occasionally replaced by narrow linear stands of common reed and the two species occasionally intermingle in variably sized ecotones. Arrow weed commonly occurs in the broad ditch between the canal bank and the berm on the international border where the shrubs are of shorter stature (1–1.5 meters tall) and cover values range primarily from 10–45 percent and in some places up to 75 percent.

Wherever arrow weed stands occur they are monotypic probably because of the amount of shade cast on the ground surface which precludes establishment of other plant species. When other species occur (common reed, tamarisk, alkali mallow) they provide less than 1 percent cover. On the eastern portion of Section B-4 within this shrubs' distribution, it becomes understory to codominant with tamarisk shrubs and forms a narrow ecotone with creosotebush and fourwing saltbush where the desert uplands and riparian lowlands meet. This ecotone and transition to creosotebush-dominated desert uplands occurs where the All-American Canal diverges to the north.

It is likely that arrow weed became established on the saturated canal banks from seed then spread to the drier habitats south of the canal via underground rhizomes. It is unknown if the majority of water supporting arrow weed stands is provided directly from plants along the canal bank or if individual shrubs within the drier ditch have tapped the groundwater table resulting from seepage through the riprap-lined earth canal. Soil investigations within the ditch indicate that saturation does not occur in close proximity to the surface in these areas.

Tamarisk or salt-cedar tall shrubs up to 5 meters tall have become established east of the Alamo River. The soils occupied by tamarisk tall shrubs appear to be more alkaline or saline than those occupied by arrow weed short shrubs. However, there is considerable mixing of the two vegetation types and most stands of tamarisk, which provide from 50–80 percent cover, also have low understory cover by arrow weed ranging from 5–15 percent cover.

Near the terminus of the riparian vegetation distribution in Section B-4, a moderately large playa has formed on the international boundary. Although mostly devoid of vegetation across the playa bottom, tamarisk, including a stand of Athel tamarisk, has become established around the playa margin. Some of these tall shrubs have attained heights up to 6–7 meters. The playa has been disturbed by agriculture and activities associated with development of the All-American Canal. Levees and berms occur in the northern and eastern sections of the playa and in Mexico to the south. A drop structure occurs in the northeastern corner of the playa which directs flow under the All-American Canal to an irrigation ditch on the north side of the canal. Drainage channels and irrigation canals bordering and within the playa in Mexico likely direct flows into or out of the playa.

Jurisdictional Wetlands and Other Waters of the United States within the Project Corridor. Field surveys were conducted after the preliminary site assessments in Sections B-1, B-2, B-4, B-5A, and B-5B on January 17 through January 19, 2008, to delineate jurisdictional wetlands and other waters of the United States within the project corridors. Delineations were also conducted along access roads and staging areas associated with the fence alignments. Formal delineations were conducted within a 150-foot corridor associated with the fence alignments, 60 feet to either side of access roads, and within staging areas.

Determination of the occurrence and extent of jurisdictional wetlands and other waters of the United States was based on the application of procedures established in the USACE *Wetlands Delineation Manual*, Technical Report Y−87−1 (USACE 1987) and the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region,* Technical Report ERDC/EL TR-06-16 (USACE 2006). Determination of the occurrence of jurisdictional wetlands was based on the presence or absence of hydrophytic (wetland) vegetation, hydric (wetland) soils, and wetland hydrology. The presence of all three of the criteria is necessary for an area to be designated as a jurisdictional wetland under normal conditions.

Determination of the extent of jurisdictional washes and other waters of the United States in the project areas was based on characterization of the landward extent of the ordinary high water mark (OHM). Indicators used to determine the occurrence and extent of jurisdictional washes included the following:

- The presence of developed channels, typically 2 feet or greater in width
- The occurrence of an OHM
- The absence of fine sediments along flow paths, distinct changes in the vegetative assemblage, or larger or more dense vegetation than surrounding areas
- The presence of cut banks
- The presence of litter, debris, or rack lines
- Occurrence of desiccation cracks or other indicators of hydrology
- Other indicators of the occurrence of intermittent water flow regimes.

All wetlands and other waters of the United States within the projects areas were delineated and the determination was provided to the USACE-Los Angeles District.

Table 6-2 provides the section locations, wetland or other waters of the United States type, the delineated acreage of each identified wetland or other waters of the United States and potential acreages of impacts in Sections B-1, B-2 and B-4. No wetlands or other waters of the United States were identified in Sections B-5A or B-5B.

Based on the field surveys, 8 wash channels, designated as WL 1 through WL 7, cross the project alignment in Section B-1. Wash WL 1 which flows to the north is a main channel of the Pinto Wash. Vegetation occurring in association with the wash is characterized by catclaw acacia (*Acacia greggi*), creosote bush, burrobush (*Ambrosia dumosa*), and snake weed (*Gutierrezia* sp.). Washes WL 2 through WL 7 are unvegetated tributaries that flow to the north into Pinto Wash.

One wetland (WL 9) was delineated in Section B-2. WL 8 is an unvegetated wash that flows to the northeast through an abandoned gravel pit. The channel of the wash has been modified in places as a result of past gravel pit activities and was determined to be non-jurisdictional by USACE-Los Angeles District. WL 9 is a palustrine emergent wetland associated with seepage from an irrigation ditch near the eastern end of Section B-2. Vegetation in the narrow emergent wetland is characterized by phragmites (*Phragmites australis*), broad-leaved cattail (*Typha latifolia*), arrow weed, and tamarix.

Three wetlands or other waters of the United States (WL 10 through WL 12) were identified in Section B-4. WL 10 is the All-American Canal. The canal borders the project corridor on its northern side for approximately 6 miles in the western

Table 6-2. Wetlands and Other Waters of the United States, Delineated Acreages and Potential Impact Acreages in USBP El Centro Sector Sections B-1, B-2, and B-4

Wetland or Other Waters of the United States Identification	Fence Section	Wetland or Other Waters of the United States Type	Delineated Acreage	Potential Impacted Acreage
WL1	B-1	Wash	4.11	0.45
WL2	B-1	Wash	0.06	0.02
WL3	B-1	Wash	0.08	0.01
WL4	B-1	Wash	0.08	0.03
WL5W	B-1	Wash	0.04	0.01
WL5E	B-1	Wash	0.03	
WL6	B-1	Wash	1.17	0.24
WL7	B-1	Wash	0.07	0.02
WL8	B-2	Wash	0.07	0.00
SW1	B-2	Drainage Channel	1.14	0.00
WL9	B-2	Seepage	1.08	1.08
WL10	B-4	Canal	122.95	0.00
WL11	B-4	Man-made Playa	84.74	6.24
WL12	B-4	Riverine/emergent (Alamo River)	0.52	0.38
Totals			**216.14 acres**	**8.48 acres**

section of B-4. Submerged beds of ditchgrass and water milfoil occur within the All-American Canal in areas along its south bank. Common reed and arrow weed are common on the banks of the canal. WL 11 is a man made playa located near the eastern end of B-4. The central area of the playa is primarily devoid of vegetation, while the perimeters are characterized by near monotypic stands of tamarisk. There was an open water component of the playa located in its southeastern section at the time of the field survey. The open water component is primarily in Mexico. The playa appears to receive discharge flows form irrigation canals originating in both the United States and Mexico (see additional description above). WL12 is the Alamo River between the United States and Mexico Border and the drop inlet that directs river flow under the All-American Canal. The river emerges on the north side of the All-American Canal then flows to the north. Common reed and salt cedar occur in association with the river on the south side of the All-American Canal. There were no wetlands or other Waters of the United States identified in the project assessment areas for USBP El Centro Sections B-5A or B-5B. No wetland surveys were conducted in Section B-3.

6.2.3 Direct and Indirect Effects of the Project

Surface Waters, Wetlands, and Other Waters of the United States. Minor short- and long-term impacts on washes in Section B-1 will be expected. The tactical infrastructure for Section B-1 will consist of a primary vehicle fence, patrol road, access roads, and staging areas. The primary vehicle fence and patrol road will cross eight wash channels in Section B-1. No wetlands or other Waters of the United States were identified in close proximity to access roads and staging areas in B-1. Patrol roads currently exist along much of the alignment and temporary vehicle fence is already in place along the eastern one third of Section B-1. Placement of permanent primary vehicle fence, patrol roads, or upgrades to existing patrol roads across wash channels will result in short-term impacts on the washes as a result of fence and access road construction and upgrades. CBP will require the construction contractor to prepare a SWPPP, sediment and erosion control plans, and other environmental protection plans for the Project (discussed below) which will minimize potential for adverse effects on the washes. Long-term effects will be associated with the placement of the fence and potential fill associated with patrol road development or upgrades to existing patrol roads. The maximum potential area of long-term impacts in Section B-1 is expected to be 0.8 acre. Impacts on the washes will be avoided to the maximum extent practicable.

Minor short- and long-term impacts on wetlands or other waters of the United States will be expected in Section B-2. Tactical infrastructure for Section B-2 will consist of a primary pedestrian fence, lighting, patrol road, and access roads. One emergent wetland (WL 9) occurs along an irrigation channel bank at the eastern end of Section B-2. WL 9 borders the fence alignment on its southern side. Direct impacts on WL 9 will be expected as a result of grading and the placement of fill necessary to accommodate development of the tactical infrastructure. The maximum potential area of long-term impacts in Section B-2 is expected to be 1.08 acres. Short-term indirect impacts associated with fence and access road construction will also be expected as a result of potential erosion and resultant sedimentation associated with land disturbance during tactical infrastructure development. Erosion and sediment controls and storm water management practices will be implemented during and following construction to minimize potential for adverse effects on WL 9. Any impacts on the wetlands or other waters of the United States will be avoided to the maximum extent practicable.

Moderate short- and long-term adverse impacts on wetlands and other waters of the United States will be expected in Section B-4. Tactical infrastructure for Section B-4 will consist of a primary pedestrian fence, lighting, patrol road, access roads, and staging areas. The All-American Canal (WL 9) borders the northern boundary of the B-4 alignment for approximately 6 miles on its western side, and a man made playa (WL 10) occurs along the alignment in its eastern section. In addition, a riverine/emergent wetland occurs in association with the Alamo River where it is diverted under the All-American Canal in Section B-4. No direct impacts will be expected to the All-American Canal or associated wetland habitats as a result of the Project. Erosion and sediment controls and storm water management practices will be implemented during construction to minimize potential for adverse effects on water quality and aquatic habitats in the canal.

The tactical infrastructure alignment will cross approximately 4,500 feet of a 164 acre (84 acres in the United States) disturbed playa on the United States and Mexico Border in the eastern section of B-4. An approximately 20-acre staging area was initially proposed for the playa. After wetland delineations and consultation with the USACE-Los Angeles District the construction staging area was moved to reduce potential impacts on the area. Long-term impacts on the playa will occur as a result of the placement of fill to accommodate fence and patrol road placement. The fence and patrol road will be designed to minimize the amount of necessary fill, and to allow existing flow and drainage in the playa to continue. The maximum potential area of long-term impacts to WL 11 is expected to be 6.24 acres. Impacts on the playa will be avoided to the maximum extent practicable.

The primary pedestrian fence will also cross the Alamo River just south of where it is diverted under the All-American Canal. Long-term impacts to WL 12 will occur as a result of the placement of fill to accommodate the fence. The fence will be designed to minimize the amount of necessary fill, and to allow existing flow and drainage in the river to continue. The maximum potential area of long-term impacts to WL 12 is expected to be 0.38 acres. Impacts on the Alamo River will be avoided to the maximum extent practicable. Implementation of the Project will be expected to have minor short-term, adverse effects on surface water quality as a result of potential erosion and associated transport of sediments into adjacent surface waters.

Adverse effects on jurisdictional wetlands, washes, and other waters of the United States will be avoided or minimized to the maximum extent practicable.

Delineations of wetlands and other waters of the United States were completed in January 2008 and provided to the USACE-Los Angeles District. The delineations and associated analysis identified 8.48 acres of potential jurisdictional wetland and other waters of the United States impacts. A wetlands mitigation and restoration plan will be developed to compensate for unavoidable impacts on wetlands not previously subject to a wetlands mitigation plan.

6.3 FLOODPLAINS

6.3.1 Definition of the Resource

Although the Secretary's waiver means that CBP no longer has any specific obligation under the CWA, the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines associated with the CWA as the basis for evaluating potential environmental impacts and on floodplains.

Floodplains are areas of low-level ground present along rivers, stream channels, or coastal waters. The living and nonliving parts of natural floodplains interact with each other to create dynamic systems in which each component helps to maintain the characteristics of the environment that supports it. Floodplain ecosystem functions include natural moderation of floods, flood storage and conveyance, groundwater recharge, nutrient cycling, water quality maintenance, and a diversity of plants and animals. Floodplains provide a broad area to spread out and temporarily store floodwaters. This reduces flood peaks and velocities and the potential for erosion. In their natural vegetated state, floodplains slow the rate at which the incoming overland flow reaches the main water body (FEMA 1986).

Floodplains are subject to periodic or infrequent inundation due to rain or melting snow. Risk of flooding typically hinges on local topography, the frequency of precipitation events, and the size of the watershed above the floodplain. Flood potential is evaluated by FEMA, which defines the 100-year floodplain. The 100-year floodplain is the area that has a 1 percent chance of inundation by a flood event in a given year. Certain facilities inherently pose too great a risk to be in either the 100- or 500-year floodplain, such as hospitals, schools, or storage buildings for irreplaceable records. Federal, state, and local regulations often limit floodplain development to passive uses, such as recreational and preservation activities, to reduce the risks to human health and safety.

6.3.2 Affected Environment

According to the March 15, 1984, FEMA FIRM Panel No. 0600651025B for Imperial County, California, a small portion of the project corridor for B-4 is within the 100-year floodplain associated with the banks of the Alamo River where it emerges from a culvert under the northern side of the All-American Canal and continues its flow north to the Salton Sea (FEMA 1984). Based on review of the FIRM for the project area, the All-American Canal and areas south to the United States border are outside of the 100-year floodplain.

6.3.3 Direct and Indirect Effects of the Project

Negligible adverse impacts on floodplain resources will occur as a result of the Project. According to the FEMA FIRM Panel No. 0600651025B, it will be possible to avoid adverse impacts on the 100-year floodplain associated with the Alamo River by limiting construction activities to the south of the All-American Canal and north of the U.S./Mexico international border in this portion of the USBP El Centro Sector. USBP has determined that due to the proximity of the All-American Canal and the south-to-north-flowing Alamo River on the Mexican side of the border, this short section of the tactical infrastructure in Section B-4 cannot be practicably located outside the floodplain. .

Erosion and sediment control and storm water management practices will be implemented during and after construction. Adverse effects on floodplain resources will be minimized.

THIS PAGE INTENTIONALLY LEFT BLANK

7. BIOLOGICAL RESOURCES

7.1 VEGETATION RESOURCES

7.1.1 Definition of the Resource

Although the Secretary's waiver means that CBP no longer has any specific legal obligations for the tactical infrastructure segments addressed in this ESP, the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines for evaluating environmental impacts and mitigations for vegetation resources.

Vegetation resources include native or naturalized plants and serve as habitat for a variety of animal species. Wetlands are discussed in **Chapter 6**. This section describes the affected environment for native and nonnative vegetation followed by potential impacts on those resources from the Project. This analysis is based on site surveys conducted in September and October 2007. More detailed information on vegetation resources, including vegetation classification, species observed, and the survey methodology is contained in the Biological Survey Report (see **Appendix D**).

7.1.2 Affected Environment

The vegetation in the El Centro Sector of southern California has generally been classified under the Dry Domain (300), Tropical / Subtropical Desert Division (320) of Bailey (1995). The project area is more finely classified as the American Semidesert and Desert Province (322). The *Jepson Manual* (Hickman 1996) describes vegetation geography using combined features of the natural landscape including natural vegetation types and plant communities, and geologic, topographic, and climatic variation. This geographic system places the project area in the Desert Province and Sonoran Desert Region (also referred to locally and regionally as the Colorado Desert).

Occurring within the Salton Trough, the drainage of the project area in general and the Alamo River located within Section B-4, flows from south-to-north to the Salton Sea. Overall, the project area is located on an extensive plain of arid desert that is gently undulating. Bailey (1995) describes the vegetation pattern as dry-desert, a class of xerophytic plants that are widely dispersed and provide negligible ground cover. The climate is continental desert, is of extreme aridity, and results in high air and soil temperatures. Summers are long and hot however the brief winter is moderate in terms of temperature. There are typically no summer rains and the average annual precipitation of the area is approximately 2.6 inches. The evaporation rate during the summer season is very high, even more so due to light to moderate winds.

NatureServe (2007) has defined ecological systems to represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes such as fire or flooding. Ecological systems represent classification units that are readily identifiable by conservation and resource managers in the field. The ensuing vegetation description for the project area was prepared in the framework of ecological systems that include (1) Sonora – Mojave Creosotebush – White Bursage Desert Scrub, (2) North American Warm Desert Active and Stabilized Dune, (3) North American Warm Desert Pavement, (4) North American Warm Desert Playa, (5) North American Warm Desert Riparian Woodland and Shrubland, (6) North American Warm Desert Riparian Mesquite Bosque, (7) North American Warm Desert Wash, and (8) North American Arid West Emergent Marsh.

Habitats observed, sampled, and photographed within the project corridor range from active sand dunes of the Imperial Dune system, Signal Mountain toeslopes, the ephemeral Pinto Wash, and saturated and aquatic types of the All-American Canal. Habitats of the easternmost portion of the project receive some form of regular or intermittent disturbance that ranges from camping and all-terrain vehicle use in the desert upland types of Sections B-5A and B-5B to berm construction and canal bank clearing between the border and the canal in Section B-4. Much of the habitat of Sections B-4, B-5A, and B-5B is strewn with trash left by illegal aliens making border crossings and by seasonal recreationists.

Several areas of the USBP El Centro Sector corridor are unvegetated due to development and disturbance, making them vulnerable to nonnative plant species establishment. Unvegetated sites included access roads within all sections, power line and tower access roads and construction sites (Section B–5B), a large area cleared by the Imperial Irrigation District to reclaim canal seepage on Section B-5B, a natural-appearing playa on Section B-4, and excavations and berms along Sections B-2 and B-4. On the eastern terminus of Section B-5B, active sand flats and dunes support no to <1 percent vegetative cover. An unvegetated playa approximately midway along Section B-4, east of the Alamo River, is devoid of vegetation due to seasonal flooding and accumulation of salts. Berms and ditches along the western portion of Section B-4 are often unvegetated and the soil appears compacted. The Imperial Irrigation District is currently undertaking canal seepage recovery resulting in many acres of complete surface disturbance resulting in vegetation removal and precluding the establishment of vegetation at this time. Agricultural fields occur along the eastern terminus of Section B-2.

An access road is usually present adjacent to the international border of Sections B-1 (east and west portions), B-2 (eastern one-half), B-4, B-5A, and B-5B and along the All-American Canal, in addition to electrical power transmission line access and maintenance roads constructed within Section B-5B. For the length of Sections B-5A and B-5B, unlimited camping and all-terrain vehicle access is permitted, typically during the cooler months of the year, resulting in and maintaining additional unvegetated landscape. The BLM estimated that recreation visits to the Buttercup Campground adjacent to Section B-4 as exceeds 108,000 annually (BLM 2003a).

Vegetation of the El Centro Sector corridor consists of sparse sand plains, desert washes, sand dune, and creosotebush scrub communities on Section B-1, the western two-thirds of Section B-2, the eastern one-third of Section B-4 and for the entirety of Sections B-5A and B-5B. Denser wetland and riparian communities occur on the eastern end of Section B-2 and the western two-thirds of Section B-4. Project-related effects on wetland and riparian plant communities of Sections B-2 and B-4 are presented under **Chapter 6.2**, *Waters of the United States,* and are not discussed further here.

The western end of Section B-1, west of Pinto Wash, supports sparse creosotebush scrub flats or plains. Pinto Wash contains sparse woodlands of creosotebush, honey mesquite, and ironwood tall shrubs and small trees. Section B-1 east of Pinto Wash represents diverse topography of flats, slopes, rocky outcrops, small desert washes, and small sand dunes dominated by sparse creosotebush, white bursage, and shrubby coldenia. The west end of Section B-2 is located on the toeslope of Signal Mountain and is characterized by sparse creosotebush and white bursage shrubs on the uplands and a mixed shrub and herbaceous community in a wash that occurs at the base of the mountain and supports honey mesquite, ocotillo, white bursage, and creosotebush. The eastern portion of Section B-2 is heavily disturbed by road maintenance or supports ditchbank wetlands and agricultural crops. The eastern one-third of Section B-4 supports sparse creosotebush shrubs associated with fourwing saltbush, longleaf jointfir, and white bursage where sandier soils occur. Scattered areas of gravel-armored desert pavement are interspersed and support sparse creosotebush shrubs with herbaceous desert annuals in years with sufficient precipitation for the seeds to germinate.

Section B-5A and the western three-fourths of Section B-5B support sparse creosotebush shrubs associated with longleaf jointfir where sandier soils occur. Scattered areas of gravel-armored desert pavement are interspersed and support sparse creosotebush shrubs with herbaceous desert annuals in years with sufficient precipitation for the seeds to germinate. The eastern one-fourth of Section B-5B occupies active sand dunes on the edge of the Imperial Sand Dune system that are devoid of vegetation; support sparse longleaf jointfir shrubs; or support sparse creosotebush, longleaf jointfir, and desert buckwheat shrubs. Sections B-5A and B-5B in their entirety lie within the BLM's Buttercup Recreation Management Area, designated Multiple-use Class I "Intensive" and is used for camping, off-road vehicle (ORV) riding, sightseeing, commercial vending, education, filming, and ROWs (BLM 2003a). A detailed description of vegetation resources can be found in the Biological Survey Report (see **Appendix D**).

7.1.3 Direct and Indirect Effects of the Project

Under the Project, new boundary roads and construction access will occur and the existing international border access road segments will be widened from approximately 16 feet to approximately 20 feet resulting in the loss of approximately 5.3 acres of sparse creosotebush shrub communities corridor-wide; approximately 3.4 acres of desert wash vegetation in Pinto Wash of Section B-1; and approximately 8.3 acres of active sand dune communities adjacent to Sections B-4, B-5A, and B-5B. Additional loss of habitat resulting from clearing of lay-down areas for construction materials and maintenance and storage areas for heavy equipment will be minimal as previously disturbed areas will be selected for these functions to the extent practicable. Effects of Colorado Desert vegetation removal will be moderate, adverse, and long-term due to the highly disturbed condition of the entire B-5A and B-5B corridor and the large amount of similar vegetation present in the region. Sites within the corridors that are disturbed temporarily during construction could re-vegetate with annual plant species (seasonally and during moist precipitation cycles) resulting in minor beneficial and adverse, short- and long-term effects due to provision of food sources and ground cover for wildlife. The potential spread of nonnative species during construction and operation will be mitigated by the implementation of BMPs; therefore, the Project will not substantially impact vegetation through the establishment of invasive species.

Revegetation will be considered unlikely to occur due to the around-the-clock international border security patrol access needs, the tremendous seasonal presence of recreational vehicles, and low annual precipitation. Therefore vegetation impacts related to fence installation will be considered long-term to permanent. The primary pedestrian fence in Section B-5B will be designed to account for the unique conditions of the active dunes. Portions of the primary pedestrian fence constructed into the active dune field will require periodic maintenance to remove the sand deposited at the base of the fence to prevent its eventual burial, thus preventing vegetation re-establishment.

Effects on sparse Colorado Desert vegetation communities due to elimination of illegal human foot and vehicle traffic following construction of the primary pedestrian fence will be long-term, minor, and beneficial.

Construction, operation, and maintenance of tactical infrastructure will increase border security in the USBP El Centro Sector and may result in a change to illegal cross-border traffic patterns. However, changes to illegal cross-border traffic patterns result from a myriad of factors in addition to USBP operations and therefore are considered unpredictable and beyond the scope of this ESP.

7.2 WILDLIFE AND AQUATIC RESOURCES

7.2.1 Definition of the Resource

Although the Secretary's waiver means that CBP no longer has any specific obligation under the Migratory Bird Treaty Act (MBTA), the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines associated with the MBTA as the basis for evaluating potential environmental impacts and developing appropriate mitigations for wildlife and aquatic resources.

Wildlife and aquatic resources include native or naturalized mammals, birds (including migratory birds), reptiles, amphibians, fish, mollusks, and crustaceans. Identification of the species potentially occurring in the project area was accomplished through literature reviews, coordination with appropriate Federal and state resource managers, other knowledgeable experts, and field surveys.

The MBTA (16 United States Code [U.S.C.] 703–712), as amended, implements various treaties for the protection of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds is unlawful without a valid permit. Under Executive Order (EO) 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, the USFWS has the responsibility to administer, oversee, and enforce the conservation provisions of the MBTA, which include responsibility for population management (e.g., monitoring), habitat protection (e.g., acquisition, enhancement, and modification), international coordination, and regulations development and enforcement. The MBTA defines a migratory bird as any bird listed in 50 CFR 10.13, which includes nearly every native bird in North America.

This analysis is based on site surveys conducted in September, October, and November 2007. More detailed information on wildlife and aquatic resources, including species observed and the survey methodology is contained in the Biological Survey Report in **Appendix D**. CBP also worked closely with the USFWS to develop the Biological Resources Plan (see **Chapter 7.3** and **Appendix E**) and reduce adverse environmental impacts from the Project.

7.2.2 Affected Environment

The Imperial Desert occurs within the Colorado Desert Bioregion and supports more than 15 species of amphibians including the common bullfrog (*Rana catesbeiana*) and Couch's spadefoot toad (*Scaphiopus couchi*); more than 60 species of mammals including the big brown bat (*Eptesicus fuscus*), kit fox (*Vulpes macrotis*), roundtail ground squirrel (*Spermophilus tereticaudus*), and black-tailed jackrabbit (*Lepus californicus*); more than 430 species of birds including neotropical migratory birds, shorebirds, raptors, and waterfowl; and 70 species of reptiles including desert iguana (*Dipsosaurus dorsalis*), zebra-tailed lizard (*Callisaurus draconoides*), western whiptail lizard (*Aspidoscelis tigris*), and

FTHL (*Phrynosoma (=Anota) mcallii*). The majority of the bird species are present in the spring and fall, when migrants on the Pacific Flyway pass through on their way to either summer breeding or wintering grounds, and during winter when summer residents from the north arrive to spend the winter.

The most common fish in the All-American Canal and associated laterals is the triploid grass carp, a sterile form of the nonnative grass carp (*Ctenopharyngodon idella*) from Asia. This sterile form is actively raised and introduced to the canal system by the Imperial Irrigation District to control hydrilla (*Hydrilla verticillata*), an invasive nonnative species of aquatic vascular plant.

Mammals and birds observed during the September, October, and November 2007 surveys included ground squirrel (*Spermophilus* sp.), black-tailed jackrabbit (*Lepus californicus*), coyote (*Canis latrans),* desert cottontail (*Sylvilagus audubonii*), red-tailed hawk (*Buteo lineatus*), Gambel's quail (*Callipepla gambeli*), American coot (*Fulica Americana*), killdeer (*Charadrius vociferous*), greater road runner (*Geococcyx californianus*), Inca dove (*Columbina inca*), mourning dove (*Zenaida macroura*), common ground dove (*Columbina □asserine*), rock dove (*Columba livia*), great tailed grackle (*Quiscalus mexicanus*), cliff swallow (*Hirundo pyrrhonota*), burrowing owl (*Athene cunicularia hypugaea),* and zebra-tailed lizard *(Callisaurus draconoides*)*.* A complete list of wildlife observed is provided in the Biological Survey Report (see **Appendix D**).

7.2.3 Direct and Indirect Effects of the Project

Under the Project, existing border access roads will be widened from approximately 16 feet to approximately 20 feet resulting in the loss of approximately 5.3 acres of habitat. Additional loss of habitat resulting from clearing of lay-down areas for construction materials and maintenance and storage areas for heavy equipment will be minimal as previously disturbed areas will be selected for these functions to the extent practicable. Potential impacts on wildlife and aquatic life include habitat loss, habitat fragmentation, noise and physical disturbance associated with construction and subsequent maintenance activities, impacts of lights on nocturnal species, and beneficial impacts due to reduced cross-border violator traffic.

Impacts on wildlife from habitat loss will be short-term moderate and long-term minor adverse. Adverse impact from habitat fragmentation on small mammals would be minor due to the large amount of nearby available habitat. No impacts on aquatic species are anticipated from construction, assuming implementation of standard BMPs such as use of silt fencing and other mechanisms to control erosion and runoff. Impacts of construction and subsequent maintenance activities, including noise and physical disturbance, are anticipated to be short-term moderate and long-term minor adverse, respectively. These adverse impacts will be offset by the beneficial impact of reduced cross-border violator traffic through remaining habitat.

Lights along the fence corridor could behaviorally exclude nocturnal wildlife such as the kit fox from the illuminated zone, while potentially providing additional food sources for insectivorous bats such as the big brown bat. As such, lights will have minor to moderate, adverse and beneficial impacts on nocturnal wildlife depending on the species examined.

Impacts on migratory birds could occur, given the potential timing of fence construction. However, implementation of BMPs to avoid or minimize adverse impacts could markedly reduce their intensity. The following is a list of BMPs recommended for reduction or avoidance of impacts on migratory birds:

- Any groundbreaking construction activities should be performed before migratory birds return to the area (approximately 1 March) or after all young have fledged (approximately 31 July) to avoid incidental take.
- If construction is scheduled to start during the period in which migratory bird species are present, steps should be taken to prevent migratory birds from establishing nests in the potential impact area. These steps could include covering equipment and structures, and use of various excluders (e.g., noise). Birds can be harassed to prevent them from nesting on the site. Once a nest is established, they cannot be harassed until all young have fledged and left the nest site.
- If construction is scheduled to start during the period when migratory birds are present, a supplemental site-specific survey for nesting migratory birds should be performed immediately prior to site clearing.
- If nesting birds are found during the supplemental survey, construction should be deferred until the birds have left the nest. Confirmation that all young have fledged should be made by a competent biologist.

Assuming implementation of the above BMPs to the fullest extent feasible, impacts of the Project on migratory birds is anticipated to be short- and long-term, minor, and adverse due to construction disturbance and associated loss of habitat, and long-term, minor, and beneficial due to reduction of cross-border violator traffic through migratory bird habitat north of the impact corridor.

7.3 THREATENED AND ENDANGERED SPECIES

7.3.1 Definition of the Resource

Although the Secretary's waiver means that CBP no longer has any specific obligation under the Endangered Species Act (ESA), the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines associated with the ESA as the basis for evaluating potential environmental impacts and developing appropriate mitigations for threatened and endangered species.

Federal and state threatened and endangered species are addressed in this section of the ESP. In addition, one BLM sensitive species which is the subject of a multi-agency management strategy is also addressed as the Project location occurs within a designated management area.

The ESA, as amended (16 U.S.C. §§ 1531–1544 et seq.), provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the United States or elsewhere. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species.

Under the ESA, a Federal endangered species is defined as any species which is in danger of extinction throughout all or a substantial portion of its range. The ESA defines a Federal threatened species as any species which is likely to become an endangered species within the foreseeable future throughout all or a substantial portion of its range.

The California Endangered Species Act (CESA) states that all native species of fish, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats, threatened with extinction and those experiencing a substantial decline which, if not halted, would lead to a threatened or endangered designation, will be protected or preserved.

7.3.2 Affected Environment

There are four state-listed taxa that have the potential to occur within or proximal to the fence corridors in Imperial County: two endangered plants, one endangered bird, and one threatened bird (see **Table 7-1**). Of those, three are also federally listed species: one threatened plant and two endangered birds. No state threatened or endangered species were observed during the September, October, or November 2007 surveys (see **Appendix D**). Subsequent surveys conducted in February 2008 recorded Peirson's milkvetch in areas east of the fence alignment; however, no individuals of this species were observed in the project corridor for the USBP El Centro Sector fence sections (see **Appendix D**).

The riparian vegetation occurring along the All-American Canal and smaller irrigation canals and ditches of the area does not appear to provide suitable habitat for the Yuma clapper rail. Most such areas contain dense stands of common reed extending into open water with little other emergent wetland vegetation or sandbars or other substrate features for foraging areas.

Trees associated with wet areas south of the All-American Canal, and which probably established and survive based on seepage water from that canal, are a mixture dominated by salt cedar. Density and distribution of these trees is not perceived to provide suitable habitat for the southwestern willow flycatcher.

Table 7-1. State and Federal Threatened and Endangered Species Near Project Area in Imperial County

Common Name	Scientific Name	Federal Status	State Status	General Habitat
PLANTS				
Algodones dunes sunflower	*Helianthus niveus* ssp. *Tephrodes*	--	E	Found in sandy desert area of Algodones Sand Dunes in CA and southwestern AZ.
Peirson's milk-vetch	*Astragalus magdalenae var. peirsonii*	T	E	Only known occurrence in the U.S. is in Algodones Sand Dunes. Found at elevations of 55–250 meters.
BIRDS				
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	E	Inhabits thickets, brushy areas, and riparian woodlands.
Yuma clapper rail	*Rallus longirostris yumanensis*	E	T	Inhabits freshwater or brackish streamsides and marshlands. Forages in higher marsh vegetation, mudflat interface, and along tidal creeks.
REPTILES				
Flat-tailed horned lizard*	*Phrynosoma mcallii*	-- (Proposed)	SSC	Inhabits sandy flats or areas with a veneer of fine, windblown sand.
MAMMALS				
Peninsular bighorn sheep	*Ovis canadensis*	E	T	Restricted to east facing, lower elevation slopes, of the Peninsular ranges along the northwestern edge of the Sonoran Desert.

Notes:

T = threatened, E = endangered, SSC = Special Status Species

* Although not listed as threatened or endangered, the flat-tailed horned lizard is included here because it is a BLM-sensitive species for which a multi-agency management strategy has been developed and the USFWS is a signatory on that plan (BLM 2003b).

Potential habitat for the Algodones Dunes sunflower and Peirson's milkvetch occurs along the fence alignment in Section B-5B which enters into the west side of the Algodones Dunes. Potential habitat for Peninsular bighorn sheep in Section B-1 in the area between Interstate Highway 8 and the U.S./Mexico international border extending from the east facing slopes of the Jacumba

Mountains (adjacent to Section B-1) eastward approximately 0.6 miles (1 kilometer) from the toe of the slope. Further details on the natural history of these three species are provided in **Appendices D** and **E**. Two fence sections occur within designated management areas for the flat-tailed horned lizard (FTHL) (*Phrynosoma (=Anota) mcallii*). Sections B-1 and B-5A are within the Yuha Desert and East Mesa FTHL management areas, respectively. Additionally, a portion of Section B-1 and the construction access roads for Section B-1, Coyote Road 2 and Access Road #1, traverse Peninsular bighorn sheep critical habitat near the Jacumba mountains.

7.3.3 Direct and Indirect Effects of the Project

Under the Project, new boundary roads and construction access will occur and the existing international border access road segments will be widened from approximately 26 feet to approximately 30 feet resulting in the loss of approximately 5.3 acres of sparse creosotebush shrub communities corridor-wide; approximately 3.4 acres of desert wash vegetation in Pinto Wash of Section B-1; and approximately 8.3 acres of active sand dune communities adjacent to Sections B-4, B-5A, and B-5B. Additional loss of habitat resulting from clearing of lay-down areas for construction materials and maintenance and storage areas for heavy equipment will be minimal as previously disturbed areas will be selected for these functions to the extent practicable. Potential impacts on listed species include habitat loss, noise and physical disturbance associated with construction and subsequent maintenance activities, and beneficial impacts due to reduced cross-border violator traffic.

Algodones dune sunflower and Peirson's milkvetch. Section B-5B extends into potential habitat for Algodones dune sunflower and Peirson's milk vetch. Surveys of this section, conducted in September 2007, revealed no plants of these species. Subsequent surveys conducted in February 2008 also revealed no Peirson's milk vetch in the impact corridor of any USBP El Centro Sector fence sections (see **Appendices D** and **E**).

Flat-tailed horned lizard. The following conservation measures are identified in the FTHL Management Strategy (BLM 2003b) and will be implemented under the Project to the fullest extent applicable and practicable.

1. To the extent possible, surface-disturbing projects will be located outside of Management Areas (MAs) and the Research Area (RA), and will be timed to minimize mortality. If a project must be located within a MA or RA, effort will be made to locate the project in a previously disturbed area or in an area where habitat quality is poor. A survey of the project site will be conducted prior to construction in order to assist in locating the project.
2. Prior to project initiation, an individual will be designated as a field contact representative. The field contact representative will have the authority to ensure compliance with protective measures for the FTHL and will be the primary agency contact dealing with these measures. The field contact

representative will have the authority and responsibility to halt activities that are in violation of these terms and conditions.

3. All project work areas will be clearly flagged or similarly marked at the outer boundaries to define the limit of work activities. All construction and restoration workers will restrict their activities and vehicles to areas that have been flagged to eliminate adverse impacts on the FTHL and its habitat. All workers will be instructed that their activities are restricted to flagged and cleared areas.
4. Within FTHL habitat, the area of disturbance of vegetation and soils will be the minimum required for the project. If possible, specify a maximum disturbance allowable based on the specifics of the project. Clearing of vegetation and grading will be minimized. Wherever possible, rather than clearing vegetation and grading the ROW, equipment and vehicles will use existing surfaces or previously disturbed areas. Where grading is necessary, surface soils will be stockpiled and replaced following construction to facilitate habitat restoration. To the extent possible, disturbance of shrubs and surface soils due to stockpiling will be minimized.
5. Existing roads will be used for travel and equipment storage whenever possible.
6. Where feasible and desirable, in the judgment of the lead agency, newly created access routes will be restricted by constructing barricades, erecting fences with locked gates at road intersections, or by posting signs. In these cases, CBP will maintain, including monitoring, all control structures and facilities for the life of the project and until habitat restoration is completed.
7. A biological monitor will be present in each area of active surface disturbance throughout the work day from initial clearing through habitat restoration, except where the project is completely fenced and cleared of FTHLs by a biologist (see Measure 8). The biological monitors will meet the requirements set in Appendix 6 of the Management Strategy (BLM 2003b).

   The monitor(s) will perform the following functions:

   a. Develop and implement a worker education program. Wallet-cards summarizing this information will be provided to all construction and maintenance personnel.

      The education program will include the following aspects at a minimum:

      - Biology and status of the FTHL
      - Protection measures designed to reduce potential impacts on the species
      - Function of flagging designating authorized work areas

  - Reporting procedures to be used if an FTHL is encountered in the field
  - Importance of exercising care when commuting to and from the project area to reduce mortality of FTHLs on roads.

   b. Ensure that all project-related activities comply with these measures. The biological monitor will have the authority and responsibility to halt construction activities that are in violation of these terms and conditions.

   c. Examine areas of active surface disturbance periodically (at least hourly when surface temperatures exceed 85 degrees Fahrenheit (°F)) for the presence of FTHLs. In addition, all hazardous sites (e.g., open pipeline trenches, holes, or other deep excavations) will be inspected for the presence of FTHLs prior to backfilling.

   d. Work with the project supervisor to take steps, as necessary, to avoid disturbance to FTHLs and their habitat. If avoiding disturbance to an FTHL is not possible or if an FTHL is found trapped in an excavation, the affected lizard will be captured by hand and relocated.

8. Sites of permanent or long-term (greater than one year) projects in MAs where continuing activities are planned and where FTHL mortality could occur can be enclosed with FTHL barrier fencing to prevent lizards from wandering onto the project site where they could be subject to collection, death, or injury. Barrier fencing should be in accordance with the standards outlined in Appendix 7 of the Management Strategy. After clearing the area of FTHLs (also see Appendix 7 [BLM 2003b]), no on-site monitor is needed (see Measure 7).

9. CBP will develop a project-specific habitat restoration plan in coordination with resource agencies. The plan will consider and include, as appropriate, the following methods: replacement of topsoil, seedbed preparation, fertilization, seeding of species native to the project area, noxious weed control, and additional erosion control. Generally, the restoration objective will be to return the disturbed area to a condition that will perpetuate previous land use. CBP will conduct periodic inspection of the restored area. Restoration will include eliminating any hazards to FTHLs created by construction, such as holes and trenches in which lizards might become entrapped. Disturbance of existing perennial shrubs during restoration will be minimized, even if such shrubs have been crushed by construction activities.

10. Construction of new paved roads will include a lizard barrier fence on each side of the road that is exposed to occupied FTHL habitat. Exceptions might occur in accordance with the following evaluation, to be applied separately to each side of the road. This prescription can also be applied to canals or other fragmenting projects.

If the side is made nonviable for FTHLs even if connected to the other side:

- Compensate for the entirety of the fragmented parcel.

If the side is viable only if connected to the other side:

- Compensate for the entirety of the fragmented parcel
- Provide fencing and effective culverts or underpasses that will maintain connectivity.

If the side is viable even if not connected to the other side:

- Provide fencing (no culverts).

Specifications for barrier fences are provided in Appendix 7 of the Management Strategy (BLM 2003b). Culvert design will be provided by the FTHL Interagency Coordinating Committee.

Assuming implementation of applicable and practicable BMPs, impacts of construction and subsequent maintenance activities on FTHL, including noise and physical disturbance, are anticipated to be short-term moderate and long-term minor adverse, respectively. These adverse impacts will be offset by the beneficial impact of reduced cross-border violator traffic through remaining habitat.

Peninsular Bighorn Sheep. The project will result in a temporary increase in traffic on the Section B-1 construction access roads, Coyote Road 2 and Access Road #1, which traverse Peninsular Bighorn Sheep Critical Habitat in the Jacumba Mountains. Specifically, these roads cross portions Pinto Wash, which is an important foraging habitat. Traffic makes bighorn sheep, especially ewes, hesitant to cross roads (Rubin *et al.* 1998, Epps *et al.* 2005). Therefore use of these access roads could result in a decrease in the availability of Pinto Wash as foraging habitat for Peninsular bighorn sheep.

Increased human disturbance could also result in physiological effects, such as elevated heart rate or the additional energy expended in moving away from perceived danger. Also, Project timing coincides with the reproductive period, which may result in increased impacts to ewes with lambs, which are typically are more sensitive to disturbance (Light and Weaver 1973, Wehausen 1980). While bighorn sheep have evolved to deal with occasional disruptions of their usual behavioral patterns, such as the presence of a predator, it appears that beyond a certain level of human activity, bighorns can simply be overwhelmed, and subsequently alter their behavior.

Since fence construction in section B-1 is anticipated to be completed by December 2008, the majority of the impacts associated with the use of Coyote 2 Road and Access Road #1 for construction access to section B-1 is anticipated to be temporary, occurring within the 9-month construction period (April to December 2008). Additionally, the implementation of general and species specific BMPs (see **Appendix E**) would further reduce impacts on Peninsular bighorn sheep. These BMPs will require that any work that could disturb Peninsular bighorn sheep cease as soon as soon as individuals are observed within a mile of any construction activities or along associated access roads.

8. CULTURAL RESOURCES

8.1 DEFINITION OF THE RESOURCE

Although the Secretary's waiver means that CBP no longer has any specific obligation under the National Historic Preservation Act (NHPA), the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines associated with the NHPA as the basis for evaluating potential environmental impacts and developing appropriate mitigations for cultural resources.

Cultural resources is an umbrella term for many heritage-related resources. The NHPA focuses on historic properties, specifically, prehistoric or historic districts, sites, buildings, or structures included in, or eligible for, the National Register of Historic Places (NRHP), including related artifacts, records, and material remains. Traditional, religious, and cultural properties holding significance for Native American tribes, and Native Alaskan and Native Hawaiian organizations can also be considered NRHP-eligible. Depending on the condition and historic use, such resources might provide insight into living conditions in previous civilizations or might retain cultural and religious significance to modern groups.

Other cultural resources laws and regulations include the Archeological and Historic Preservation Act (1974), the American Indian Religious Freedom Act (1978), the Archeological Resources Protection Act (ARPA) (1979), and the Native American Graves Protection and Repatriation Act (NAGPRA) (1990).

Typically, cultural resources are subdivided into archeological resources (prehistoric or historic sites where human activity has left physical evidence of that activity but no structures remain standing); architectural resources (buildings or other structures or groups of structures, or designed landscapes that are of historic or aesthetic significance); or resources of traditional, religious, or cultural significance to Native American tribes. Archeological resources are locations containing evidence of human activity. In southern California, archeological resources dating to the prehistoric period (prior to European contact) typically consist of deposits of artifacts, such as flaked and ground stone tools; bone or shell ornaments or tools; dietary refuse such as bone, shells, or burned seeds; and occasionally features such as house floors, hearths, bedrock milling elements, or human remains. Archeological resources dating to the historic period might consist of structural remains such as foundations, cisterns, or privies; features such as roads, railroad grades, or water canals; or deposits of artifacts representing domestic, commercial, or other activities.

Architectural resources include standing structures such as buildings, dams, canals, bridges, transmission lines, and other structures of historic or aesthetic value. Although architectural resources generally must be more than 50 years old to be considered for protection, exceptions can be made where the structures are likely to gain value in the future.

Resources of traditional, religious, or cultural significance to Native American tribes are those that relate to the traditional practices, beliefs, and religions of a living community, and are considered essential to maintaining the identity of that culture. Traditional cultural resources might include the locations of historical or mythological events, traditional hunting or gathering areas, sacred areas, or any other location of traditional cultural importance.

The Area of Potential Effect (APE) for cultural resources consists of the approximately 44.6-mile corridor of tactical infrastructure along the U.S./Mexico international border in the USBP El Centro Sector including access roads and construction staging areas. The project is entirely within California, near Calexico, in Imperial County. The tactical infrastructure will consist of primary pedestrian and vehicle fence, and supporting patrol roads and other tactical infrastructure. The APE for cultural resources concerns was determined to be a corridor with a width of 300 feet to the north of the U.S./Mexico international border, with the border as the southern limit. This corridor was determined based on the construction needs and description provided. The APE was defined to be sufficiently large to include all of the anticipated activities for access, construction and ongoing maintenance of the infrastructure.

8.2 AFFECTED ENVIRONMENT

The Project will occur in Imperial County, California, along the U.S./Mexico international border. The sections range from the western end of the Imperial Valley to the eastern edge, near the border with Arizona. A project-specific cultural resources survey was prepared in support of this project. The APE for the project includes lands owned or managed by the BLM, Bureau of Reclamation, USIBWC, and private property. The results of the archeological survey assessment are summarized below and included in a cultural resources report provided to the BLM and California SHPO.

An archeological site record and archival search was conducted at the Southeastern Information Center in El Centro, California. The archeological site record and archival search were completed to identify and collect data regarding cultural resources recorded within a 0.5-mile radius of the project APE. Archeological site records and archival information, including information regarding recorded sites (CA-SDI) and Primary Numbers (P-37) plotted on the Calexico, Bonds Corner, and Grays Well USGS Quadrangles was reviewed. The record search area included access roads and all areas known to be part of the project as of October 2007.

The record search results indicate that there are 106 sites in the general study area, 11 of which are plotted in or immediately adjacent to the APE (see **Table 8–1**). While this is a large number of sites, the recorded resources are generally characterized as isolated prehistoric artifacts (prehistoric pottery sherds, flakes, flaked stone tools), features associated with the All-American Canal, historic trash dumps, or artifacts associated with the historic Plank Road. A total of 21 of the recorded resources are categorized as isolated finds, meaning there were fewer than three items found at the location. As the definition of a cultural resources site by the BLM is three or more artifacts in a 50-square-meter area,

Table 8-1. Recorded Sites within or Adjacent to the APE by Fence Section

Site Number CA-IMP-	Fence Section
4307	B-1
6174	B-1
4481	B-2
4829	B-2
4833	B-2
3811	B-5A
3813	B-5A
4760	B-5A
4761	B-5A
4762	B-5B
4763	B-5B

many of these sites represent the minimal number of items needed to qualify as an archeological site and, in fact, under other site definitions will not have been recorded as sites.

None of the sites on **Table 8-1** have been evaluated for NRHP eligibility. In 2003 a survey by the BLM (Hangan 2003) was completed with the intent to relocate sites CA-IMP-4479, -4481, -4758, -4760, and -4761; no evidence of the sites was found within a 50-m radius of where they are plotted on the site records. The status of the remaining sites is not known.

A search of the National Archeological Data Base (NADB) was completed in an effort to identify cultural resources management reports for previously completed cultural resources management activities (archeological survey and evaluation excavations) over a 0.5-mile radius around the APE. Information provided in the NADB indicates that a number of sections of the APE and vicinity have been previously surveyed and several of the previously recorded sites have been subjected to archeological evaluation. There have been 37 cultural resources studies conducted in the search area. These studies include large areas associated with transmission line projects, private developments, and projects associated with various border studies. The majority of the studies have been negative for archeological resources, and have resulted in the recording of numerous resource isolates and fewer cultural resources sites.

An intensive pedestrian survey of the APE was conducted in October 2007 under BLM Cultural Resource Use Permit CA-08-03 and a Fieldwork Authorization Permit. The survey covered an area approximately 90 m (300 feet) in width along the designated corridor of access and construction. The survey corridor was intensively examined using pedestrian transects that did not exceed 10 m between team members. Areas of substantial disturbance or alteration were spot-checked for evidence of archeological materials. The ground surface visibility was excellent and survey conditions were optimal.

None of the 11 previously recorded sites (see **Table 8-1**) were relocated within the survey corridor. It is likely that none of these sites are in the precise locations that are plotted on the original site records. It is also possible that the alteration and dynamic conditions of the survey area could have buried or obscured these sites since their original recording, or that the original surveyors could have collected the materials visible on the surface, thereby leaving no discernable evidence of the site behind.

The pedestrian survey resulted in the recording of two previously unknown archeological resources (one historic artifact scatter and one prehistoric stone chipping station) and two prehistoric isolates (one prehistoric ceramic sherd and one piece of chipping waste/debitage). Site information regarding the resources was submitted to the Southeastern Information Center for assignment of permanent trinomials. All four resources are immediately adjacent to the APE. By definition, the two isolates are not eligible for NRHP consideration; evaluations were not conducted on the two newly discovered archeological sites, although both appear to have limited research potential.

Historic Architectural Resources. There are no buildings or other standing structures of historic or aesthetic value within or within the viewshed of the APE. The area surveyed is generally void of built features, though land alteration is common. Sections of the All-American Canal (feature determined to be NRHP-eligible) are adjacent to the APE, but outside of the project corridor.

Traditional Cultural Resources and Native American Issues. A letter initiating consultation was sent by the USACE-Fort Worth District to 14 tribal groups with cultural links to the project area. The concerns of these groups were considered during the preparation of this document and information regarding Traditional Cultural Properties has been considered as part of the impact analysis. There are no reported resources of traditional, religious, or cultural significance to Native American tribes recorded within or adjacent to the APE.

8.3 DIRECT AND INDIRECT EFFECTS OF THE PROJECT

There are no archeological sites within the APE for the Project. Of the archeological resources adjacent to the APE, none have been assessed for NRHP eligibility or are determined to be eligible to the NRHP. The two newly discovered resources are adjacent to the APE and have not been evaluated for NRHP eligibility. No historic architectural resources or resources of traditional, religious, or cultural significance to Native American tribes are known to be within the APE.

Accordingly, the Project does not have the potential to directly impact archeological or architectural resources and no additional archeological survey work will be conducted. Due to the low potential for inadvertent discovery of previously unidentified, buried, or masked cultural resources within the project, archeological monitoring is not needed for project-related excavation or other ground-disturbing construction activities. Archeological resources in areas where there will be no primary pedestrian fence—west of fence section B-2 and east of B-5B—could be adversely impacted by increased cross-border activities into those areas where there will be no fence. The severity of the impact will vary depending on the extent of cross-border violator traffic that could reduce vegetation, disturb soils, and uncover and destroy currently unknown resources. A worker education program will be developed and a clear delimitation of work areas will occur to ensure that there will be no inadvertent damages to cultural resources outside but near the project areas.

THIS PAGE INTENTIONALLY LEFT BLANK.

9. SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND PROTECTION OF CHILDREN

9.1 DEFINITION OF THE RESOURCE

Although the Secretary's waiver means that CBP no longer has any specific legal obligations for the tactical infrastructure segments addressed in this ESP, the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines for evaluating environmental impacts on socioeconomic and environmental justice resources.

Socioeconomics. Socioeconomics is defined as the basic attributes and resources associated with the human environment, particularly characteristics of population and economic activity. Regional birth and death rates and immigration and emigration affect population levels. Economic activity typically encompasses employment, personal income, and industrial or commercial growth. Changes in these two fundamental socioeconomic indicators are typically accompanied by changes in other components, such as housing availability and the provision of public services. Socioeconomic data at county, state, and national levels permit characterization of baseline conditions in the context of regional, state, and national trends.

Data in three areas provide key insights into socioeconomic conditions that might be affected by a Project. Data on employment identify gross numbers of employees, employment by industry or trade, and unemployment trends. Data on personal income in a region can be used to compare the “before” and “after” effects of any jobs created or lost as a result of a Project. Data on industrial or commercial growth or growth in other sectors provide baseline and trend line information about the economic health of a region.

Demographics identify the population levels and changes to population levels of a region. Demographics data might also be obtained to identify, as appropriate to evaluation of a Project, a region’s characteristics in terms of race, ethnicity, poverty status, educational attainment level, and other broad indicators.

Socioeconomic data shown in this chapter are presented at census tract, county, municipality, and state levels to characterize baseline socioeconomic conditions in the context of regional and state trends. Data have been collected from previously published documents issued by Federal, state, and local agencies; and from state and national databases (e.g., U.S. Bureau of Economic Analysis’ Regional Economic Information System).

Environmental Justice and Protection of Children. EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* February 11, 1994, addresses the Federal policy of Federal agencies' actions substantially affecting human health or the environment to not exclude persons, deny persons benefits, or subject persons to discrimination because of their race, color, or national origin. The purpose of the EO is to ensure the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no groups of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the adverse environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, state, tribal, and local programs and policies. Consideration of environmental justice concerns includes race, ethnicity, and the poverty status of populations in the vicinity of a Project. Such information aids in evaluating whether a Project will render vulnerable any of the groups targeted for protection in the EO.

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, addresses the Federal policy of protection of children from exposure to disproportionate environmental health and safety risks. This EO established that each agency has a responsibility to ensure that its policies, programs, activities, and standards address risk to children that results from environmental health risks or safety risks.

9.2 AFFECTED ENVIRONMENT

Socioeconomics. The Project includes the construction of primary pedestrian and vehicle fence along the U.S./Mexico international border southeast of Calexico, California, in Imperial County, California, and north and northeast of Mexicali, Mexico. The Project will occur in a rural/undeveloped area in the United States. For the purposes of this ESP, the Region of Influence (ROI) includes census tracts 119 and 124 in Imperial County, California, (adjacent to the location of the Project). Census tracts are designed to be relatively homogenous units with respect to population characteristics, economic status, and living conditions at the time of establishment. The most current census tract data is from Census 2000.

Employment types in the ROI vary (see **Table 9-1**). The largest employment type in the ROI, Imperial County, and California is educational, health, and social services (18.4, 22.0, and 18.5 percent, respectively). A substantially larger portion of residents in the ROI (18.4 percent) were employed in the finance, insurance, real estate, and rental and leasing industry as compared to Imperial County (3.7 percent) and California (6.9 percent). Other employment types in the ROI resemble the percentages of Imperial County and California (U.S. Census Bureau 2002). In 2006, Imperial County had a 15.3 percent unemployment rate compared to a 4.9 percent unemployment rate for California (Fedstats undated).

Residents, businesses, and industry in Mexicali, Baja California, Mexico, could also be affected by the Project. The population of Mexicali is approximately

1 million. Numerous international businesses occur in Mexicali, such as the diversified "maquiladora" industry (assembly plants) and other cultural facilities. Baja California has the 8th highest state-level per capita income in Mexico. Residents within Mexicali, Baja California, have the highest economic well-being in Baja California. Economic well-being is an indicator developed by Mexico's census bureau that uses a statistical technique called cluster analysis to compare and rank municipalities. This analysis ranks municipalities using a large number of social and demographic variables.

Table 9-1. Employment Type of Residents in ROI, Imperial County, and the State of California

Economic and Social Indicators	ROI	Imperial County	California
Employed Persons in Armed Forces	0.4	0.3	0.6
Employed Persons in Civilian Labor Force (By Industry)			
Agriculture, forestry, fishing and hunting, and mining	15.8	11.7	1.9
Construction	2.2	5.3	6.2
Manufacturing	7.8	4.8	13.1
Wholesale trade	5.4	5.4	4.1
Retail trade	18.2	12.3	11.2
Transportation and warehousing, and utilities	4.5	6.4	4.7
Information	6.9	1.3	3.9
Finance, insurance, real estate, and rental and leasing	18.4	3.7	6.9
Professional, scientific, management, administrative, and waste management services	5.2	5.3	11.6
Educational, health and social services	18.4	22.0	18.5
Arts, entertainment, recreation, accommodation and food services	5.3	6.3	8.2
Other services (except public administration)	3.6	4.4	5.2
Public administration	7.5	11.0	4.5

Source: U.S. Census Bureau 2002

Note: Census 2000 data are the most recent comprehensive employment data for the ROI.

Environmental Justice. For the purposes of the environmental justice analysis for this ESP, the residents of the ROI and Mexicali, Mexico, were evaluated. The ROI is considered to have a disproportionately high percentage of low-income or minority residents under either of two conditions: (1) the percentage of low-income or minority populations within the ROI is greater than Imperial County's minority percentage, or low-income percentage, or (2) the percentage of persons in low-income or minority populations within the ROI is greater than 50 percent. Based on these two conditions, the ROI is not considered to have a disproportionately high percentage of low-income or minority residents according to Census 2000 data.

Table 9-2 shows demographic data and economic indicators of the ROI, Imperial County, and California. The ROI has a lower percentage of minority populations than Imperial County. Approximately 35.7 percent of the population in the ROI and 39.1 percent of the population in California are reported as “Some other race,” as compared to 16.8 percent in Imperial County (see **Table 9-2**). The economic characteristics of the ROI are similar to those of Imperial County.

Table 9-2. Demographic and Economic Characteristics of the ROI, Imperial County, and the State of California

	ROI	Imperial County	California
Total Population	5,585	142,361	33,871,648
Percent White	57.8	49.4	59.5
Percent Black or African American	2.1	4.0	6.7
Percent American Indian Alaska Native	0.6	1.9	1.0
Percent Asian	0.4	2.0	10.9
Percent Native Hawaiian and Other Pacific Islander	0.1	0.1	0.3
Percent “Some other race”	35.7	39.1	16.8
Percent Reporting 2 or more races	3.2	3.6	4.7
Hispanic or Latino (of any race)	71.2	72.2	32.4
Percent Below Poverty	18.1	22.6	14.2
Per Capita Income	$13,224	$13,239	$22,711
Median Household Income	$31,744	$35,226	$53,025

Source: U.S. Census Bureau 2002

Note: Census 2000 data are the most recent comprehensive economic and demographic data for the ROI.

However, the economic characteristics of both the ROI and Imperial County are slightly lower than California (see **Table 9-2**). Residents living in the ROI and Imperial County have lower median household incomes and per capita incomes than the State of California (see **Table 9-2**) (Fedstats undated). In the ROI and Imperial County, 18.1 percent and 22.6 percent of the residents are living below the poverty level, respectively, as compared to 14.2 percent in the State of California (see **Table 9-2**). Residents, businesses, and industry in Mexicali occur as close as 50 feet from the project corridor.

9.3 DIRECT AND INDIRECT EFFECTS OF THE PROJECT

Construction expenditure impacts are assessed in terms of direct effects on the local economy and related effects on other socioeconomic resources (e.g., housing). The magnitude of potential impacts can vary greatly, depending on the location of a Project. For example, implementation of an action that creates 10 employment positions might go unnoticed in an urban area, but could have considerable impacts in a rural region. If potential socioeconomic changes were to result in substantial shifts in population trends or a decrease in regional spending or earning patterns, they will be considered adverse. Analysis of Project impacts focused on the potential to:

- Change the local business volume, employment, personal income, or population that exceeds the ROI's historical annual change
- Adversely affect social services or social conditions, including property values, school enrollment, county or municipal expenditures, or crime rates.

Socioeconomics. Short-term minor direct beneficial effects will be expected as a result of construction associated with the Project. The construction activities will occur over calendar year (CY) 2008. It is assumed that local materials, supplies, and contractors will be used. However, the limited nature of the construction and new employment associated with the Project will not substantially affect on personal income, poverty levels, or other demographic employment indicators in the ROI.

Environmental Justice. Environmental justice concerns and special risks to the populations in Mexicali, Mexico, living closest to the construction (as close as 50 feet) include safety, noise, pollutants, and hazardous materials. Additional risks to children could occur. Children have physiological and behavioral characteristics that make them more vulnerable than adults to damage from environmental effects. Safety precautions to protect children and other populations in areas surrounding work sites will include adequate measures to restrict access, minimization of hazards associated with construction activities, and proper handling and disposal of hazardous materials (see **Chapter 10**). These BMPs will reduce the potential for impacts on any populations or age groups, including children. Noise associated with construction will be intermittent and short in duration (described in **Chapter 3**).

THIS PAGE INTENTIONALLY LEFT BLANK.

10. HAZARDOUS MATERIALS AND WASTES

10.1 DEFINITION OF THE RESOURCE

Although the Secretary's waiver means that CBP no longer has any specific obligation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA), and the Superfund Amendments and Reauthorization Act (SARA) the Secretary committed CBP to responsible environmental stewardship of our valuable natural and cultural resources. CBP supports this objective and has applied the appropriate standards and guidelines associated with CERCLA, RCRA, TSCA, and SARA as the basis for evaluating potential environmental impacts and developing appropriate mitigations for hazardous materials and wastes.

Solid Wastes. Solid waste management primarily relates to the availability of landfills to support a population's residential, commercial, and industrial needs. Alternative means of waste disposal might involve waste-to-energy programs or incineration. In some localities, landfills are designed specifically for, and limited to, disposal of construction and demolition debris. Recycling programs for various waste categories (e.g., glass, metals, papers, asphalt, and concrete) reduce reliance on landfills for disposal.

Hazardous Wastes. Hazardous materials are defined by 49 CFR 171.8 as "hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (49 CFR 172.101), and materials that meet the defining criteria for hazard classes and divisions" in 49 CFR 173. Transportation of hazardous materials is regulated by the U.S. Department of Transportation regulations within 49 CFR.

Hazardous substances are defined by CERCLA at 42 U.S.C. §9601(14), as amended by SARA and TSCA. The definition of hazardous substance includes (1) any substance designated pursuant to 33 U.S.C. §1321 (b)(2)(A); (2) any element, compound, mixture, solution, or substance designated pursuant to 42 U.S.C. §9602; (3) any hazardous waste; (4) any toxic pollutant listed under 33 U.S.C. §1317(a); (5) any hazardous air pollutant listed under Section 112 of the CAA (42 U.S.C. §7412); and (6) any imminently hazardous chemical substance or mixture with respect to which the Administrator of USEPA has taken action pursuant to 15 U.S.C. §2606. The term hazardous substance does not include petroleum products and natural gas.

Hazardous wastes are defined by RCRA at 42 U.S.C. §6903(5), as amended by the Hazardous and Solid Waste Amendments, as "a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (A) cause, or substantially contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed." Certain types of hazardous wastes are subject to special management provisions intended to ease the management burden and facilitate the recycling of such materials. These are called universal wastes and their associated regulatory requirements are specified in 40 CFR 273. Four types of waste are currently covered under the universal waste regulations: hazardous waste batteries, hazardous waste pesticides that are either recalled or collected in waste pesticide collection programs, hazardous waste thermostats, and hazardous waste lamps.

Toxic substances are regulated under TSCA (15 U.S.C. §2601 et seq.), which was enacted by Congress to give USEPA the ability to track the approximately 75,000 industrial chemicals currently produced or imported into the United States. USEPA screens these chemicals and can require reporting or testing of those that might pose an environmental or human-health hazard. USEPA can ban the manufacture and import of those chemicals that pose an unreasonable risk. Asbestos and polychlorinated biphenyls (PCBs) are among the chemicals regulated by TSCA.

In general, hazardous materials, hazardous substances, and hazardous wastes include elements, compounds, mixtures, solutions, and substances which, when released into the environment or otherwise improperly managed, could present substantial danger to the public health, welfare, or the environment.

Evaluation of hazardous materials and wastes focuses on underground storage tanks (USTs); aboveground storage tanks (ASTs); and the storage, transport, handling, and use of pesticides, herbicides, fuels, solvents, and petroleum, oil, and lubricants (POL). Evaluation might also extend to generation, storage, transportation, and disposal of hazardous wastes when such activity occurs at or near the project site. In addition to being a threat to humans, the improper release of hazardous materials and wastes can threaten the health and well-being of wildlife species, botanical habitats, soil systems, and water resources. In the event of release of hazardous materials or wastes, the extent of contamination varies based on the type of soil, topography, and water resources.

10.2 AFFECTED ENVIRONMENT

Solid Wastes. The California Integrated Waste Management Board (CIWMB) is responsible for regulating solid waste in California. The CIWMB promotes waste reduction and management of materials for the highest and best use (CIWMB 2007a). Solid wastes in Imperial County, California, are managed by the Imperial County Department of Public Works, Solid Waste/Recycling Division. The Department administers and operates ten landfills in compliance with all applicable Federal, state, and local regulations. Each landfill has a separate permit which is subject to review every 5 years. Recently these permits have required revisions because of increased development in outlying, rural areas which increases the amount of daily tonnage and increased daily vehicle count (ICDPW undated). The total household solid waste disposal rate in Imperial County, California, is 4,588 tons per year. The total business solid waste disposal rate in Imperial County, California, is 148,357 tons per year (CIWMB 2007b).

Hazardous Wastes. The Cal/EPA, California Department of Toxic Substance Control (DTSC) regulates the treatment, storage, transport, and disposal of hazardous waste. DTSC also administers some site clean-up programs. DTSC is authorized by the USEPA to regulate and enforce the provisions of RCRA. There are no known hazardous waste clean-up sites within the construction corridor (CDTSC undated). Environmental Due Diligence Assessments are also being prepared to identify the presence of hazardous materials and wastes within the project corridor.

10.3 DIRECT AND INDIRECT EFFECTS OF THE PROJECT

Solid Waste. Short-term minor adverse effects on solid waste management in Imperial County, California, will be expected as a result of the Project. Solid waste generated from the construction activities will consist of building materials such as concrete and metals (conduit and piping). The contractor will recycle construction materials to the greatest extent possible. Solid waste generated as a result of the Project is expected to be minor compared to the solid waste currently generated in Imperial County. The contractor will dispose of nonrecyclable construction debris at one or more of the permitted Imperial County landfills, which have not yet been identified. The construction debris associated with the Project will not result in exceeding the capacity of any landfill or the violation of any permit for any landfill.

Hazardous Wastes. Long-term minor adverse effects will be expected as a result of the Project. Products containing hazardous materials (such as fuels, oils, lubricants, pesticides, and herbicides) will be procured and used during construction. It is anticipated that the quantity of products containing hazardous materials used will be minimal and their use will be of short duration. It is anticipated that the quantity of hazardous and petroleum wastes generated from construction will be negligible. Accidental spills could occur as a result of the construction. A spill could potentially result in adverse effects on wildlife, soils, water, and vegetation. However, the amount of hazardous materials at the construction site will be limited and the equipment necessary to quickly contain any spill will be present when refueling. Contractors will be responsible for the management of hazardous materials and wastes.

There are no known USTs, ASTs, or hazardous waste clean-up sites within the project corridor.

THIS PAGE INTENTIONALLY LEFT BLANK.

11. RELATED PROJECTS AND POTENTIAL EFFECTS

The following analysis summarizes expected environmental effects from the Project when added to other past, current, and reasonably foreseeable future actions. The geographic scope of the analysis varies by resource area. For example, the geographic scope of cumulative impacts on resources such as noise, visual resources, soils, and vegetation is very narrow and focused on the location of the resource. The geographic scope of air quality, wildlife and sensitive species, and socioeconomics is much broader and considers more county- or regionwide activities. Projects that were considered for this analysis were identified by reviewing USBP documents, news releases, and published media reports, and through consultation with planning and engineering departments of local governments, and state and Federal agencies. Projects that do not occur in close proximity (i.e., within several miles) of the fence will not contribute to a cumulative impact and are generally not evaluated further.

11.1 PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

Cumulative Fencing, Southern Border. There are currently 62 miles of landing mat fence at various locations along the U.S./Mexico international border (CRS 2006); 14 miles of single, double, and triple fence in San Diego, California; 70 miles of new primary pedestrian fence approved and currently under construction at various locations along the U.S./Mexico international border; and fences at POE facilities throughout the southern border. In addition, 225 miles of fence will be built (including the 44.6 miles in the USBP El Centro Sector) in Texas, New Mexico, Arizona, and California.

Past Actions**.** Past actions are those within the cumulative effects analysis areas that have occurred prior to the development of this ESP. The effects of these past actions are generally described under each resource area. For example, extensive off-highway vehicle use in the Algodones Dunes has contributed to the existing environmental conditions of the area.

Present Actions**.** Present actions include current or funded construction projects, USBP or other agency operations in close proximity to the fence locations, and current resource management programs and land use activities within the cumulative effects analysis areas. Ongoing actions considered in the cumulative effects analysis include the following:

- <u>New Fence</u>. In January 2004, USBP approved construction of approximately 5 miles of primary pedestrian fence along the U.S./Mexico international border starting approximately 2 miles west of the Calexico POE (designated as Section B-3 in this ESP). This fence is currently under construction. In August 2007, USBP approved the installation of 7.62 miles of maintenance road and 2.62 miles of additional primary pedestrian fence to extend the 5 miles of primary pedestrian fence previously approved. Section B-2 will be west of and connected to the 2.62 miles of primary pedestrian fence approved in August 2007 (CBP 2007).

- Construction of Primary Fence. The FY 2007 DHS Appropriations Act provided $1.2 billion for the installation of fencing, infrastructure, and technology along the border (CRS 2006). CBP will construct 225 miles of primary fence in Rio Grande Valley, Marfa, Del Rio, and El Paso, Texas; Tucson and Yuma, Arizona; El Centro and San Diego, California, Sectors. Section B-5B will be approximately 11 miles from an adjoining fence in the Yuma, Arizona, Sector.
- New River Safety Barrier. USBP approved construction of a retractable safety barrier/gate-style fence on the New River near the City of Calexico (CBP 2005). This project also proposed installation of approximately 2 miles of permanent lighting near the City of Calexico.
- All-American Canal Relining Project (AACRP). In 1994, the Bureau of Reclamation approved the AACRP and it is currently under construction near Section B-5B. This project consists of constructing a 23-mile concrete-lined canal parallel to the existing earthen canal, from 1 mile west of Pilot Knob to Drop 3. Construction is expected to continue through Spring 2010 (USBR 1994).

Reasonably Foreseeable Future Actions. Reasonably foreseeable future actions consist of activities that have been approved and can be evaluated with respect to their effects. The following activities are reasonably foreseeable future actions:

- SBI*net*. A comprehensive program focused on transforming border control through technology and infrastructure. The goal of the program is to field the most effective proven technology, infrastructure, staffing, and response platforms, and integrate them into a single comprehensive border security suite for DHS. Potential future SBI*net* projects include deployment of sensor technology, communications equipment, command and control equipment, fencing, barriers capable of stopping a vehicle, and any required road or components such as lighting and all-weather access roads (Boeing 2007). Over the next year, 225 miles of primary fence will be built (including the 25.2 miles in this ESP). The first phase of construction will occur in areas that have already been developed (e.g., currently contains permanent vehicle barriers or temporary vehicle barriers) and, thus, little or no additional environmental impacts will be expected. The second phase of construction will generally occur in more remote areas.
- Additional Tactical Infrastructure within the USBP El Centro Sector. USBP has identified additional tactical infrastructure that might be required in the future, including secondary pedestrian fences and all-weather patrol roads in urban areas near POEs. While specific future operational requirements

are not currently known, have not been funded, and are not reasonably certain to occur, additional tactical infrastructure can be identified for the purposes of the cumulative effects analysis. Based on operational requirements in urban areas in other sectors, the USBP El Centro Sector can reasonably foresee the need for approximately 5.9 miles of secondary (double) fencing and an all-weather road in the urban area of Calexico, California; approximately 2.4 miles of secondary fencing and an all-weather road along Section B-2; approximately 7.4 miles of secondary fencing and an all-weather road along Section B-3; and approximately 8.6 miles of secondary fencing along Section B-4. Lighting and sensors might be needed in the distant future in Sections B-2, B-3, and B-4. The USBP El Centro Sector has also projected the need for a vehicle bridge with a gate spanning the New River, fencing, an all-weather road, and lighting along both sides of the river.

- <u>BLM Eastern San Diego Draft Resource Management Plan</u>. BLM has prepared a Draft Resource Management Plan and Environmental Impact Statement (EIS) which will provide future management guidance for use and protection of the resources on approximately 100,000 acres of public lands managed by BLM's El Centro Field Office in the eastern portion of San Diego County, California (BLM 2007b).
- <u>City of Calexico</u>. The City of Calexico is proposing to annex a 640-acre parcel of land near the All-American Canal. The proposed annex is along the eastern edge of the City of Calexico and will be developed as a housing, commercial, and industrial area (CBP 2005).
- <u>San Diego Gas & Electric (SDG&E) transmission line</u>. SDG&E has proposed to construct a new 150-mile transmission line between the cities of El Centro and San Diego. The stated purpose of the project is to bring renewable energy sources into San Diego from Imperial County, reduce energy costs, and improve electric reliability in the San Diego area. SDG&E has filed an application with the California Public Utilities Commission to construct the Sunrise Powerlink Project. A joint EIS/Environmental Impact Report is being prepared (BLM 2007c).
- <u>California Department of Transportation (Caltrans)</u>. Caltrans has several road improvement projects scheduled for Imperial County in the next 5 years. However, the potential for adverse cumulative impacts would be low as the majority of the construction would be within existing ROW. The following projects are in the planning stage and potential impacts are unknown at this time: new Interstate 8 and Imperial Avenue interchange, construction of 5.5 miles of four-lane divided highway with access control from State Highway 98 to Interstate 8, upgrade existing State Route (SR) 111 between Ross Road and SR 78 in Imperial County, and widen or realign SR 98 between SR 111 and SR 7 from four to six lanes (CBP 2007).

- Lower Colorado River Drop 2 Storage Reservoir. This project is approximately 30 miles east of the City of El Centro, and might be near Sections B-5A and B-5B. The plans call for a 450-acre reservoir on a 615-acre site. Administrative and office buildings as well as mechanical equipment necessary for operations of the reservoir would be on the 615-acre site. In addition to the reservoir, this project also includes 6.5 miles of new canal to connect the Coachella Valley Canal to the reservoir and from the reservoir to the All-American Canal. The total acreage expected to be impacted from this proposed project is 967 acres (CBP 2007).

Table 11-1 presents the cumulative effects that might occur from implementation of the Project.

11.2 AIR QUALITY

Minor short-term adverse cumulative effects on air quality are expected from the construction of tactical infrastructure in combination with other reasonably foreseeable future actions. Emissions from construction, operation, and maintenance activities will not be expected to affect local or regional air quality.

11.3 NOISE

Negligible cumulative effects on ambient noise will be expected as a result of construction, operation, and maintenance activities associated with the Project. There are no other known activities in the vicinity of the Project that are expected to contribute noticeably to the overall noise environment.

11.4 LAND USE AND VISUAL RESOURCES

Construction of tactical infrastructure would result in minor changes to land use. Recent activities that have most affected land use near the tactical infrastructure is the AACRP, construction of new energy and communications infrastructure, and construction of other USBP tactical infrastructure. Moderate cumulative impacts on land use are expected from the additive effects of the past, present, and reasonably foreseeable future actions.

Minor to moderate impacts on visual resources are expected from the additive effects of past, present, and reasonably foreseeable future actions. The presence of construction equipment under the Project will produce a short-term adverse impact on visual resources. Once installed, the tactical infrastructure will create a permanent and fixed visual interruption at fixed points. Adverse cumulative effects could include temporary construction impacts and the introduction of light poles and increased night illumination during construction. Recreational activities such as star-gazing will be adversely affected by this cumulative impact in night illumination.

Table 11-1. Summary of Potential Cumulative Effects

Resource	Past Actions	Current Background Activities	Project	Known Future Actions	Cumulative Effects
Air Quality	State nonattainment for 8-hour O_3; Federal moderate maintenance for CO; State nonattainment for PM_{10} and $PM_{2.5}$.	Existing emissions sources continue to adversely affect regional air quality.	Construction activities will temporarily contribute to CO and PM emissions.	Existing emissions sources continue to adversely affect regional air quality. No new major sources identified in El Centro.	Construction activities will temporarily contribute to CO and PM emissions.
Noise	Commercial and residential development, vehicles dominate ambient noise near urban areas. Remote areas temporarily impacted by ORV recreational activities.	Commercial and residential development, vehicles dominate ambient noise near urban areas. Remote areas temporarily impacted by ORV recreational activities.	Short-term noise impacts from construction.	None.	Current activities will be the dominant noise source. Negligible cumulative impacts.

Resource	Past Actions	Current Background Activities	Project	Known Future Actions	Cumulative Effects
Land Use and Visual Resources	Commercial and residential development, infrastructure improvements on natural areas. Historical development of undeveloped lands.	Commercial and residential development near Calexico and infrastructure improvements. BLM Eastern San Diego Draft Resource Management Plan (RMP) identifies management direction for lands. Development of natural areas for community and industry infrastructure.	CBP purchase of land or easements to construct tactical infrastructure. Natural areas developed for tactical infrastructure. Constant static visual interruption at fixed points. Loss of recreational area.	Commercial and residential development and infrastructure improvements permanently alter natural areas and agricultural lands. Continued moderate to severe impacts on Class I and Class III Visual Resources.	Moderate adverse impacts on natural areas. Minor to moderate long-term impacts to visual resources from permanent infrastructure.
Geology and Soils	Installation of infrastructure, intrusions by cross-border violators have modified soils.	Installation of infrastructure; continued cross-border violators activities adversely affect soils.	Minor grading and recontouring will disturb soils.	Continued cross-border violator activities adversely affect soils. Installation of infrastructure.	Minor long-term impact from construction of additional infrastructure.
Water Use and Quality (Hydrology and Groundwater)	High dissolved solids concentrations, fluoride, and boron in two major aquifers.	Groundwater primarily used for industrial applications.	Short-term minor adverse effects from groundwater use for dust suppression during construction.	Long-term adverse effects on groundwater recharge from reservoir and canal relining projects.	Minor short-term impact from groundwater use during construction.

Resource	Past Actions	Current Background Activities	Project	Known Future Actions	Cumulative Effects
Water Use and Quality (Surface Waters and Waters of the United States)	Degradation of water resources due to pollution.	Surface water quality adversely impacted by development.	Soil disturbance, erosion during construction, impacts on wetlands.	Construction erosion and sediment runoff, potential oil spills and leaks.	Nonpoint discharges, construction erosion and sediment runoff, potential oil spills and leaks.
Water Use and Quality (Floodplains)	Floodplain adversely impacted by development, decreased vegetation, increased impervious surfaces, and soil compaction.	Various storm water and floodplain management practices when activities are in or near floodplains.	Short-term potential for minor impacts during construction. Only a small portion of Section B-4 is within 100-year floodplain.	Increased development activities and water reservoir and canal projects could change peak flow or floodplain capacity during high-volume storm events.	Project will not be expected to contribute to flood hazards.
Biological Resources (Vegetation Resources)	Degraded historic habitat of sensitive and common wildlife species.	Continued urbanization results in loss of native species.	Habitat fragmentation. Minor to moderate loss of native species and habitat.	Minor to moderate loss of native species and habitat.	Moderate adverse impacts on native habitats and vegetation.
Biological Resources (Wildlife and Aquatic Resources)	Loss of native habitat due to development; loss of wildlife corridors; impacted habitat and food sources.	Development continues to impact biological resources and wildlife habitat.	Minor to moderate loss of habitat, wildlife corridors, habitat fragmentation.	Minor to moderate loss of habitat and wildlife corridors.	Minor to moderate loss of habitat and wildlife corridors.
Biological Resources (Threatened and Endangered Species)	Degraded habitat impacted sensitive species.	Urbanization and agricultural development degraded habitat for sensitive species.	Minor to moderate loss of habitat, habitat fragmentation.	Loss of habitat for sensitive species.	Minor to moderate loss of habitat, habitat fragmentation.

Resource	Past Actions	Current Background Activities	Project	Known Future Actions	Cumulative Effects
Cultural Resources	Development and infrastructure improvements adversely affected cultural resources.	Development and infrastructure improvements adversely affect cultural resources; some preservation.	None.	Continued development and infrastructure improvements to adversely affect cultural resources; continued preservation efforts.	None.
Socioeconomics, Environmental Justice, and Protection of Children	Commercial and residential development around Calexico.	Commercial and residential development around Calexico.	Minor, temporary contribution to local construction industry.	Infrastructure development to support future commercial and residential development around Calexico.	Minor stimulation of local economies from construction activities. No adverse effects on environmental justice issues, children, or human health and safety.
Hazardous Materials and Wastes	Use of hazardous substances in vehicles. Possible illegal dumping.	Use of hazardous substances in vehicles. Possible illegal dumping.	Minor use of hazardous materials during construction.	Minor use of hazardous materials during construction.	None.

11.5 GEOLOGY AND SOILS

Additive effects include a minor increase in erosion. Construction of the tactical infrastructure adjacent to the AACRP would have a minor cumulative effect on soils due to construction.

11.6 WATER USE AND QUALITY

11.6.1 Hydrology and Groundwater

Minor adverse cumulative effects could occur on groundwater resources if groundwater was to be used for dust suppression during Project construction. The AACRP is designed to reduce canal seepage to the groundwater table in the Mexicali Valley by up to 68,000 acre-feet annually, potentially reducing the volume, duration, and quality of irrigation return water into the Alamo River. Due to the short-term nature of Project construction potential adverse cumulative effects when combined with the AACRP would be minor.

11.6.2 Surface Water and Waters of the United States

Minor impacts on surface water and waters of the United States could occur from the Project and reasonably foreseeable future actions. As discussed in **Chapter 6.2.3**, wetland delineations were completed in January 2008 and provided to the USACE-Los Angeles District which identified 8.48 acres of jurisdictional wetland impacts. Long-term adverse cumulative impacts on vegetated wetlands occurring in association with the All-American Canal would be expected as a result of the AACRP. Relining or realignment of the canal would be expected to directly impact wetlands occurring in and on the banks of the canal as a result of diversion of flows and direct removal of vegetation associated with channel lining. Cumulative impacts on wetlands in proximity to the canal could occur following completion of the AACRP if the adjacent wetlands were receiving hydrologic input from seepage of the canal prior to its lining. The cumulative impacts on wetlands will be long-term adverse and moderate.

Potential cumulative adverse effects on Alamo River surface water flow volume, duration, and water quality could result from the AACRP to the east that will reduce canal seepage to the groundwater table in the Mexicali Valley by up to 68,000 acre-feet annually, potentially reducing the volume, duration, and quality of irrigation return water into the Alamo River.

11.6.3 Floodplains

Minor adverse effects from construction adjacent to the 100-year floodplain and from a small portion of Segment B-4 within the 100-year floodplain could occur. Continued development, AACRP, and proposed Lower Colorado River Storage Reservoir could affect flood dynamics, though it is assumed that floodplain management will be incorporated as appropriate into all development projects to reduce the potential for adverse effects on the 100-year floodplain. Implementation of the Project will have a negligible long-term effect on floodplain resources.

11.7 BIOLOGICAL RESOURCES

11.7.1 Vegetation Resources

Minor impacts on native species vegetation and habitat are expected from the additive effects of past, present, and reasonably foreseeable future actions. As discussed in **Chapter 7.1**, vegetation in the project corridor has been highly disturbed by previous construction activities for the All-American Canal, utility infrastructure, recreational ORV uses, and USBP patrol roads. In addition, vegetation in these areas has been impacted over time by illegal cross-border traffic.

Long-term adverse cumulative impacts on vegetation associated with wetlands in proximity to the All-American Canal will be expected as a result of the AACRP. Relining or realignment of the canal will be expected to directly impact vegetation occurring in and on the banks of the canal as a result of diversion of flows and direct removal of vegetation associated with channel lining. Cumulative impacts on wetland vegetation in proximity to the canal could occur following completion of the AACRP if the adjacent wetlands were receiving hydrologic input from seepage of the canal prior to its lining. The cumulative impacts on wetlands will be long-term and adverse.

11.7.2 Wildlife and Aquatic Resources

Minor impacts on wildlife and species are expected from the additive effects of the past, present, and reasonably foreseeable future actions. Cumulative impacts will mainly result from loss of habitat, habitat disturbance and degradation, construction traffic, and the AACRP reducing groundwater discharge to wetlands habitat. Displaced wildlife will move to adjacent habitat if sufficient habitat exists. Wildlife could also be adversely impacted by noise during construction, operational lighting, and loss of potential prey species under the Project. Species will also be impacted by equipment spills and leaks. The permanent lighting could have minor, adverse cumulative impacts on migration, dispersal, and foraging activities of nocturnal species.

11.7.3 Threatened and Endangered Species

As discussed in **Chapter 7**, CBP has begun Section 7 preconsultation coordination with the USFWS regarding potential impacts on listed species or designated critical habitat. Minor adverse impacts are possible on the Algodones dunes sunflower, Peirson’s milkvetch, and FTHL due to loss of habitat. Special status species are commonly protected because their historic range and habitat has been reduced and will only support a small number of individuals.

Construction, operation, and maintenance of tactical infrastructure, when combined with past, present, and future residential and commercial development, has the potential to result in minor to major adverse cumulative impacts on these species.

11.8 CULTURAL RESOURCES

Because there are no known cultural resources within the Project area, there are no expected impacts on cultural resources and therefore will not contribute to cumulative impacts. Recorded cultural resources are outside the immediate Project and will not be directly or indirectly impacted. A cultural resources technical report has been provided to BLM and the California SHPO.

11.9 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND PROTECTION OF CHILDREN

Minor, short-term beneficial impacts on local and regional socioeconomic resources are expected from the additive effects of past, present, and reasonably foreseeable future actions. Economic benefits will be realized by construction companies, their employers and suppliers, and by Imperial County through a minor increase in tax receipts for the purchase of goods and services. Construction of tactical infrastructure has the potential for minor beneficial effects from temporary increases in construction jobs and the purchase of goods and services. Since the construction jobs will be temporary, negligible cumulative effects on population growth, income, or other services will be expected.

The cumulative impacts of USBP activities to control the border of the United States and the concomitant effects upon the Nation’s health and economy, violent and drug-related crimes, community cohesion, property values, and traditional family values will be long-term and beneficial, both nationally and locally. Residents of adjacent towns will benefit from increased security, a reduction in illegal drug-smuggling activities and the number of violent crimes, less damage to and loss of personal property, and less financial burden for entitlement programs. This will be accompanied by the concomitant benefits of reduced enforcement and insurance costs. Operation and maintenance of the tactical infrastructure has little potential for cumulative impacts on socioeconomics.

11.10 HAZARDOUS WASTES AND HAZARDOUS MATERIALS

Construction, operation, and maintenance of tactical infrastructure will require minimal quantities of hazardous materials and generate small quantities of hazardous wastes. Therefore, minimal cumulative impacts on hazardous materials and wastes will occur as a result of the Project.

THIS PAGE INTENTIONALLY LEFT BLANK.

12. REFERENCES

ATSDR 2002 — Agency of Toxic Substances & Disease Registry (ATSDR). 2002. "Division of Toxicology ToxFAQs: DDT, DDE, and DDD." U.S. Department of Health and Human Services, Public Health Service, ATSDR. September 2002. Available online: <*http://www.atsdr.cdc.gov/tfacts35.html*>. Accessed 20 November 2007.

Bailey 1995 — Bailey, Robert F. 1995. *Ecoregions of the United States*. U.S. Forest Service. Available online: <*http://www.fs.fed.us/coloimagemap/images/300.html*>. Accessed 4 November 2004.

BLM 1986a — U.S. Bureau of Land Management (BLM). 1986. *BLM Manual H-8410-1, Visual Resource Inventory, Bureau of Land Management*. 17 January 1986.

BLM 1986b — BLM. 1986. *BLM Manual 8431 Visual Resource Contrast Rating, Bureau of Land Management*. 17 January 1986.

BLM 2003a — BLM. 2003. *Imperial Sand Dunes Recreation Area Management Plan (RAMP)*. U.S. Department of the Interior, BLM, El Centro Field Office. El Centro, CA.

BLM 2003b — BLM. 2003. *Flat-Tailed Horned Lizard Rangewide Management Strategy, Revision 1*. U.S. Department of the Interior, BLM, El Centro Field Office.

BLM 2007a — BLM. 2007. BLM El Centro Field Office, Personal correspondence between John Johnson, Wilderness Coordinator, BLM El Centro Field Office, and Ron Lamb, e²M. 3 December 2007.

BLM 2007b — BLM. 2007. *Eastern San Diego County Draft Resource Management Plan and Draft Environmental Impact Statement*. Prepared by U.S. Department of the Interior, BLM, El Centro Field Office. February 2007. Available online: <*http://www.blm.gov/ca/st/en/fo/elcentro/esdrmp.html*>. Accessed 20 November 2007.

BLM 2007c — BLM. 2007. *Sunrise Powerlink Project*. Available online: <*http://www.blm.gov.ca.st.en.fo.elcentro/sunrise.html*>. Accessed 22 October 2007.

BLM undated — BLM. Undated. "El Centro, Programs." Available online: <*http://www.blm.gov/ca/st/en/fo/elcentro/whatwedo.1.html*>. Accessed 11 September 2007.

Boeing 2007 — Boeing Integrated Defense System (Boeing). 2007. *SBInet Backgrounder*. March 2007

CADWR 2003 — California Department of Water Resources (CADWR). 2003. *California's Groundwater, Bulletin 118. Update 2003.* Available online: <*http://www.groundwater.water.ca.gov/bulletin118/ update2003/index.cfm*>. Accessed 7 September 2007.

CARB 2007a — California Air Resources Board (CARB). 2007. *Ambient Air Quality Standards*. Available online: <*http://www.arb.ca.gov/research/ aaqs/aaqs2.pdf*>. Accessed 3 October 2007.

CARB 2007b — CARB. 2007. *California 1990 Greenhouse Gas Emissions Level and 2020 Emissions Limit*. Available online: <*http://www.arb.ca.gov/cc/ ccei/inventory/1990_level.htm*>. Accessed 20 November 2007.

CBP 2005 — U.S. Customs and Border Protection (CBP). 2005. *Environmental Assessment for Gamma Imaging Inspection System, Port of Entry (West) Calexico, Imperial County, California*. U.S. Department of Homeland Security, CBP, Applied Technology Division. March 2005.

CBP 2007 — CBP. 2007. Final Supplemental Environmental Assessment for the Proposed Installation of 2.62 Miles of Primary Fence near Calexico, California. August 2007.

CDTSC undated — California Department of Toxic Substances Control (CDTSC). Undated. "Find Clean Sites." Available online: <*http://www.envirostor.dtsc.ca.gov/public/*>. Accessed 4 September 2007.

CIWMB 2007a — California Integrated Waste Management Board (CIWMB). 2007. "Integrated Waste Management Board." Available online: <*http://www.ciwmb.ca.gov/*>. Accessed 12 September 2007.

CIWMB 2007b — CIWMB. 2007. "California Waste Stream Profiles, Imperial County Overview." Available online: <*http://www.ciwmb.ca.gov/Profiles/ County/CoProfile1.asp*>. Accessed 12 September 2007.

CRS 2006 — Congressional Research Service (CRS). 2006. *Border Security: Barriers Along the U.S. International Border*. Report For Congress prepared by Blas Nunez-Neto and Stephen Vina. Updated 12 December 2006.

EIA 2000 — U.S. Energy Information Administration (EIA). 2000. Inventory of Electric Utility Power Plants in the United States 2000. U.S. Department of Energy, EIA. Available online: <*http://www.eia.doe.gov/cneaf/electricity/ipp/html1/ippv1td2p2.html*>. Accessed 17 March 2008.

Epps 2005	Epps, C. W., P. J. Palsboll, J. D. Wehausen, G. K. Roderick, R. R. Ramey II, and D. R. McCullouch. 2005. Highways block gene flow and cause a rapid decline in genetic diversity of desert bighorn sheep. Ecology Letters 8:1029-1038.
Fedstats undated	Fedstats. 2007. "Mapstats, Imperial County, California." Available online: <*http://www.fedstats.gov/qf/states/06/06025.html*>. Accessed 13 September 2007.
FEMA 1984	Federal Emergency Management Agency (FEMA). 1984. Map Service Center Viewer – Flood Insurance Rate Map (FIRM) Panel No. 0600651025B for Imperial County, California. Effective Date 15 March 1984. Available online: <*https://msc.fema.gov*>. Accessed 19 September 2007.
FEMA 1986	FEMA. 1986. A Unified National Program for Floodplain Management, March 1986.
Graber 1996	Graber, David M. 1996. "Chapter 25: Status of Terrestrial Vertebrates." In: *Sierra Nevada Ecosystem Project: Final Report to Congress, Volume II, Assessments and Scientific Basis for Management Options*. University of California, Centers for Wildlife Resources. Available online: <*http://ceres.ca.gov/snep/ pubs/v2s3.html*>. Accessed 20 November 2007.
Hangan 2003	Hangan, Margaret. 2003. *Bureau of Land Management 110 Survey.*
Hickman 1996	Hickman, James C., ed. 1996. *The Jepson Manual: Higher Plants of California*. University of California Press: Berkley.
Hunt 1974	Hunt, C.B. 1974. *Natural Regions of the United States and Canada*. W.H. Freeman and Company: San Francisco.
IBWC 2007	U.S. International Boundary and Water Commission (USIBWC). 2007. "The International Boundary and Water Commission, Its Mission, Organization and Procedures for Solution of Boundary and Water Problems." Available online: <*www.ibwc.state.gov/About_Us/ About_Us.html*>. Accessed 20 September 2007.
ICAPCD 2007	Imperial County Air Pollution Control District (ICAPCD). 2007. Rule 202, *Exemptions*. Available online: <*http://www.arb.ca.gov/drdb/imp/ curhtml/r202.pdf*>. Accessed 3 October 2007.

ICDPW Undated — Imperial County Department of Public Works (ICDPW). Undated. "Solid Waste/Recycling Division." Available online: <*http://www.co.imperial.ca.us/PublicWorks/Index.htm*>. Accessed 12 September 2007.

ICPD 1998 — Imperial County Planning Division (ICPD). 1998. Title 9, Land Use Ordinance.

IID 2005 — Imperial Irrigation District (IID). 2005. *2005 Annual Water Report*. Imperial, CA. Available online: <*http://www.iid.com/Water_Index.php?pid=2675*>. Accessed 20 November 2007.

IID 2007 — IID. 2007. *Efficiency Conservation Definite Plan, Final Report*. Prepared as part of the IID Efficiency Conservation Definite Plan. Imperial, CA. May 2007. Available online: <*http://www.iid.com/Water_Index.php?pid=268*>. Accessed 20 November 2007.

Landrum & Brown 2002 — Landrum & Brown, Inc. 2002. "Common Noise Sources." Available online: <*www.landrum-brown.com/env/PVD/EIS/Jan%202002%20Chapter%204/ 4%201-1%20%20common_noise_sources.pdf*>. Accessed 6 July 2004.

LeBlanc et al. 2004 — LeBlanc, Lawrence A., James L. Orlando, and Kathryn M. Kuivila. 2004. Pesticide Concentrations in Water and in Suspended and Bottom Sediments in the New and Alamo Rivers, Salton Sea Watershed, California, April 2003. U.S. Department of the Interior, U.S. Geological Survey, Data Series 104, in cooperation with the California State Regional Water Quality Control Board. Reston, VA. Available online: <*http://pubs.usgs.gov/ds/ds104/*>. Accessed 20 November 2007.

Light and Weaver 1973 — Light, J. T. and R. Weaver. 1973. Report on bighorn sheep habitat study in the areas for which an application was made to expand the Mt. Baldy winter sports facility. U .S. For. Serv. Cajon Ranger Dist., San Bernardino Nat. For. 39 pp.

Morton 1977 — Morton, P.K. 1977. *Geology and Mineral Resources of Imperial County, California.* County Report 7, California Division of Mines and Geology, Sacramento, California.

NatureServe 2007 — NatureServe Explorer. 2007. Comprehensive Reports Alliance and Associations. Available online: <*http://www.natureserve.org/explorer/servlet/*>.

Rubin et al 1998	Rubin, E. S., W. M. Boyce, M. C. Jorgensen, S. G. Torres, C. L. Hayes, C. S. O'Brien, and D. A. Jessup. 1998. Distribution and abundance of bighorn sheep in the Peninsular Ranges, California. The Wildlife Society Bulletin 26(3):539-551.
Spectrum undated	Spectrum Laboratories (Spectrum). 2007. "Chemical Fact Sheet – Chemical Abstract Number 759944: Eptam." Available online: <*http://www.speclab.com/compound/c759944.htm*>. Accessed 20 November 2007.
SSA 1997	The Salton Sea Authority (SSA). 1997. "The Salton Sea: A Brief Description of Its Current Conditions, and Potential Remediation Projects." Available online: <*http://www.sci.sdsu.edu/salton/ Salton%20Sea%20Descriptions.html*>.
Stene undated	Stene, Eric A. Undated. "Boulder Canyon Project: All-American Canal System." 2nd Draft. Available online: <*http://www.usbr.gov/dataweb/html/allamer1.d2.html*>. Accessed 20 November 2007.
TopoZone. com 2007	TopoZone.com. 2007. USGS Calexico, Bonds Corner, and Grays Well topographic maps. Copyright TopoZone.com © 1999–2003 Maps a la carte, Inc. Available online: <*http://www.topozone.com*>. Accessed 5 September 2007.
U.S. Census Bureau 2002	U.S. Census Bureau. 2002. "Decennial, Census 2000." Available online: <*http://factfinder.census.gov/servlet/ DatasetMainPageServlet?_program=DEC&_submenuId=datasets_0&_lang=en*>. Accessed 12 September 2007.
USACE 1987	U.S. Army Corps of Engineers (USACE). 1987. *Wetlands Delineation Manual*. Technical Report Y-87-1, USACE Waterways Experiment Station, Environmental Laboratory, Vicksburg, Mississippi.
USACE 2000	USACE. 2000. *Environmental Assessment for the Proposed JTF-6 Levee Road Maintenance and Repair Project, Brownsville, Texas*. USACE Fort Worth District. April 2000.
USACE 2006	U.S. Army Corps of Engineers (USACE). 2006. *Wetlands Regulatory Assistance Program, Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region.* ERDC/EL TR-06-16. December 2006. Available online: <*http://stinet.dtic.mil/cgi-bin/GetTRDoc?AD=ADA460380&Location=U2&doc=GetTRDoc.pdf*>. Accessed 18 March 2008.

USBR 1994 — U.S. Bureau of Reclamation (USBR). 1994. *Record of Decision for the Final Environmental Impact Statement for the All-American Canal Lining Project, Imperial County, California*. U.S. Department of the Interior, Bureau of Reclamation. May 1994.

USBR 2001 — USBR. 2001. *New River Wetlands Project Environmental Assessment*. U.S. Department of the Interior, Bureau of Reclamation, Lower Colorado Region. Brawley and Imperial, CA.

USBR 2005 — USBR. 2005. Biological Assessment for the All-American Canal Lining Project, Potential Species Impacts in the Republic of Mexico. 18 November 2005. Available online: <*http://www.usbr.gov/lc/region/programs/aac.html*>. Accessed 20 November 2007.

USDA-NRCS 2007a — U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS). 2007. National Cooperative Soil Survey (NCSS) Web Soil Survey Version 1.1. Available online: <*http://websoilsurvey.nrcs.usda.gov/app/*>. Accessed 6 September 2007.

USDA-NRCS 2007b — USDA-NRCS. 2007. Interpreting Wetland Indicator Status – USDA PLANTS. Available online: <*http://plants.usda.gov/wetinfo.html*>.

USDOJ 2007 — U.S. Department of Justice (USDOJ). 2007. "Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States* and *Carabell v. United States*." Prepared for the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers. Available online: <*http://www.epa.gov/owow/wetlands/guidance/CWAwaters.html*>. Accessed 20 November 2007.

USEPA 1971 — U.S. Environmental Protection Agency (USEPA). 1971. *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances*. NJID 300.1. 31 December 1971.

USEPA 1974 — USEPA. 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. March 1974.

USEPA 2006a — USEPA. 2006. "National Ambient Air Quality Standards." Available online: <*http://www.epa.gov/air/criteria.html*>. Accessed 3 October 2007.

USEPA 2006b — USEPA. 2006. AirData NET Tier Report for Southeast Desert AQCR. Available online: *<http://www.epa.gov/air/data/geosel.html>.* Accessed 3 October 2007.

USEPA 2007a	USEPA. 2007. "Clean Water Act: History, Introduction, Electronic Clean Water Act Snapshot, and Finding Updates." Last updated 7 September 2007. Available online: <*http://www.epa.gov/r5water/ cwa.htm*>. Accessed 20 November 2007.
USEPA 2007b	USEPA. 2007. *Green Book Nonattainment Areas for Criteria Pollutants*. Available online: <*http://www.epa.gov/oar/oaqps/greenbk*>. Accessed 3 October 2007.
USFS 1995	U.S. Forest Service (USFS). 1995. *Forested Wetlands: Functions, Benefits and the Use of Best Management Practices*. NA-PR-01-95. U.S. Department of Agriculture, USFS. David J. Welsch (USFS) with David L. Smart (NRCS) , James N. Boyer (USACE), Paul Minken (USEPA), Howard C. Smith (NRCS), and Tamara L. McCandless (USFWS).
Wehausen 1980	Wehausen, J.D. 1980. Sierra Nevada bighorn sheep: history and population ecology. Ph. D. Thesis, Univ. Michigan, Ann Arbor. 243 pp.

THIS PAGE INTENTIONALLY LEFT BLANK

13. ABBREVIATIONS AND ACRONYMS

$\mu g/m^3$	micrograms per cubic meter
°C	degrees Celsius
°F	degrees Fahrenheit
AACRP	All-American Canal Relining Project
APE	area of potential effect
AQCR	air quality control region
ARPA	Archeological Resources Protection Act
AST	aboveground storage tank
BLM	Bureau of Land Management
BMP	Best Management Practice
CAA	Clean Air Act
Cal/EPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CBP	U.S. Customs and Border Protection
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CIWMB	California Integrated Waste Management Board
cm	Centimeter
CM&R	Construction, Mitigation, and Restoration
CO	carbon monoxide
CO_2	carbon dioxide
CRS	Congressional Research Service
CWA	Clean Water Act
CY	calendar year
dBA	A-weighted decibels
DDE	dichlorodiphenyl-dichloroethylene
DDT	dichlorodiphenyltrichloroethane
DHS	U.S. Department of Homeland Security
DTSC	Department of Toxic Substance Control
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FAC	Facultative
FACU	Facultative Upland
FACW	Facultative Wetland
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FPPA	Farmland Protection Policy Act
FR	Federal Register
ft^3/s	cubic feet per second
FTHL	flat-tailed horned lizard
FY	fiscal year
IBWC	International Boundary and Water Commission
ICAPCD	Imperial County Air Pollution Control District
IIRIRA	Illegal Immigration Reform and Immigrant Responsibility Act of 1996, as amended
MA	Management Areas
MBTA	Migratory Bird Treaty Act
m	meter

mg/m^3	milligrams per cubic meter
MMTCE	million metric tons of carbon equivalent
MSL	mean sea level
NA	No Agreement or Not Applicable
NAAQS	National Ambient Air Quality Standards
NADB	National Archeological Data Base
NAGPRA	Native American Graves Protection and Repatriation Act
ng/g	nanograms per gram
ng/L	nanograms per Liter
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NI	no indicator
NO	No Occurrence or nitrogen oxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NRCS	Natural Resources Conservation Service
O_3	ozone
OBL	obligate wetland
OHM	ordinary high water mark
ORV	off-road vehicle
OSHA	Occupational Safety and Health Administration
P.L.	Public Law
Pb	lead
PCB	polychlorinated biphenyl
PM_{10}	particles equal to or less than 10 microns in diameter
$PM_{2.5}$	particles equal to or less than 2.5 microns in diameter
POE	Port of Entry
POL	petroleum, oil, and lubricants
ppm	parts per million
RA	Research Area
RCRA	Resource Conservation and Recovery Act
RMP	Resource Management Plan
ROI	Region of Influence
ROW	right-of-way
SAAQS	State Ambient Air Quality Standards
SARA	Superfund Amendments and Reauthorization Act
SBI	Secure Border Initiative
SDAQCR	Southeast Desert Air Quality Control Region
SDG&E	San Diego Gas & Electric
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	sulfur dioxide
SPCC	Spill Prevention Control and Countermeasure
SR	State Route
SWPPP	Storm Water Pollution Prevention Plan
TSCA	Toxic Substances Control Act
U.S.C.	United States Code
UPL	Obligate Upland
USACE	U.S. Army Corps of Engineers
USBP	U.S. Border Patrol
USEPA	U.S. Environmental Protection Agency
USIBWC	U.S. Section of the International Boundary and Water Commission
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
VOC	volatile organic compound
VRM	Visual Resource Management

APPENDIX A

Secretary of Homeland Security Determination Pursuant to Section 102 of IIRIRA of 1996, as Amended

Vascular Diseases Research; 93.838, Lung Diseases Research; 93.839, Blood Diseases and Resources Research, National Institutes of Health, HHS)

Dated: March 26, 2008.

Jennifer Spaeth,

Director, Office of Federal Advisory Committee Policy.

[FR Doc. E8–6702 Filed 4–2–08; 8:45 am]

BILLING CODE 4140–01–M

DEPARTMENT OF HOMELAND SECURITY

Office of the Secretary

Determination Pursuant to Section 102 of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, as Amended

AGENCY: Office of the Secretary, Department of Homeland Security.

ACTION: Notice of determination.

SUMMARY: The Secretary of Homeland Security has determined, pursuant to law, that it is necessary to waive certain laws, regulations and other legal requirements in order to ensure the expeditious construction of barriers and roads in the vicinity of the international land border of the United States.

DATES: This Notice is effective on April 3, 2008.

Determination and Waiver: I have a mandate to achieve and maintain operational control of the borders of the United States. Public Law 109–367, § 2, 120 Stat. 2638, 8 U.S.C. 1701 note. Congress has provided me with a number of authorities necessary to accomplish this mandate. One of these authorities is found at section 102(c) of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (''IIRIRA''). Public Law 104–208, Div. C, 110 Stat. 3009–546, 3009–554 (Sept. 30, 1996) (8 U.S.C 1103 note), as amended by the REAL ID Act of 2005, Public Law 109–13, Div. B, 119 Stat. 231, 302, 306 (May 11, 2005) (8 U.S.C. 1103 note), as amended by the Secure Fence Act of 2006, Public Law 109–367, § 3, 120 Stat. 2638 (Oct. 26, 2006) (8 U.S.C. 1103 note), as amended by the Department of Homeland Security Appropriations Act, 2008, Public Law 110–161, Div. E, Title V, Section 564, 121 Stat. 2090 (Dec. 26, 2007). In Section 102(a) of IIRIRA, Congress provided that the Secretary of Homeland Security shall take such actions as may be necessary to install additional physical barriers and roads (including the removal of obstacles to detection of illegal entrants) in the vicinity of the United States border to deter illegal crossings in areas of high illegal entry into the United States. In Section 102(b) of IIRIRA, Congress has called for the installation of fencing, barriers, roads, lighting, cameras, and sensors on not less than 700 miles of the southwest border, including priority miles of fencing that must be completed by December 2008. Finally, in section 102(c) of the IIRIRA, Congress granted to me the authority to waive all legal requirements that I, in my sole discretion, determine necessary to ensure the expeditious construction of barriers and roads authorized by section 102 of IIRIRA.

I determine that the areas in the vicinity of the United States border described on the attached document, which is incorporated and made a part hereof, are areas of high illegal entry (collectively ''Project Areas''). These Project Areas are located in the States of California, Arizona, New Mexico, and Texas. In order to deter illegal crossings in the Project Areas, there is presently a need to construct fixed and mobile barriers (such as fencing, vehicle barriers, towers, sensors, cameras, and other surveillance, communication, and detection equipment) and roads in the vicinity of the border of the United States. In order to ensure the expeditious construction of the barriers and roads that Congress prescribed in the IIRIRA in the Project Areas, which are areas of high illegal entry into the United States, I have determined that it is necessary that I exercise the authority that is vested in me by section 102(c) of the IIRIRA as amended.

Accordingly, I hereby waive in their entirety, with respect to the construction of roads and fixed and mobile barriers (including, but not limited to, accessing the project area, creating and using staging areas, the conduct of earthwork, excavation, fill, and site preparation, and installation and upkeep of fences, roads, supporting elements, drainage, erosion controls, safety features, surveillance, communication, and detection equipment of all types, radar and radio towers, and lighting) in the Project Areas, all federal, state, or other laws, regulations and legal requirements of, deriving from, or related to the subject of, the following laws, as amended: The National Environmental Policy Act (Pub. L. 91–190, 83 Stat. 852 (Jan. 1, 1970) (42 U.S.C. 4321 *et seq.*)), the Endangered Species Act (Pub. L. 93–205, 87 Stat. 884 (Dec. 28, 1973) (16 U.S.C. 1531 *et seq.*)), the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act) (33 U.S.C. 1251 *et seq.*)), the National Historic Preservation Act (Pub. L. 89–665, 80 Stat. 915 (Oct. 15, 1966) (16 U.S.C. 470 *et seq.*)), the Migratory Bird Treaty Act (16 U.S.C. 703 *et seq.*), the Clean Air Act (42 U.S.C. 7401 *et seq.*), the Archeological Resources Protection Act (Pub. L. 96–95, 16 U.S.C. 470aa *et seq.*), the Safe Drinking Water Act (42 U.S.C. 300f *et seq.*), the Noise Control Act (42 U.S.C. 4901 *et seq.*), the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq.*), the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601 *et seq.*), the Archaeological and Historic Preservation Act (Pub. L. 86–523, 16 U.S.C. 469 *et seq.*), the Antiquities Act (16 U.S.C. 431 *et seq.*), the Historic Sites, Buildings, and Antiquities Act (16 U.S.C. 461 *et seq.*), the Wild and Scenic Rivers Act (Pub. L. 90–542, 16 U.S.C. 1281 *et seq.*), the Farmland Protection Policy Act (7 U.S.C. 4201 *et seq.*), the Coastal Zone Management Act (Pub. L. 92–583, 16 U.S.C. 1451 *et seq.*), the Wilderness Act (Pub. L. 88–577, 16 U.S.C. 1131 *et seq.*), the Federal Land Policy and Management Act (Pub. L. 94–579, 43 U.S.C. 1701 *et seq.*), the National Wildlife Refuge System Administration Act (Pub. L. 89–669, 16 U.S.C. 668dd–668ee), the Fish and Wildlife Act of 1956 (Pub. L. 84–1024, 16 U.S.C. 742a, *et seq.*), the Fish and Wildlife Coordination Act (Pub. L. 73–121, 16 U.S.C. 661 *et seq.*), the Administrative Procedure Act (5 U.S.C. 551 *et seq.*), the Otay Mountain Wilderness Act of 1999 (Pub. L. 106–145), Sections 102(29) and 103 of Title I of the California Desert Protection Act (Pub. L. 103–433), 50 Stat. 1827, the National Park Service Organic Act (Pub. L. 64–235, 16 U.S.C. 1, 2–4), the National Park Service General Authorities Act (Pub. L. 91–383, 16 U.S.C. 1a–1 *et seq.*), Sections 401(7), 403, and 404 of the National Parks and Recreation Act of 1978 (Pub. L. 95–625), Sections 301(a)–(f) of the Arizona Desert Wilderness Act (Pub. L. 101–628), the Rivers and Harbors Act of 1899 (33 U.S.C. 403), the Eagle Protection Act (16 U.S.C. 668 *et seq.*), the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 *et seq.*), the American Indian Religious Freedom Act (42 U.S.C. 1996), the Religious Freedom Restoration Act (42 U.S.C. 2000bb), the National Forest Management Act of 1976 (16 U.S.C. 1600 *et seq.*), and the Multiple Use and Sustained Yield Act of 1960 (16 U.S.C. 528–531).

This waiver does not supersede, supplement, or in any way modify the previous waivers published in the **Federal Register** on September 22, 2005 (70 FR 55622), January 19, 2007 (72 FR

2535), and October 26, 2007 (72 FR 60870).

I reserve the authority to make further waivers from time to time as I may determine to be necessary to accomplish the provisions of section 102 of the IIRIRA, as amended.

Dated: April 1, 2008.

Michael Chertoff,

Secretary.

[FR Doc. 08–1095 Filed 4–1–08; 2:03 pm]

BILLING CODE 4410–10–P

DEPARTMENT OF HOMELAND SECURITY

Office of the Secretary

Determination Pursuant to Section 102 of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, as Amended

AGENCY: Office of the Secretary, Department of Homeland Security.

ACTION: Notice of determination.

SUMMARY: The Secretary of Homeland Security has determined, pursuant to law, that it is necessary to waive certain laws, regulations and other legal requirements in order to ensure the expeditious construction of barriers and roads in the vicinity of the international land border of the United States.

DATES: This Notice is effective on April 3, 2008.

Determination and Waiver: The Department of Homeland Security has a mandate to achieve and maintain operational control of the borders of the United States. Public Law 109–367, Section 2, 120 Stat. 2638, 8 U.S.C. 1701 note. Congress has provided the Secretary of Homeland Security with a number of authorities necessary to accomplish this mandate. One of these authorities is found at section 102(c) of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (''IIRIRA''). Public Law 104–208, Div. C, 110 Stat. 3009–546, 3009–554 (Sept. 30, 1996) (8 U.S.C 1103 note), as amended by the REAL ID Act of 2005, Public Law 109–13, Div. B, 119 Stat. 231, 302, 306 (May 11, 2005) (8 U.S.C. 1103 note), as amended by the Secure Fence Act of 2006, Public Law 109–367, Section 3, 120 Stat. 2638 (Oct. 26, 2006) (8 U.S.C. 1103 note), as amended by the Department of Homeland Security Appropriations Act, 2008, Public Law 110–161, Div. E, Title V, Section 564, 121 Stat. 2090 (Dec. 26, 2007). In Section 102(a) of the IIRIRA, Congress provided that the Secretary of Homeland Security shall take such actions as may be necessary to install additional physical barriers and roads (including the removal of obstacles to detection of illegal entrants) in the vicinity of the United States border to deter illegal crossings in areas of high illegal entry into the United States. In Section 102(b) of the IIRIRA, Congress has called for the installation of fencing, barriers, roads, lighting, cameras, and sensors on not less than 700 miles of the southwest border, including priority miles of fencing that must be completed by December of 2008. Finally, in section 102(c) of the IIRIRA, Congress granted to me the authority to waive all legal requirements that I, in my sole discretion, determine necessary to ensure the expeditious construction of barriers and roads authorized by section 102 of the IIRIRA.

I determine that the area in the vicinity of the United States border as described in the attached document, hereinafter the Project Area, which is incorporated and made a part hereof, is an area of high illegal entry. In order to deter illegal crossings in the Project Area, there is presently a need to construct fixed and mobile barriers and roads in conjunction with improvements to an existing levee system in the vicinity of the border of the United States as a joint effort with Hidalgo County, Texas. In order to ensure the expeditious construction of the barriers and roads that Congress prescribed in the IIRIRA in the Project Area, which is an area of high illegal entry into the United States, I have determined that it is necessary that I exercise the authority that is vested in me by section 102(c) of the IIRIRA as amended. Accordingly, I hereby waive in their entirety, with respect to the construction of roads and fixed and mobile barriers (including, but not limited to, accessing the project area, creating and using staging areas, the conduct of earthwork, excavation, fill, and site preparation, and installation and upkeep of fences, roads, supporting elements, drainage, erosion controls, safety features, surveillance, communication, and detection equipment of all types, radar and radio towers, and lighting) in the Project Area, all federal, state, or other laws, regulations and legal requirements of, deriving from, or related to the subject of, the following laws, as amended: The National Environmental Policy Act (Pub. L. 91–190, 83 Stat. 852 (Jan. 1, 1970) (42 U.S.C. 4321 *et seq.*)), the Endangered Species Act (Pub. L. 93–205, 87 Stat. 884) (Dec. 28, 1973) (16 U.S.C. 1531 *et seq.*)), the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act) (33 U.S.C. 1251 *et seq.*), the National Historic Preservation Act (Pub. L. 89–665, 80 Stat. 915 (Oct. 15, 1966) (16 U.S.C. 470 *et seq.*)), the Migratory Bird Treaty Act (16 U.S.C. 703 *et seq.*), the Clean Air Act (42 U.S.C. 7401 *et seq.*), the Archeological Resources Protection Act (Pub. L. 96–95, 16 U.S.C. 470aa *et seq.*), the Safe Drinking Water Act (42 U.S.C. 300f *et seq.*), the Noise Control Act (42 U.S.C. 4901 *et seq.*), the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq.*), the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601 *et seq.*), the Archaeological and Historic Preservation Act (Pub. L. 86–523, 16 U.S.C. 469 *et seq.*), the Antiquities Act (16 U.S.C. 431 *et seq.*), the Historic Sites, Buildings, and Antiquities Act (16 U.S.C. 461 *et seq.*), the Farmland Protection Policy Act (7 U.S.C. 4201 *et seq.*), the Coastal Zone Management Act (Pub. L. 92–583, 16 U.S.C. 1451 *et seq.*), the Federal Land Policy and Management Act (Pub L. 94–579, 43 U.S.C. 1701 *et seq.*), the National Wildlife Refuge System Administration Act (Pub. L. 89–669, 16 U.S.C. 668dd–668ee), the Fish and Wildlife Act of 1956 (Pub. L. 84–1024, 16 U.S.C. 742a, *et seq.*), the Fish and Wildlife Coordination Act (Pub. L. 73–121, 16 U.S.C. 661 *et seq.*), the Administrative Procedure Act (5 U.S.C. 551 *et seq.*), the Rivers and Harbors Act of 1899 (33 U.S.C. 403), the Eagle Protection Act (16 U.S.C. 668 *et seq.*), the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 *et seq.*), the American Indian Religious Freedom Act (42 U.S.C. 1996), the Religious Freedom Restoration Act (42 U.S.C. 2000bb), and the Federal Grant and Cooperative Agreement Act of 1977 (31 U.S.C. 6303–05).

I reserve the authority to make further waivers from time to time as I may determine to be necessary to accomplish the provisions of section 102 of the IIRIRA, as amended.

Dated: April 1, 2008.

Michael Chertoff,

Secretary.

[FR Doc. 08–1096 Filed 4–1–08; 2:03 pm]

BILLING CODE 4410–10–P

APPENDIX B

Standard Design for Tactical Infrastructure

APPENDIX B

STANDARD DESIGN FOR TACTICAL INFRASTRUCTURE

A properly designed tactical infrastructure system is an indispensable tool in deterring those attempting to illegally cross the U.S. border. Tactical infrastructure is also integral to maintaining USBP's flexibility in deploying agents and enforcement operations. A formidable infrastructure acts as a force multiplier by slowing down illegal entrants and increasing the window of time that agents have to respond. Strategically developed tactical infrastructure should enable USBP managers to better utilize existing manpower when addressing the dynamic nature of terrorists, illegal aliens, and narcotics trafficking (INS 2002).

USBP apprehension statistics remain the most reliable way to codify trends in illegal migration along the border. Based on apprehension statistics, in a 2006 report on border security, the Congressional Research Service concluded that "the installation of border fencing, in combination with an increase in agent manpower and technological assets, has had a significant effect on the apprehensions made in the San Diego sector" (CRS 2006).

Since effective border enforcement requires adequate scope, depth, and variety in enforcement activity, any single border enforcement function that significantly depletes USBP's ability to satisfactorily address any other enforcement action creates exploitable opportunities for criminal elements. For example, the intense deployment of personnel resources necessary to monitor urban border areas without tactical infrastructure adversely affects the number of agents available for boat patrol, transportation check points, patrolling remote border areas, and other tasks. Tactical infrastructure reduces this effect by reinforcing critical areas, allowing the agents to be assigned to other equally important border enforcement roles (INS 2002).

Fencing

Three applications for fencing have been developed in an effort to control illegal cross-border traffic: 1) vehicle fences, 2) primary pedestrian fences that are built on the border, and 3) secondary fences that are constructed parallel to the primary pedestrian fences. These fences present a formidable physical barrier which impede cross-border violators and increases the window of time USBP agents have to respond (INS 2002). **Figure B-1** presents permanent Normandy style vehicle fence proposed for USBP El Centro Section B-1.

Fence in Section B5-B has been designed for dune conditions to ensure that sand does not built up around the fence. **Figure B-3** presents the special fence design proposed for USBP El Centro Section B-5B.

Figure B-1. Normandy Vehicle Fence

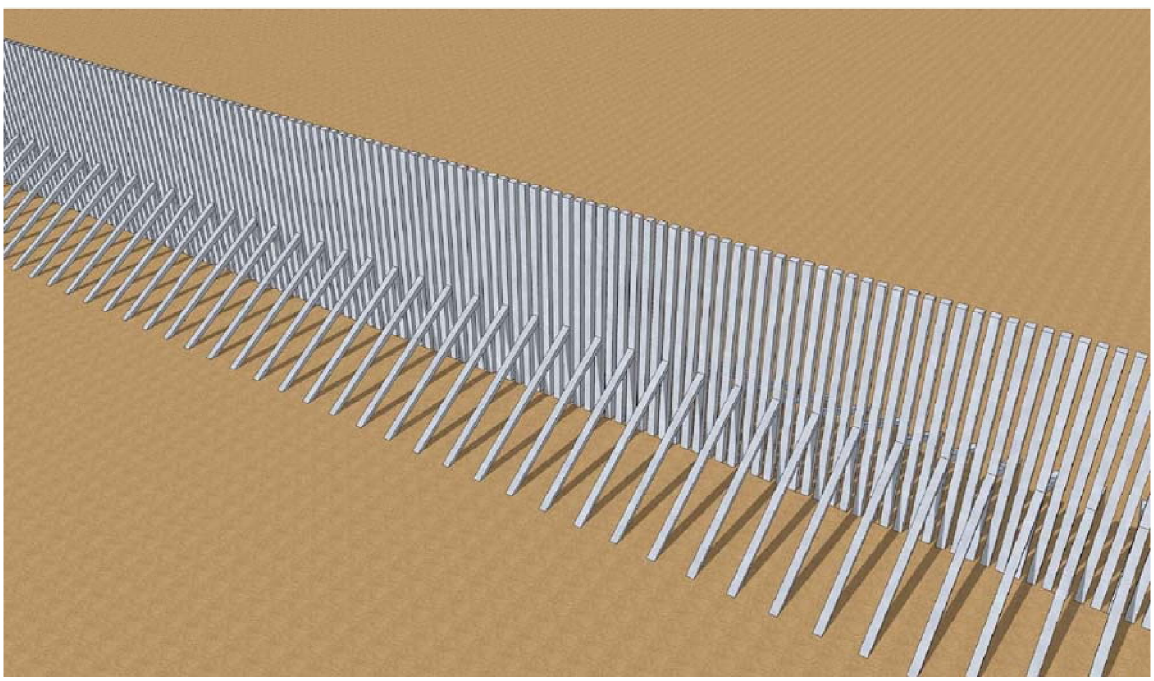


Figure B-2. PV4 Primary Pedestrian Fence Design

There are several types of primary pedestrian fence designs USBP can select for construction depending on various site conditions and law enforcement tactics employed. Each option offers relative advantages and disadvantages. Fencing composed of concrete panels, for example, is among the more cost-effective options, but USBP agents cannot see through it. USBP prefers fencing structures offering visual transparency, allowing observation of activities developing on the other side of the border. USBP would use bollard-style primary pedestrian fencing for the Proposed Action in Sections B-2, B-4, and B-5A (**Figure B-3**).

Bollard fencing has been effective in its limited deployment and can also be seen through. However, it is expensive to construct and to maintain. Landing mat fencing is composed of Army surplus carbon steel landing mats which were used to create landing strips during the Vietnam War. Chain-link fencing is relatively economical, but more easily compromised. In selecting a particular fencing design, USBP weighs various factors such as its effectiveness as a law enforcement tool, the costs associated with construction and maintenance, potential environmental impacts, and other public interest concerns. USBP continues to develop fence designs to best address these objectives and constraints.

Figure B-3. Bollard Fence

Patrol Roads

Patrol roads provide USBP agents with quick and direct access to anyone conducting illegal activity along the border, and allow agents access to the various components of the tactical infrastructure system. Patrol roads typically run parallel to and a few feet north of the pedestrian fence. Patrol roads are typically unpaved, but in some cases “all-weather” roads are necessary to ensure continual USBP access (INS 2002).

Lighting

Two types of lighting (permanent and portable) might be constructed in specific urban locations. Illegal entries are often accomplished by using the cover of darkness, which would be eliminated by lighting. Lighting acts as a deterrent to cross-border violators and as an aid to USBP agents in capturing illegal aliens, smugglers, terrorists, or terrorist weapons after they have entered the United States (INS 2001). Lighting locations are determined by USBP based on projected operational needs of the specific area.

The permanent lighting would be stadium-type lights on approximately 30- to 40-foot high poles with two to four lights per pole. Each light would have a range of 400 to 1,000 watts, with lower-wattage bulbs used where feasible. Wooden poles, encased in concrete and steel culvert pipe to prevent them from being cut down, would most often be used, although steel poles with concrete footings might also be used. The poles might be existing poles or they might need to be installed. Electricity would be run in overhead lines unless local regulations require the lines to be underground (DHS 2004). Lights would operate from dusk to dawn. Light poles adjacent to U.S. IBWC levees would be coordinated with and approved by the U.S. IBWC. The final placement and direction of lighting has been and would continue to be coordinated with the USFWS, with the USFWS having final review over both placement and direction along each fence section.

Portable lights are self-contained units with generators that can be quickly moved to meet USBP operational requirements. Portable lights are powered by a 6-kilowatt self-contained diesel generator. Portable lights would generally operate continuously every night and would require refueling every day prior to the next night’s operation. The portable light systems can be towed to the desired location by USBP vehicles, but they are typically spaced approximately 100 to 400 feet apart, depending upon topography and operational needs. Each portable light would have a light fan directed toward the fence to produce an illuminated area of 100 ft^2. The lighting systems would have shields placed over the lamps to reduce or eliminate the effects of backlighting. Effects from the lighting would occur along the entire corridor where they could be placed; however, in reality, only parts of the fence would be illuminated at a given time since the portable lights would be periodically relocated to provide the most effective deterrent and enforcement strategy (INS 2001).

References

CRS 2006	Congressional Research Service (CRS). 2006. "Report For Congress." *Border Security: Barriers Along the U.S. International Border*. 12 December 2006.
DHS 2004	U.S. Department of Homeland Security (DHS). 2004. *Environmental Impact Statement for Operation Rio Grande*. CBP, Washington D.C. April 2004.
INS 2001	Immigration and Naturalization Service (INS). 2001. *Final Environmental Assessment, Portable Lights within the Naco Corridor*. Cochise County, Arizona. December 2001.
INS 2002	Immigration and Naturalization Service (INS). 2002. *Draft Environmental Impact Statement for the Completion of the 14-Mile Border Infrastructure System, San Diego, CA*. Immigration and naturalization Service. January 2002

APPENDIX C

Air Quality Emissions Calculations

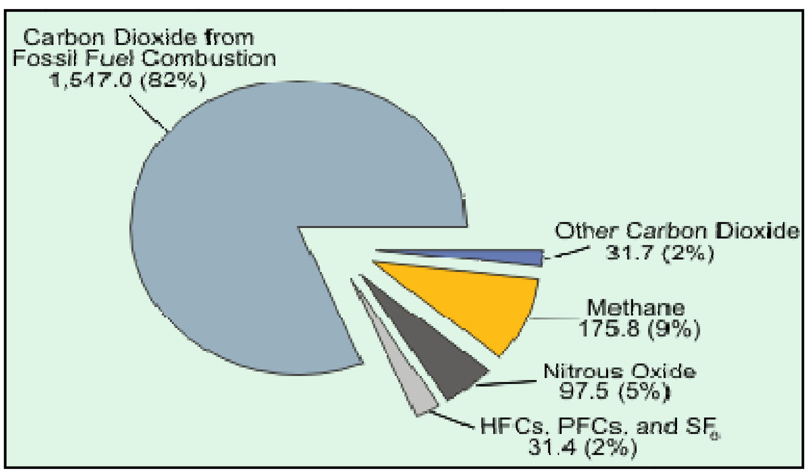
APPENDIX C
AIR QUALITY EMISSIONS CALCULATIONS

Greenhouse Gases

In April 2007, the U.S. Supreme Court declared that carbon dioxide (CO_2) and other greenhouse gases are air pollutants under the Clean Air Act (CAA). The Court declared that the U.S. Environmental Protection Agency (USEPA) has the authority to regulate emissions from new cars and trucks under the landmark environment law.

Many chemical compounds found in the Earth's atmosphere act as "greenhouse gases." These gases allow sunlight to enter the atmosphere freely. When sunlight strikes the Earth's surface, some of it is reflected back towards space as infrared radiation (heat). Greenhouse gases absorb this infrared radiation and trap the heat in the atmosphere. Over time, the trapped heat results in the phenomenon of global warming.

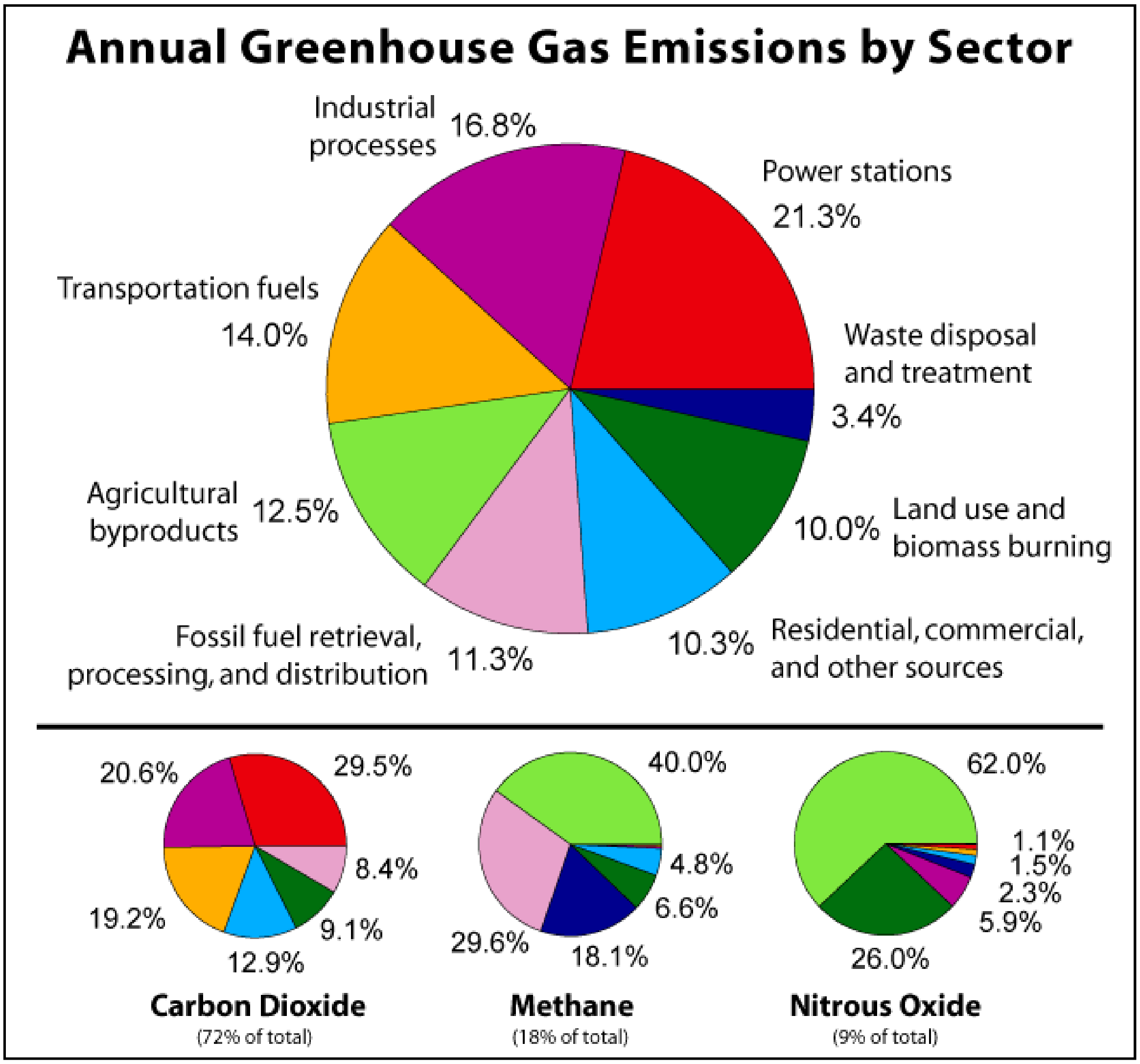
Many gases exhibit these "greenhouse" properties. The sources of the majority of greenhouse gases come mostly from natural sources but are also contributed to by human activity and are shown in **Figure C-1**. It is not possible to state that a specific gas causes a certain percentage of the greenhouse effect because the influences of the various gases are not additive.



Source: Energy Information Administration 2003

Figure C-1. Greenhouse Gas Emissions From Burning of Gas (Million Metric Tons of Carbon Equivalent)

Figure C-2 displays the annual greenhouse gas emissions by sector in the United States. Most government agencies and military installations are just beginning to establish a baseline for their operations and their impact on the greenhouse effect. Since the USEPA has not promulgated an ambient standard or *de minimis* level for CO_2 emissions for Federal actions, there is no standard value to compare an action against in terms of meeting or violating the standard. Hence, we shall attempt to establish the effects on air quality as a result of the amount of CO_2 produced by the Federal action and what could be done to minimize the impact of these emissions.



Source: Rosmarino 2006

Figure C-2. Annual Greenhouse Gas Emissions by Sector

References

Energy Information Administration. 2003. "Greenhouse Gases, Climate Change, and Energy." EIA Brochure. 2003. Available online: <*http://www.eia.doe.gov/oiaf/1605/ggccebro/chapter1.html*>. Last updated April 2, 2004. Accessed November 4, 2007.

Tanyalynnette Rosmarino, Director of Field Engineering, Northeast, BigFix, Inc. 2006. "A Self-Funding Enterprise Solution to Reduce Power Consumption and Carbon Emissions." Slide presentation for the NYS Forum's May Executive Committee Meeting Building an Energy Smart IT Environment. 2006. Available online: <*http://www.nysforum.org/documents/html/2007/execcommittee/may/enterprisepowerconsumptionreduction_files/800x600/slide1.html*>. Accessed November 4, 2007.

THIS PAGE INTENTIONALLY LEFT BLANK

Summary Summarizes total emissions by calendar year.

Combustion Estimates emissions from non-road equipment exhaust as well as painting.

Fugitive Estimates fine particulate emissions from earthmoving, vehicle traffic, and windblown dust

Grading Estimates the number of days of site preparation, to be used for estimating heavy equipment exhaust and earthmoving dust emissions

AQCR Tier Report Summarizes total emissions for the Metropolitan Philadelphia Interstate AQCR Tier Reports for 2001, to be used to compare project to regional emissions.

2008 Emissions

		NO_x (ton)	VOC (ton)	CO (ton)	SO_2 (ton)	PM_{10} (ton)	$PM_{2.5}$ (ton)	CO_2 (ton)
Alternative 2	Construction Combustion	3.998	0.247	1.508	0.080	0.244	0.237	474.387
	Construction Fugitive Dust	-	-	-	-	66.877	9.798	-
	Construction Generators	19.095	1.559	4.113	1.256	1.342	1.256	710.109
	TOTAL Alternative 2	***23.093***	***1.806***	***5.622***	***1.336***	***68.464***	***11.291***	***1,184.496***
Alternative 3	Construction Combustion	8.432	0.522	3.181	0.169	0.515	0.500	1,000.659
	Construction Fugitive Dust	-	-	-	-	167.169	24.491	-
	Construction Generators	19.095	1.559	4.113	1.256	1.342	1.256	710.109
	TOTAL Alternative 3	***27.527***	***2.081***	***7.295***	***1.424***	***169.027***	***26.247***	***1,710.768***

2009+ Emissions

		NO_x (ton)	VOC (ton)	CO (ton)	SO_2 (ton)	PM_{10} (ton)	$PM_{2.5}$ (ton)	CO_2 (ton)
Alternative 2 or 3	Operations & Maintenance	2.164	0.273	2.003	0.002	0.078	0.067	248.148
	TOTAL Alternative 2 or 3	***2.164***	***0.273***	***2.003***	***0.002***	***0.078***	***0.067***	***248.148***

Since future year budgets were not readily available, actual 2001 air emissions inventories for the counties were used as an approximation of the regional inventory. Because the Project is several orders of magnitude below significance, the conclusion would be the same, regardless of whether future year budget data set were used.

Southeast Desert Air Quality Control Region

	Point and Area Sources Combined					
Year	**NO_x (tpy)**	**VOC (tpy)**	**CO (tpy)**	**SO_2 (tpy)**	**PM_{10} (tpy)**	**$PM_{2.5}$ (tpy)**
2001	87,859	52,726	263,307	5,731	59,359	21,073

Source: USEPA-AirData NET Tier Report (http://www.epa.gov/air/data/geosel.html). Site visited on 3 April 2007.

Determination Significance (Significance Threshold = 10%)

Alternative 2

	Point and Area Sources Combined					
	NO_x (tpy)	**VOC (tpy)**	**CO (tpy)**	**SO_2 (tpy)**	**PM_{10} (tpy)**	**$PM_{2.5}$ (tpy)**
Regional Emissions	87,859	52,726	263,307	5,731	59,359	21,073
CY2008 Emissions (Highest Year)	23.0926	1.8062	5.6216	1.3356	68.4639	11.291
Alternative 2 %	**0.0263%**	**0.0034%**	**0.0021%**	**0.0233%**	**0.1153%**	**0.0536%**

Determination Significance (Significance Threshold = 10%)

Alternative 3

	Point and Area Sources Combined					
	NO_x (tpy)	**VOC (tpy)**	**CO (tpy)**	**SO_2 (tpy)**	**PM_{10} (tpy)**	**$PM_{2.5}$ (tpy)**
Regional Emissions	87,859	52,726	263,307	5,731	59,359	21,073
CY2008 Emissions (Highest Year)	27.5274	2.0806	7.2947	1.4243	169.0267	26.2472
Alternative 3 %	**0.0313%**	**0.0039%**	**0.0028%**	**0.0249%**	**0.2848%**	**0.1246%**

Combustion Emissions for CY 2008

Combustion Emissions of VOC, NO_x, SO_2, CO, $PM_{2.5}$, and PM_{10} Due to Construction

Includes:

All Construction for pedestrian fences and patrol road 14,129,280 ft^2 324.36 acres

Total Disturbed Area: 14,129,280 ft^2
Construction Duration: 10.0 months
Annual Construction Activity: 190 days/yr

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)	CO_2 (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87	1456.90
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64	1141.65
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47	4941.53

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.
c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Project will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.
d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)						
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$	CO_2
Grading Equipment	32	1332.519	82.464	502.717	26.650	81.456	79.013	158128.843

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days
Grading:	14,129,280	324.36	6

(from "CY2008 Grading" worksheet)

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2
Grading Equipment	7,995.12	494.78	3,016.30	159.90	488.74	474.08	948,773
Total Emissions (lbs):	**7,995.12**	**494.78**	**3,016.30**	**159.90**	**488.74**	**474.08**	**948,773**

Results: Total Project Annual Emission Rates

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2
Total Project Emissions (lbs)	7,995.12	494.78	3,016.30	159.90	488.74	474.08	948,773
Total Project Emissions (tons)	3.9976	0.2474	1.5082	0.0800	0.2444	0.2370	474.3865

Fugitive Dust Emissions for CY 2008

Calculation of PM_{10} Emissions Due to Site Preparation (Uncontrolled).

User Input Parameters / Assumptions

Acres graded per year:	324.36	acres/yr	(From Combustion worksheet)
Grading days/yr:	5.44	days/yr	(From Grading worksheet)
Exposed days/yr:	14	assumed days/yr graded area is exposed with BMPs	
Grading Hours/day:	8	hr/day	
Soil piles area fraction:	0.10	(assumed fraction of site area covered by soil piles)	
Soil percent silt, s:	8.5	%	(mean silt content; expected range: 0.56 to 23, AP-42 Table 13.2.2-1)
Soil percent moisture, M:	12	%	(http://www.cpc.noaa.gov/products/soilmst/w.shtml)
Annual rainfall days, p:	30	days/yr rainfall exceeds 0.01 inch/day (AP-42 Fig 13.2.2-1)	
Wind speed > 12 mph %, I:	23	%	Ave. of wind speed at San Diego, CA (http://www.epa.gov/ttn/naaqs/ozone/areas/windr/23188.gif)
Fraction of TSP, J:	0.5	per California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993, p. A9-99	
Mean vehicle speed, S:	5	mi/hr	(On-site)
Dozer path width:	8	ft	
Qty construction vehicles:	100.00	vehicles	(From Grading worksheet)
On-site VMT/vehicle/day:	5	mi/veh/day	(Excluding bulldozer VMT during grading)
PM_{10} Adjustment Factor k	1.5	lb/VMT	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor a	0.9	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor b	0.45	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
Mean Vehicle Weight W	40	tons	assumed for aggregate trucks
$PM_{2.5}$ fraction of PM_{10}	14	%	(AP-42 Section 11.9, 7/98, Table 11.9 for Bulldozing overburdon)
$PM_{2.5}$ fraction of PM_{10}	5	%	(AP-42 Section 11.9, 7/98, Table 11.9 for Grading)
$PM_{2.5}$ fraction of PM_{10}	10	%	(AP-42 Table 13.2.2-2 12/03 'k' factor for PM2.5 for vehicle traffic on unpaved roads)
$PM_{2.5}$ fraction of PM_{10}	15	%	(AP-42 Section 13.2.5, 11/06, page 13.2.6-3 for wind-generated emissions)

TSP - Total Suspended Particulate
VMT - Vehicle Miles Traveled

Emissions Due to Soil Disturbance Activities

Operation Parameters (Calculated from User Inputs)

Grading duration per acre	0.1 hr/acre	
Bulldozer mileage per acre	1 VMT/acre	(Miles traveled by bulldozer during grading)
Construction VMT per day	500 VMT/day	
Construction VMT per acre	8.4 VMT/acre	(Travel on unpaved surfaces within site)

Equations Used (Corrected for PM_{10})

Operation	Empirical Equation	Units	AP-42 Section (5th Edition)
Bulldozing	$0.75(s^{1.5})/(M^{1.4})$	lbs/hr	Table 11.9-1, Overburden
Grading	$(0.60)(0.051)s^{2.0}$	lbs/VMT	Table 11.9-1,
Vehicle Traffic (unpaved roads)	$[(k(s/12)^{a}(W/3)^{b})]\ [(365-P)/365]$	lbs/VMT	Section 13.2.2

Source: Compilation of Air Pollutant Emission Factors, Vol. I, USEPA AP-42, Section 11.9 dated 10/98 and Section 13.2 dated 12/03

Calculation of PM_{10} Emission Factors for Each Operation

Operation	Emission Factor (mass/ unit)	Operation Parameter	Emission Factor (lbs/ acre)
Bulldozing	0.57 lbs/hr	0.1 hr/acre	0.06 lbs/acre
Grading	0.77 lbs/VMT	1 VMT/acre	0.80 lbs/acre
Vehicle Traffic (unpaved roads)	3.24 lbs/VMT	8.4 VMT/acre	27.20 lbs/acre

Emissions Due to Wind Erosion of Soil Piles and Exposed Graded Surface

Reference: California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993.

Soil Piles EF = 1.7(s/1.5)[(365 - p)/235](I/15)(J) = (s)(365 - p)(I)(J)/(3110.2941), p. A9-99.

Soil Piles PM_{10} EF = 10.5 lbs/day/acre covered by soil piles

Consider soil piles area fraction so that EF applies to graded area

Soil piles area fraction: 0.10 (Fraction of site area covered by soil piles)
Soil Piles PM_{10} EF = 1.05 lbs/day/acres graded

Graded Surface PM_{10} EF = 26.4 lbs/day/acre (default value suggested in CEQA Manual, p. A9-93).

Calculation of Annual Emissions

Source	Emission Factor	Graded Acres/yr	Exposed days/yr	PM_{10} Emissions lbs/yr	PM_{10} Emissions tons/yr	$PM_{2.5}$ Emissions tons/yr
Bulldozing	0.06 lbs/acre	324.36	NA	19	0.010	0.0014
Grading	0.80 lbs/acre	324.36	NA	259	0.130	0.006
Vehicle Traffic	27.20 lbs/acre	324.36	NA	8,823	4.411	0.441
Erosion of Soil Piles	1.05 lbs/acre/day	324.36	14	4,768	2.384	0.358
Erosion of Graded Surface	26.40 lbs/acre/day	324.36	14	119,885	59.942	8.991
TOTAL				133,755	66.88	9.798

Soil Disturbance PM10 EF: 28.06 lbs/acre
Wind Erosion PM10 EF: 27.45 lbs/acre/day

Back calculate to get PM_{10} EF: 75.87 lbs/acre/grading day

Grading Schedule for CY 2008

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 324.36 acres/yr (from Combustion Worksheet)

Qty Equipment: 100.00 (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	324.36	40.55
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	324.36	158.58
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	162.18	163.53
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	162.18	67.09
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	324.36	113.76
TOTAL								543.51

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 543.51
Qty Equipment: 100.00
Grading days/yr: 5.44

Combustion Emissions for CY 2008

Combustion Emissions of VOC, NO_x, SO_2, CO, $PM_{2.5}$, and PM_{10} Due to Construction

Includes:

All Construction for pedestrian fences and patrol road	35,323,200 ft^2	810.91 acres
Total Disturbed Area:	35,323,200 ft^2	
Construction Duration:	10.0 months	
Annual Construction Activity:	190 days/yr	

Emission Factors Used for Construction Equipment

References: Guide to Air Quality Assessment, SMAQMD, 2004; and U.S. EPA NONROAD Emissions Model, Version 2005.0.0
Emission factors are taken from the NONROAD model and were provided to e²M by Larry Landman of the Air Quality and Modeling Center (Landman.Larry@epamail.epa.gov) on 12/14/07. Factors provided are for the weighted average US fleet for CY2007.
Assumptions regarding the type and number of equipment are from SMAQMD Table 3-1 unless otherwise noted.

Grading

Equipment	No. Reqd.[a] per 10 acres	NO_x (lb/day)	VOC[b] (lb/day)	CO (lb/day)	SO_2[c] (lb/day)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)	CO_2 (lb/day)
Bulldozer	1	13.60	0.96	5.50	1.02	0.89	0.87	1456.90
Motor Grader	1	9.69	0.73	3.20	0.80	0.66	0.64	1141.65
Water Truck	1	18.36	0.89	7.00	1.64	1.00	0.97	2342.98
Total per 10 acres of activity	3	41.64	2.58	15.71	0.83	2.55	2.47	4941.53

a) The SMAQMD 2004 guidance suggests a default equipment fleet for each activity, assuming 10 acres of that activity, (e.g., 10 acres of grading, 10 acres of paving, etc.). The default equipment fleet is increased for each 10 acre increment in the size of the construction project. That is, a 26 acre project would round to 30 acres and the fleet size would be three times the default fleet for a 10 acre project.
b) The SMAQMD 2004 reference lists emission factors for reactive organic gas (ROG). For the purposes of this worksheet ROG = VOC. The NONROAD model contains emissions factors for total HC and for VOC. The factors used here are the VOC factors.
c) The NONROAD emission factors assume that the average fuel burned in nonroad trucks is 1100 ppm sulfur. Trucks that would be used for the Project will all be fueled by highway grade diesel fuel which cannot exceed 500 ppm sulfur. These estimates therefore over-estimate SO2 emissions by more than a factor of two.
d) Typical equipment fleet for building construction was not itemized in SMAQMD 2004 guidance. The equipment list above was assumed based on SMAQMD 1994 guidance.

PROJECT-SPECIFIC EMISSION FACTOR SUMMARY

Source	Equipment Multiplier*	Project-Specific Emission Factors (lb/day)						
		NO_x	VOC	CO	SO_2**	PM_{10}	$PM_{2.5}$	CO_2
Grading Equipment	81	3372.939	208.736	1272.502	67.459	206.187	200.001	400263.634

*The equipment multiplier is an integer that represents units of 10 acres for purposes of estimating the number of equipment required for the project.

**Emission factor is from the evaporation of solvents during painting, per "Air Quality Thresholds of Significance", SMAQMD, 1994

Example: SMAQMD Emission Factor for Grading Equipment NOx = (Total Grading NOx per 10 acre)*(Equipment Multiplier)

Summary of Input Parameters

	Total Area (ft^2)	Total Area (acres)	Total Days	
Grading:	35,323,200	810.91	5	(from "CY2008 Grading" worksheet)

Total Project Emissions by Activity (lbs)

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2
Grading Equipment	16,864.70	1,043.68	6,362.51	337.29	1,030.93	1,000.01	2,001,318
Total Emissions (lbs):	**16,864.70**	**1,043.68**	**6,362.51**	**337.29**	**1,030.93**	**1,000.01**	**2,001,318**

Results: Total Project Annual Emission Rates

	NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2
Total Project Emissions (lbs)	16,864.70	1,043.68	6,362.51	337.29	1,030.93	1,000.01	2,001,318
Total Project Emissions (tons)	8.4323	0.5218	3.1813	0.1686	0.5155	0.5000	1,000.6591

Fugitive Dust Emissions for CY 2008

Calculation of PM_{10} Emissions Due to Site Preparation (Uncontrolled).

User Input Parameters / Assumptions

Acres graded per year:	810.91	acres/yr	(From Combustion worksheet)
Grading days/yr:	4.53	days/yr	(From Grading worksheet)
Exposed days/yr:	14	assumed days/yr graded area is exposed with BMPs	
Grading Hours/day:	8	hr/day	
Soil piles area fraction:	0.10	(assumed fraction of site area covered by soil piles)	
Soil percent silt, s:	8.5	%	(mean silt content; expected range: 0.56 to 23, AP-42 Table 13.2.2-1)
Soil percent moisture, M:	12	%	(http://www.cpc.noaa.gov/products/soilmst/w.shtml)
Annual rainfall days, p:	30	days/yr rainfall exceeds 0.01 inch/day (AP-42 Fig 13.2.2-1)	
Wind speed > 12 mph %, I:	23	%	Ave. of wind speed at San Diego, CA (http://www.epa.gov/ttn/naaqs/ozone/areas/windr/23188.gif)
Fraction of TSP, J:	0.5	per California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993, p. A9-99	
Mean vehicle speed, S:	5	mi/hr	(On-site)
Dozer path width:	8	ft	
Qty construction vehicles:	300.00	vehicles	(From Grading worksheet)
On-site VMT/vehicle/day:	5	mi/veh/day	(Excluding bulldozer VMT during grading)
PM_{10} Adjustment Factor k	1.5	lb/VMT	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor a	0.9	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
PM_{10} Adjustment Factor b	0.45	(dimensionless)	(AP-42 Table 13.2.2-2 12/03 for PM_{10} for unpaved roads)
Mean Vehicle Weight W	40	tons	assumed for aggregate trucks
$PM_{2.5}$ fraction of PM_{10}	14	%	(AP-42 Section 11.9, 7/98, Table 11.9 for Bulldozing overburdon)
$PM_{2.5}$ fraction of PM_{10}	5	%	(AP-42 Section 11.9, 7/98, Table 11.9 for Grading)
$PM_{2.5}$ fraction of PM_{10}	10	%	(AP-42 Table 13.2.2-2 12/03 'k' factor for PM2.5 for vehicle traffic on unpaved roads)
$PM_{2.5}$ fraction of PM_{10}	15	%	(AP-42 Section 13.2.5, 11/06, page 13.2.6-3 for wind-generated emissions)

TSP - Total Suspended Particulate
VMT - Vehicle Miles Traveled

Emissions Due to Soil Disturbance Activities

Operation Parameters (Calculated from User Inputs)

Grading duration per acre	0	hr/acre	
Bulldozer mileage per acre	1	VMT/acre	(Miles traveled by bulldozer during grading)
Construction VMT per day	1500	VMT/day	
Construction VMT per acre	8.4	VMT/acre	(Travel on unpaved surfaces within site)

Equations Used (Corrected for PM_{10})

Operation	Empirical Equation	Units	AP-42 Section (5th Edition)
Bulldozing	$0.75(s^{1.5})/(M^{1.4})$	lbs/hr	Table 11.9-1, Overburden
Grading	$(0.60)(0.051)s^{2.0}$	lbs/VMT	Table 11.9-1,
Vehicle Traffic (unpaved roads)	$[(k(s/12)^{a}(W/3)^{b})]\ [(365-P)/365]$	lbs/VMT	Section 13.2.2

Source: Compilation of Air Pollutant Emission Factors, Vol. I, USEPA AP-42, Section 11.9 dated 10/98 and Section 13.2 dated 12/03

Calculation of PM_{10} Emission Factors for Each Operation

Operation	Emission Factor (mass/ unit)	Operation Parameter	Emission Factor (lbs/ acre)
Bulldozing	0.57 lbs/hr	0 hr/acre	0.00 lbs/acre
Grading	0.77 lbs/VMT	1 VMT/acre	0.80 lbs/acre
Vehicle Traffic (unpaved roads)	3.24 lbs/VMT	8.4 VMT/acre	27.20 lbs/acre

Emissions Due to Wind Erosion of Soil Piles and Exposed Graded Surface

Reference: California Environmental Quality Act (CEQA) Air Quality Handbook, SCAQMD, 1993.

Soil Piles EF = 1.7(s/1.5)[(365 - p)/235](I/15)(J) = (s)(365 - p)(I)(J)/(3110.2941), p. A9-99.

Soil Piles PM_{10} EF = 10.5 lbs/day/acre covered by soil piles

Consider soil piles area fraction so that EF applies to graded area

Soil piles area fraction: 0.10 (Fraction of site area covered by soil piles)
Soil Piles PM_{10} EF = 1.05 lbs/day/acres graded

Graded Surface PM_{10} EF = 26.4 lbs/day/acre (default value suggested in CEQA Manual, p. A9-93).

Calculation of Annual Emissions

Source	Emission Factor	Graded Acres/yr	Exposed days/yr	PM_{10} Emissions lbs/yr	PM_{10} Emissions tons/yr	$PM_{2.5}$ Emissions tons/yr
Bulldozing	0.00 lbs/acre	810.91	NA	0	0.000	0.0000
Grading	0.80 lbs/acre	810.91	NA	649	0.324	0.016
Vehicle Traffic	27.20 lbs/acre	810.91	NA	22,057	11.028	1.103
Erosion of Soil Piles	1.05 lbs/acre/day	810.91	14	11,920	5.960	0.894
Erosion of Graded Surface	26.40 lbs/acre/day	810.91	14	299,712	149.856	22.478
TOTAL				334,338	167.17	24.491

Soil Disturbance PM10 EF: 28.00 lbs/acre
Wind Erosion PM10 EF: 27.45 lbs/acre/day

Back calculate to get PM_{10} EF: 91.03 lbs/acre/grading day

Grading Schedule for CY 2008

Estimate of time required to grade a specified area.

Input Parameters

Construction area: 810.91 acres/yr (from Combustion Worksheet)

Qty Equipment: 300.00 (calculated based on 3 pieces of equipment for every 10 acres)

Assumptions.

Terrain is mostly flat.
An average of 6" soil is excavated from one half of the site and backfilled to the other half of the site; no soil is hauled off-site or borrowed.
200 hp bulldozers are used for site clearing.
300 hp bulldozers are used for stripping, excavation, and backfill.
Vibratory drum rollers are used for compacting.
Stripping, Excavation, Backfill and Compaction require an average of two passes each.
Excavation and Backfill are assumed to involve only half of the site.

Calculation of days required for one piece of equipment to grade the specified area.

Reference: Means Heavy Construction Cost Data, 19th Ed., R. S. Means, 2005.

Means Line No.	Operation	Description	Output	Units	Acres per equip-day)	equip-days per acre	Acres/yr (project-specific)	Equip-days per year
2230 200 0550	Site Clearing	Dozer & rake, medium brush	8	acre/day	8	0.13	810.91	101.36
2230 500 0300	Stripping	Topsoil & stockpiling, adverse soil	1,650	cu. yd/day	2.05	0.49	810.91	396.44
2315 432 5220	Excavation	Bulk, open site, common earth, 150' haul	800	cu. yd/day	0.99	1.01	405.45	408.83
2315 120 5220	Backfill	Structural, common earth, 150' haul	1,950	cu. yd/day	2.42	0.41	405.45	167.73
2315 310 5020	Compaction	Vibrating roller, 6 " lifts, 3 passes	2,300	cu. yd/day	2.85	0.35	810.91	284.41
TOTAL								1358.77

Calculation of days required for the indicated pieces of equipment to grade the designated acreage.

(Equip)(day)/yr: 1358.77
Qty Equipment: 300.00
Grading days/yr: 4.53

Emissions from Diesel Powered Generators for Construction Equipment & Portable Lights

Diesel Powered Generator Emission Factors

NO_x	4.41	lb/MMBtu
VOC	0.36	lb/MMBtu
CO	0.95	lb/MMBtu
SO_x	0.29	lb/MMBtu
PM_{10}	0.31	lb/MMBtu
$PM_{2.5}$	0.29	lb/MMBtu
CO_2	164	lb/MMBtu

Note: Generators horsepower output capacity is only 0.363 percent efficient (AP-42 Chapter 3.3).
Source: USEPA AP-42 Volume I, Stationary Internal Combustion Sources, Table 3.3-1 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)
As per Appendix A of SCAQMD's "Final Methodology to Calculate PM2.5 and PM2.5 Significance Thresholds" (October 2006), the PM2.5/PM10 fraction for gasoline combustion is assumed to be 0.920 for off-road diesel equipment.

Emissions from Generators for Construction Equipment

The Project would require six diesel powered generators to power construction equipment. These generators would operate approximately 8 hours per day for 190 working days.

Number of Generators	6	
Maximum Hours of Operation	8	hrs/day
Number of Construction Days	190	
Total Generator Capacity	75	hp
Hourly Rate	0.5262	MMBtu/hr
Annual Use	4,799	MMBtu/yr

Example: 1hp=0.002546966 MMBtu/Hr
Hourly Rate (MMBtu) = (75 Hp/0.363)*(0.002546699 MMBtu/hr) =0.5262 MMBtu/hr
Annual Use (MMBtu) = (Number of Generator * Hours Operation/Day * Number of Construction Days) = (6*8*190*0.5262) = 4,799 MMBtu/yr

Emissions (Diesel)

NO_x	10.581	tpy
VOC	0.864	tpy
CO	2.279	tpy
SO_x	0.696	tpy
PM_{10}	0.744	tpy
$PM_{2.5}$	0.696	tpy
CO_2	393.497	tpy

Example: Total NOx Emissions = (Annual MMBtu/year*(EF)/2000 = (4,799*4.41)/2000 = 10.581 tpy

Emissions from Generators for Portable Lights

To be conservative, it was assumed that up to 30 portable light units would be needed for construction. These portable lights are powered by a 6-kilowatt self-contained diesel generators. Portable lights would generally operate continuously every night (approximately 12 hours) 190 days per year.

Number of Generators	30	
Maximum Hours of Operation	12	hrs/day
Number of Operational Days	190	

Total Generator Capacity	8	hp
Hourly Rate	0.0564	MMBtu/hr
Annual Use	3,861	MMBtu/yr

Example: 1hp=0.002546966 MMBtu/Hr
Hourly Rate (MMBtu) = (8 Hp/0.363)*(0.002546699 MMBtu/hr) = 0.0564 MMBtu/hr
Annual Use (MMBtu) = (Number of Generator * Hours Operation/Day * Number of Operational Days) = (30*12*190*0.0564) = 3,861 MMBtu/yr

Emissions (Diesel)

NO_x	8.514	tpy
VOC	0.695	tpy
CO	1.834	tpy
SO_x	0.560	tpy
PM_{10}	0.598	tpy
$PM_{2.5}$	0.560	tpy
CO_2	316.613	tpy

Example: Total NOx Emissions = (Annual MMBtu/year*(EF)/2000 = (3,861*4.41)/2000 = 8.514 tpy

Operations & Maintenance

Following completion of construction activities at the end of CY 2008, border patrol operations along the fence sections would occur. The combined total of all fence sections, once contructed, would total approximately 45 miles. It is anticipated that operations would be similar to ongoing operations in the El Centro Sector.

Project Assumptions:

5 maintenance vehicles operate per day
100 miles traveled per vehicle per workday, round trip
365 workdays per year

Annual Vehicle Miles Traveled (VMT): **182,500 miles/year**
VMT in miles/year = (5 vehicles) * (100 miles/vehicle/day) * (365 days/year)

Vehicle Class: >8,500 pounds
Vehicle Year: 2008

Emissions Factors (in pounds/mile)						
NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2
2.37E-02	2.99E-03	2.19E-02	2.56E-05	8.56E-04	7.39E-04	2.72E+00

Source: South Coast Air Quality Management District. EMFAC 2007 (ver 2.3) On-Road Emissions Factors. Last updated November 9, 2007. Available online: <http://www.aqmd.gov/ceqa/handbook/onroad/onroad.html>. Accessed January 23, 2008.

Note: Assumed that ROG = VOC, for purposes of analysis.

Estimated Air Pollutant Emissions Associated with Operations & Maintenance Activities (2009 and beyond):

Emissions (in tons per year)						
NO_x	VOC	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2
2.164	0.273	2.003	0.002	0.078	0.067	248.148

Emissions in tons/year = (Vehicle miles/year) * (Emissions Factor in pounds/mile) * (1 ton/2000 pounds)

Southeast Desert Air Quality Control Region

			Area Source Emissions						Point Source Emissions					
Row # SORT	State	County	CO	NOx	PM10	PM2.5	SO2	VOC	CO	NOx	PM10	PM2.5	SO2	VOC
1	CA	Imperial Co	55,867	15,887	15,306	4,816	195	11,186	216	796	885	416	68.9	67.3
2	CA	Kern Co	200,112	54,605	39,554	13,636	1,651	38,899	7,112	16,571	3,614	2,205	3,816	2,574
3	CA	Los Angeles Co	1,544,169	254,667	63,478	28,466	7,461	232,906	18,187	21,335	5,022	4,474	9,170	18,649
4	CA	Riverside Co	341,679	51,314	42,853	12,301	575	44,419	1,031	1,494	474	375	98.1	1,822
5	CA	San Bernardino Co	331,485	81,596	33,305	13,727	1,602	46,991	6,769	27,891	5,764	4,728	1,646	3,298
Grand Total			255,979	70,492	54,860	18,452	1,846	50,085	7,328	17,367	4,499	2,621	3,885	2,641

SOURCE:
http://www.epa.gov/air/data/geosel.html
USEPA - AirData NET Tier Report
*Net Air pollution sources (area and point) in tons per year (2001)
Site visited on 2 October 2007.

Southeast Desert AQCR (40 CFR 81.167): Imperial County, portions of Kern County, portions of Los Angeles County, portions of Riverside County, and portions of San Bernardino County, California

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX D

Biological Survey Report

BIOLOGICAL SURVEY REPORT

FOR

CONSTRUCTION, MAINTENANCE, AND OPERATION OF TACTICAL INFRASTRUCTURE EL CENTRO SECTOR, CALIFORNIA

U.S. DEPARTMENT OF HOMELAND SECURITY
CUSTOMS AND BORDER PROTECTION
U.S. BORDER PATROL
EL CENTRO SECTOR, CALIFORNIA

Prepared by

Solutions Today for a Sustainable Tomorrow

APRIL 2008

ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
ATV	all-terrain vehicles
BLM	U.S. Bureau of Land Management
BMP	Best Management Practice
BSR	Biological Survey Report
CBP	U.S. Customs and Border Protection
CFR	Code of Federal Regulations
CDFA	California Department of Food and Agriculture
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CWA	Clean Water Act
EPA	Environmental Protection Agency
ESP	Environmental Stewardship Plan
GIS	Geographic Information Systems
GPS	Global Positioning System
FTHL	Flat-Tailed Horned Lizard
MA	Management Area
OHV	Off-highway vehicle
POE	Port of Entry
ROE	Right of entry
ROW	right-of-way
USACE	U.S. Army Corps of Engineers
USBP	U.S. Border Patrol
USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator

BIOLOGICAL SURVEY REPORT
FOR
CONSTRUCTION AND OPERATION OF TACTICAL INFRASTRUCTURE
USBP EL CENTRO SECTOR

TABLE OF CONTENTS

APPENDICES

FIGURES

TABLES

1. Introduction

The Biological Survey Report (BSR) synthesizes information collected from a variety of literature sources and field surveys to describe the biological resources within the Project corridor, provides support information from the Project region, allows evaluation of the potential impacts of the Project on those biological resources within the Project corridor by the Environmental Stewardship Plan (ESP), and provides the basis of recommendations for avoidance or reduction of those impacts using mitigation including best management practices (BMP). Information was gathered from publicly available literature, data provided by relevant land management agencies, review of aerial photography and U.S. Geological Survey (USGS) topographic maps (Coyote Wells, Yuha Basin, Mount Signal, Calexico, Bonds Corner, Midway Well NW, Midway Well, and Grays Well), and data from the California Native Plant Society (CNPS) electronic inventory, the California Natural Diversity Database (CNDDB), NatureServe, and corridor field surveys conducted in September and October 2007 and January 2008.

The BSR analyzes the potential impacts to biological resources resulting from the construction, operation, and maintenance of the planned Project. The BSR was prepared as an independent document that is an attachment to the ESP developed for this Project.

The Project corridor is approximately 44.6 miles long and 60-feet-wide, which represents approximately 210 acres of nonnative and native vegetation and wildlife habitat, and 90 acres of fallow and irrigated agriculture, roads and disturbed recreation sites, and canals, ditches, playas, and other open water. The most common vegetation is creosote bush shrubland (108 acres) followed by desert buckwheat active dunes shrubland (78 acres). Access roads represent an additional 87 acres (91 percent of which is creosote bush shrubland) and stating areas represent 21.5 acres (36 percent of which is Tamarisk and 28 percent is creosote bush shrubland).

THIS PAGE INTENTIONALLY LEFT BLANK

2. Project Description

U.S. Customs and Border Protection (CBP) plans to construct, maintain, and operate tactical infrastructure consisting of pedestrian, aesthetic, or hybrid fence; associated access roads; patrol roads; lights; and other tools along the U.S./Mexico international border in the U.S. Border Patrol (USBP), El Centro Sector, California. The locations of tactical infrastructure are based on a USBP El Centro Sector assessment of local operational requirements where it will assist USBP agents in reducing illegal cross-border activities. Tactical infrastructure will be constructed in five discrete sections along the international border in Imperial County, California (see **Table 2-1**). The individual tactical infrastructure sections range from approximately 2.4 miles to more than 22 miles in length.

Table 2-1. Tactical Infrastructure Sections, El Centro Sector

Fence Section Number	Border Patrol Station	Project Section Identification	General Location	Approximate Mileage (mi)
B-1	El Centro	ELC-ELS-2	1.5 miles west of Pinto Wash to Monument 225	11.31
B-2	El Centro	ELC-ELS-3	Monument 224 to ELS West Checks	2.36
B-4	Calexico	ELC-CAX-1	CAX East Checks	8.59
B-5A	Calexico	ELC-CAX-3	Between B-4 and B-5B	22.40
B-5B	Calexico	ELC-CAX-2	East End of CAX E Checks to Monument 210 (start of B-5A)	2.95
			Total	**47.61**

2.1 Fence Section Summary

A general description of each fence section is provided herein:

- Section B-1 (ELC-ELS-2): Entirely managed by the Bureau of Land Management (BLM), the westernmost terminus will be located approximately 1.5 miles west of Pinto Wash, at the easternmost boundary of the Jacumba Wilderness; it will extend easterly, to International Boundary Monument 225. Section B-1 traverses variable terrain including sandy or gravelly flats, rocky outcrops, the large Pinto Wash and several small washes, and sand dunes. Much of the vegetation is sparse creosotebush shrublands; the plant communities are disturbed at the eastern terminus. Pinto Wash is classified as a 100-year floodplain and supports woodland and tall shrub habitats. Flat-tailed horned lizards

(FTHL) are uncommon to common on sandy plains and small dunes with scattered creosotebush and other shrubs.

- Section B-2 (ELC-ELS-3): Extends from Monument 224 at its western terminus to the northward All American Canal bend, terminating in agricultural lands with minor canals, ditches, drains, cultivated fields, and associated access roads. West of the agricultural land is an area disturbed by recent grading and earthmoving resulting in an unvegetated landscape. From the graded site west to the toeslope of Signal Mountain, creosotebush shrublands characterize the section which culminates in a sparse but diverse desert wash complex.
- Section B-4 (ELC-CAX-1): Extends east of the existing fence located on the east edge of the City of Calexico, paralleling the All American Canal and occupying its footprint for approximately 5 miles. Vegetation south of the All American Canal responds to seepage and consists of mesic shrublands and grasslands characterized by salt-cedar, arrow-weed, common reed, and Bermuda grass. East of the canal and its attendant seepage section will cross approximately 2.8 miles of relatively undisturbed sparse creosotebush shrubland that has become established on sandy plains and small dunes and represents suitable FTHL habitat.
- Section B-5A (ELC-CAX-3): Managed by the BLM, this section extends east from Monument Marker 211, paralleling the All American Canal, which is located approximately 0.5 miles north of the section. The vegetation is characterized by sparse creosotebush shrublands that occupy low sand dunes and gravelly flats. Disturbance from off-highway vehicle (OHV) recreational use emanating from the BLM-administered Buttercup Campground is evident along the eastern one-half of the segment and there are numerous power line and border access roads and trails. Much of this section supports sandy flats that are suitable FTHL habitat.
- Section B-5B (ELC-CAX-2): Begins south of the Grays Well Road exit from Interstate Highway I-8 and extends eastward; the western two-thirds of the section is characterized by sparse creosotebush shrublands established on low sand dunes and gravelly flats and the eastern one-third is located on the nearly unvegetated dune apron ascending towards the Imperial Sand Dune crest to the east. This section occurs within the heavily used BLM managed Algodones Dunes (also known as Imperial Sand Dunes) Recreation Area.

3. Survey Methods

To provide flexibility in placement of tactical infrastructure within the Project corridor and to ensure consideration of potential impacts due to construction, patrol, and maintenance, surveys were conducted in an area extending 150 to 300 feet north from the international boundary and extending at least 0.5 miles past the termini of each section. The areas thus defined are referred to hereafter as the survey corridor or Project corridor.

Intuitive controlled investigations of the survey corridor were conducted by biologists of engineering-environmental Management, Inc. (e²M): Jim Von Loh (senior ecologist, e²M), Karen Stackpole (staff biologist, e²M), Brent Eastty (staff botanist, e²M), Shannon Kulseth (staff botanist, e²M), Shannon Cauley (senior wetlands biologist, e²M), and Dan Savercool (senior wetlands biologist, e²M). The September and October 2007 and January 2008 surveys examined the Project corridor beginning on 4 September, 16 October, and 17 January. Necessary to access properties were rights-of-entry (ROE) approvals and CBP escort.

Due to the time-frame for acquiring field information, e²M assigned senior ecologists and biologists familiar with the vegetation and wildlife habitat classification and mapping protocols, and field sampling methods to intuitively examine the landscape and Project corridor for the 48-mile length. The surveys were controlled, in that ROE were approved for a 150- to 300-foot corridor width, and survey crews were required to be accompanied by USBP agents who served as guides, shared knowledge of wildlife sightings and other pertinent information, contacted landowners and managers, if necessary, and ensured surveyor safety while in the field. Investigations included observed plant and wildlife species lists by fence section, an assessment of habitat and surveys for rare plant and wildlife species, landscape photography points, observation points recording dominant species/location/cover/environmental conditions/photo-documentation, determination of potential wetlands, and general note-taking of natural resources.

Biologists walked the Project corridor for each tactical infrastructure section where approved ROE was obtained. They conducted reconnaissance level surveys on areas of land use (agricultural fields, disturbed sites, and urban areas) and examined in detail areas containing unique species compositions or habitat that may be conducive to sensitive species (sparse shrublands, desert washes, sand dunes, wetlands, canal banks and water bodies, etc.). Observation data (Universal Transverse Mercator [UTM] coordinates, photographs, field notes, environmental information, vegetation structure, and plant community composition) were recorded at regular intervals along the corridor where vegetation occurred as homogenous stands and also where plant communities presented substantial shifts in species composition. These data were used to generate a vegetation classification and map to inform delineation of habitat types, analyses of potential sensitive species occurrences, and analyses of potential Project impacts on biological resources (**Attachment A**).

Vegetation type and land use maps are included as a digital file in this final report. Although no protocol surveys were conducted, botanists and wildlife biologists specifically examined habitats to determine the presence of state- and Federal-listed species (see **Table 3-1**). Descriptions of the Federally listed species are provided in **Attachment B**.

3.1 Pierson's Milk-vetch Survey

A focused Pierson's milk-vetch survey was requested by U.S. Fish and Wildlife Service (USFWS) within Sections B-5A and B-5B in the El Centro Sector. Surveys were conducted on February 11 and 12, 2008 by e²M biologists Angela Hyder and Brent Eastty; both familiar with Pierson's Milk-vetch. A 60-ft wide corridor along the international boundary was surveyed for the presence of Pierson's milk-vetch, however, it was not found within the 60-ft corridor in the fence Sections B-5A and B-5B.

Table 3-1. Federal and State Listed Species Potentially Occurring in the Project Area

Common Name	Scientific Name	Federal Status	State Status	General Habitat
Plants				
Algodones dunes sunflower	*Helianthus niveus* ssp. *tephrodes*	--	E	Sandy desert of the Algodones (Imperial or Glamis) Sand Dunes of CA and AZ.
Peirson's milk-vetch	*Astragalus magdalenae* var. *peirsonii*	T	E	Sandy desert of the Algodones (Imperial or Glamis) Sand Dunes of CA and AZ at elevations of 55-250 meters.
Birds				
Burrowing owl	*Athene cunicularia*	--	SSC	Inhabits dry grassland and desert habitats. In Imperial County are commonly observed on unvegetated banks of the All American Canal using small mammal burrows.
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	E	Inhabits mesic thickets, brushy areas, and riparian woodlands.
Yuma clapper rail	*Rallus longirostris yumanensis*	E	T	Inhabits freshwater or brackish stream-sides and marshlands. Forages in higher marsh vegetation, mudflat interface, and along

Common Name	Scientific Name	Federal Status	State Status	General Habitat
				tidal creeks.
Yellow warbler	*Dendroica petechia brewsteri*	None	SSC	Inhabits riparian woodlands of cottonwood, willow, and alder. Requires dense brush understory for nesting.
Mammals				
Western yellow bat	*Lasiurus xanthinus*	None	SSC	Reported in valley foothill riparian, desert riparian, desert wash, and palm oasis habitats. Roost and feed in palm oases and riparian habitats.
Western mastiff bat	*Eumops perotis californicus*	None	SSC	Occur in many open, semiarid to arid habitats, including palm oases, sparse desert shrublands, and urban areas.
Pocket free-tailed bat	*Nyctinomops femorosaccus*	None	SSC	Uses sparse desert shrubland habitat, desert riparian, desert wash, alkali desert shrublands, and palm oases. Prefers rocky desert habitats with high cliffs or rocky outcrops.
American badger	*Taxidea taxus*	None	SSC	Uses semiarid shrub and herbaceous habitats with friable soils. Known to dig burrows in sandy soil with a sparse overstory.
Reptiles				
Flat-tailed horned lizard	*Phrynosoma mcallii*	-- (Proposed)	SSC	Inhabits sandy flats or areas with a veneer of fine, windblown sand. Forages on species of ants.

Source: BLM, El Centro Field Office, USFWS, Carlsbad Field Office, and California Natural Diversity Database (CNDDB)

Notes:

E=Endangered, T=Threatened, SSC=Species of Special Concern (State of CA Designation)

THIS PAGE INTENTIONALLY LEFT BLANK

4. Environmental Setting

The Project area climate is continental desert of extreme aridity and high air and soil temperatures. Summers are long and hot however the brief winter is moderate in terms of temperature (Bailey 1995). Average low temperatures range from 40 degrees Fahrenheit (^{o}F) in December and January to 76^{o}F in August. Average high temperatures range from 70^{o}F in December and January to 108^{o}F in July. There are typically no summer rains and the average annual precipitation of the area is approximately 2.5 inches. The evaporation rate during the summer season is very high and is further influenced by light to moderate winds. A long growing season of more than 300 days is experienced for the Project region.

The vegetation of the Colorado Desert of southern California has generally been classified under the Dry Domain (300), Tropical/Subtropical Desert Division (320), and more finely classified as the American Semidesert and Desert Province (322) by Bailey (1995). The Jepsen Manual (Hickman 1996) describes the vegetation geography using combined features of the natural landscape including natural vegetation types and plant communities, and geologic, topographic, and climatic variation. This geographic classification system places the Project area within the Desert Province and Sonoran Desert Region (also referred to locally and regionally as the Colorado Desert). Overall, the Project area is located within the Salton Trough on an extensive plain of arid desert that is gently undulating with the eastern terminus located on the Imperial (Algodones, Glamis) Sand Dunes apron. Principle drainage of runoff is to the north via the New and Alamo rivers to the Salton Sea.

Within the Project corridor, the All American Canal has had and continues to have a large influence on plant community establishment. There are large areas devoid of vegetation as a result of canal construction, operation, and maintenance. Additionally large areas occur where principally nonnative riparian and wetland plant communities have become established due to seepage from the unlined canal. The canal banks and permanent water supply also provide habitats that will not otherwise occur in this arid desert landscape.

THIS PAGE INTENTIONALLY LEFT BLANK

5. Biological Resources

5.1 Vegetation Classification

The California Natural Diversity Database (CNDDB) (CDFG 2003) recognizes nine vegetation systems with alliances and the non-vegetated desert modifier within the Project area. The systems include: (1) Active Desert Dunes and Sand Fields, (2) Creosote Bush Scrub, (3) Creosote Bush – White Bursage Scrub, (4) California Ephedra, (5) Alkali Common Reed, (6) Cattail Wetland, (7) Desert Wash Riparian Woodland, (8) Arrow-weed Scrubs, and (9) Tamarisk Scrubs and Woodlands. Active dunes occur predominantly within Section B-5B, as do sand fields and California ephedra provides a common sparse cover. Creostebush-dominated shrublands occur throughout all sections where the influence of irrigated agriculture is absent. Small desert washes occur throughout the Project corridor, but the large Pinto Wash flows within Section B-1. The wetland and riparian communities are supported by canal seepage and occur within Sections B-2 and B-4.

NatureServe (2007) has defined ecological systems to represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes such as fire or flooding. Ecological systems represent classification units that are readily identifiable by conservation and resource managers in the field. The ensuing vegetation description for the Project area was prepared in the framework of ecological systems that include: (1) Sonora – Mojave Creosotebush – White Bursage Desert Scrub (CES302.756); (2) North American Warm Desert Active and Stabilized Dune (CES302.744); (3) North American Warm Desert Pavement (CES302.750); (4) North American Warm Desert Playa (CES302.751); (5) North American Warm Desert Riparian Woodland and Shrubland (CES302.753); (6) North American Warm Desert Riparian Mesquite Bosque (CES302.752); (7) North American Warm Desert Wash (CES302.755); and (8) North American Arid West Emergent Marsh (CES300.729). **Table 5-1** provides a crosswalk between the systems recognized by CNDDB (2003) and the ecological systems of NatureServe (2007).

Classification of existing vegetation was achieved by accessing the Project corridor, access roads, and staging areas, sampling observation points, and relating them to the NatureServe Explorer classification database (2007). At the coarsest level, the eight above-named ecological systems were determined and local vegetation types described using the national system. A finer level of classification equaling or approximating the vegetation alliance level of the National Vegetation Classification System (NatureServe 2007) was used to prepare the plant community discussions under each ecological system.

Habitats observed, sampled, and photographed within the Project corridor range from widespread creosotebush shrublands within all sections, mostly nonnative

Table 5-1. Crosswalk Relationship of CNDDB Systems and Alliances with NVCS Ecological Systems and Vegetation Alliances

Ecological System (NatureServe 2007) (Vegetation Alliance)	Systems (CNDDB 2003) (Alliance)
Sonora – Mojave Creosotebush – White Bursage Desert Scrub - Creosotebush – White Bursage Shrubland - Creosotebush – White Bursage – Longleaf Jointfir Shrubland - Creosotebush – White Bursage – Fourwing Saltbush Shrubland - Shrubby Coldenia Dwarf-shrubland	Sonoran and Mojavean Desert Scrub - Creosote Bush Scrub - Creosote Bush – White Bursage Scrub - California Ephedra
North American Warm Desert Active and Stabilized Dune - Active Desert Dunes and Sand Fields	Cismontane and Desert Interior Dunes - Active Desert Dunes and Sand Fields - Desert Sand-verbena - Stabilized and Partially Stabilized Desert Dunes - Stabilized and Partially Stabilized Desert Sand Fields
North American Warm Desert Pavement - Creosotebush with Disturbance - Shrubby Coldenia Dwarf-shrubland	Non-Vegetated Desert
North American Warm Desert Playa	Non-Vegetated Desert - Playa
North American Warm Desert Riparian Woodland and Shrubland - Common Reed Herbaceous Vegetation - Bermuda Grass Herbaceous Vegetation - Heliotrope Herbaceous Vegetation - Alkali Mallow Herbaceous Vegetation - Athel Tamarisk Shrubland and Woodland - Tamarisk Shrubland	Low to High Elevation Riparian Scrub - Arrow Weed Scrubs - Tamarisk Scrubs and Woodlands
North American Warm Desert Riparian Mesquite Bosque - Arrow Weed Shrubland	Desert Wash Riparian Woodland
North American Warm Desert Wash - Active Desert Dunes and Sand Fields - Desert Wash Shrubland	Desert Wash Riparian Woodland - Mesquite Woodland - Smoke Tree Woodland and Scrub - Desert Dry Wash Woodland Non-Vegetated Desert - Sandy to Cobbly Wash Bottom
North American Arid West Emergent Marsh - Broad-leaved Cattail Herbaceous Vegetation - Common Reed Herbaceous Vegetation - Ditchgrass Submerged Aquatic Vegetation	Marsh - Cattail Wetland - Alkali Common Reed

grasslands, forblands, and shrublands south of the All American Canal in Sections B-2 and B-4, active dunes in Section B-5B, and desert washes including Pinto Wash in Section B-1. Vegetation cover is often sparse. Agricultural fields occur along much of the Project corridor and include alfalfa, cotton, row crop vegetables (particularly asparagus, onions, beans, broccoli, etc.), or fields that were fallow at the time of the site visit.

A brief description of each plant community observed within Sections B-1 through B-5B is provided herein; they are distinguished using the NatureServe and CNDDB Vegetation Alliance level of classification or an approximation. To the extent possible, each community is illustrated and supported by representative ground photographs and foliar cover information for dominant species.

Active Desert Dunes and Sand Fields

This habitat type occurs on the eastern one-third of Section B-5B, east of the electrical power transmission line towers. Active dunes form a low apron leading to the topographically higher Imperial Sand Dunes to the east and support widely scattered desert tea shrubs (less than 1 percent cover) on the taller sand deposits onsite (see **Figure 5-1**). Along the margins of the dune field, where lower dunes and areas of deflation occur, sparse stands (less than1percent – 4 percent cover) of creosotebush, longleaf jointfir, desert buckwheat, and Devil's lanterns occurs. The shrubs alter movement of sand particles to form mounds up to 1.5 meters tall around their bases to the foliage drip-line. Areas between shrubs and their attendant sand mounds are heavily traveled by all-terrain vehicles (ATVs) however the shrubs and sand mounds provide important burrowing sites for small mammals and reptiles. This landform occurs within the North American Warm Desert Active and Stabilized Dune and North American Warm Desert Wash ecological systems of NatureServe (2007).

Figure 5-1. Representative Photographs of Active Desert Dune and Sand Field Habitat

Creosotebush with Disturbance

Adjoining and west of the dune and sand fields is a flat plain that is armored by small gravel and as a result is relatively resistant to wind erosion (see **Figure 5–2**). The habitat occurs in the eastern portion of Section B-5A and the middle portion of Section B-5B and less commonly in Sections B-1 and B-2. This habitat was disturbed historically to construct electrical power line towers and the border access road and is continually disturbed due to power line maintenance activities, travel on and maintenance of the border road, and camping and ATV recreational use. Creosotebush can provide up to 5 percent cover within this sparse community but there are relatively large stands that support 1 percent or less cover by short-stature and widely scattered creosotebush shrubs. The creosotebush shrubs of this vegetation type have captured little sand and the mounds associated with them are low up to 0.25 meters tall. Associated species include shrubby coldenia and longleaf jointfir that each provide less than1 percent cover within the stands. Annual grasses and forbs (Mediterranean grass, crane's-bill, fiddleneck) can provide up to 1percent cover, based on the dried leaves and stems observed. This vegetation type occurs within the Sonora – Mojave Creosotebush – White Bursage Desert Scrub and North American Warm Desert Pavement ecological systems of NatureServe (2007).

Figure 5-2. Representative Photographs of Creosotebush with Disturbance Habitat

Creosotebush – White Bursage – Longleaf Jointfir Shrubland

Characterizing much of Sections B-1 and B-2 and the eastern portion of Section B-4, most of Section B-5A, and a few sites along Section B-5B, are areas with deeper sand deposits supporting relatively tall creosotebush and longleaf jointfir shrubs, the sand mounds (up to 1.5 meters tall) are interspersed with areas of deflation exposing a veneer of small gravel (see **Figure 5-3**). Cover within this type is sparse, sometimes approaching 10 percent and white bursage may be absent or provides from 1-5 percent cover. Individual longleaf jointfir shrubs and sand mounds can become quite large however ground cover is typically 1percent or less in sampled stands. Burrowing activity for small mammals and reptiles is at its highest density within this upland desert habitat. This vegetation type occurs within the Sonora – Mojave Creosotebush – White Bursage Desert Scrub ecological system of NatureServe (2007).

Figure 5-3. Representative Photographs of Creosotebush – White Bursage – Longleaf Jointfir Habitat

Creosotebush – White Bursage – Fourwing Saltbush Shrubland

The eastern end of Sections B-2 and B-4 supports bands of this vegetation type, which occurs on deeper sand deposits with a few deflation areas armored by small gravel (see **Figure 5-4**). It forms a minor, narrow ecotone with arrow-weed shrubs that extend up some small washes. Creosotebush cover ranges between 1percent and 8 percent, while fourwing saltbush cover is typically less than1percent but can be as high as 4 percent cover. Both longleaf jointfir and white bursage can be present providing less than1percent cover and annual grasses and forbs (Mediterranean grass, crane’s-bill, desert plantain) can provide up to 1percent cover. During moist periods, the annual growth and subsequent ground cover could be extensive. This vegetation type occurs within the Sonora – Mojave Creosotebush – White Bursage Desert Scrub ecological system of NatureServe (2007).

Figure 5-4. Representative Photographs of Creosotebush – White Bursage – Fourwing Saltbush Habitat

Creosotebush – White Bursage Shrubland

The common creosotebush scrub community within Sections B-1 and the western portion of Section B-2 is characterized by sparse cover, from 1-5 percent cover of creosotebush and less than 1-3 percent cover by white bursage. This vegetation type occupies sandy flats, low dunes, small washes, and rocky outcrops (see **Figure 5-5**). It occurs within the Sonora – Mojave Creosotebush – White Bursage Desert Scrub ecological system of NatureServe (2007).

Figure 5-5. Representative Photographs of Creosotebush – White Bursage Habitat

Desert Wash Shrubland

The large drainage, Pinto Wash occurs near the western terminus of Section B-1 where it is approximately 0.5 miles wide. Pinto Wash supports a mixed, sparse tall shrub stand of creosotebush, honey mesquite, and ironwood that provides up to 5 percent cover and a sparse understory of longleaf jointfir, white bursage, and shrubby coldenia that provides less than 1percent cover (see **Figure 5-6**). The herbaceous layer typically provides sparse cover, but following significant precipitation forbs including manybristle chinchweed and sand verbena can provide up to 5 percent cover. Another large desert wash occurs at the base of Signal Mountain at the western terminus of Segment B-2; it is characterized by sparse creosotebush, honey mesquite, and ocotillo tall shrubs that provide up to 5 percent cover. This wash has higher species diversity in the short shrub and herbaceous layers, which include desert holly, shrubby coldenia, white bursage, big galleta, grama, manybristle chinchweed, spurge, Thomas buckwheat, sand verbena, wire lettuce, and Spanish needles. This vegetation type occurs within the North American Warm Desert Wash ecological system of NatureServe (2007).

Figure 5-6. Representative Photographs of Desert Wash Habitat

Shrubby Coldenia Dwarf-Shrubland

A small patch of shrubby coldenia, occupying approximately 2,000 square meters, occurs in sandy soil between the All American Canal bank and the low berm that demarcates the international border within Section B-4 (see **Figure 5-7**). This unique type supports up to 4 percent cover of shrubby coldenia along with a few stems, less than 1percent cover of arrow-weed. Shrubby coldenia occurs commonly as a component of creosotebush scrub communities of all Project sections. This vegetation type occurs within the Sonora – Mojave Creosotebush – White Bursage Desert Scrub and North American Warm Desert Pavement ecological systems of NatureServe (2007).

Figure 5-7. Representative Photographs of Shrubby Coldenia Habitat

Common Reed Herbaceous Vegetation

Common reed forms linear, dense stands (up to 80 percent cover) on saturated soils of the banks of the All American Canal and broader, moderately dense stands (up to 45 percent cover) in the ditch between the canal bank and the berm that has been formed on the international border within Sections B-2 and B-4 (see **Figure 5-8**). Stand height also varies relative to depth to saturated soils ranging from approximately 2 meters tall on drier sites to 4 meters tall on moist sites. Although often occurring in monotypic stands, up to 10 percent cover may be provided by Bermuda grass or heliotrope. Common reed typically alternates in dominance on both the canal bank and in the ditch between the canal and the border berm with arrow-weed shrubs. This vegetation type occurs within the North American Warm Desert Riparian Woodland and Shrubland ecological system of NatureServe (2007).

Figure 5-8. Representative Photographs of Common Reed Habitat

Bermuda Grass Herbaceous Vegetation

Nearly pure stands of Bermuda grass have become established in the ditch between the canal bank and the berm that has been formed along the international border within Sections B-2 and B-4 (see **Figure 5-9**). These sites are likely too dry to support common reed and too alkaline for arrow-weed shrubs to flourish. Typically, this short grass provides up to 15 percent cover and the stands are monotypic. Abundant burrowing activity by pocket gophers occurs within these stands, which controls the amount of top growth as roots and rhizomes are consumed. This vegetation type occurs within the North American Warm Desert Riparian Woodland and Shrubland ecological system of NatureServe (2007).

Figure 5-9. Representative Photographs of Bermuda Grass Habitat

Heliotrope Herbaceous Vegetation

One large patch of heliotrope, providing approximately 10 percent cover, has become established within the ditch between the canal bank and the berm of Section B-4 near the international border (see **Figure 5-10**). This stand occupies approximately 1 acre and supports high levels of pocket gopher burrowing activity. Sparse cover, less than 1percent cover of alkali mallow, also occurs. This vegetation type occurs within the North American Warm Desert Riparian Woodland and Shrubland ecological system of NatureServe (2007).

Figure 5-10. Representative Photograph of Heliotrope Habitat

Alkali Mallow Herbaceous Vegetation

One large patch of alkali mallow, providing up to 6 percent cover, has become established within the ditch between the canal bank and the international border berm of Section B-4 (see **Figure 5-11**). This stand occupies approximately 1 acre and includes a few shrubs of arrow-weed that provide sparse cover, up to 1percent cover. This vegetation type occurs within the North American Warm

Desert Riparian Woodland and Shrubland ecological system of NatureServe (2007).

Figure 5-11. Representative Photograph of Alkali Mallow Habitat

Broad-leafed Cattail Herbaceous Vegetation

Patches of broad-leafed cattail occurred mostly on saturated soils of the south-facing banks of the All American Canal. These patches were associated with common reed and were less than 25 square meters in area; a few occur within the canal reach of Sections B-2 and B-4. Therefore, they were not sampled or photographed and will be inclusively mapped with common reed. This vegetation type occurs within the North American Arid West Emergent Marsh ecological system of NatureServe (2007).

Ditchgrass Submerged Aquatic Vegetation

Submerged beds of aquatic vascular vegetation have become established within the All American Canal and appear to support ditchgrass and water milfoil, primarily (see **Figure 5-12**). In these beds are an abundance of aquatic insects, minnows, and larger fish. Submerged aquatic beds of vegetation are subject to disturbance when the canal banks are periodically cleared of vegetation and sediments are removed from the canal. This vegetation type occurs within the North American Arid West Emergent Marsh ecological system of NatureServe (2007).

Figure 5-12. Representative Photographs of Submerged Aquatic Bed Habitat

Arrow-weed Shrubland

The most common riparian shrub in terms of distribution and cover is arrow-weed, ranging from open stands of 10 percent to 25 percent cover on drier sites to dense stands of 50 percent to 80 percent cover on moist sites (see **Figure 5-13**). Except for small reaches dominated by common reed and very small patches of broad-leafed cattail, the banks of the All American Canal are lined with thick stands of arrow-weed shrubs up to three-meters tall. Arrow-weed shrubs are dominant on the south-facing canal bank, occupying the moist soils adjacent to the canal. Arrow-weed shrubs are also the dominant shrub within the ditch area between the canal bank and the berm that marks the international border in Section B-4. Small patches of arrow-weed also occur near the canal in Section B-2 and in a shallow wash crossing Section B-5A.

Arrow-weed is the principal colonizing species when soils south of the canal are disturbed. The stands typically are monotypes and when other species occur (common reed, tamarisk, alkali mallow) they typically provide less than 1 percent cover. On the eastern portion of Section B-4, arrow-weed becomes understory to co-dominant with tamarisk shrubs and it forms a narrow ecotone with creosote bush and fourwing saltbush where the desert uplands and riparian lowlands meet within Section B-4. This vegetation type occurs within the North American Warm Desert Riparian Mesquite Bosque ecological system of NatureServe (2007).

Figure 5-13. Representative Photographs of Arrow-Weed Shrubland Habitat

Athel Tamarisk Shrubland and Woodland

An occasional tree or tall shrub of Athel tamarisk occurs within stands of tamarisk shrublands within the western portion of Section B-4 (see **Figure 5-14**). The unvegetated playa near the middle of Section B-4 is rimmed on the north shore by Athel tamarisk, where it forms a dense patch (up to 80 percent cover) of approximately 100 square meters. A few fourwing saltbush shrubs occur along the margin of this tall Athel tamarisk shrubland patch.

Figure 5-14. Representative Photographs of Athel Tamarisk Habitat

This vegetation type occurs within the North American Warm Desert Riparian Woodland and Shrubland ecological system of NatureServe (2007).

Tamarisk Shrubland

Dense stands of tamarisk tall riparian shrublands occur within Section B-4, near the eastern portion and in the area north of the unvegetated playa where the canal orients away from the international border to the northeast (see **Figure 5–15**). The stands are often mixed with tamarisk (up to 5 meters tall) and the short shrub arrow weed (up to 3 meters tall) providing up to 80 percent and 10 percent cover, respectively. In general, little understory vegetation can tolerate the dense shading and salinity associated with the ground beneath tamarisk stands. An occasional Athel tamarisk or fan palm tree and rarely a Fremont cottonwood or Goodding willow tree may add structure in these stands, but they contribute little to the cover value. This vegetation type occurs within the North American Warm Desert Riparian Woodland and Shrubland ecological system of NatureServe (2007).

Figure 5-15. Representative Photographs of Tamarisk Habitat

Non-Vegetated Formations and Sites

Several areas of the El Centro Sector Project corridor are unvegetated. On the eastern terminus of Section B-5B, active sand flats and dunes support no to less than 1 percent vegetative cover (see **Figure 5-16**). An unvegetated playa located approximately midway along Section B-4, east of the Alamo River, is devoid of vegetation due to seasonal flooding and accumulation of salts (see **Figure 5-17**). Berms and ditches along the western portion of Section B-4 are often unvegetated and the soil appears compacted (see **Figure 5-18**). The Imperial Irrigation District is currently undertaking canal seepage recovery resulting in many acres of complete surface disturbance resulting in vegetation removal and precluding the establishment of vegetation at this time (see **Figure 5-19**). An area of Section B-2 has been disturbed by grading and earthmoving equipment however the need could not be ascertained.

Figure 5-16. Unvegetated Sand Flats and Dunes

Figure 5-17. Unvegetated Playa

Throughout all sections an access road is maintained adjacent to the international border and along the All American Canal in addition to electrical power transmission line access and maintenance roads (see **Figure 5-20**). For the length of Sections B-5A and B-5B, unlimited camping and ATV access is permitted, typically during the cooler months of the year, resulting in and maintaining additional unvegetated landscape (see **Figure 5-21**). The BLM estimated that more than 108,000 visits to the Buttercup Campground adjacent to Section B-4 occur annually (USBLM 2003a).

Figure 5-18. Unvegetated Berms and Ditches

Figure 5-19. Unvegetated Seepage Recovery Area

Figure 5-20. Unvegetated Access Roads and Trails

Figure 5-21. Unvegetated Recreation Sites

5.2 Plant Species Identified

A complete list of plant species identified during the field surveys, including wetland status and the fence section in which the species was identified is provided in **Table 5-2**. Sixty-four taxa were identified during late fall and winter surveys and 3 species occurred in all of the 5 sections examined.

Table 5-2. Plant Species Observed in El Centro Sector Fence Sections

Scientific Name / Common Name	Wetland Indictor Status	B-1	B-2	B-4	B-5A	B-5B	Total Number of Fence Sections in which Species occurs
Abronia villosa / Sand Verbena	---	X	X				2
Ambrosia dumosa / White Bursage or Burrobush	---	X	X	X	X	X	5
Amsinckia sp. / Fiddleneck	---			X		X	2
Asclepias subulata / Rush Milkweed	---			X	X		2
Asparagus officianalis / Asparagus	FACU		X				1
Atriplex canescens / Four-wing Saltbush	FACU	X	X	X			3
Atriplex hymenelytra / Desert Holly	---		X				1
Atriplex lentiformis / Quailbush	FAC	X	X	X			3
Boraginaceae	---		X				1
Bouteloua sp.	---	X	X				2
Brassica cf tournefortii / Mustard	---			X			1
Chamaesyce sp. / Spurge	---		X				1
Chenopodiaceae	---		X				1
Conyza canadensis / Canadian Horseweed	FACU		X				1
Coreopsis sp. / Tickseed	---				X		1
Cucurbita palmata / Coyote Melon	---	X					1

Scientific Name / Common Name	Wetland Indictor Status	B-1	B-2	B-4	B-5A	B-5B	Total Number of Fence Sections in which Species occurs
Cylindropuntia echinocarpa cf / Golden cholla	---	X					1
Cynodon dactylon / Bermuda Grass	FAC		X	X			2
Echinochloa sp. / Barnyard Grass	FACW		X				1
Eleocharis acicularis / Spike-rush	OBL			X			1
Encelia frutescens / Button Brittlebush	---	X					1
Ephedra trifurca / Longleaf Jointfir or Mormon-tea	---	X		X	X	X	4
Ericameria laricifolia / Turpentine Bush	---			X	X		2
Eriogonum deserticola / Desert Buckwheat	---					X	1
Eriogonum thomasii / Thomas' buckwheat	---		X				1
Erodium cicutarium / Crane's-bill	---			X		X	2
Euphorbiaceae	---	X					1
Ferocactus cylindraceus / Barrel Cactus	---	X					1
Fouquieria splendens / Ocotillo	---	X	X				2
Heliotropium curassivicum / Heliotrope	---			X			1
Hesperocallis undulata / Desert lily	---	X					1
Hymenoclea salsola / Cheesebush	---			X			1
Kallestroemia sp. / Goat's-head		X					1
Larrea tridentata / Creosotebush	---	X	X	X	X	X	5

Scientific Name / Common Name	Wetland Indictor Status	B-1	B-2	B-4	B-5A	B-5B	Total Number of Fence Sections in which Species occurs
Malvella leprosa / Alkali Mallow, Whiteweed	FAC*			X			1
Myriophyllum sp. / Water-milfoil	OBL			X			1
Oenothera deltoides / Devil's Lantern	---				X	X	2
Olneya tesota / Ironwood	---	X					1
Parkinsonia aculeata / Jerusalem Thorn or Mexican Palo Verde	FAC-		X				1
Palafoxia arida var. *arida* / Spanish Needle	---	X	X		X		3
Pectis papposa / Manybristle Cinchweed	---	X	X				2
Petalonyx sp. / Sandpaper Plant	---	X					1
Phragmites australis / Common Reed	FACW		X	X			2
Phoenix sp. / Date Palm	---			X			1
Plantago insularis / Annual Plantain	---			X			1
Pleuraphis rigida / Big Galleta	---	X					1
Pluchea sericea / Arrow Weed	FACW		X	X	X		3
Populus fremontii / Fremont Cottonwood	FACW			X			1
Prosopis glandulosa / Mesquite	---	X	X	X	X		4
Psorothamnus emoryi / Dyebush	---	X			X		2
Psorothamnus spinosus / Smoketree	---	X					1
Rumex sp. / Dock	---		X				1
Ruppia sp. / Ditchgrass	OBL			X			1

Scientific Name / Common Name	Wetland Indictor Status	B-1	B-2	B-4	B-5A	B-5B	Total Number of Fence Sections in which Species occurs
Salix gooddingii / Goodding Willow	OBL			X			1
Schismus barbatus / Mediterranean Grass	---			X		X	2
Stephanomeria pauciflora/ Wire Lettuce	---		X		X		2
Stillingia spinulosa / Stillingia	---				X		1
Tamarix aphylla / Athel Tamarisk	FACW-			X			1
Tamarix ramosissima / Tamarisk, Salt-Cedar	FAC		X	X	X		3
Thamnosa montana / Turpentine-broom	---	X					1
Tiquilia plicata / Shrubby Coldenia or Fanleaf Crinklemat	---	X	X	X	X	X	5
Typha latifolia / Broad-leafed Cattail	OBL		X	X			2
Washingtonia sp. / Fan Palm	FACW		X				1
Ziziphus obtusifolia / Graythorn	---	X					1
Total # of FACW- to OBL species per section	**NA**	**0**	**5**	**9**	**1**	**0**	**NA**
Total # of species per fence section	**NA**	**26**	**28**	**29**	**15**	**9**	**NA**

Note:

Wetland Indicator Status (USDA NRCS 2007): Facultative Upland (FACU) – usually occurs in non-wetlands, but occasionally found in wetlands; Facultative (FAC) – equally likely to occur in wetlands or non-wetlands; Facultative Wetland (FACW) – usually occurs in wetlands but occasionally found in non-wetlands; Obligate Wetland (OBL) – occurs almost always under natural conditions in wetlands. (*) = tentative assignments based on limited information, (-) = less frequently found in wetlands).

5.3 Fence Section Characteristics and Description of Habitat Quality

To insure the most recent data were acquired for rare species analyses, e²M requested Element Occurrence Data from NatureServe Central Databases in Arlington, Virginia, through a referral from the USFWS (NatureServe and e²M 2007a). Additionally, rare species data were acquired from the BLM and CNDDB at the Project inception. General descriptions of the habitat quality as it relates to rare plant species and the landscape characteristics of each section were provided by the field biologists based on field observations and are provided below.

Section B-1

Potential Listed Species:	Flat-tailed horned lizard
Listed Species Observed:	None (tracks only)
Suitable Listed Species Habitat Present:	Yes
If so, Habitat Quality:	High

Section Habitat Description: Section B-1 occurs at the easternmost edge of the Jacumba Wilderness, and crosses the 100-year floodplain of Pinto Wash and its dry wash woodland plant community. High densities of FTHL occur in the Yuha desert, specifically in the Pinto Wash area. The Yuha Basin Management Area encompassing Section B-1 is a designated FTHL management area and Area of Critical Environmental Concern (ACEC) for monitoring and protection of the species.

Section B-2

Potential Listed Species:	Flat-tailed horned lizard
Listed Species Observed:	None (no tracks observed)
Suitable Listed Species Habitat Present:	Yes
If so, Habitat Quality:	Low due to agriculture and disturbance

Section Habitat Description: The eastern terminus of Section B-2 crosses agricultural land use consisting of minor canals, irrigated and fallow fields, and associated access routes. Vegetation is limited in this area to the berm of the primary east-west canal and is characterized by a mixture of nonnative grasses and forbs primarily Bermuda grass. West of the agricultural land use, the relatively flat desert landscape has been disturbed by recent grading and earthmoving activity in addition to recreation use and USBP patrol activities. The existing habitat is characterized by creosotebush, white bursage, and fourwing saltbush. A large wash complex at the northern base of Mt. Signal supports sparse vegetation with relatively high species diversity. Cover provided by individual species is variable and typically low within the braids, slopes, and channels of the wash complex.

Section B-4

Potential Listed Species:	None
Listed Species Observed:	None
Suitable Listed Species Habitat Present:	No
If so, Habitat Quality:	NA

Section Habitat Description: The drainage of this section flows to the Alamo River and is carried north under the All American Canal to the Salton Sea. Principally nonnative shrub (tamarisk), native shrub (arrow-weed), and nonnative herbaceous (common reed, Bermuda grass, heliotrope, alkali mallow) plant communities occur in the western two-thirds of Section B-4 and are supported by seepage from the All American Canal. Characterizing much of the eastern portion of Section B-4 are habitats that have become established on deeper sand deposits and including relatively tall creosotebush and longleaf jointfir shrubs. Sand mounds (up to 1.5 meters tall) have formed around the shrubs and are interspersed with areas of deflation exposing a veneer of small gravel.

Section B-5A

Potential Listed Species:	Peirson's milkvetch Algodones dunes sunflower
Plant Occurrence:	None
Suitable Listed Plant Habitat Present:	Yes
If so, Habitat Quality:	Moderate

Section Habitat Description: The eastern portion of Section B-5A, beginning at Monument Marker 211, supports sparse creosotebush shrublands with a disturbed understory. Disturbances from OHV use, power line construction and maintenance, and border access roads are easily observable. As Imperial Irrigation District construction related to reducing canal seepage continues westward, additional acreage located on the northern edge of the survey area will likely be reclassified as Unvegetated Seepage Recovery Area. Most of the central and western portions of Section B-5A are classified as creosote bush – white bursage – longleaf jointfir habitat with one significant depression or shallow wash dominated by arrow-weed shrubland habitat.

Section B-5B

Potential Listed Species:	Peirson's milkvetch Algodones dunes sunflower
Plant Occurrence:	None
Suitable Listed Plant Habitat Present:	Yes
If so, Habitat Quality:	Moderate

Section Habitat Description: Section B-5B lies within the BLM's Buttercup Recreation Management Area, designated Multiple-use Class I "Intensive" and is used for camping, OHV riding, site-seeing, commercial vending, education, filming, and rights-of-way (USBLM 2003a). This section occurs entirely within the Algodones (Imperial, Glamis) Dunes. Surveys were conducted for Pierson's milk-vetch and the Algodones dunes sunflower, however, no live or dead material was observed. Generally, Pierson's milk-vetch occurs in the more interior portions of the dunes east of Section B-5B (USFWS 2007).

5.4 Wetlands and Waters of the United States

Wetlands and waters of the United States can be confusing terms and are defined here for the convenience of document users. The U.S. Corps of Engineers (USACE) has jurisdiction to protect wetlands under Section 404 of the Clean Water Act using the following definition:

> *. . . areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 Code of Federal Regulations [CFR] 328.3[b]). Wetlands generally include swamps, marshes, bogs, and similar areas.*

Wetlands have three diagnostic characteristics that include: (1) over 50 percent of the dominant species present must be classified as obligate, facultative wetland, or facultative, (2) the soils must be classified as hydric, and (3) the area is either permanently or seasonally inundated (Environmental Laboratory 1987).

Waters of the U.S. are defined under 33 *United States Code* (USC) 1344, as follows:

a. The term "waters of the United States" means
    1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
    2. All interstate waters including interstate wetlands;
    3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
        i. Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
        ii. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

iii. Which are used or could be used for industrial purpose by industries in interstate commerce;

4. All impoundments of waters otherwise defined as waters of the United States under the definition;
5. Tributaries of waters identified in paragraphs (a)(1)-(4) of this section;
6. The territorial seas;
7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this section.
8. Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the Clean Water Act (CWA) (other than cooling ponds as defined in 40 CFR 123.11(m) which also meet the criteria of this definition) are not waters of the United States.
9. Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the CWA, the final authority regarding CWA jurisdiction remains with the Environmental Protection Agency (EPA).

b. The term "wetlands" means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

c. The term "adjacent" means bordering, contiguous, or neighboring. Wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are "adjacent wetlands."

d. The term "high tide line" means the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm.

e. The term "ordinary high water mark" means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

The term “tidal waters” means those waters that rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by hydrologic, wind, or other effects.

5.4.1 Field Evaluation Summary

Observations and initial identification of potential wetlands and waters of the U.S. for El Centro were recorded during the fall of 2007 field inventories. During January 2008, wetland ecology teams sampled 11 potential and known wetland sites to determine the wetlands classification, boundary, determination of jurisdictional status (jurisdictional determination form), record physical site data (wetland data observation form), and acquire on-the-ground photographs (see **Table 5-3**). The teams assessed wetlands and waters of the U.S. within a 150-foot-wide corridor (extending north of the alignment) for the length of the Project. A 60-foot wide corridor on both sides of identified access roads and construction staging areas were assessed for wetlands and waters of the U.S. in conjunction with the corridor analyses. In general, wetlands of the Project corridor have become established on seeps and playas, along canals and ditches, and cover approximately 0.5 acres.

Eight of the sampled sites (WL1–8) were ephemeral washes; the largest of these was Pinto Wash (WL1) which can be up to 0.5 miles wide. The smaller ephemeral washes ranged in channel width from 5–25 feet. One of the small ephemeral washes (WL-8) has been disturbed by sand, gravel, and cobble mining that resulted in a narrow and incised drainage. Seepage from a concrete-lined irrigation ditch supports wetland vegetation at site WL9 on its immediate banks. The All American Canal banks support wetland plant communities for nearly their entire length and the canal also provides flowing water to support aquatic vegetation types within the channel. A moderate-sized playa (WL11) receives runoff following precipitation events and also drainage from irrigated agricultural fields in Mexico; the ground water level under this playa may be elevated as a result of All American Canal seepage.

Table 5-3. Summary of Jurisdictional(*) and Non-Jurisdictional Wetlands for El Centro

ID	Section	NWI Type	Boundary Recorded Using GPS in Field	Jurisdictional Determination Form Completed	Routine Data Form Completed	Ground Photos / Map Included
WL1	B-1	Dry wash	Yes	No	No	Yes / Yes
WL2	B-1	Dry wash	Yes	No	No	Yes / Yes
WL3	B-1	Dry wash	Yes	No	No	Yes / Yes
WL4	B-1	Dry wash	Yes	No	No	Yes / Yes
WL5	B-1	Dry wash	Yes	No	No	Yes / Yes
WL6	B-1	Dry wash	Yes	No	No	Yes / Yes
WL7	B-1	Dry wash	Yes	No	No	Yes / Yes
WL8	B-2	Dry wash	Yes	No	No	Yes / Yes
SW1	B-2	Drainage channel	Yes	No	No	Yes / Yes
*WL9	B-2	PSS/ PEM	Yes	Yes	Yes	Yes / Yes
WL10	B-4	POW / Irrigation canal	No–aerial photo interpretation	No	No	No / Yes
*WL11	B-4	PSS playa	Yes	Yes	Yes	Yes / Yes

Notes:
PEM=Palustrine Emergent, POW=Palustrine Open Water, and PSS=Palustrine Scrub/Shrub

5.4.2 Wetlands Vegetation Summary

Wetlands delineated within the Imperial Valley included shrubland and herbaceous types. The characteristic species for each wetlands type sampled and delineated in the field are presented below by stand physiognomy.

Shrubland

1. Arrow-weed / Common Reed Shrubland
2. Salt-cedar (Tamarisk) Shrubland

Herbaceous

1. Common Reed – Broadleaf Cattail / Arrow-weed Herbaceous Vegetation

5.4.3 Wetlands Soil Summary

Soils supporting wetlands and waters of the U.S. within the Imperial Valley included: (1) Imperial–Glenbar Silty Clay Loams and (2) Vint Loamy Very Fine Sand. The common soil textures of these basin or valley sites are heavy silt loam, silt loam, silty clay loam, clay loam, and sand. Abundant crystalline salt occurred at one site. The matrix color of the A horizon for Imperial Valley wetland soils included reddish-yellow (7.5YR) to brown (10YR) hues with the value ranging from 3 to 4 and 3 to 6, respectively; and the chroma ranging from 2 to 4 and 2 to 4, respectively. Wetland soils under long-term standing water or soils saturated by the groundwater table exhibited faint mottling. The mottles were typically a reddish-yellow hue (7.5YR) and faint in terms of value and chroma.

5.5 Noxious Weeds and Invasive Nonnative Species

The State of California maintains a noxious weed definition, species list, and control districts under a legislative determination (CDFA 2008a). The legislature has determined that: (1) the destructive impact of invasive and often poisonous noxious weeds is profound, affecting California's cropland, rangeland, forests, parks, and wildlands; (2) these pests cause enormous losses of private, state, and federal resources through decreased land productivity, degradation of wildlife habitat, and outright destruction of crops, livestock, wetlands, waterways, watersheds, and recreational areas; and (3) the estimated lost crop productivity caused by noxious weeds is seven billion four hundred million dollars nationwide, a large proportion of which is attributable to California and nationally, the direct and indirect costs of controlling noxious weeds may be as high as five billion four hundred million dollars annually (Sections 7270-7276). Under Chapter 7270.5 of this act: "noxious and invasive weeds means weeds that the department has determined to be either noxious or invasive weed species".

The code designates the California Department of Food and Agriculture (CDFA) as the lead department in noxious weed management and created a fund called the Noxious Weed Management Account. A Weed Management Area must be formed to receive these funds and Imperial County became so designated in 1999. California maintains a website providing lists of weeds as does the BLM and two plant species observed in the corridor, Bermuda grass and alkali mallow occur within this Sector (CDFA 2008, USBLM 2008) (see **Table 5-4**). These species are not listed as noxious by the Federal government and appear on the California Pest Rating List C as defined below.

Table 5-4. Noxious Weed List for the Project Corridor

Common Name	Scientific Name	Fence Sections Observed
Bermuda Grass (PRL-C)	*Cynodon dactylon*	B-2, B-4
Alkali Mallow (PRL-C)	*Malvella leprosa (Sida leprosa* var. *hederacea)*	B-4

Sources: http://www.blm.gov/ca/st/en/prog/weeds/weedlist.html; and http://www.cdfa.ca.gov/phpps/ipc/weedinfo/winfo_list-fednoxweeds.htm.

The CDFA defines noxious weed species and seed under pest ratings of A through C. Pest Rating List A includes 42 species to be treated with eradication, containment, rejection, or other holding action at the state-county level; quarantine interceptions to be rejected or treated at any point in the state. Pest Rating List B includes 57 species to be treated with eradication, containment, control, or other holding action at the discretion of the commissioner. Pest Rating List C includes 25 species to be treated with state endorsed holding action and eradication only when found in a nursery; action to retard spread outside of nurseries at the discretion of the commissioner; reject only when found in a crop-seed for planting or at the discretion of the commissioner. Five plant species are currently awaiting assignment to a Pest Rating List.

In general, nonnative noxious and invasive plant species represent a serious management concern and their inventory, monitoring, and control is expensive for land managers. Nonnative species usually lower the value of wildlife habitat and compete with agricultural crops resulting in lower forage value and production. Once inventoried, methods commonly used to control nonnative species include biological, mechanical, and chemical. Controls must be ongoing to be effective in reducing, but only rarely eliminating, nonnative plant species.

5.6 Wildlife and Wildlife Habitat

5.6.1 Introduction

The Salton Basin encompasses about 8,360 square miles, bounded on the northwest by the San Gorgonio Mountains, on the west by the San Jacinto and Santa Rosa Mountains and the Peninsular Range, and on the east by the Little San Bernardino and Chocolate Mountains. To the south, the basin includes the Imperial and Mexicali valleys through which the Alamo and New rivers and Pinto Wash flow from Mexico to the Salton Sea which lies below sea level in the northern portion of the basin (USBR 2001). Colorado Desert plant and animal communities occur within Imperial County ranging from active dunes to sand flats and desert washes to mountain peaks. Due to irrigation systems related to the All American Canal, several wetland and riparian habitats in addition to agricultural crops have become available for wildlife. The communities observed along the international border have been crosswalked to the National Vegetation Classification System at the ecological system level (NatureServe 2007) where eight ecological systems have been described by vegetation alliances and plant associations.

Wildlife typical of and adapted to this arid Sonoran Desert environment occur in the areas that support native albeit sometimes disturbed habitat that is often characterized by sparse creosotebush shrublands. Additional species are able to survive in and use the agricultural habitats, permanent water sources, and seeps related to the canal and ditch systems resulting in a moderate level of diversity.

5.6.2 Wildlife and Habitat Overview

The Project corridor supports moderately diverse populations and individuals of vertebrate and invertebrate wildlife species (see **Table 5-5**), and unique-to-common native and nonnative wildlife habitats, described as vegetation alliances, plant associations, and land use types in this BSR (see **Table 5-1**). **Table 5-5** lists wildlife observed during the field surveys by section and can provide a general indication of species richness in each section. **Table 5-5** also lists the habitat observed during the surveys, and the estimated acreage in each segment. Along the international border, climate, geology, soils, land forms, geography, precipitation, and plant communities combine to provide low to moderate habitat diversity.

Vegetation and wildlife diversity within these native and nonnative habitats is moderate and wildlife species observed and recorded during late summer, fall, and winter surveys included 5 species of mammals, 19 species of birds, and 4 reptile species. Sixty-four plant taxa were observed and potentially provide wildlife habitat within the Project corridor.

Within the Salton Basin/Imperial Valley Project corridor the broad habitat types available to resident and migrating wildlife species include herbaceous vegetation, shrubland, woodland and forest, agriculture, water bodies, and residential and urban types. The available wildlife habitat has become established on a variety of landscape features from floodplains to mountains. This section provides a brief summary of wildlife habitats observed and sampled in 2007 (see **Table 5-5**) during ESP preparation, categorized as follows:

- <u>Herbaceous Vegetation</u>: This class of wildlife habitat includes annual and perennial species of grasses, forbs, and graminoids, which typically are characterized by no less than 15 percent cover by shrubs or trees. Stands of herbaceous vegetation range from less than 0.5 up to 3.0 meters tall and range from sparse to dense in terms of cover. Herbaceous wildlife habitat occurs as patches and small stands, most pronounced south of the All American Canal in Sections B-2 and B-4.

Table 5-5. Estimated Acreages for Each Habitat

Wildlife Habitat Type Observed	Acreage by Section Numbers						Total Acreage of Wildlife Habitats
	B-1	B-2	B-4	B-5A	B-5B	C-1	
Herbaceous Vegetation							
Bermuda Grass - Heliotrope - Alkali Mallow Non-native Herbaceous Vegetation		1.4473	9.0847		1.4473	5.7102	17.690
Common Reed Herbaceous Vegetation							0.000
Shrubland							0.000
Creosotebush / Sparse Understory Shrubland	12.1386	4.0885			4.0885		20.316
Creosotebush - White Bursage - Mixed Shrubs Shrubland	58.3394						58.339
Creosotebush - Honey Mesquite - Ironwood - Desert Wash Shrub	9.3235	0.3759			0.3759		10.075
Creosotebush - Longleaf Jointfir - Stabilized Dunes Shrub			8.3579			1.4458	9.804
Creosotebush - Four-wing Saltbush - Shrubland		5.2395	0.7837		5.2395		11.263
Longleaf Jointfir - Desert Buckwheat Active Dunes Shrubland				78.1266		0.0411	78.168
Smoke-tree / Button Brittlebush Alluvial Fan Shrubland							0.000
Active Desert Dunes and Sand Fields						64.9703	64.970
Arrow Weed Shrubland			5.9357	0.3526		0.405	6.6933
Tamarisk (Tamarix chinensis, aphylla) / Arrow Weed Shrubland		0.4879	3.9278	0.5349	0.4879	2.0969	7.535
Woodland and Forest							0.000
Black Willow Woodland / Shrubland						0.1817	0.182
Open Water							0.000
Open Water Pond / Lake			16.9375				16.938
Open Water River / Ditch / Canal							0.000
Playa			0.5663				0.566
Land Use							
Agricultural Field / Fallow		1.2852			1.2852		2.570
Agriculture Cropped							0.000
Drop and Diversion Structures in the All American Canal			0.0549				0.055

Fence Structure			0.0516				0.052
Other Bare Ground		0.0718	5.2642		0.0718		5.408
Roads, Trails, Canal Banks and Berms	2.5772	4.2828	10.0259	60.3540	4.2828	0.0234	81.546
Urban Development							0.000
Total	82.3787	17.2789	60.9902	139.3681	17.2789	74.8744	392.169

a. *Grasslands* – predominantly nonnative grassland habitat characterized by Bermuda grass and common reed occurs in patches to linear stands adjacent to the All American Canal and ditches paralleling the canal on approximately 18 acres. Bermuda grass can occur as pastures north of the canal that are used for grazing livestock and grass hay fields. These nonnative grassland habitats have low floristic species diversity and provide sparse to dense foliar cover. Wildlife species often burrowed within grasslands particularly pocket gophers and cottontail rabbits. Tracks and scat indicate that raccoons, possibly coyotes, and feral dogs and cats forage in the grassland habitats. Species of dove and sparrows forage for seeds within and raptors including the red-tailed hawk, American kestrel, and turkey vulture hunt over available grassland habitat.

b. *Forblands* – forbs, including heliotrope and alkali mallow are rare and form small patches south of the All American Canal. Forb-dominated habitats occur on less than 1 acre within the Project corridor and provide quantities of seeds for birds and small mammals. Granivores, particularly species of blackbirds, doves, and sparrows feed in forblands.

c. *Emergent Wetlands* – broad-leaved cattail and common reed occur on the margins of the All American Canal, ditches, and the Alamo River banks. Emergent wetlands can be tall, from 2 –4 meters in height and dense, providing habitat for birds, mammals, herpetiles, and many invertebrates. Avian species that use emergent wetlands for roosting, nesting and brood rearing, foraging, and as escape cover include blackbirds, swallows, American coots, and wading birds including great blue herons, cattle egrets, and American egrets.

- <u>Shrublands</u>: this habitat class is common within the Project corridor, occupying approximately 267 acres. The characteristic shrubs range from 0.5 –10 meters tall and include creosotebush, shrubby tiquilia, longleaf joint fir, white bursage, arrow-weed, mesquite, and tamarisk. Shrublands provide sparse to dense cover dependent on the local hydrology.

a. *Dwarf-shrublands* – dwarf-shrublands in a patchy distribution along the Project corridor and are characterized by woody tiquilia which provides limited wildlife habitat. Reptiles including the rare flat-tailed horned lizard can use dwarf-shrub stands for foraging and as limited escape cover.

b. *Short Shrublands* – stands of sparse short shrubs characterized by creosotebush, longleaf jointfir, and white bursage occur on dunes, sand flats, gravel flats, slopes, ridges, and hills throughout the Project corridor and occupy approximately 88.5 acres. Arrow-weed dense short shrub stands have become established on 6 acres adjacent to the All American Canal. Short shrublands provide habitat for species of reptiles including the zebra-tailed lizard, side-blotched lizard, long-tailed brush lizard, and desert sidewinder that use them for foraging, breeding, resting, and as escape cover. Birds that commonly forage, breed, rest, and use short shrub habitats as escape cover include species of doves, the greater roadrunner, larks, sparrows, and raptors including the American kestrel, red-tailed hawk, and turkey vulture which hunt over short shrub habitats. Jackrabbits, cottontail rabbits, and coyotes commonly use short-shrub habitats for home ranges and kangaroo rats and ground squirrels burrow into finer soils at the base of shrubs.

c. *Tall Shrublands* – stands of tall shrubs occur predominantly near the All American Canal and within desert washes. Characterized by tamarisk tall shrubs from 4 –10 meters tall in canal-affected sites and ironwood, mesquite, and desert smoke in desert washes, this habitat type ranges from sparse to dense in terms of foliar cover and occupies approximately 7.5 acres within the Project corridor. Tall shrubs provide important perching, breeding, nesting, brood rearing, and escape cover for a variety of birds including species of doves, blackbirds, and sparrows. Mammals commonly use tall shrub habitats for resting, foraging, and as part of home ranges and include bobcat, coyote, fox, raccoon, cottontails, and small mammals. Sparse tall shrublands of desert washes such as Pinto Wash, provide valuable habitat for the rare flat-tailed horned lizard.

- <u>Woodlands</u>: open to closed-canopy patches to small stands of Athel tamarisk trees occupy less than 1 acre adjacent to the All American Canal of Sections B-2 and B-4. Woodland patches provide habitat structure, moderate canopy cover, and range between 10 –20 meters tall. The tall shrub layer comprised of dense tamarisk and sometimes arrow-weed occurs around Athel tamarisk patches, which enhances the wildlife habitat value. Tree patches are valuable for perches, escape cover, and as nesting sites for species of dove, sparrows, blackbirds, and raptors in particular. These stands provide hiding cover and burrowing/denning sites for cottontail rabbits, coyotes, raccoons, and other mammals using canal-affected habitats.

- <u>Open Water</u>: occurs in the All American Canal, associated ditches and in the Alamo River, covering approximately 17.5 acres within the Project corridor.

Open water habitats are species-rich in terms of wildlife use including fisheries. Of the avian species observed during the field research for the ESP, over half are waterfowl, wading birds, or shorebirds. The bottom substrate is typically sand and fine sediments or mud.

a. *Rivers and Canals* – flowing open water habitat includes the All American Canal, associated ditches, and the Alamo River. A fishery has become established in the All American Canal and provides important local recreation. Waterfowl species that commonly use flowing open water to rest and forage include the American coot, species of teal, egrets, cormorants, and wading birds including herons and black-necked stilts. Many wildlife species use the open water for drinking.

b. *Playas* – a moderately large playa occurs in Section B-4 and receives flows from irrigation run-off and following precipitation events of sufficient volume. When it is holding shallow water, this playa will become a valuable habitat for shorebirds and waterfowl for resting, foraging, and possibly breeding.

- <u>Land Use</u>: moderately large areas in the Project corridor are maintained on a regular basis, ranging from nearly daily maintenance in urban areas to seasonal/annual maintenance on agricultural lands. Even though subject to disturbance these habitats are important to many species of resident and migratory wildlife for all life stages ranging from movement corridors to hiding and breeding sites to important foraging sites.

a. *Irrigated Agriculture* – fields actively used to grow crops typically included alfalfa, sorghum, and truck crops such as asparagus, onions, and broccoli. The fields under production provide valuable hiding cover, dispersal corridors, roosts, forage, and some nesting habitat. Many individuals of a variety of wildlife species including herpetiles, mammals, and birds can be displaced to surrounding habitats or killed when crops are harvested by mechanical means, fields are burned to remove litter, and the ground is tilled post-harvest. Open agricultural fields are commonly used for hunting or foraging by the American kestrel, doves, cattle egrets, and ibis which often occur in croplands and pastures.

b. *Fallow Agriculture* – fields under seasonal rest often contain waste grain or support annual forbs and grasses that produce quantities of seed used by foraging wildlife. Seeds present on fallow fields attract bird species including doves, blackbirds, European starlings, quail, ducks, and geese.

c. *Residential and Urban Development* – a myriad of habitats and food and water sources are present within residential and urban areas including landscaping, open yards, structures related to buildings and other urban infrastructure, corrals, and backyard feeding stations for domestic pets and birds. Domestic pets, particularly cats, can kill individuals of small mammals and birds within urban and adjacent rural areas. Wildlife species that use residential and urban habitats regularly include raccoons, skunks, house mice, Norwegian rats, European starlings, house sparrows and finches, rock doves, mourning doves, and grackles.

d. *Highways, Roads, and Trails* – wildlife species use established transportation corridors to move and disperse rapidly across the landscape. As a result, some death occurs depending on adjacent habitat importance to wildlife, population levels, and design speed and safety features of transportation corridors. Wildlife that forage on carrion or are omnivorous, including the turkey vulture, raccoon, and coyote can benefit from the presence of road-killed animals. Transportation structures such as bridges can provide hiding and roosting cover for owls or nesting sites for swallows and rock doves.

5.7 Species Groups and Habitat Affinity

5.7.1 Mammals

In general mammals were rarely observed except for tracks and burrowing activity during late summer to winter field surveys within the Project corridor (see **Appendix D** for a more complete Imperial Valley list). Medium-sized predators included the coyote along with feral dogs and cats in the vicinity of Calexico and Mexicali. Additional medium-sized mammals that were observed included the common raccoon, desert cottontail, and black-tailed jackrabbit. Small mammal burrows that were evident included pocket gophers, kangaroo rats, and ground squirrels.

5.7.2 Birds

Bird species are moderately diverse because of the agricultural activity and the habitats resulting from All American Canal seepage. Approximately 200 avian species, including neotropical migratory birds, shorebirds, raptors, and waterfowl, can occur (see **Appendix D**).

More than 800 species of birds spend all or part of their lives in the U.S. as they migrate from summer breeding grounds in the north to winter in warmer climates of the south, including Latin America (USFWS 2002). Because migratory birds depend on habitats across many political boundaries, a coordinated conservation effort has been established internationally, with the USFWS being the principal Federal authority in the United States. Many birds migrate seasonally through or overwinter in the Imperial Valley using natural, managed, and agricultural habitats for forage, roosting, and cover.

Migratory birds are also economically important, e.g., birders recreate in many areas to identify migrant species and some hunters focus on species of dove, pheasants, and migrating waterfowl, including species of ducks and geese. Federal and state agencies and private organizations use donations to protect and restore wetlands and associated riparian and upland systems used by migrating avifauna. Federal agencies in general are responsible to protect migratory birds under Executive Order 13186 (Federal Register 2001). This executive order states that migratory birds are of great ecological and economical value to the U.S. and to other countries. They contribute to biological diversity and bring tremendous enjoyment to those who study, watch, feed, or hunt them and the critical importance of this shared resource has been recognized through ratification of international, bilateral conventions for migratory bird conservation. A list of all migratory birds included under this executive order is available under 50 CFR 10.13; a focused list for species occurring in the Project corridor is presented in **Appendix D**.

In general, the Imperial Valley represents important and unique habitat for migrant bird species, largely a result of geography, moderately diverse plant communities, and federally managed lands. The range of desert, hill, open water, riparian, playa, grassland, shrubland, woodland, and agricultural land provide habitats for migrating birds. In the absence of stopover habitat, migration will be difficult to likely impossible for bird species that require places to rest, feed, and avoid predators. The burrowing owl, a migrant and federal species of special concern, was observed using small mammal burrows on the banks of the All American Canal.

5.7.3 Herpetiles

More than 50 species of reptiles and amphibians occur in southern California desert habitats (see **Appendix D** for a specific list of herpetile species). Colorado Desert communities provided habitat for reptiles, including the zebra-tailed lizard, side-blotched lizard, long-tailed brush lizard, and desert sidewinder, in addition to the rare FTHL.

5.8 Flat-Tailed Horned Lizard and Designated Management Areas

FTHL may rarely to occasionally be encountered in Sections B-1, B-2, B-5A, and B-5B; the highest potential to encounter FTHL occurs in Section B-1. While no observations of FTHL were recorded during field surveys, active ant mounds (the principle forage) were observed in Sections B-1 and B-5A and three inactive ant mounds occurred in Section B-5B.

Flat-tailed Horned Lizard Management Area

The FTHL was listed by the Federal government as a sensitive species in California in 1980 and the El Centro Field Office of the BLM has designated five FTHL management areas within their jurisdiction. Section B-1 traverses the management area (MA) known as the Yuha Basin FTHL MA (USBLM 2003b).

The overall goal of the FTHL MA is to maintain a self-sustaining population of FTHL in perpetuity. The management objectives include: continuing to maintain sufficient habitat for FTHL populations in each of the five designated MAs; maintain a stable population; support research and promote conservation of the species, particularly in recreation areas; limit the loss of habitat within and outside of the MAs through the application of effective mitigation and compensation; and encourage Mexico to develop and implement a FTHL management strategy (USBLM 2003b).

Flat-tailed Horned Lizard Species Description

The FTHL has a round, flattened body like other horned lizard species. It is distinguished from other species by its dark vertebral stripe, lack of external ear openings, long, broad, flattened tail, and comparatively long spines on the head. It has two rows of fringed scales on each side of its body. The FTHL ranges from pale gray to light rusty brown on the dorsal side, and white or cream colored ventrally. Adult weight varies between 10 to 25 grams. Ants constitute 97 percent of their prey and harvester ants are the most important insect in the FTHL diet (USBLM 2003b).

The habitat for FTHL consists of the creosotebush-white bursage series of Sonoran desert scrub. Most records for the FTHL are from sandy flats or areas with a veneer of fine, windblown sand; the population occurs in the lowest density in parts of the Algodones dune fields (USBLM 2003b).

5.9 Wildlife Observed

Table 5-6 below lists wildlife observed during the field surveys. The table can provide a general indication of species richness in each section.

Table 5-6. Wildlife Observed During Natural Resources Surveys

Scientific Name / Common Name	Species Status	B-1	B-2	B-4	B-5A	B-5B	Total Number of Fence Sections Observed
Mammals							
Canis latrans / Coyote	C				X		1
Dipodomys sp. / Kangaroo rat	C					X	1
Lepus californicus / Black-tailed jackrabbit	C				X	X	2
Spermophilus tereticaudus tereticaudus / Round-tailed ground squirrel	C	X			X		2
Sylvilagus audubonii / Desert cottontail	C				X	X	2
Reptiles							
Callisaurus draconoides / Zebra-tailed lizard	C		X		X		2

Scientific Name / Common Name	Species Status	B-1	B-2	B-4	B-5A	B-5B	Total Number of Fence Sections Observed
Crotalus cerastes laterorepens / Desert sidewinder	C				X		1
Urosaurus graciosus / Long-tailed brush lizard	C		X				1
Uta stansburiana / Side-blotched lizard	C		X				1
Birds							
Athene cunicularia hypugaea / Burrowing owl	SSC				X		1
Bubulcus ibis / Cattle egret	C		X				1
Buteo lineatus / Red-tailed hawk	C			X		X	2
Cathartes aura meridionalisb / Turkey vulture	C		X		X		2
Callipepla gambeli / Gambel's quail	C			X			1
Charadrius vociferous / Killdeer	C			X			1
Columbina inca / Inca dove	C			X			1
Columba livia / Rock dove	C			X			1
Columbina passerine / Common ground dove	C			X			1
Eremophila alpestris / Horned lark	C	X					1
Falco sparverius / American Kestrel	C			X			1
Fulica Americana / American coot	C		X	X			2
Geococcyx californianus / Greater road runner	C				X	X	2
Himantopus mexicanus / Black-necked Stilt	C			X			1
Hirundo pyrrhonota / Cliff swallow	C			X	X		2
Pandion haliaetus carolinensis / Osprey	C		X				1
Phalacrocorax auritus / Double-crested cormorant	C		X				1

Scientific Name / Common Name	Species Status	B-1	B-2	B-4	B-5A	B-5B	Total Number of Fence Sections Observed
Quiscalus mexicanus / Great-tailed grackle	C			X			1
Zenaida macroura / Mourning dove	C			X			1

Notes: C = Common; SSC = Species of special concern

THIS PAGE INTENTIONALLY LEFT BLANK

6. Rare Species Data

To ensure the most recent data were acquired for rare species analyses, e²M requested Element Occurrence Data from NatureServe Central Databases in Arlington, Virginia, through a referral from the USFWS (NatureServe and e²M 2007a). The data fields requested and geographic scope of this request were:

1. Location and habitat data for endangered, threatened, and candidate species provided in list form by the USFWS and supplemented with online information from the CDGF-CNDDB and information from the NatureServe database.
2. The USFWS requested that all rare species occurring within 25-miles of the international border with Mexico be considered in this data search. Data were therefore requested for Imperial County.
3. Data were requested to be delivered electronically in the form of Geographic Information System (GIS) layers depicting population polygons or point locations and Excel tables for species lists/tabular data and narratives of habitat and natural history information.

To protect sensitive data, a license agreement between NatureServe and e²M was signed in 2007. Data covered under the LA reside in a Multi-Jurisdictional Dataset, which includes all precise species location data for species that are Federally listed (listed endangered, listed threatened, or candidate) or are listed under the State of California endangered species legislation. Additionally, the license agreement describes a 25-mile occurrence corridor north of the international border between the U.S. and Mexico as the licensed dataset for this Project. Data and text fields delivered by NatureServe under the license agreement included life history, threats, trends and management recommendations, classification status, confidence extent, county name, element information, U.S. Federal Information Processing Standard code, first observation date, global information, habitat types for animals, observation dates, location information, subnational information, survey information, and species status information.

The license agreement provides guidelines which stipulate external use of the data, they are:

1. "Named" Locations: species names linked with locations cannot be displayed at a scale of less than 1:100,000 or the precise species location must be randomized within a USGS topographic quadrangle.
2. "Blind" Locations: when species names are not linked with locations specific locations can be displayed, except when the species records are flagged "sensitive" or if they can be identified easily by geographic attributes at a particular location.

3. Exceptions: the only allowable exception to the guidelines occurs when data are obtained from a source independent from NatureServe and the member programs.

7. Project Database and Interactive GIS

A Microsoft Access database was developed to serve as a centralized storage system for data collected during biological field surveys. The database data entry form closely mimics the field form utilized to record ecological information within the Project corridor (**Attachment A**).

During field surveys, UTM coordinates were collected with Global Positioning System (GPS) receivers to locate observation points, photo-documentation points, wetlands, etc. The GPS data were post-processed and incorporated into feature classes for use in a GIS. Additional data collected in the field were manually entered into the Microsoft Access database.

The information stored in the database was also linked to an interactive GIS. The interactive file, or published map document, can be viewed with ESRI's ArcReader. The datasets collected and included in the published map are: biological survey areas, observation points, National Wetlands Inventory, e^2M delineated wetlands, plant communities, wildlife habitats, wildlife areas and refuges, land use, and aerial photography. The observation points are interactively hyperlinked with ground photographs acquired in the field.

THIS PAGE INTENTIONALLY LEFT BLANK

8. List of Preparers

Domenick Alario
B.A. Geography
Years of Experience: 2

A. Brent Eastty
B.S. Biology
Years of Experience: 7

Stuart Gottlieb
B.A. Geography
GIS Professional Certificate
Years of Experience: 5

Shawn Gravatt
M.S. Environmental Studies
B.S. Earth Science and Geography
Years of Experience: 10

Brian Hoppy
B.S. Biology
Certified Environmental Manager
Years of Experience: 17

Ronald E. Lamb
M.S. Environmental Science
M.A. Political Science/International Economics
B.A. Political Science
Years of Experience: 22

Cheryl Schmidt
B.S. Biology
M.S. Biology
Ph.D. Biology
Years of Experience: 22

Sarah Spratlen
Masters of Engineering
Years of Experience: 5

Karen Stackpole
B.S. Biology
M.S. Environmental Science and Education
Years of Experience: 11

Jim Von Loh
B.S. Biology
M.S. Biology
Years of Experience: 32

Lauri Watson
B.S. Environmental Science
Years of Experience: 5

THIS PAGE INTENTIONALLY LEFT BLANK

9. References

Bailey 1995	Bailey, Robert F. 1995. Ecoregions of the United States. U.S. Forest Service. Accessed On-line at: *http://www.fs.fed.us/colorimagemap/images/300.html*.
CDFA 2008	California Department of Food and Agriculture. 2008. Food and Agriculture Code, Section 7270-7276. Accessed online at: *http://www.leginfo.ca.gov/cgi-bin/*.
CDFA 2008	California Department of Food and Agriculture. 2008. Weed List. Accessed online at: *http://www.cdfa.ca.gov/phpps/ipc/weedinfo_list-fednoxweeds.htm.*
CDFG 2003	California Department of Fish and Game. 2003. The Vegetation Classification and Mapping Program; List of California Terrestrial Natural Communities Recognized by the California Natural Diversity Database. Biogeographic Data Branch. Sacramento, CA.
CNDDB 2003	California Natural Diversity Database (CNDDB). 2003.
Environmental Laboratory 1987	Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS., NTIS No. AD A176 912.
Federal Register 2001	Federal Register. 2001. Executive Order 13186: Responsibilities of Federal Agencies to Protect Migratory Birds. President W.C. Clinton, January 10, 2001. Available online at: <*http://www.archives.gov/federal-register/executive-orders/2001-Clinton.html#13186*>.
Hickman 1996	Hickman, James C. Editor. 1996. The Jepson Manual, Higher Plants of California. University of California Press. Berkeley, CA.
NatureServe 2007	NatureServe Explorer. 2007. Ecological System Comprehensive Reports. Accessed On-line at: *http://www.natureserve.org/explorer/servlet/NatureServe?sourceTemplate=tabular_report*.
USBLM 2008	U.S. Bureau of Land Management. 2008. List of Noxious Weeds in California. Accessed online at: *http://www.b.m.gov/ca/st/en/prog/weeds/weedlist.html*.
USBLM 2003a	USBLM. 2003. Imperial Sand Dunes Recreation Area Management Plan (RAMP). El Centro Field Office. El Centro, CA.

USBLM 2003b	USBLM. Flat-Tailed Horned Lizard Rangewide Management Strategy, Revision 1. 2003. El Centro Field Office. El Centro, CA.
USFWS 2007	U.S. Fish and Wildlife Service (USFWS). 2007. Peirson's Milk-Vetch Fact Sheet. Accessed On-line at: http://www.fws.gov/carlsbad/Rules/PMV/pmv_fact.pdf
USDA NRCS 2007	U.S. Department of Agriculture, Natural Resources Conservation Service. 2007. PLANTS Database. Accessed On-line at: <*http://plants.usda.gov/*>.

ATTACHMENT A

BIOLOGICAL SURVEY
OBSERVATION POINT FORM AND INSTRUCTION MANUAL

OBSERVATION SURVEY FORM

SURVEY AND SITE INFORMATION

Point Code: TX __ __ __ Quad name: ______________ BPU Code: ________ Aerial Photo #: _________

Type of Observation (Please Circle One): VEG/OBS OTHER (Specify) ______________

Site Name ______________

Survey Date ______________ Surveyors ______________ Size of Area: ______________

GPS file name ______________ Field UTM X__ __ __ __ __ __ m E Field UTM Y __ __ __ __ __ __ __ m N

☐ Coordinates from USGS Quad Map (if checked enter coordinates under GPS comments)

Datum NAD 83 Zone: ________ GPS Unit: ______________ PDOP: _______ 3D Differential? Y / N

GPS Comments: Error: +/- ______ m

Camera Name and Model:

Roll #	Frame #	Photographer	Direction/Comments

ENVIRONMENTAL DESCRIPTION

Elevation ___________ m /f t From: GPS / Map (circle one) | Slope ______________ Aspect ______________

Topographic Position:

Landform: | Geology:

Cowardin System	Hydrology		
___ Upland ___ Palustrine	___Permanently Flooded ___Semipermanently Flooded	___ Unknown ___Seasonally Flooded ___Saturated	___Temporarily Flooded ___Intermittently Flooded

Environmental Comments:

Unvegetated Surface: *(please use cover scale below)*

___ Bare soil	___ Small rocks (0.2-10cm)	___ Wood (>1cm)	___ Other (describe) ______________
___ Bedrock	___ Large rocks (>10cm)	___ Litter / duff	
	___ Sand (0.1-2mm)		

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic Class	Cover scale for strata and unvegetated surfaces:
Trees and Shrubs __Evergreen __Cold-deciduous __Mixed evergreen-cold-deciduous Herbs ___Annual ___Perennial	___Broad-leaved ___Needle-leaved ___Microphyllous ___Graminoid ___Forb ___Pteridophyte ___Non-vascular ___Mixed (describe)	___Forest ___Woodland ___Shrubland ___Wooded Shrubland ___Dwarf Shrubland ___Shrub Herbaceous ___Herbaceous ___Nonvascular ___Sparsely Vegetated ___Wooded herbaceous	01 = 0 – 10% 02 = 10 – 25% 03 = 25 – 60% 04 = 60 – 100%

OBSERVATION SURVEY FORM

Provisional Community Name:________________________________ Plot Code: TX __ __ __

	Stratum Height Class	Stratum Cover Class	Dominant Species (mark Diagnostic species with *)	% Cover
T1 Emergent	______	______	______	______
T2 Canopy	______	______	______	______
T3 Sub-canopy	______	______	______	______
S1 Tall shrub (> 2 m)	______	______	______	______
S2 Short Shrub (< 2 m)	______	______	______	______
S3 Dwarf Shrub (< 0.5 m)	______	______	______	______
H Herbaceous	______	______	______	______
N Non-vascular	______	______	______	______

Height Scale for strata:

01 = < 0.5 m	06 = 10-15m
02 = 0.5-1 m	07 = 15-20m
03 = 1-2 m	08 = 20-35 m
04 = 2-5 m	09 = 35-50 m
05 = 5-10 m	10 = >50 m

Cover scale for strata and unvegetated surfaces:

01 = 0 – 10%
02 = 10 – 25%
03 = 25 – 60%
04 = 60 – 100%

Vegetation Characterization in Texas
OBSERVATION POINT MANUAL - 2007

This document is intended to assist you in collecting observation point data in Texas during the 2007 field season. Detailed, field-by-field instructions for data collection are provided.

VEGETATION DATA COLLECTION INSTRUCTIONS

LOCATING AN OBSERVATION POINT

You will locate sampling points based on homogenous or unique aerial photo signatures and by using site maps, topographic maps, handheld GPS receivers, and/or aerial photos.

- Topography (Topo) maps are useful in identifying the landscape through which you will be navigating, and in determining the elevation of a site.
- Aerial photos aid in navigating through the landscape, and are essential in determining where to sample to inform photo-interpreters (this will be explained in more detail). **Please** record the vegetation, and its condition, that you walk through and sample on the photo or accompanying digital orthophoto. Feel free to write comments regarding unique features as well.

Along the way... look around. Context is everything – you will have a much better sense of how your sample sites represent the landscape if you are always in analysis mode. Keep in mind that the goal of this field work and field work being conducted for vegetation classification is to sample **all** the different vegetation and geologic types that occur at the site.

Special Features... in the process of locating observation points you will encounter unique features or vegetative stands too small to sample, record their coordinates using the GPS receiver and note them on aerial photos and maps. These UTM coordinates may be added to the final production map as "Special Features. Locations of significant weed occurrences (highly invasive species that pose a big threat) and large areas of infestation may also be documented as they may represent a "semi-natural" vegetation type.

OBSERVATION POINT FORM INSTRUCTIONS – 2007

The primary role of Observation Point forms is to inform aerial photo interpretation; a secondary role is to help fill out plant association descriptions and provide distribution information for writing local descriptions of plant associations. They are representative of large and homogenous aerial photo signatures, unusual signatures, confusing signatures, and signatures that are slightly different due to shifts in dominant/understory species composition. The same vegetation type should be sampled where it occurs on different geology, where slope aspect leads to changes in density, and where effects due to fire, landslide, etc. have occurred.

- **IDENTIFIERS / LOCATORS SECTION**

Observation Point Code
This is a unique identifier you give each sample plot using the format "TX.XXX". **Please record the observation point code on both sides of the form in the provided field.**

Quad Name
Record the **full name** of the 7.5-minute quadrangle, such as "The Knoll".

1

Aerial Photo Number
The photo number is in the upper right hand corner of the photo in the format FLIGHTLINE-FRAME #. Record this number on the form. Locate your observation point on the Mylar overlay of the photo, and mark your location with a dot in a circle and the observation point number. *Again, please draw and comment on the photo overlay regarding the vegetation of the plot and the surroundings.*

County
This field will be completed in the office as part of processing the GPS data.

State
TX

Site Name
This is best determined from a topographic or site map. Select a nearby feature that is an obvious waypoint, such as the name of a canyon, lava flow, etc. This name does not need to be unique. If you sample a number of observation points in a small area, you can use the same site name for all of them.

Survey Date
Date the plot was sampled. Please use this format: Month - Day - Year.

Surveyors
List the last names of the field team members present.

GPS File Name - this is the name you give to the waypoint when you mark the observation point location in your GPS receiver. When logging an observation point, the file name would be "TX" and the number (e.g., TX101 for point #101). Mark the aerial photo with a dot with a circle around it and the observation point number, "TX101.

Datum
ALWAYS check datum settings on your GPS unit at the beginning of each day. It should **always** be NAD83. This information is **CRITICAL** for correctly applying your waypoints to the final vegetation map. If it is anything other than NAD83, **please, please, please** record this on the form. This step will keep your work from being wasted.

UTM Zone
This value is recorded from the GPS unit read-out.

Field UTM X, Field UTM Y
Record the UTM easting and northing you saved as a waypoint in your GPS receiver. Please double-check to make sure that the easting is six digits and the northing is seven digits. If recorded incorrectly, your plot will show up in Venezuela or the middle of Wyoming.

In mountainous or deep canyon country it is often difficult to obtain UTM coordinates from a GPS receiver (your unit has to be able to receive at least three or four satellites). If you are unable to obtain UTM coordinates in the observation point, or if the PDOP is greater than 8 (or EPE is greater than ±50m), first try to acquire a signal from a higher point outside (but still close to) the site. If that fails, you will need to estimate the UTM coordinates from the topo map, and manually enter these UTMs into the GPS unit.

Use a map which is in NAD83 if at all possible, since the project standard is the NAD83 datum. However, you may need to use USGS 7.5 minute maps, which use the NAD27 datum, note this.

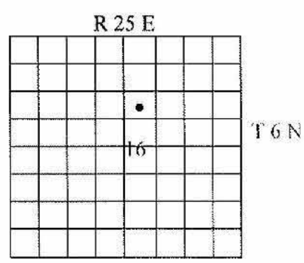
GPS Unit:
Record the name and model of the GPS receiver being used to record data for the observation point. If a GPS unit was not used to determine UTMs record 'none' here and be sure to complete the 'GPS Comments' field below.

GPS Error
Note the PDOP (or "Estimated Position Error" (EPE), if you're using a Garmin unit) displayed on your GPS unit. The lower the number, the more accurate your reading.

3D Differential?
Circle Y or N accordingly. 3D differential is obtained when your GPS unit can "see" a satellite that does nothing but correct the tiny errors in the positioning or clocks of other GPS satellites. This satellite broadcasts a real-time differential correction so that your location coordinates are as accurate as possible. It is in geosynchronous orbit in the southern sky, so if you can see the southern sky, you will generally be able to obtain 3D differential. This system is known as the Wide-Area Augmentation System, or WAAS. The Garmin and Trimble units have a field in their setup pages for turning WAAS on or off. Please make sure that WAAS is **always** on.

GPS Comments:
VERY IMPORTANT: If you resorted to estimating the observation point location UTMs on the topo map, note that in this field. If you're usual GPS croaked and you had to borrow an old Magellan from a friend, note that. Also, if you left the site to obtain a reading from a high point, record that here, along with the compass bearing and distance of the GPS location from the observation point site (unless you used the offset function on the Trimble GeoXM- in that case, enter "point offset.")

Directions to Observation Point
Give precise directions to the observation point beginning with a landmark (e.g., a named point on the topo map, a major highway, marked trailhead) readily locatable on a 7.5 minute topo map as the starting point. Use clear sentences that will be understandable to someone who is unfamiliar with the area and has only your directions to follow. Give distances and use compass directions. Be aware of the ambiguity of words like "above", "near", beyond", "on the back side of", "past". Again, using the GPS unit to give distances can be very helpful. If observation point locations lack major landmark features as guides, use township, range and sections from the topo maps. If there are no features within a reasonable distance of your site and writing directions is taking an inordinately long time, you can use a TRS description to the nearest quarter-quarter-quarter section. The TRS for the plot in the section below is "NW4SW4NE4 Sec. 16, T 6 N, R 25 E".



Photos Taken?
Circle Y or N accordingly for observation point photos.

Camera Name and Model
Circle or enter the name and model of your camera

Photos: Type/Roll Number/Frame Number/Photographer/Direction and Comments
For each photo taken at the observation point record the following: *Photo type:* indicate whether photo is a 'stand' or 'landscape' photo. *Photo number*: record photo number. *Photographer*: record last name of person taking photograph.

3

Directions/Comments: record the direction the photos were taken from and towards (eg. SE→NW) and any other comments to clarify contents of the photo (especially landscape/scenery photos).

Taking photographs
Take one representative digital photo of each observation point. The purpose is to obtain a good representation of the vegetation, not individual species. Try to include a little sky (about 10%) for perspective. Use a chalkboard to record the observation point number and the direction the photo is taken. Thus, for observation point 241, the board in the photo taken from the SE edge, facing NW, will read "SDC241, SE→NW". Take the photograph looking across the contour if site occupies a steep slope. In addition, you will need to keep a photograph log for all photos not taken on observation points.

SDC241 SE→NW

- **ENVIRONMENTAL DESCRIPTION SECTION**

Elevation
Take this measurement from the GPS receiver, in meters. Specify on the data sheet whether the measurement is in feet or meters, and whether your elevation source was the GPS unit or the topo map.

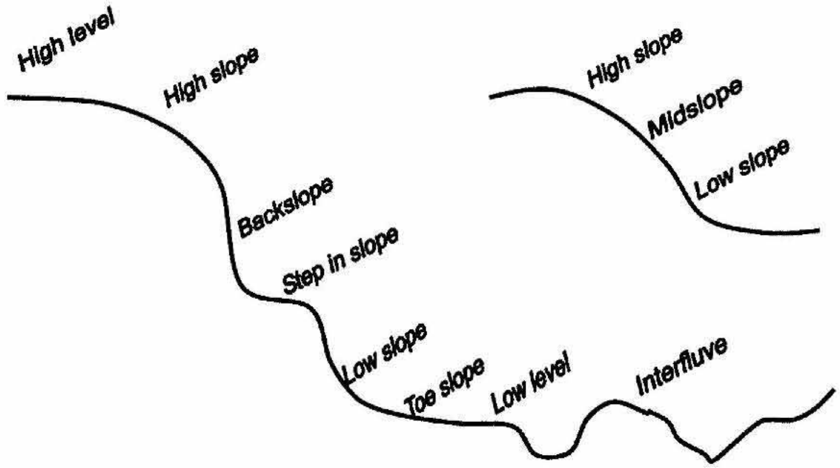
Slope
Measure the slope in degrees using a clinometer. The degree scale is the left-hand scale as you look through the clinometer. If the slope varies, estimate an average. If the observation point is on rolling microtopography, enter "variable." Describe these further under the Environmental Comments section.

Aspect
Measure the site aspect in degrees using a compass (set for local magnetic declination). If the slope is flat, enter "n/a" for aspect. If the site wraps around different aspects on a slope, enter "variable" and describe further under the Environmental Comments section.

Topographic Position
This is the position of the observation point on its related landform. Determining this requires you to think of the landform in cross-section, which is roughly diagramed below. You **must** use the terms listed below:

Interfluve (crest, summit, ridge). Linear top of ridge, hill, or mountain; the elevated area between two drainages that sheds water to the drainages.
High slope (shoulder slope, upper slope, convex creep slope). The uppermost inclined surface at the top of a slope. Includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.
High level (mesa, summit). Level top of a plateau.
Midslope (transportational midslope). Intermediate slope position.
Backslope (dipslope). Subset of midslopes that are steep, linear, and may include cliff segments.
Step in slope (ledge, terracette). Nearly level shelf interrupting a steep slope, rock wall, or cliff face.
Lowslope (lower slope, foot slope, colluvial footslope). Inner gently inclined surface at the base of a slope. Surface profile is generally concave and a transition between midslope or backslope, and toeslope.
Toeslope (alluvial toeslope). Outermost gently inclined surface at base of a slope. In profile, usually gentle, linear and characterized by alluvial deposition.
Low level (terrace). Valley floor or shoreline representing the former position of an alluvial plain, or lake.

TOPOGRAPHIC POSITION



Landform
Enter the landform(s) that describes the site where the plot was sampled. Referring to the topo map for the landscape context may help you decide what landform(s) to choose. Note that the landform choices may describe different scales, or that a landform feature can be described by more than one term. For example, your plot may be on a ledge on the rim of a canyon. A suggested list of landforms and definitions is provided in **APPENDIX 1.**

Note: The topographic position selected above should relate to the scale of the landform chosen here.

Surficial Geology
Note the geologic substrate where the plant community occurs. The geology map should help, but if you can't tell the geology at all or you do not have the geology map with you at the plot, put a general description (e.g., coarse sandstone, green shale, aeolian sands, or obscured by soils).

Cowardin System
The majority of the plots you'll be conducting will be "Uplands". Any wetland plots will be in the Palustrine category. This includes riparian stands. They are all fed by groundwater and support vascular plant communities.

> **Palustrine:** All nontidal wetlands dominated by trees, shrubs, persistent emergent species, emergent mosses, or lichens. This category also includes wetlands lacking such vegetation but with all of the following characteristics: (1) area less than 8 ha; (2) lacking an active wave-formed or bedrock boundary; (3) water depth in the deepest part of the basin less than 2 m (6.6 ft) at low water; and (4) ocean-derived salinities less than 0.5 parts per thousand.

Hydrology
This field will mostly be completed if you are in a wetland, however, some areas considered uplands may be subject to intermittent flooding. Select from the following definitions (from Cowardin et al. 1979):

5

Permanently flooded. Water covers the land surface at all times of the year in all years.
Semipermanently flooded. Surface water persists throughout growing season in most years except during periods of drought. Land surface is normally saturated when water level drops below soil surface.
Seasonally flooded. Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is very variable, extending from saturated to a water table well below the ground surface.
Saturated. Surface water is seldom present, but substrate is saturated to surface for extended periods during the growing season.
Temporarily flooded. Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Often characterizes flood-plain wetlands.
Intermittently flooded. Substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season and is dependent upon highly localized rain storms. This modifier was developed for use in the arid West for water regimes of playa lakes, intermittent streams, and dry washes but can be used in other parts of the U.S. where appropriate. This modifier can be applied to both wetland and non-wetland situations.
Unknown. The water regime of the area is not known. The unit is labeled a non-tidal wetland.

Environmental Comments

Enter any additional noteworthy comments on the environmental setting and its effect on the vegetation. Examples include: "stunted trees due to shallow soils", "vegetation only where pockets of soil occur", or "large colluvial boulders and small rocks litter surface of soil". This field can also be used to describe site history such as fire events. This is an extremely important field for crews to document so please take the time to do a thorough job. Information from this field will be used to prepare local descriptions of the plant community and for photo interpretation.

Ground Cover

Estimate the approximate percentage of the *total* surface area covered by each category. The sum of all fields should equal 100%. A helpful hint in making ocular estimates is that in a 0.5-hectare (1.24-acre) observation point, one 7 x 7m square is equal to 1%. The sum of the cover values should equal 100%. *Notes*: Estimating lichens, dark cyanobacteria and moss also take an extra step in visualization. Also note that it is possible to have bare soil and sand in a plot if sand has blown in, or to have sand on the surface of the site. If a category is present but covers less than 1% (> 0.5%) of the ground, enter a "T" on the line next to it. If a category is present but covers a tiny bit (<0.5%) of ground, enter "t".

Animal Use Evidence

Comment on any evidence of use of the site by non-domestic animals (i.e., tracks, scat, burrows, etc.) and domestic animal use (grazing) under the Environmental Comments.

Natural and Anthropogenic Disturbance

Comment on any evidence of natural or anthropogenic disturbance and specify the source, severity and effects on the vegetation. Common disturbances on sites include gullies, colluvial deposition of rocks on slopes flash flooding and sometimes old tin cans from cowboys or miners. Notes on livestock grazing and other disturbances you may encounter in the buffer include off-road vehicle use, fire, and mass-wasting are valuable. Enter disturbance comments under the Environmental Comments

Other Comments

Record any other comments. What is the extent of the community you sampled? Describe the landscape context of the community. Describe the adjacent plant communities and their relationship to the plot. Are there any other landscape features or processes influencing this community? Is there an important species that occurs in the stand but is not within your plot? Is there a large amount of a dead plant material in the plot? Record these under the Environmental Comments field.

Unvegetated Surface

This field is an ocular estimate of ground cover. Because there is no designated sample size for areas surveyed as Observation Points, you will have to estimate percent covers for whatever size the documented area encompasses. For this estimate, you must use the cover classes listed in the bottom right hand corner of the data sheet. If an unvegetated surface category is not present in your observation point area (e.g., water is very uncommon in the sampling units), leave the corresponding line blank.

• VEGETATION DESCRIPTION SECTION

Leaf Phenology

Select the best description for the leaf phenology of the **dominant** stratum. The dominant stratum is the tallest stratum that contains at least 10% cover. Leave blank for non-vascular plots.

Evergreen. Greater than 75% of the total woody cover is never without green foliage. (Some tricky examples: most *Artemisia* and all *Chrysothamnus*)
Cold deciduous. Greater than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost.
Mixed evergreen - cold deciduous. Evergreen and deciduous species are mixed within the type and generally contribute 25-75% of the total woody cover.
Perennial. Herbaceous vegetation composed of more than 50% perennial species.
Annual. Herbaceous vegetation composed of more than 50% annual species.

Leaf Type

Select the best description for the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% total plot coverage. Within that dominant stratum, the species that makes up greater than 50% of cover defines the leaf type.

Broad-leaved. Woody vegetation that is primarily broad-leaved (Sagebrush, oak, California lilac).
Needle-leaved. Woody vegetation that is primarily needle-leaved (Juniper, pine, spruce, fir, hemlock).
Microphyllous. Woody cover that is primarily microphyllous (*Ephedra*).
Graminoid. Herbaceous vegetation composed of more than 50 percent graminoid species (grasses, sedges, rushes, etc).
Forb (broad-leaf-herbaceous). Herbaceous vegetation composed of more than 50% broad-leaf forb species (*Phlox, Astragalus, Lupinus, Thalictrum, Erigeron,* etc).
Pteridophyte. Herbaceous vegetation composed of more than 50 percent ferns or fern allies (scouring rushes).
Non-vascular. Dominated by lichens or mosses.
Mixed. As with leaf phenology, the dominant stratum may be composed approximately equally of species with several different leaf types. Describe the mix briefly or circle leaf types that apply.

Physiognomic Class

This represents what you see when you are standing in the plot looking across at the vegetation. The following definitions can be used as guidelines. For example, areas with scattered pines and junipers may not fit the cover classes below but they would best be described as a woodland.

Forest. Trees with their crowns overlapping (generally forming 60-100% cover).
Woodland. Open stands of trees with crowns not usually touching (generally forming 10-60% cover). Canopy tree cover may be less than 10% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover, respectively.
Shrubland. Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less than 10% cover). Shrub cover may be less than 25% where it exceeds tree, dwarf-shrub, herb, and nonvascular cover, respectively. Vegetation composed of woody vines is included this class.
Wooded Shrubland
Trees forming approximately equal cover with a shrub component.

Dwarf-shrubland. Low-growing shrubs usually under 0.5 m tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs generally less than 10% cover). Dwarf-shrub cover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover, respectively.
Shrub Herbaceous. Low or taller shrubs forming approximately equal cover with a grass or forb component. Individuals or clumps of shrubs generally not touching and usually forming more than 25% cover; trees less than 10% cover. Spaces between shrubs are generally mostly occupied by grasses and/or forbs.
Wooded Herbaceous. Trees forming approximately equal cover with a grass or forb component.
Herbaceous. Perennial herbs (graminoids or forbs) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 10% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover, respectively.
Nonvascular. Nonvascular cover (bryophytes, lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular perennial vegetation cover may be less than 25%, as long as it exceeds tree, shrub, dwarf-shrub, and herb cover.
Sparsely Vegetated. Abiotic substrate features dominant. Perennial vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources. Total vegetation cover is typically less than 10% and greater than 2%. Badlands, ash fields, lava beds, or sand dunes supporting communities of annual plants should be included in this category, regardless of cover.

Provisional Community Name
Record the dominant species names creating the association which most closely resembles your observation point. Devise the name based on: (1) the dominant species of the dominant strata (including nonvascular) and (2) indicate the physiognomic class (this must match the physiognomic class checked on the back side of the datasheet). For example, if you are in a P-J woodland with only scattered shrubs but a really nice galleta grass layer, you would use a provisional name like "*Pinus edulis – Juniperus osteosperma / Pleuraphis jamesii* Woodland". The provisional name is also a great help to the ecologists who will be using your work to construct a classification. Note: this field should be completed only after the entire plot is completed.

- **DOMINANT PLANT SPECIES LIST**

Species/Strata Data. The form has been developed for recording information on *species* composition and cover and *strata* cover and height. Species lists (diagnostic species) and cover estimates should be completed first; then cover class and height class estimates for strata should be recorded. Write out the complete species name. The main body of the table is dedicated to recording species names and associated cover estimates. To begin, the observer needs to make a species list for the diagnostic species in the stand and assign each species to the appropriate stratum. The next section provides a brief discussion on assigning species to the appropriate strata, followed by instructions for completing the species level information.

Stratum: Species names will be recorded within the appropriate stratum. It is important that all crew members are consistent in assignment of species to strata throughout this project. Following are some guidelines to use in determining strata. Begin by assessing the strata at your site. Trees are defined as single-stemmed woody plants, generally 5 m in height or greater at maturity and under optimal growing conditions. Shrubs are defined as multiple-stemmed woody plants generally less than 5 m in height at maturity and under optimal growing conditions.

T1 Emergent, T2 Canopy, T3 Subcanopy. A uniform stand of pine or hemlock trees would be a good example of T2"canopy", but where trees are absent you would begin with the shrubs, or herbaceous species if no shrubs are present. If the tree crowns in your plot are mostly touching and similar in height, but a given tree species is much taller that species would be a T1"emergent." Occasionally, you will sample an area where there may be several tall, scattered pines and then shorter scattered junipers. In this case, the pines would be your "canopy" and the junipers would be the "subcanopy". You may also have pines listed in the "subcanopy" layer, if there are a number of short saplings in addition to mature tall trees.

The remaining vegetative strata are (remember to check with plant list for consistency):

S1 Tall Shrub. >2 meters tall. For example, *Sambucus racemosa, Amelanchier utahensis,*and *Cercocarpus ledifolius.*
S2 Short Shrub. <2 meters tall. For example, *Artemisia tridentata,* all *Symphoricarpos* spp.
S3 Dwarf Shrub. <0.5 meters tall. For example, *Artemisia arbuscula.*
H1 Graminoid. All grass species, including *Carex* spp. and *Juncus* spp.
H2 Forb. All forbs. (*Typha* is a forb.)
H3 Fern or Fern Ally. All ferns, including *Equisetum laevigatum.*
H4 Tree Seedlings. Seedlings are trees with vertical stems less than 1.5 m tall, but that may vary by species.
N Nonvascular. This is mainly mosses and lichens.
V Vine/liana. All vine species.
E Epiphyte. All epiphytic species.

Height can be used to define strata, but is not how species should be placed in strata. **Species characteristically belong to one stratum or another** (e.g., quaking aspen and juniper are canopy (T2), Utah serviceberry is a tall shrub (S1), antelope bitterbrush is a short shrub (S2), low sagebrush is a dwarf-shrub (S3), etc.), **EVEN when unusual environmental circumstances dictate that the plants have an unusually tall or unusually short growth form**. So even if the junipers growing in cracks are only 1.5 m tall, as long as they are mature trees, they are placed in the T2 category. About the only rule regarding height should be that the tree layer is (usually) higher than the tall shrub layer, is taller than the short shrub layer, etc.

The second point is to avoid splitting species between strata. If a few willow have been browsed to <1m tall, but most are 2m tall, they all are placed into the tall shrub stratum. There are two exceptions: (1) each height class covers more than 10% of plot, or (2) there is a reproductive layer of seedling shrubs or young trees.

The third point is how to define some of the "borderline/confusing" species. What we want to avoid is some folks calling *Apocynum* a forb and some calling it a dwarf-shrub or short shrub, for example.

Species / Percent Cover Estimates . Once you have identified your strata, list all diagnostic plant species in that strata and complete cover estimates per the following instructions.

1. **Species Name:** Refer to the plant list you have been provided for plant names used in this area. Always record the full scientific name for each species.
2. **Cover Class:** Estimate the aerial / crown cover of **each** species listed, using the cover class codes for the bottom of the page. These classes are as follows:
   01 = 0-10% 02 = 10-25% 03 = 25-60% 04 = 60-100%
3. **% Cover:** Record continuous cover value used to make cover class estimates.

Unknowns. If you can't identify or easily key out the plant at the site, assign a name to it to be recorded on your data sheet. For example, if you know what family it is in or its genus, label it "unknown Asteraceae sp." or "Unk. *Erigeron* sp.". If there is more than one unknown in a family, add a number to the name you give them. If you do not know the family, label the plant "Unknown 1", using consecutive numbers for additional unknowns. Record the cover class and other data for the unknown as you would for any other species. Then, take a sample of the species with as much of the plant as possible, especially intact sexual parts, if present. Place the sample in a plastic baggie, and either label the plant (if you are putting more than one plant in the baggie) or label the baggie with the plot code, the date and the name you gave it on the data form. Plant samples in baggies can be stored in coolers or refrigerators for short periods. If you are not able to key the plant out soon after collecting it, or you intend to keep the sample for the park collection, press the plant and with a label stating the plot or location of its collection (include UTMs if the sample is not from a plot), date, collectors name and name you assigned the plant. Also, thoroughly label any plant specimens collected as proof of plant occurrence for plants not listed on the site plant list.

Strata / Height Class, Cover Class and Diagnostic Species. Once the species list and associated cover data have been completed, the observer should then complete the following fields as specified below.

9

1. Indicate the average height class of the stratum in the first column, using the Height Scale at the bottom of the form. The height scale for this project is as follows:
2.

01 = <0.5 m	03 = 1- 2 m	05 = 5 – 10 m	07 = 15-20 m	09 = 35 – 50 m
02 = 0.5 – 1 m	04 = 2-5 m	06 = 10-15 m	08 = 20-35 m	10 = > 50 m

3. Enter the average percent cover class of the whole stratum in the second column, using the Cover Scale at the bottom of the form (same cover scale as for species above).
4. '*' – This Column is used to indicate which species in the strata are particularly abundant.

Record information on ***dominant species only***. There is one column that corresponds to the "Stratum" column in this table:

1. **Height.** Use the number code that best describes the heights of all plant species within a given stratum. The number codes are listed in the bottom left-hand corner of the data sheet.
2. **Cover Class.** For this ocular estimation you are looking at the aerial cover of **all** plants within a given stratum. Use the cover class codes listed in the bottom right hand corner of the data sheet and presented below.

Cover Classes	
01	0 – 10%
02	10 – 25%
03	25 - 60%
04	60 – 100%

3. **Dominant Species (Mark species that characterize the stand with a *).** List the plant species using the full scientific name. You may find that there are not enough lines, in which case you can write in the blank area under the stratum name and number codes.
4. **% Cover.** Estimate the percent aerial cover (T-100%) for each diagnostic plant species.

10

APPENDIX 1: Landform Glossary
(http://soils.usda.gov/technical/handbook/contents/part629glossary1.html)

alluvial cone - A semi-conical type of alluvial fan with very steep slopes; it is higher, narrower, and steeper (e.g., > 40% slopes) than a fan, and composed of coarser, and thicker layers of material deposited by a combination of alluvial episodes and to a much lesser degree, landslides (e.g., debris flow). Compare - alluvial fan, talus cone.

alluvial fan - A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes, shaped like an open fan or a segment of a cone, deposited by a stream (best expressed in semiarid regions) at the place where it issues from a narrow mountain or upland valley; or where a tributary stream is near or at its junction with the main stream. It is steepest near its apex which points upstream and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

alluvial flat (a) (colloquial: western US) A nearly level, graded, alluvial surface in bolsons and semi-bolsons which commonly does not manifest traceable channels, terraces or floodplain levels. Compare - flood-plain step, terrace, valley flat. (b) (**not preferred**) A general term for a small flood plain bordering a river, on which alluvium is deposited during floods.

alluvial plain - (a) A large assemblage of fluvial landforms (braided streams, terraces, etc.,) that form low gradient, regional ramps along the flanks of mountains and extend great distances from their sources (e.g., High Plains of North America. SW (b) (not recommended, use flood plain.) An general, informal term for a broad flood plain or a low-gradient delta. Compare - alluvial flat.

alluvial plain remnant - An erosional remnant of an alluvial plain which retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to a present-day stream or drainage network. Compare - alluvial plain, erosional remnant, paleoterrace.

alluvial terrace - (not preferred) refer to stream terrace.

alluvium - Unconsolidated, clastic material subaerially deposited by running water, including gravel, sand, silt, clay, and various mixtures of these. Compare - colluvium, slope alluvium.

anticline - (a) A unit of folded strata that is convex upward and whose core contains the stratigraphically oldest rocks, and occurs at the earth's surface. In a single anticline, beds forming the opposing limbs of the fold dip away from its axial plane. Compare - monocline, syncline, fold. (b) A fold, at any depth, generally convex upward whose core contains the stratigraphically older rocks.

arroyo - (colloquial: southwest A.) The channel of a flat-floored, ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material; sometimes called a wash. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed. Where arroyos intersect zones of ground-water discharge, they are more properly classed as intermittent stream channels.

artificial levee - An artificial embankment constructed along the bank of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel.

backslope - The hillslope profile position that forms the steepest and generally linear, middle portion of the slope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below. They may or may not include cliff segments (i.e. free faces). Backslopes are commonly erosional forms produced by mass movement, colluvial action, and running water. Compare - summit, shoulder, footslope, toeslope.

backswamp - A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces. Compare - valley flat.

badlands - A landscape which is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes with narrow interfluves. Badlands develop on surfaces with little or no vegetative cover, overlying unconsolidated or poorly cemented materials (clays, silts, or in some cases sandstones) sometimes with soluble minerals such as gypsum or halite.

bajada - (colloquial: southwestern US.) A broad, gently inclined, alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins. Synonym - coalescent fan piedmont. Compare - colluvial apron.

ballena - (colloquial: western US.) A fan remnant having a distinctively-rounded surface of fan alluvium. The ballena's broadly-rounded shoulders meet from either side to form a narrow summit and merge smoothly with concave sideslopes and then concave, short pediments which form smoothly-rounded drainageways between adjacent ballenas. A partial ballena is a fan remnant large enough to retain some relict fan surface on a remnant summit. Compare - fan remnant.

ballon - (colloquial: western US). A rounded, dome-shaped hill, formed by erosion or uplift.

bar - A general term for a ridge-like accumulation of sand, gravel, or other alluvial material formed in the channel, along the banks, or at the mouth of a stream where a decrease in velocity induces deposition; e.g. a channel bar or a meander bar. A generic term for any of various elongate offshore ridges, banks, or mounds of sand, gravel, or other unconsolidated material submerged at least at high tide, and built up by the action of waves or currents, especially at the mouth of a river or estuary, or at a slight distance offshore from the beach.

barchan dune - A crescent-shaped dune with tips extending leeward (downwind), making this side concave and the windward (upwind) side convex. Barchan dunes tend to be arranged in chains extending in the dominant wind direction. Compare - parabolic dune.

base slope - A geomorphic component of hills consisting of the concave to linear slope (perpendicular to the contour) which, regardless of the lateral shape is an area that forms an apron or wedge at the bottom of a hillside dominated by colluvial and slope wash processes and sediments (e.g., colluvium and slope alluvium). Distal base slope sediments commonly grade to, or interfinger with, alluvial fills, or gradually thin to form pedisediment over residuum. Compare - head slope, side slope, nose slope, interfluve, free face.

basin - (a) Drainage basin; (b) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated. (c) (colloquial: western US) A general term for the nearly level to gently sloping, bottom surface of an intermontane basin (bolson). Landforms include playas, broad alluvial flats containing ephemeral drainageways, and relict alluvial and lacustrine surfaces that rarely, if ever, are subject to flooding. Where through-drainage systems are well developed, flood plains are dominant and lake plains are absent or of limited extent. Basin floors grade mountainward to distal parts of piedmont slopes.

basin floor - A general term for the nearly level, lower-most part of intermontane basins (i.e. bolsons, semi-bolsons). The floor includes all of the alluvial, eolian, and erosional landforms below the piedmont slope. Compare - basin, piedmont slope.

basin-floor remnant - (colloquial: western US) A flat erosional remnant of any former landform of a basin floor that has been dissected following the incision of an axial stream.

bench - (not preferred) refer to structural bench.

beveled base - The lower portion of a canyon wall or escarpment marked by a sharp reduction in slope gradient from the precipitous cliff above, and characteristically composed of thinly mantled colluvium (e.g. < 1 m) and / or carapaced with a thin surficial mantle of large rock fragments from above, which overly residuum of less resistant rock (e.g., shale) whose thin strata intermittently outcrop at the surface; a zone of erosion and transport common in the canyonlands of the semi-arid, southwestern US. Compare - talus slope.

blowout - A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand, loose soil, or where protective vegetation is disturbed or destroyed; the adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Commonly small, some blowouts may be large (kilometers in diameter). Compare - deflation basin.

bluff - (a) A high bank or bold headland, with a broad, precipitous, sometimes rounded cliff face overlooking a plain or body of water, especially on the outside of a stream meander; ex. a river bluff. (b) (not preferred) use cliff. Any cliff with a steep, broad face.

bolson - (colloquial: western US.) A landscape term for an internally drained (closed) intermontane basin into which drainages from surrounding mountains converge inward toward a central depression. Bolsons are often tectonically depressed areas and, according to Peterson, include alluvial flat, alluvial plain, beach plain, barrier beach, lake plain, sand sheets, dunes, and playa. The piedmont slope includes slopes of erosional origin adjoining the mountain front (pediments) and complex construction surfaces (fans). A semi-bolson is an externally drained (open) bolson. Synonym - intermontane basin.

borrow pit - An excavated area from which earthy material has been removed typically for construction purposes offsite; also called barrow pit.

bottomland - (not recommended) use flood plain. An obsolete, informal term loosely applied to varying portions of a flood plain.

box canyon - a) A narrow gorge or canyon containing an intermittent stream following a zigzag course, characterized by high, steep rock walls and typically closed upstream by a similar wall, giving the impression, as viewed from its bottom, of being surrounded or "boxed in" by almost vertical walls. b) A steep-walled canyon heading against a cliff a dead-end canyon.

braided stream - A channel or stream with multiple channels that interweave as a result of repeated bifurcation and convergence of flow around inter-channel bars, resembling (in plan view) the strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, high bedload, non-cohesive bank material, and a steep gradient. At bank-full discharge, braided streams have steeper slopes and shallower, broader, and less stable channel cross sections than meandering streams. Compare - meandering channel, flood-plain landforms.

break - (slopes) An abrupt change or inflection in a slope or profile. Compare - knickpoint, shoulder, escarpment. (geomorphology) A marked variation of topography, or a tract of land distinct from adjacent land, or an irregular or rough piece of ground. Compare - breaks.

breaks - (colloquial: western US) A landscape or large tract of steep, rough or broken land dissected by ravines and gullies and marks a sudden change in topography as from an elevated plain to lower hilly terrain, or a line of irregular cliffs at the edge of a mesa or a river (e.g., the Missouri River breaks).

butte - An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments, commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks. Compare - mesa, plateau, cuesta.

caldera - A large, more or less circular depression, formed by explosion and/or collapse, which surrounds a volcanic vent or vents, and whose diameter is many times greater than that of the included vent, or vents. Compare - crater.

canyon - A long, deep, narrow, very steep-sided valley cut primarily in bedrock with high and precipitous walls in an area of high local relief (e.g., mountain or high plateau terrain), often with a perennial stream at the bottom; similar to but larger than a gorge. Compare - gorge, box canyon, slot canyon.

canyon bench - One of a series of relatively narrow, flat landforms occurring along a canyon wall and caused by differential erosion of alternating strong and weak horizontal strata; a type of structural bench.

canyonlands - A deeply and extensively dissected landscape composed predominantly of relatively narrow, steep-walled valleys with small flood plains or valley floors; commonly with considerable outcrops of hard bedrock on steep slopes, ledges, or cliffs, and with broader summits or interfluves than found in badlands. Sideslopes exhibit extensive erosion, active back-wearing, and relatively sparse vegetation.

channel - (a) The hollow bed where a natural body of surface water flows or may flow. The deepest or central part of the bed of a stream, containing the main current and occupied more or less continuously by water. (b) (colloquial: western US.) The bed of a single or braided watercourse that commonly is barren of vegetation and is formed of modern alluvium. Channels may be enclosed by banks or splayed across and slightly mounded above a fan surface and include bars and mounds of cobbles and stones. (c) Small, trough-like, arcuate or sinuous channels separated by small bars or ridges, caused by fluvial processes; common to flood plains and young alluvial terraces; a constituent part of *bar and channel* topography.

cinder cone - A conical hill formed by the accumulation of cinders and other pyroclastics, normally basaltic or andesitic composition. Slopes generally exceed 20 percent.

cliff - Any high, very steep to perpendicular or overhanging face of rock or earth; a precipice. Compare - bluff.

climbing dune - A dune formed by the piling-up of sand by wind against a cliff or mountain slope; very common in arid regions with substantial local relief and strong winds. Compare - sand ramp.

closed depression - A generic name for an enclosed area that has no surface drainage outlet and from which water escapes only by evaporation or subsurface drainage; an area of low ground indicated on a topographic map by a hachured contour line forming a closed loop. Compare - open basin.

collapse sinkhole - A type of sinkhole that is formed by collapse of a cave within the underlying soluble bedrock (e.g., limestone, gypsum, salt). Compare - solution sinkhole.

colluvium - Unconsolidated, unsorted material being transported or deposited on sideslopes and/or at the base of slopes by mass movement (e.g. direct gravitational action) and by local, unconcentrated runoff. Compare - alluvium, slope alluvium, scree, talus, mass movement.

complex landslide - A category of mass movement processes, associated sediments (complex landslide deposit) or resultant landforms characterized by a composite of several mass movement processes none of which dominates or leaves a prevailing landform. Numerous types of complex landslides can be specified by naming the constituent processes evident (e.g. a complex earth spread - earth flow landslide). Compare - fall, topple, slide, lateral spread, flow, landslide.

crest - (a) The commonly linear, narrow top of a ridge, hill, or mountain. It is appropriately applied to elevated areas where retreating backslopes are converging such that these high areas are almost exclusively composed of convex shoulders; (b) (not preferred) Sometimes used as an alternative for the hillslope component *summit*. Compare - summit (*part b*), saddle.

cuesta - An asymmetric, homoclinal ridge capped by resistant rock layers of slight to moderate dip (commonly less than 15 percent); produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope), that roughly parallels the inclined beds, and on the other side has a relatively short and steep or cliff-like slope (scarp) that cuts through the tilted rocks. Compare - hogback, mesa, dipslope, scarp slope, cuesta valley.

cuesta valley - A low relief, low angle, asymmetrical depression which lies parallel to the strike of underlying strata; a type of strike valley. It's formed by the differential erosion of weaker strata interbedded with more resistant bedrock. It may or may not contain a local drainage network and commonly lies above and is not connected to the regional drainage system. Compare - cuesta, valley, trough, hanging valley.

debris fall - The process, associated sediments (debris fall deposit) or resultant landform characterized by a rapid type of *fall* involving the relatively free, downslope movement or collapse of detached, unconsolidated material which falls freely through the air (lacks an underlying slip face); sediments have substantial proportions of both fine earth and coarse fragments; common along undercut stream banks. Compare - rock fall, soil fall, landslide.

debris flow - The process, associated sediments (debris flow deposit) or landform resulting from a very rapid type of *flow* dominated by a sudden downslope movement of a mass of rock, soil, and mud (more than 50% of the particles are > 2mm), and whether saturated or comparatively dry, behaves much as a viscous fluid when moving. Compare - lahar, mudflow, landslide.

deflation basin - A topographic basin excavated and maintained by wind erosion which removes unconsolidated material and commonly leaves a rim of resistant material surrounding the depression. Unlike a blowout, a deflation basin does not include adjacent deposits derived from the basin. Compare - blowout.

depression - Any relatively sunken part of the Earth's surface; especially a low-lying area surrounded by higher ground. A closed depression has no natural outlet for surface drainage (e.g. a sinkhole). An open depression has a natural outlet for surface drainage. Compare - closed depression, open depression.

desert pavement - A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments, mantling a desert surface. It is formed where wind action and sheetwash have removed all smaller particles or where coarse fragments have migrated upward through sediments to the surface. It usually protects the underlying, finer-grained material from further deflation. The coarse fragments commonly are cemented by mineral matter. Compare - erosion pavement, stone line.

dike - A tabular igneous intrusion that cuts across the bedding or foliation of the country rock. Compare – sill.

dip - A geomorphic component (characteristic piece) of flat plains (e.g., lake plain, low coastal plain, low-relief till plain) consisting of a shallow and typically closed depression that tends to be an area of focused groundwater recharge but not a permanent water body and that lies slightly lower and is wetter than the adjacent talf, and favors the accumulation of fine sediments and organic materials.

ditch - An open and usually unpaved (unlined), channel or trench excavated to convey water for drainage (removal) or irrigation (addition) to or from a landscape; smaller than a canal; some ditches are modified natural waterways.

divide - (a) The line of separation; (b) The summit area, or narrow tract of higher ground that constitutes the watershed boundary between two adjacent drainage basins; it divides the surface waters that flow naturally in one direction from those that flow in the opposite direction. Compare – interfluve.

dome - (a) An uplift or anticlinal structure, either circular or elliptical in outline, in which the rocks dip gently away in all directions. A dome may be small (e.g. a salt dome) or many kilometers in diameter. (b) A smoothly rounded landform of rock mass such as a rock-capped mountain summit, that roughly resembles the dome of a building. (e.g. the rounded granite peaks of Yosemite, CA).

drainageway - (a) A general term for a course or channel along which water moves in draining an area. (b) a term restricted to relatively small, roughly linear or arcuate depressions that move concentrated water at some time, and either lack a defined channel (e.g. head slope, swale) or have a small, defined channel (e.g. low order streams).

draw - A small, natural watercourse cut in unconsolidated materials, generally more open with a broader floor and more gently sloping sides than an arroyo, ravine or gulch, and whose present stream channel may appear inadequate to have cut the drainageway that it occupies.

dune - A low mound, ridge, bank or hill of loose, windblown, subaerially deposited granular material (generally sand), either barren and capable of movement from place to place, or covered and stabilized with vegetation, but retaining its characteristic shape. (See barchan dune, parabolic dune, parna dune, shrub-coppice dune, seif dune, transverse dune).

dune field - An assemblage of moving and/or stabilized dunes, together with sand plains, interdune areas, and the ponds, lakes, or swamps produced by the blocking of steams by the sand. See dune lake.

earthflow - The process, associated sediments (earthflow deposit) or resultant landforms characterized by slow to rapid types of flow dominated by downslope movement of soil, rock, and mud (more than 50% of the particles are < 2 mm), and whether saturated or comparatively dry, behaves as a viscous fluid when moving. Compare - debris flow (coarser, less fluid), mudflow (finer, more fluid).

eolian deposit - Sand, silt or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess. Conventionally, primary volcanic deposits (e.g. tephra) are handled separately. Compare - loess, parna, beach sands.

eolian sands - Sand-sized, clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sand sheet. Compare - beach sands.

ephemeral stream - Generally a small stream, or upper reach of a stream, that flows only in direct response to precipitation. It receives no protracted water supply from melting snow or other sources and its channel is above the water table at all times. Compare - arroyo, intermittent stream, perennial stream.

eroded fan remnant - All, or a portion of an alluvial fan that is much more extensively eroded and dissected than a fan remnant; sometimes called an *erosional fan remnant*. It consists primarily of a) eroded and highly dissected sides (*eroded fan-remnant sideslopes*) dominated by hillslope positions (shoulder, backslope, etc.), and b) to a lesser extent an intact, relatively planar, relict alluvial fan "summit" area best described as a tread.

eroded fan-remnant sideslope - A rough or broken margin of an *eroded fan remnant* highly dissected by ravines and gullies that can be just a fringe or make up a large part of an eroded alluvial fan; its bounding escarpments (risers), originally formed by inset channels, have become highly dissected and irregular such that terrace components (tread and riser) have been consumed or modified and replaced by hillslope positions and components (shoulder, backslope, footslope, etc.); sometimes referred to as *fan remnant sideslopes*. Compare - eroded fan remnant.

escarpment - A continuous, steep slope or cliff produced by erosion or faulting and that topographically interrupts or breaks the general continuity of more gently sloping land surfaces . The term is most commonly applied to cliffs produced by differential erosion. Synonym = scarp.

falling dune - An accumulation of sand that is formed as sand is blown off a mesa top or over a cliff face or steep slope, forming a solid wall, sloping at the angle of repose of dry sand, or a fan extending downward from a re-entrant in the mesa wall. Compare - climbing dune, sand ramp.

fan - (a) A gently sloping, fan-shaped mass of detritus forming a section of a low-angle cone commonly at a place where there is a notable decrease in gradient; specifically an alluvial fan (not preferred – use alluvial fan). Compare - alluvial fan, alluvial cone. (b) A fan-shaped mass of congealed lava that formed on a steep slope by the continually changing direction of flow.

fan apron - A sheet-like mantle of relatively young alluvium and soils covering part of an older fan piedmont (and occasionally alluvial fan) surface, commonly thicker and further down slope (e.g., mid-fan or mid-fan piedmont) than a fan collar. It somewhere buries an older soil that can be traced to the edge of the fan apron where the older soil emerges as the land surface, or relict soil. No buried soils should occur within a fan-apron mantle itself. Compare - fan collar.

fan collar - A landform comprised of a thin, short, relatively young mantle of alluvium along the very upper margin (near the proximal end or apex) of a major alluvial fan. The young mantle somewhere buries an older soil that can be traced to the edge of the collar where the older soil emerges at the land surface as a relict soil. Compare - fan apron.

fan remnant - A general term for landforms that are the remaining parts of older fan-landforms, such as alluvial fans, fan aprons, inset fans, and fan skirts, that either have been dissected (erosional fan-remnants) or partially buried (nonburied fan-remnants). An erosional fan remnant must have a relatively flat summit that is a relict fan-surface. A nonburied fan-remnant is a relict surface in its entirety. Compare - eroded fan remnant, ballena.

fan skirt - The zone of smooth, laterally-coalescing, small alluvial fans that issue from gullies cut into the fan piedmont of a basin or that are coalescing extensions of the inset fans of the fan piedmont, and that merge with the basin floor at their toeslopes. These are generally younger fans which onlap older fan surfaces.

fault-line scarp - (a) A steep slope or cliff formed by differential erosion along a fault line, as by the more rapid erosion of soft rock on the side of a fault as compared to that of more resistant rock on the other side; e.g. the east face of the Sierra Nevada in California. (b) (not recommended) A fault scarp that has been modified by erosion. This usage is not recommended because the scarp is usually not located on the fault line.

fen - Waterlogged, spongy ground containing alkaline decaying vegetation, characterized by reeds, that develops into peat. It sometimes occurs in sinkholes of karst regions. Compare - bog, marsh, swamp.

finger ridge - One in a group of small, tertiary spur ridges that form crudely palmate extensions of erosional remnants along the flanks or nose of larger ridges. Compare - ballena, rib.

flat - (a) (adjective) Said of an area characterized by a continuous surface or stretch of land that is smooth, even, or horizontal, or nearly so, and that lacks any significant curvature, slope, elevations, or depressions. (b) (noun) An informal, generic term for a level or nearly level surface or small area of land marked by little or no local relief. Compare - mud flat. (c) (not recommended) A nearly level region that visibly displays less relief than its surroundings.

flood plain - The nearly level plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the streams.

foothills - A steeply sloping upland composed of hills with relief of 30 up to 300 meters and fringes a mountain range or high-plateau escarpment. Compare - hill, mountain, plateau. SW &

footslope - The hillslope profile position that forms the concave surface at the base of a hillslope. It is a transition zone between upslope sites of erosion and transport (shoulder, backslope) and downslope sites of deposition (toeslope). Compare - summit, shoulder, backslope, and toeslope.

free face - A geomorphic component of hills and mountains consisting of an outcrop of bare rock that sheds rock fragments and other sediments to, and commonly stands more steeply than the angle of repose of, the colluvial slope immediately below; most commonly found on shoulder and backslope positions, and can comprise part or all of a nose slope or side slope. Compare - interfluve, crest, nose slope, side slope, head slope, base slope.

gorge - (a) A narrow, deep valley with nearly vertical, rocky walls, smaller than a canyon, and more steep-sided than a ravine; especially a restricted, steep-walled part of a canyon. (b) A narrow defile or passage between hills or mountains.

graben - An elongate trough or basin bounded on both sides by high-angle, normal faults that dip towards the interior of the trough. It is a structural form that may or may not be geomorphically expressed as a rift valley. Compare - horst.

gravel pit - A depression, ditch or pit excavated to furnish gravel for roads or other construction purposes; a type of borrow pit.

ground soil - Any soil at the present-day land surface and actively undergoing pedogenesis,

gulch - (colloquial: western US.; not preferred - refer to ravine) A small stream channel, narrow and steep-sided in cross section, and larger than a gully, cut in unconsolidated materials. General synonym - ravine. Compare - arroyo, draw, gully, wash.

16

gully - A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water usually during and immediately following heavy rains or ice / snow melt. A gully generally is an obstacle to wheeled vehicles and too deep (e.g., > 0.5 m) to be obliterated by ordinary tillage; (a rill is of lesser depth and can be smoothed over by ordinary tillage). Compare - rill, ravine, arroyo, swale, draw.

hanging valley - A tributary valley whose floor at the lower end is notably higher than the floor of the main valley in the area of junction.

head slope - A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway, resulting in converging overland water flow (e.g. sheet wash); head slopes are dominated by colluvium and slope wash sediments (e.g., slope alluvium); contour lines form concave curves. Slope complexity (downslope shape) can range from simple to complex. Headslopes are comparatively moister portions of hillslopes and tend to accumulate sediments (e.g., cummulic profiles) where they are not directly contributing materials to channel flow. Compare - side slope, nose slope, free face, interfluve, crest, base slope.

headwall - A steep slope at the head of a valley; e.g. the rock cliff at the back of a cirque. Compare - cirque headwall.

high hill - A generic name for an elevated, generally rounded land surface with high local relief, rising between 90 meters (approx. 300 ft.) to as much as 300 m (approx. 1000 ft.) above surrounding lowlands. Compare - low hill, hill, hillock.

hill - A generic term for an elevated area of the land surface, rising at least 30 m (100 ft.) to as much as 300 meters (approx. 1000 ft.) above surrounding lowlands, usually with a nominal summit area relative to bounding slopes, a well-defined, rounded outline and slopes that generally exceed 15 percent. A hill can occur as a single, isolated mass or in a group. A hill can be further specified based on the magnitude of local relief: *low hill* (30 - 90 m) or *high hill* (90 - 300 m). Informal distinctions between a hill and a mountain are often arbitrary and dependent on local convention. Compare - hillock, plateau, mountain, foothills, hills.

hillock - A generic name for a small, low hill, generally between 3 - 30 m in height and slopes between 5 and 50% (e.g., bigger than a mound but smaller than a hill); commonly considered a microfeature. Compare - mound, hill.

hillslope - A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill. Compare - mountain slope.

hogback - A sharp-crested, symmetric (homoclinal) ridge formed by highly tilted resistant rock layers; produced by differential erosion of interlayered resistant and weak rocks with dips greater than about 25 degrees (45 percent). Compare - cuesta.

hoodoo - A bizarrely shaped column, pinnacle, or pillar of rock produced by differential weathering or erosion in a region of sporadically heavy rainfall. Formation is facilitated by joints and layers of varying hardness. Compare - earth pillar.

horst - An elongate block that is bounded on both sides by normal faults that dip away from the interior of the horst. It is a structural form and may or may not be expressed geomorphically.

hummock - (a) (not preferred - see hillock). An imprecise, general term for a rounded or conical mound or other small elevation. (b) (not preferred) A slight rise of ground above a level surface.

impact crater - a) A generally circular or elliptical depression formed by hypervelocity impact of an experimental projectile or ordinance into earthy or rock material. Compare - caldera, crater, meteorite crater. SW; b) (not recommended - use meteorite crater) A generally circular crater formed by the impact of an interplanetary body (projectile) on a planetary surface.

inset fan - (colloquial; western US) The flood plain of an ephemeral stream that is confined between fan remnants, ballenas, basin-floor remnants, or closely-opposed fan toeslopes of a basin.

interdune - The relatively flat surface, whether sand-free or sand-covered, between dunes. GG

interfluve - A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways. Compare - divide.

intermittent stream - A stream, or reach of a stream, that does not flow year-round (commonly dry for 3 or more months out of 12) and whose channel is generally below the local water table; it flows only when it receives a) base flow (i.e. solely during wet periods), or b) ground-water discharge or protracted contributions from melting snow or other erratic surface and shallow subsurface sources. Compare - ephemeral stream.

island - (a) Land completely surrounded by water; (b) An elevated area of land surrounded by swamp, or marsh, or isolated at high water or during floods. Compare - barrier island.

knob - (a) A rounded eminence, a small hill or mountain; especially a prominent or isolated hill with steep sides, commonly found in the Southern United States. (b) A peak or other projection from the top of a hill or mountain. Also, a boulder or group of boulders or an area of resistant rocks protruding from the side of a hill or mountain. Compare - stack.

knoll - A small, low, rounded hill rising above adjacent landforms.

lake - An inland body of permanent standing water, fresh or saline, occupying a depression, generally of appreciable size (larger than a pond) and too deep to permit vegetation (excluding subaqueous vegetation) to take not completely across the expanse of water.

lakebed - (a) The flat to gently undulating ground underlain or composed of fine-grained sediments deposited in a former lake. (b) The bottom of a lake; a lake basin.

lakeshore - The narrow strip of land in contact with or bordering a lake; especially a beach.

landslide - A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials, caused by gravitational forces and which may or may not involve saturated materials. Names of landslide types generally reflect the dominant process and/or the resultant landform. The main operational categories of mass movement are *fall* (rockfall, soil fall, topple), *slide* (rotational landslide, block glide, debris slide, lateral spread), *flow* [rock fragment flow (especially rockfall avalanche), debris avalanche, debris flow (e.g., lahar), earthflow, (creep, mudflow)], and *complex landslides*. Compare - solifluction.

ledge - (a) A narrow shelf or projection of rock, much longer than wide, formed on a rock wall or cliff face, as along a coast by differential wave action on softer rocks; erosion is by combined biological and chemical weathering. (b) A rocky outcrop; solid rock. (c) A shelf-like quarry exposure or natural rock outcrop. Compare - structural bench.

levee - An artificial or natural embankment built along the margin of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel. Compare artificial levee, natural levee.

longitudinal dune - A long, narrow sand dune, usually symmetrical in cross profile, oriented parallel to the prevailing wind direction ; it is wider and steeper on the windward side but tapers to a point on the lee side. It commonly forms behind an obstacle in an area where sand is abundant and the wind is strong and constant. Such dunes can be a few meters high and up to 100 km long. Compare - seif dune, transverse dune.

low hill - A generic name for an elevated, generally rounded land surface with low local relief, rising between 30 meters (100 ft.) to as much as 90 m (approx. 300 ft.) above surrounding lowlands. Compare - high hill, hill, hillock.

lowland - (a) A generic, imprecise term for low-lying land or an extensive region of low-lying land, especially near a coast and including the extended plains or country lying not far above tide level. (b) (not preferred) A generic, imprecise term for a landscape of low, comparatively level ground of a region or local area, in contrast with the adjacent higher country. (c) (not recommended - use valley, bolson, etc.) A generic term for a large valley. Compare - upland.

marsh - Periodically wet or continually flooded areas with the surface not deeply submerged. Covered dominantly with sedges, cattails, rushes, or other hydrophytic plants. Compare - salt marsh, swamp, bog, fen.

meander belt - The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops. Landform components of the meander-belt surface are produced by a combination of gradual (lateral and down-valley) migration of meander loops and avulsive channel shifts causing abrupt cut-offs of loop segments. Landforms flanking the sinuous stream channel include: point bars, abandoned meanders, meander scrolls, oxbow lakes, natural levees, and flood-plain splays. Meander belts may not exhibit prominent natural levee or splay forms. Flood plains of broad valleys may contain one or more abandoned meander belts in addition to the zone flanking the active stream channel.

meander scar - (a) A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream which impinged upon and undercut the bluff; if it's no longer adjacent to the modern stream channel it indicates an

18

abandoned route of the stream; (b) (not recommended - refer to oxbow) An abandoned meander, commonly filled in by deposition and vegetation, but still discernable.

meander scroll - (a) One of a series of long, parallel, close fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank. Compare - meander belt, point bar. (b) (not recommended; refer to oxbow lake) - A small, elongate lake on a flood plain in a well-defined part of an abandoned stream channel.

mesa - A broad, nearly flat-topped, and usually isolated landmass bounded by steep slopes or precipitous cliff and capped by layers of resistant, nearly horizontal, rocky summit width greater than the height of bounding escarpments. (Colloquial: western US; not preferred) Also used to designate broad structural benches and alluvial terraces that occupy intermediate levels in stepped sequences of platforms bordering canyons and valleys. Compare - butte, plateau, cuesta.

monocline - (a) A unit of folded strata that dips from the horizontal in one direction only, is not part of an anticline or syncline, and occurs at the earth's surface.. This structure is typically present in plateau areas where nearly flat strata locally assume steep dips caused by differential vertical movements without faulting. Compare - anticline, syncline, fold. (b) - A local steepening in an otherwise uniform gentle dip.

mountain - A generic term for an elevated area of the land surface, rising more than 300 meters above surrounding lowlands, usually with a nominal summit area relative to bounding slopes and generally with steep sides (greater than 25 percent slope) with or without considerable bare-rock exposed. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are primarily formed by tectonic activity and/or volcanic action and secondarily by differential erosion. Compare - hill, hillock, plateau, foothills, mountains.

natural levee - A long, broad low ridge or embankment of sand and coarse silt, built by a stream on its flood plain and along both sides of its channel, especially in time of flood when water overflowing the normal banks is forced to deposit the coarsest part of its load. It has a gentle slope away from the river and toward the surrounding floodplain, and its highest elevation is closest to the river bank. Compare - levee, artificial levee, meander belt.

open depression - A generic name for any enclosed or low area that has a surface drainage outlet whereby surface water can leave the enclosure; an area of lower ground indicated on a topographic map by contour lines forming an incomplete loop or basin indicating at least one surface exit. Compare - closed basin.

overbank deposit - Fine-grained sediments (silt and clay) deposited from suspension on a flood plain by floodwaters that cannot be contained within the stream channel.

overflow stream channel - A watercourse that is generally dry but conducts flood waters that have overflowed the banks of a river, commonly from large storms or annual meltwater.

oxbow - A closely looping stream meander having an extreme curvature such that only a neck of land is left between the two parts of the stream. (colloquial: northeastern A.) the land enclosed, or partly enclosed, within an oxbow. Compare - meander belt, oxbow lake, bayou.

oxbow lake - The crescent-shaped, often ephemeral body of standing water situated by the side of a stream in the abandoned channel (oxbow) of a meander after the stream formed a neck cutoff and the ends of the original bend were silted up. Compare - meander belt, oxbow.

parabolic dune - A sand dune with a long, scoop-shaped form, convex in the downwind direction so that its horns point upwind, whose ground plan, when perfectly developed, approximates the form of a parabola.

peak - Sharp or rugged upward extension of a ridge chain, usually at the junction of two or more ridges; the prominent highest point of a summit area.

pediment - A gently sloping erosional surface at the foot of a receding hill or mountain slope. The surface may be essentially bare, exposing earth material that extends beneath adjacent uplands; or it may be thinly mantled with alluvium and colluvium, ultimately in transit from upland front to basin or valley lowland. In hill-foot slope terrain the mantle is designated "pedisediment." The term has been used in several geomorphic contexts: Pediments may be classed with respect to (a) landscape positions, for example, intermontane-basin piedmont or valley-border footslope surfaces (respectively, apron and terrace pediments); (b) type of material eroded, bedrock or regolith; or (c) combinations of the above. Compare - Piedmont slope.

perennial stream - A stream or reach of a stream that flows continuously throughout the year and whose surface is generally lower than the water table adjacent to the region adjoining the stream. Compare - Ephemeral stream, Intermittent stream.

piedmont - (adjective) Lying or formed at the base of a mountain or mountain range; e.g., a piedmont terrace or a piedmont pediment. (noun) An area, plain, slope, glacier, or other feature at the base of a mountain; e.g., a foothill or a bajada. In the United States, the Piedmont is a low plateau extending from New Jersey to Alabama and lying east of the Appalachian Mountains.

piedmont slope - (colloquial - western US) The dominant gentle slope at the foot of a mountain; generally used in terms of intermontane-basin terrain in arid to subhumid regions. Main components include: (a) An erosional surface on bedrock adjacent to the receding mountain front (pediment, rock pediment); (b) A constructional surface comprising individual alluvial fans and interfan valleys, also near the mountain front; and (c) A distal complex of coalescent fans (bajada), and alluvial slopes without fan form. Piedmont slopes grade to basin-floor depressions with alluvial and temporary lake plains or to surfaces associated with through drainage (e.g., axial streams). Compare - bolson, fan piedmont.

plain - A general term referring to any flat, lowland area, large or small, at a low elevation. Specifically, any extensive region of comparatively smooth and level gently undulating land. A plain has few or no prominent hills or valleys but sometimes has considerable slope, and usually occurs at low elevation relative to surrounding areas. Where dissected, remnants of a plain can form the local uplands. A plain may be forested or bare of trees and may be formed by deposition or erosion. Compare - lowland, plateau.

plateau - A comparatively flat area of great extent and elevation; specifically an extensive land region considerably elevated (more than 100 meters) above adjacent lower-lying terrain, and is commonly limited on at least one side by an abrupt descent, has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level. Compare - hill, foothill, mountain, mesa, plain.

playa - The usually dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those occurring on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation-runoff events. Playa deposits are fine grained and may or may not have high water table and saline conditions.

point bar - One of a series of low, arcuate ridges of sand and gravel developed on the inside of a growing meander by the slow addition of individual accretions accompanying migration of the channel toward the outer bank. Compare - meander scroll.

pond - (a) A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger than a pool. (b) A small artificial body of water, used as a source of water. Compare - salt pond.

pool - A small, natural body of standing water, usually fresh; e.g. a stagnant body of water in a marsh, or a transient puddle in a depression following a rain.

quarry - Excavation areas, open to the sky, usually for the extraction of stone.

ravine - A small stream channel; narrow, steep-sided, commonly V-shaped in cross section and larger than a gully, cut in unconsolidated materials. General synonym (not preferred) - gulch. Compare - arroyo, draw, gully.

reef - (a) A ridge-like or mound-like structure, layered or massive, built by sedentary calcareous organisms, especially corals, and consisting mostly of their remains; it is wave-resistant and stands above the surrounding contemporaneously deposited sediment. Also, such a structure built in the geologic past and now enclosed in rock, commonly of differing lithology. (b) A mass or ridge of rocks, especially coral and sometimes sand, gravel, or shells, rising above the surrounding sea or lake bottom to or nearly to the surface, and dangerous to navigation; specifically such a feature at 10 fathoms (18.3 m) or less, formerly 6 fathoms (11 m).

ridge - A long, narrow elevation of the land, usually sharp crested with steep sides and forming an extended upland between valleys. The term is used in areas of both hill and mountain relief.

rill - A very small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water, usually during and immediately following moderate rains or after ice/snow melt. Generally, a rill is not an obstacle to wheeled vehicles and is shallow enough to be obliterated by ordinary tillage. Compare - gully.

rim - The border, margin, edge, or face of a landform, such as the curved brim surrounding the top part of a crater or caldera; specifically the rimrock of a plateau or canyon.

rise - (refer to lake plain) (a) A general term for a slight increase in slope and elevation of the land surface, usually with a broad summit and gently sloping sides. (b) same as (a) but the term is restricted to microfeatures in areas of very low relief such as lake plains or coastal plains.

river - (a) A general term for a natural, freshwater surface stream of considerable volume and generally with a permanent base flow, moving in a defined channel toward a larger river, lake, or sea. (b) (not recommended: colloquial - New England, US) A small watercourse which elsewhere in the US is known as a *creek*. Compare - stream.

river valley - an elongate depression of the Earth's surface; carved by a river during the course of it's development. Compare - valley side, valley floor.

rockfall - The process, associated sediments (rockfall deposit) or resultant landform characterized by a very rapid type of *fall* dominated by downslope movement of detached rock bodies which fall freely through the air or by leaps and bounds (lacks an underlying slip face); also spelled rock fall. Compare - debris fall, soil fall, landslide.

rock pediment - An erosion surface of low relief, cut directly into and across bedrock and composed of either bare rock or thinly veneered pedisediment or residuum (e.g. < 1.5 m) over bedrock; it occurs along the flanks of mountain fronts, or at the base of mountains or high hills. Its surface grades to the backwearing mountain slopes or hillslopes above, and generally grades down to and merges with a lower-lying alluvial plain, piedmont slope or valley floor below.

rotational slide - The process, associated sediments (rotational landslide deposit) or resultant landforms characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely soil-rock materials, portions of which remain largely intact and in which movement occurs along a well-defined, concave shear surface and resulting in a backward rotation of the displaced mass. The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase). Compare - rotational debris slide, rotational earth slide, rotational rock slide, translational slide, lateral spread, landslide.

rubble - An accumulation of loose angular rock fragments, commonly overlying outcropping rock; the unconsolidated equivalent of a breccia. Compare - scree, talus.

saddle - A low point on a ridge or interfluve, generally a divide (pass, col) between the heads of streams flowing in opposite directions. Compare - summit, crest.

sandhills - A region of semi-stabilized sand dunes or sandy hills, either covered with vegetation or bare, as in north-central Nebraska and the midlands of the Carolinas.

sand plain - (a) A sand-covered plain which may originate by deflation of sand dunes, and who's lower limit of erosion is governed by the ground-water level. Also spelled *sandplain.* (b) (not preferred - refer to *sandy* outwash plain) A small outwash plain composed chiefly of sand deposited by meltwater streams flowing from a glacier.

sand ramp - A sand sheet blown up onto the lower slopes of a bedrock hill or mountain and forming an inclined plane, sometimes filling small mountain-side valleys and even crossing low passes. Compare - climbing dune, sand sheet.

sand sheet - A large, irregularly shaped, commonly thin, surficial mantle of eolian sand, lacking the discernible slip faces that are common on dunes.

scarp - An escarpment, cliff, or steep slope of some extent along the margin of a plateau, mesa, terrace, or structural bench. A scarp may be of any height. Compare - escarpment.

scarp slope - The relatively steeper face of a cuesta, facing in a direction opposite to the dip of the strata. Compare - dip slope.

scree - A collective term for an accumulation of coarse rock debris or a sheet of coarse debris mantling a slope. Scree is not a synonym of talus, as scree includes loose, coarse fragment material on slopes without cliffs. Compare - talus, colluvium, mass movement.

scree slope - A portion of a hillside or mountainslope mantled by scree and lacking an up-slope rockfall source (i.e. cliff). Compare - talus slope, scree, talus.

seep - (noun) An area, generally small, where water or oil percolates slowly to the land surface. For water, it may be considered as a seepage spring, but it is used by some for flows too small to be considered as springs.

shoulder - The hillslope profile position that forms the convex, erosional surface near the top of a hillslope. If present, it comprises the transition zone from summit to backslope. Compare - summit, crest, backslope, footslope, and toeslope.

shrub-coppice dune - A small, streamlined dune that forms around brush and clump vegetation.

side slope - A laterally planar area of a hillside, resulting in predominantly parallel overland water flow (e.g., sheet wash); contour lines generally form straight lines. Side slopes are dominated by colluvium and slope wash sediments. Slope complexity (downslope shape) can range from simple to complex. Compare - head slope, nose slope, free face, interfluve, crest, base slope. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluve. It is generally linear along the slope width.

slide - (a) Mass movement processes, associated sediments (slide deposit) or resultant landforms (e.g., rotational, translational, and snow slide) characterized by a failure of earth, snow, or rock under shear stress along one or several surfaces that are either visible or may reasonably be inferred. The moving mass may or may not be greatly deformed, and movement may be rotational (rotational slide) or planar (translational slide). A slide can result from lateral erosion, lateral pressure, weight of overlying material, accumulation of moisture, earthquakes, expansion owing to freeze-thaw of water in cracks, regional tilting, undermining, fire, and human agencies. Compare -fall, topple, lateral spread, flow, complex landslide. (b) The track of bare rock or furrowed earth left by a slide. (c) The mass of material moved by or deposited by a slide.

slip face - The steeply sloping surface of a dune, standing at or near the angle of repose of loose sand, and advancing downwind by a succession of slides wherever that angle is exceeded.

slope - (also called slope gradient or gradient) The inclination of the land surface from the horizontal. Percent slope is the vertical distance divided by the horizontal distance, then multiplied by 100.

slope alluvium - Sediment gradually transported down mountain or hill slopes primarily by non-channel alluvial processes (i.e., slope wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of coarse fragments and may be separated by stone lines. Sorting of pebbles or cobbles and burnished peds distinguish these materials from unsorted colluvial deposits. Compare - colluvium, slope wash.

slope wash - A collective term for non-fluvial, incipient alluvial *processes* (e.g. overland flow, minor rills) that detach, transport, and deposit sediments down hill and mountain slopes. Related sediments (*slope alluvium*) exhibit nominal sorting or rounding of particles, peds, etc., and lateral sorting downslope on long slopes; stratification is crude and intermittent and readily destroyed by pedoturbation and frost action. Also called *slope wash processes*. Compare - slope alluvium, colluvium, valley-side alluvium.

slot canyon - A long, narrow, deep and tortuous channel or drainageway with sheer rock walls eroded into sandstone or other sedimentary rocks, especially in the semi-arid western US (e.g. Colorado Plateau); subject to flash flood events; depth to width ratios exceed 10:1 over most of its length and can approach 100:1; commonly containing unique ecological communities distinct from the adjacent, drier uplands.

strath terrace - A type of stream terrace, formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

stream - (a) A body of running water that moves under gravity to progressively lower levels, in a relatively narrow but clearly defined channel on the ground surface, in a subterranean cavern, or beneath or in a glacier. It is a mixture of water and dissolved, suspended, or entrained matter. (b) A term used in quantitative geomorphology interchangeably with channel. Compare - river.

stream terrace - One or a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, and representing the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition (i.e., currently very rarely or never floods; inactive cut and fill and/or scour and fill processes). Erosional surfaces cut into bedrock and thinly mantled with stream deposits (alluvium) are called "strath terraces." Remnants of constructional valley floors thickly mantled with alluvium are called alluvial terraces. Compare - alluvial terrace, flood-plain step, strath terrace, terrace.

strike valley - A subsequent valley eroded in, and developed parallel to the strike of, underlying weak strata; such as a cuesta; a valley that often, but not necessarily contains a strike valley.

structural bench - A platform-like, nearly level to gently inclined erosional surface developed on resistant strata in areas where valleys are cut in alternating strong and weak layers with an essentially horizontal attitude. Structural benches are bedrock controlled, and in contrast to stream terraces, have no geomorphic implication of former, partial erosion cycles and base-level controls, nor do they represent a stage of flood-plain development following an episode of valley trenching. Compare - pediment, ledge; see scarp.

summit - (a) The topographically highest position of a hillslope profile with a nearly level (planar or only slightly convex) surface. Compare - shoulder, backslope, footslope, and toeslope, crest. (b) A general term for the top, or highest area of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluve area of relatively gentle slope that is flanked by steeper slopes, e.g., mountain fronts or tableland escarpments.

swale - (a) A shallow, open depression in unconsolidated materials which lacks a defined channel but can funnel overland or subsurface flow into a drainageway. Soils in swales tend to be more moist and thicker (cummulic) compared to surrounding soils. (b) A small, shallow, typically closed depression in an undulating ground moraine formed by uneven glacial deposition; Compare - swell-and-swale topography. (c) (not preferred; refer to interdune) A long, narrow, generally shallow, trough-like depression between two beach ridges, and aligned roughly parallel to the coastline.

syncline - (a) A unit of folded strata that is concave upward whose core contains the stratigraphically younger rocks, and occurs at the earth's surface. In a single syncline, beds forming the opposing limbs of the fold dip toward its axial plane. Compare - monocline, syncline, fold. (b) A fold, at any depth, generally concave upward whose core contains the stratigraphically younger rocks.

tableland - A term for a broad upland with an extensive, nearly level or undulating summit area and steep side slopes descending to surrounding lowlands. Compare - plateau, mesa, cuesta.

talus - Rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of loose broken rock formed chiefly by falling, rolling, or sliding. Compare - talus slope, colluvium, mass movement, scree.

talus cone - A small, steep, cone-shaped landform at the base of a cliff or escarpment, that heads in a relatively small declivity or ravine, and composed of poorly sorted rock and soil debris that has accumulated primarily by episodic rockfall or, to a lesser degree, by slope wash. Not to be confused with an *alluvial cone*; a similar feature but of fluvial origin, composed of better stratified and more sorted material, and that tapers up into a more extensive drainageway. Compare - alluvial cone, beveled base, talus slope.

talus slope - a portion of a hillslope or mountainslope mantled by talus and lying below a rockfall source (e.g. cliff). Compare - scree slope, scree, talus. Compare - beveled base.

tank - (colloquial: southwestern US) A natural depression or cavity in impervious rocks in which water collects and remains for the greater part of the year.

terrace - A step-like surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, or lake or sea shore. The term is usually applied to both the relatively flat summit surface (tread), cut or built by stream or wave action, and the steeper slope (scarp, riser), descending to a lower base level. Compare - stream terrace, flood-plain step. Practically, terraces are considered to be generally flat alluvial areas above the 100 yr. flood stage.

terracettes - Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock such as sheep or cattle. Synonyms (not preferred) - catstep, sheep or cattle track.

toeslope - The hillslope position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear, and are constructional surfaces forming the lower part of a hill-slope continuum that grades to valley or closed-depression floors. Compare - summit, shoulder, backslope, footslope, valley floor.

translational slide - A category of mass movement processes, associated sediments (translational slide deposit) or resultant landforms characterized by the extremely slow to moderately rapid downslope displacement of comparatively dry soil-rock material on a surface (slip face) that is roughly parallel to the general ground surface, in contrast to falls, topples, and rotational slides. The term includes such diverse *slide* types as translational debris slides, translational earth slide, translational rock slide, block glides, and slab or flake slides. Compare - rotational slide, slide, landslide.

transverse dune - A very asymmetric sand dune elongated perpendicular to the prevailing wind direction, having a gentle windward slope and a steep leeward slope standing at or near the angle of repose of sand; it generally forms in areas of sparse vegetation. Compare - longitudinal dune.

valley - An elongate, relatively large, externally drained depression of the Earth's surface that is primarily developed by stream erosion or glacial activity. Compare - basin.

valley floor - A general term for the nearly level to gently sloping, lowest surface of a valley. Landforms include axial stream channels, the flood plain, flood-plain steps, and, in some areas, low terrace surfaces. Compare - flood-plain landforms, meander, braided channel, valley side.

valley side - The sloping to very steep surfaces between the valley floor and summits of adjacent uplands. Well-defined, steep valley sides have been termed valley walls (not recommended). Note: Scale, relief, and perspective may require use of closely related terms such as hill slope or mountain slope.

wash (dry wash) - (colloquial: western US.) The broad, flat- floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium. Note: When channels reach intersect zones of ground-water discharge they are more properly classed as "intermittent stream" channels. Synonym - arroyo. Compare - gully.

zibar - A small, low-relief sand dune that lacks discernible slip faces and commonly occurs on sand sheets, in interdune areas, or in corridors between larger dunes. Zibar spacing can range from 50-400 m with local relief < 10 m. Unlike coppice dunes, zibars are unrelated to deposition around vegetation. Generally dominated by coarse sand. Compare - dune, coppice dune.

CONSIDERATIONS FOR PLANNING

Planning for the day:

1. Safety and sustenance: Plenty of food, water, first-aid kit, raingear, sunscreen.
2. Field communications:
   a. Develop a plan with team-mate for check-in time.
   b. Does park staff know the area in which you will be working?
3. Make sure you have the right maps and photos.
4. Check your GPS receiver (Datum set to NAD83? WAAS on? Needs new batteries?).
5. Plan the day's mission before departing using a) USGS quads, b) aerial photos, c) Park/BLM/FS maps.
6. Considerations for mission planning:
   a. Plan travel based on topography, best access routes, density and complexity of vegetation (more time for forest and woodland sites, less for herbaceous and shrub).
   b. Plan data collection based on priority needs; new types get higher priority.
   c. Communicate to make sure you aren't duplicating effort when unnecessary.

Planning for the Week (do this on the first day of the trip)

1. Do you have all appropriate maps, photos?
2. Develop a reasonable estimate of the number of plots for each team broken up by day and based on an estimate of individual team's travel logistics for the week.
3. Develop plan of attack for the week to capture all essential associations in the work area.
4. Balance points two and three above with the expected work schedule of the teams and ensure adequate time-off and reduce over-time concerns.
5. Do you have all necessary information and backups for the week's planning? E.g., blank field forms, film, plenty of batteries.

Wrapup

1. Clean, recharge and repair equipment.
2. Hold brief meeting to discuss data collection issues, things that came up during the day/week, and plan for next days activities.
3. Edit field forms and file them systematically.
4. Re-file the aerial photos and maps.
5. Download flashcards.
6. Key unknown plants.
7. Enter edited data into database.

Communicate among teams / Topics for wrap-up meetings.

1. What were your questions about the sites visited daily/weekly?
2. Do you have any questions about the forms or fields?
3. What was accomplished, what was not accomplished?
4. Pass on developments and questions, e.g., were there problems with interpreting the aerial photos, or are there personnel issues, problems in consistency in interpreting the forms, or with park-related logistics?

Materials Checklist

- Site research permit
- Topo maps
- Site maps for general navigation
- Digital orthophoto for easy reference
- Geology map
- Aerial photos
- Compass with adjustable declination
- Clinometer
- GPS receiver
- Plenty of AA batteries for GPS receivers, walkie talkies, etc.
- Radio or walkie talkie and/or cell phone
- Digital camera and flash cards
- Baggies for temporary storage of unknown plants, and masking tape for labeling
- Plant press & paper
- Plant Keys / Flora(s)
- Pens / sharpies
- Forms: observation point
- Clipboard/forms holder
- Pens, pencils, pencil lead, slate board, chalk, and chalkboard eraser
- Most recent version of provisional classification of the park
- All ancillary information (cheat sheet, species list, floras, main sampling protocol).
- First aid kit, personal gear (food, water, rain gear, etc.)

ATTACHMENT B

DESCRIPTION OF FEDERALLY LISTED SPECIES

Peirson's Milk-Vetch (Astragalus magdalenae var. peirsonii)

Peirson's Milk-vetch was listed as threatened species on October 6, 1998.

Distribution: Peirson's Milk-vetch is only known to occur in the Algodones sand dunes (also called Imperial sand dunes) of Imperial County, California. Within the Algodones dunes, PMV generally occurs in the interior portions of the dunes (USFWS 2007).

Natural History:

Morphology: Perennial herb. Stems erect, 8-36 inches (2-9 decimeters) long. Leaf 1/2-6 inches (1-15 cm) long, with 3-13 leaflets. Leaflets narrow/oblong, 1/8-3/8 inches (2-8 millimeters) long, with one terminal leaflet. Inflorescence contains 5-20 flowers with pink- purple petals, often white tipped. Largest petal (banner) is 3/8-5/8 inches (10-14 millimeters) long. The fruit is a 6/8-1 3/8 inches (2-3.5 centimeters) long, and attached to the stem (sessile). The fruit is an oval pod with a small hook at the end, has stiff, straight, sharp hairs (strigose) covering it, is inflated (bladdery), and has only one chamber. Peirson's milk-vetch blooms from December to April (USBLM 2005).

Habitat: Dune area, at elevations of 55 -250 meters above sea level.

Threats:

The primary threat to the only known existing population of Peirson's milk-vetch include the destruction of existing plants and habitat by off-road vehicle usage in the Algodone dunes.

U.S. Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants: 90-Day Finding on a Petition To Delist the *Astragalus magdalenae var. peirsonii* (Peirson's milk-vetch) Federal Register: November 30, 2005 (Volume 70, Number 229), Proposed Rules, Page 71795-71799.

Yuma Clapper Rail (*Rallus longirostris yumanensis*)

Yuma Clapper rail was listed as a federally endangered species on March 11, 1967. There is no critical habitat for the species. The Yuma Clapper Rail (YCR) is also protected under the Migratory Bird Treaty Act.

Distribution: YCR is found in the Lower Colorado River from California and Arizona into Mexico; also Salton Sea, Imperial County, California (California Department of Fish and Game 1990). In California, YCR nests along the lower Colorado River, in wetlands surrounding the Coachella Canal, the Imperial Valley, and the upper end of the Salton Sea at the Whitewater River delta and Salt Creek. It is thought that this rail was not distributed along the Colorado River until suitable habitat was created through dam construction (Natureserve).

Natural History:

Morphology: Yuma clapper rail is a large footed marsh bird. It is relatively pale brown. Yuma clapper rail eats crayfish, small fishes, clams, isopods, and various insects. Probably probes in mud or sand in or near shallow water or picks items off substrate (Ehrlich et al. 1992).

Habitat: Yuma clapper rail is associated with freshwater marshes. They prefer mature stands of cattails and bulrushes with narrow channels of flowing water. However, dense common reed may also support Yuma clapper rail.

Threats:

Threats to the Yuma clapper rail population in the United States include the loss of marsh habitat due to channelization, lack of existing habitat marsh management, and lack of protection of suitable habitat area. Other threats to Yuma Clapper Rail include mosquito abatement activities, displacement due to nonnative vegetation, and contaminants in prey, particularly elevated concentrations of selenium in crayfish.

Natureserve 2007. Website accessed on-line at
http://www.natureserve.org/explorer/

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Southwestern willow flycatcher (SWF) was listed as a federally endangered species on February 27, 1995. The SWF is also protected under the Migratory Bird Treaty Act.

Distribution: BREEDS: southwestern U.S. (southern California north to Independence, Arizona, southwestern New Mexico, southern Utah, and, at least formerly, southern Nevada) and possibly northern Baja California and Sonora (very rare if present).

Natural History:

Morphology: A flycatcher with brownish-olive upperparts, a whitish throat that contrasts with the pale olive breast, a pale yellow belly, and two light wing bars; generally lacks a conspicuous eye ring; as in other flycatchers, the bill is depressed and wide at the base (NGS 1983). Nesting occurs usually from early June through the end of July, peak in mid-June (Unitt 1987); sometimes may lay eggs as early as late May.

Nests in fork or on horizontal limb of small tree, shrub, or vine, at height of 0.6–6.4 m (mean usually about 2-3 meters) (Harris 1991), with dense vegetation above and around the nest.

Clutch size usually is 3-4. Incubation lasts 12-15 days, by female. Young are tended by both parents, leave nest at 12-15 days, usually in early to mid-July. Typically raises one brood per year. Breeding territories are about 1.5 acres. Densities may be on the order of 9-14 pairs/100 acres.

Present in California from late April to September (Biosystems Analysis 1989), in southern Arizona from early May to early or mid-September (Phillips et al. 1964).

Habitat: Thickets, scrubby and brushy areas, open second growth, swamps, and open woodland (AOU 1983). Nests primarily in swampy thickets, especially of willow, sometimes buttonbush (Phillips et al. 1964, AOU 1983), tamarisk (Brown 1988), vines, or other plants, where vegetation is 4-7 meters or more in height. Tamarisk is commonly used in the eastern part of the range.

Threats:

Decline is due primarily to destruction and degradation of cottonwood-willow and structurally similar riparian habitats. The causes of habitat loss and change are water impoundment, water diversion and groundwater pumping, channelization and bank stabilization, riparian vegetation control, livestock grazing, off-road vehicle and other recreational uses, increased fires, urban and agricultural development, and hydrological changes resulting from these and other land uses. Tamarisk has replaced native riparian vegetation in many areas, with varying effects on flycatcher populations. Native riparian plant communities probably have a greater recovery value for flycatchers, but currently occupied and suitable tamarisk habitat should be maintained (USFWS 2002). Increased irrigated agriculture and livestock grazing have also resulted in increased range and abundance of Brown-headed Cowbirds; and, in some areas, heavy brood parasitism by cowbirds has contributed to the decline (Harris 1991, Brown 1988).

Natureserve 2007. Website accessed on-line at
http://www.natureserve.org/explorer/

ATTACHMENT C

GIS PRODUCTS

GIS PRODUCTS

- GIS Interactive File
- Access Database for PF225
- GIS Layer: Vegetation Database
- Maps Including Vegetation Layer
- Field Photographs

THIS PAGE INTENTIONALLY LEFT BLANK

ATTACHMENT D

IMPERIAL VALLEY SPECIES LISTS

MAMMALS OF IMPERIAL COUNTY	
Common Name	**Scientific Name**
MARSUPIALS: MARSUPIALIA	
Opossums: Family Didelphidae	
Opossum	*Didelphis virginiana virginiana* (introduced)
INSECTIVORES: ORDER INSECTIVORA	
Shrews: Family Soricidae	
Desert or Desert Gray Shrew	*Notiosorex crawfordi crawfordi***
BATS: ORDER CHIROPTERA	
Leaf-nosed Bats: Family Phyllostomatidae	
California Leaf-nosed Bat	*Macrotus californicus***
Plain-nosed Bats: Family Vespertilionidae	
Pallid Bat	*Antrozous pallidus pallidus*
Big Brown Bat	*Eptesicus fuscus pallidus***
California Myotis	*Myotis californicus stephensi***
Little Brown Myotis	*Myotis lucifugus occultus***
Cave Myotis	*Myotis velifer brevis*
Yuma Myotis	*Myotis yumanensis yumanensis***
Western Pipistrelle	*Pipistrellus hesperus hesperus***
Townsend's Big-eared Bat	*Plecotus townsendii pallescens***
Free-tailed Bats: Family Molossidae	
Western Mastiff Bat	*Eumops perotis californicus*
Pocketed Free-tailed Bat	*Nyctinomops femorosaccus*
Mexican Free-tailed Bat	*Tadarida brasiliensis mexicana***
CARNIVORES: ORDER CARNIVORA	
Dogs: Family Canidae	
Coyote	*Canis latrans mearnsi***
Gray Fox	*Urocyon cinereoargenteus scottii***
Kit Fox	*Vulpes velox arsipus***
Cats: Family Felidae	
Bobcat	*Lynx rufus baileyi***
Mountain Lion	*Puma concolor browni*
Jaguar	*Panthera onca arizonensis* (extirpated)
Weasels and Relatives: Family Mustelidae	
River Otter	*Lontra canadensis sonora*
Striped Skunk	*Mephitis mephitis estor***
Spotted Skunk	*Spilogale putorius phenax**
Badger	*Taxidea taxus berlandieri***
Raccoons and Relatives: Family Procyonidae	
Raccoon	*Procyon lotor pallidus***
Ringtail	*Bassariscus astutus yumanensis**

MAMMALS OF IMPERIAL COUNTY	
Common Name	**Scientific Name**
EVEN-TOED UNGULATES: ORDER ARTIODACTYLA	
Deer and Relatives: Family Cervidae	
Mule Deer	*Odocoileus hemionus eremicus*
Pronghorn: Family Antilocapridae	
Pronghorn	*Antilocapra americana americana* (extirpated)
Cattle, Sheep, and Relatives: Family Bovidae	
Bighorn Sheep	*Ovis canadensis* (threatened)
	O. c. cremnobates (SW corner of county)
RODENTS: ORDER RODENTIA	
Squirrels: Family Sciuridae	
White-tailed Antelope Squirrel	*Ammospermophilus leucurus leucurus***
Round-tailed Ground Squirrel	*Spermophilus tereticaudus tereticaudus***
Baja California Chipmunk	*Tamias obscurus obscurus** (SW corner of county only)
Beaver: Family Castoridae	
Beaver	*Castor canadensis repentinus***
Pocket Gophers: Family Geomyidae	
Valley or Botta's Pocket Gopher	*Thomomys bottae*
	*T. b. albatus*** (Imperial Valley and eastern Imperial Co.)
	*T. b. boregoensis*** (western Imperial Co.)
Pocket Mice: Family Heteromyidae	
Agile Kangaroo Rat	*Dipodomys agilis cabezonae* (SW corner of county only)
Desert Kangaroo Rat	*Dipodomys deserti deserti***
Merriam's Kangaroo Rat	*Dipodomys merriami*
	*D. m. trinidadensis*** (SW corner of county)
	*D. m. arenivagus*** (Imperial Valley and west)
	*D. m. merriami*** (east of Salton Sea and Imperial Valley)
Bailey's Pocket Mouse	*Chaetodipus baileyi hueyi**
San Diego Pocket Mouse	*Chaetodipus fallax pallidus*** (SW corner of county only)
Long-tailed Pocket Mouse	*Chaetodipus formosus mesembrinus***
Desert Pocket Mouse	*Chaetodipus penicillatus angustirostris***
Spiny Pocket Mouse	*Chaetodipus spinatus*
	*C. s. spinatus***
	*C. s. rufescens** (SW corner of county only)
Little Pocket Mouse	*Perognathus longimembris***
	*P. l. internationalis*** (SW corner of county)
Rats and Mice: Family Muridae	
California Vole	*Microtus californicus sanctidiegi* (SW corner of county only)
Muskrat	*Ondatra zibethicus bernardi***

MAMMALS OF IMPERIAL COUNTY	
Common Name	**Scientific Name**
RODENTS: ORDER RODENTIA (continued)	
House Mouse	*Mus musculus*** (introduced)
Norway Rat	*Rattus norvegicus* (introduced)
Roof Rat or Black Rat	*Rattus rattus* (introduced)
White-throated Woodrat	*Neotoma albigula venusta***
Desert Woodrat	*Neotoma lepida*
	*N. l. gilva*** (SW corner of county)
	*N. l. lepida*** (central and western Imperial Co.)
	*N. l. grinnelli*** (eastern Imperial Co.)
Southern Grasshopper Mouse	*Onychomys torridus pulcher***
Brush Mouse	*Peromyscus boylii rowleyi** (SW corner of county only)
California Mouse	*Peromyscus californicus insignis** (SW corner of county only)
Canyon Mouse	*Peromyscus crinitus stephensi***
Cactus Mouse	*Peromyscus eremicus eremicus***
Deer Mouse	*Peromyscus maniculatus sonoriensis***
Piñon Mouse	*Peromyscus truei martirensis** (SW corner of county only)
Western Harvest Mouse	*Reithrodontomys megalotis megalotis***
Hispid Cotton Rat	*Sigmodon hispidus eremicus***
RABBITS AND PIKAS: ORDER LAGOMORPHA	
Rabbits and Hares: Family Leporidae	
Black-tailed Jackrabbit	*Lepus californicus deserticola**
Desert Cottontail	*Sylvilagus audubonii arizonae***

Classification at the species level follows "Mammal Species of The World," 2nd ed., 1993, by D. E. Wilson and D. M. Reeder; that at the subspecies level "The Mammals of North America," 2nd ed., 1981, by E. R. Hall. English names refer to the species as a whole, not individual component subspecies. If a species has a restricted range or multiple subspecies occur in Imperial County, this range is indicated briefly. Double asterisks specify that the mammal's occurrence in Imperial County is supported by specimens in the San Diego Natural History Museum; single asterisks specify that specimens in other museums have been reported in the literature.

Source: San Diego County Museum of Natural History

http://www.sdnhm.org/research/birds/impmamm.html

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
Accipitridae		
Accipiter cooperii	Cooper's Hawk	G5/S4
Accipiter striatus	Sharp-shinned Hawk	G5/S2
Aquila chrysaetos	Golden Eagle	G5/S3
Buteo lagopus	Rough-legged Hawk	G5
Accipiter gentilis	Northern Goshawk	G5
Buteo albonotatus	Zone-tailed Hawk	G4/S3
Buteo jamaicensis	Red-tailed Hawk	G5/S5
Buteo lineatus	Red-shouldered Hawk	G5/S4
Buteo playpterus	Broad-winged Hawk	G5/S3
Buteo regalis	Ferruginous Hawk	G4/S2
Buteo swainsoni	Swainson's Hawk	G5/S4
Elanus leucurus	White-tailed Kite	G5/S4
Haliaeetus leucocephalus	Bald Eagle	G5/S3
Pandion haliaetus	Osprey	G5/S4
Parabuteo unicinctus	Harris's Hawk	G5/S3
Circus cyaneus	Northern Harrier	G5
Alaudidae		
Eremophila alpestris	Horned Lark	G5/S5
Alcedinidae		
Ceryle (Megacryle) alcyon	Belted Kingfisher	G5/S5
Anatidae		
Aix sponsa	Wood Duck	G5/S4
Anas acuta	Northern Pintail	G5/S3
Anas Americana	American Wigeon	G5/S3
Anas clypeata	Northern Shoveler	G5/S3
Anas crecca	Green-winged Teal	G5/S2
Anas cyanoptera	Cinnamon Teal	G5/S3
Anas discors	Blue-winged Teal	G5/S3
Anas Penelope	Eurasian Wigeon	G5
Anas platyrhynchos	Mallard	G5/S3
Anas strepera	Gadwall	G5/S3
Anser albifrons	Greater White-fronted Goose	G5/S5
Aythya affinis	Lesser Scaup	G5/S3
Aythya Americana	Redhead	G5/S3
Aythya collaris	Ring-necked Duck	G5
Aythya marila	Greater Scaup	G5
Aythya valisineria	Canvasback	G5/S4
Branta bernicla	Brant	G5/S2

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
Anatidae (continued)		
Branta Canadensis	Canada Goose	G5/S5
Bucephala albeola	Bufflehead	G5
Bucephala clangula	Common Goldeneye	G5
Chen caerulescens	Snow Goose	G5/S5
Chen rossii	Ross' Goose	G4/S3
Cygnus columbianus	Tundra Swan	G5
Dendrocygna autumnalis	Black-bellied Whistling-Duck	G5/S5
Dendrocygna bicolor	Fulvous Whistling-Duck	G5/S4
Lophodytes cucullatus	Hooded Merganser	G5/S3
Melanitta fusca	White-winged Scoter	G5
Melanitta perspicillata	Surf Scoter	G5
Mergus merganser	Common Merganser	G5
Mergus serrator	Red-breasted Merganser	G5
Oxyura jamaicensis	Ruddy Duck	G5/S3
Clangula hyemalis	Oldsquaw	G5
Anas formosa	Baikal Teal	
Aythya fuligula	Tufted Duck	G5
Melanitta nigra	Black Scoter	G5
Apodidae		
Cypseloides niger	Black Swift	G4
Chaetura vauxi	Vaux's Swift	G5
Aeronautes saxatalis	White-Throated Swift	G5
Ardeidae		
Ardea albus	Great Egret	G5/S5
Ardea herodias	Great Blue Heron	G5/S5
Botaurus lentiginosus	American Bittern	G4/S3
Bubulcus ibis	Cattle Egret	G5/Exotic
Butorides virescens	Green Heron	G5/S5
Egretta caerula	Little Blue Heron	G5/S5
Egretta rufescens	Reddish Egret	G4/S3
Egretta thula	Snowy Egret	G5/S5
Egretta tricolor	Tricolored Heron	G5/S5
Ixobrychus exilis	Least Bittern	G5/S4
Nycticorax nycticorax	Black-crowned Night-Heron	G5/S4
Bombycillidae		
Bombycilla cedrorum	Cedar Waxwing	G5/N5
Caprimulgidae		
Caprimulgus vociferous	Whip-poor-will	G5/S4
Chordeiles acutipennis	Lesser Nighthawk	G5/S4

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
Caprimulgidae (continued)		
Phalaenoptilus nuttallii	Common Poorwill	G5/S4
Cardinalidae		
Cardinalis sinuatus	Pyrrhuloxia	G5/S4
Cyanocompsa parellina	Blue Bunting	No NS Record
Passerina amoena	Lazuli Bunting	G5/S3
Passerina caerulea	Blue Grosbeak	G5/S4
Passerina cyanea	Indigo Bunting	G5/S5
Pheucticus ludovicianus	Rose-breasted Grosbeak	G5/S4
Pheucticus melanocephalus	Black-headed Grosbeak	G5/S4
Spiza Americana	Dickcissel	G5/S4
Cathartidae		
Cathartes aura	Turkey Vulture	G5/S5
Certhiidae		
Certhia Americana	Brown Creeper	G5/S4
Charadriidae		
Charadrius alexandrius	Snowy Plover	G4/S3
Charadrius montanus	Mountain Plover	G2/S2
Charadrius semipalmatus	Semipalmated Plover	G5/S4
Charadrius vociferous	Killdeer	G5/S5
Charadrius wilsonia	Wilson's Plover	G5/S4
Pluvialis dominicus	American Golden-Plover	G5/S3
Pluvialis squatarola	Black-bellied Plover	G5/S4
Ciconiidae		
Mycteria Americana	Wood Stork	G4/SH
Columbidae		
Columba fasciata	Banded-tail Pigeon	No NS Record
Columba livia	Rock Dove	G5/Exotic
Columbina inca	Inca Dove	G5/S5
Columbina passerine	Common Ground-Dove	G5/S4
Zenaida asiatica	White-winged Dove	G5/S5
Zenaida macroura	Mourning Dove	G5/S5
Corvidae		
Aphelocoma californica	Scrub Jay	G5
Corvus corax	Common Raven	G5
Corvus brachyrhynchos	American Crow	G5
Cuculidae		
Coccyzus Americanus	Yellow-billed Cuckoo	G5/S4
Crotophaga sulcirostris	Groove-billed Ani	G5/S4
Geococcyx Californianus	Greater Roadrunner	G5/S4

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
	Diomedeidae	
Phoebastria immutabilis	Laysan Albatross	G3
	Emberizidae	
Ammodramus leconteii	Le Conte's Sparrow	G4/S3
Ammodramus savannarum	Grasshopper Sparrow	G5/S3
Amphispiza bilineata	Black-throated Sparrow	G5/S4
Melospiza melodia	Song Sparrow	G5
Calamospiza melanocorys	Lark Bunting	G5/S4
Calcarius ornatus	Chestnut-collared Longspur	G5/S3
Chondestes grammacus	Lark Sparrow	G5/S4
Junco hyemalis	Dark-eyed Junco	G5/S5
Melospiza Georgiana	Swamp Sparrow	G5/S4
Melospiza lincolnii	Lincoln's Sparrow	G5/S5
Amphispiza belli	Sage Sparrow	G5
Passerculus sandwichensis	Savannah Sparrow	G5/S4
Pipilo erythrophthalmus	Rufous-sided Towhee	No NS Record
Pipilo aberti	Abert's Towhee	G3G4
Pipilo chlorurus	Green-tailed Towhee	G5/S4
Spizella atrogularis	Black-chinned Sparrow	G5
Pooecetes gramineus	Vesper Sparrow	G5/S5
Spizella arborea	American Tree Sparrow	G5
Spizella breweri	Brewer's Sparrow	G5/S4
Spizella passerine	Chipping Sparrow	G5/S4
Passerella iliaca	Fox Sparrow	G5
Zonotrichia albicollis	White-throated Sparrow	G5
Zonotrichia leucophrys	White-crowned Sparrow	G5/S5
Zonotrichia querula	Harris's Sparrow	G5/S4
	Falconidae	
Falco columbarius	Merlin	G5/No NS Record
Falco mexicanus	Prairie Falcon	G5/S3
Falco peregrinus	Peregrine Falcon	G4/S3
Falco sparverius	American Kestrel	G5/S4
	Fregatidae	
Fregata magnificens	Magnificent Frigatebird	G5
	Fringillidae	
Carduelis lawrencei	Lawrence's Goldfinch	G3G4
Coccothraustes vespertinus	Evening Grosbeak	G5
Carduelis pinus	Pine Siskin	G5/S2
Carduelis psaltria	Lesser Goldfinch	G5/S5
Carduelis tristis	American Goldfinch	G5/S2

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
Fringillidae (continued)		
Carpodacus mexicanus	House Finch	G5/S5
Carpodacus purpureus	Purple Finch	G5/S4
Loxia curvirostra	Red Crossbill	G5/S3
Carpodacus cassinii	Cassin's Finch	G5
Gaviidae		
Gavia stellata	Red-throated Loon	G5
Gavia immer	Common Loon	G5
Gavia pacifica	Pacific Loon	G5
Gruidae		
Grus Canadensis	Sandhill Crane	G5/S5
Haematopodidae		
Haematopus palliatus	American Oystercatcher	G5/S3
Hirundinidae		
Progne subis	Purple Martin	G5/S5
Hirundo rustica	Barn Swallow	G5/S5
Petrochelidon pyrrhonota	Cliff Swallow	G5/S4
Riparia riparia	Bank Swallow	G5/S2
Stelgidopteryx serripennis	Northern Rough-winged Swallow	G5/S3
Tachycineta bicolor	Tree Swallow	G5/S3
Tachycineta thalassina	Violet-green Swallow	G5/S4
Hydrobatidae		
Oceanodroma castro	Black Storm-Petrel	G4
Oceanodroma leucorhoa	Leach's Storm-Petrel	G5
Oceanodroma microsoma	Least Storm-Petrel	G2G3
Icteridae		
Agelaius phoeniceus	Red-winged Blackbird	G5/S5
Dolichonyx oryzivorus	Bobolink	G5/S3
Agelaius tricolor	Tricolored Blackbird	G2G3
Euphagus cyanocephalus	Brewer's Blackbird	G5/S5
Icterus bullockii	Bullock's Oriole	G5/S4
Icterus cucullatus	Hooded Oriole	G5/S4
Icterus parisorum	Scott's Oriole	G5/S3
Icterus spurious	Orchard Oriole	G5/S4
Molothrus aeneus	Bronzed Cowbird	G5/S5
Molothrus ater	Brown-headed Cowbird	G5/S5
Quiscalus mexicanus	Great-tailed Grackle	G5/S5
Sturnella neglecta	Western Meadowlark	G5/S5
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	G5/S3

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
Laniidae		
Lanius ludovicianus	Loggerhead Shrike	G4/S4
Lanius excubitor	Northern Shrike	G5
Laridae		
Chlidonias niger	Black Tern	G4/S3
Larus argentatus	Herring Gull	G5/S5
Larus atricilla	Laughing Gull	G5/S5
Larus minutus	Little Gull	G5
Larus canus	Mew Gull	G5
Larus livens	Yellow-footed Gull	G4
Larus heermanni	Heermann's Gull	G4
Larus Californicus	California Gull	G5
Larus Delawarensis	Ring-billed Gull	G5/S5
Larus fuscus	Lesser Black-backed Gull	G5
Larus hyperboreus	Glaucous Gull	G5
Larus glaucescens	Glaucous-winged Gull	G5
Larus occidentalis	Western Gull	G5
Larus Philadelphia	Bonaparte's Gull	G5/S4
Larus pipixcan	Franklin's Gull	G4G5/S2
Larus thayeri	Thayer's Gull	G5
Rissa tridactyla	Black-legged Kittiwake	G5
Stercorarius longicaudus	Long-tailed Jaeger	G5
Stercorarius parasiticus	Parasitic Jaeger	G5
Stercorarius pomarinus	Pomarine Jaeger	G5
Sterna antillarum	Least Tern	No NS Record
Sterna caspia	Caspian Tern	No NS Record
Sterna forsteri	Forster's Tern	G5/S5
Thalasseus elegans	Elegant Tern	G2
Sterna hirundo	Common Tern	G5/S1
Sterna paradisaea	Arctic Tern	G5
Sterna nilotica	Gull-billed Tern	No NS Record
Xema sabini	Sabine's Gull	G5
Mimidae		
Toxostoma lecontei	Le Conte's Thrasher	G3
Mimus polyglottos	Northern Mockingbird	G5/S5
Oreoscoptes montanus	Sage Thrasher	G5/No NS Record
Toxostoma curvirostre	Curve-billed Thrasher	G5/S4
Toxostoma bendirei	Bendire's Thrasher	G4G5
Toxostoma rufum	Brown Thrasher	G5/S4
Toxostoma crissale	Crissal Thrasher	G5

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
Motacillidae		
Anthus rubescens	American Pipit	G5/S4
Anthus spragueii	Sprague's Pipit	G4
Odontophoridae		
Phasianus colchicus	Ring-necked Pheasant	G5
Callipepla gambelii	Gambel's Quail	G5
Paridae		
Poecile gambeli	Mountain Chickadee	G5
Parulidae		
Dendroica caerulescens	Black-throated Blue Warbler	G5/S3
Dendroica castanea	Bay-breasted Warbler	G5/S4
Dendroica cerulean	Cerulean Warbler	G4/SH
Dendroica discolor	Prairie Warbler	G5/S3
Dendroica magnolia	Magnolia Warbler	G5/S4
Dendroica nigrescens	Black-throated Gray Warbler	G5/SH
Dendroica occidentalis	Hermit Warbler	G4G5/S3
Dendroica palmarum	Palm Warbler	G5/S3
Dendroica pensylvanica	Chestnut-sided Warbler	G5
Dendroica petechia	Yellow Warbler	G5/S2
Dendroica tigrina	Cape May Warbler	G5/S2
Dendroica townsendi	Townsend's Warbler	G5/S4
Geothlypis trichas	Common Yellowthroat	G5/S5
Icteria virens	Yellow-breasted Chat	G5/S5
Mniotilta varia	Black-and-white Warbler	G5/S4
Myioborus pictus	Painted Redstart	G5/S3
Oporornis tolmiei	MacGillivray's Warbler	G5/S4
Parula Americana	Northern Parula	G5/S4
Seiurus aurocapillus	Ovenbird	G5/S4
Seiurus noveboracensis	Northern Waterthrush	G5/S4
Setophaga ruticilla	American Redstart	G5/S2
Vermivora celata	Orange-crowned Warbler	G5/S4
Vermivora peregrine	Tennessee Warbler	G5/S4
Vermivora ruficapilla	Nashville Warbler	G5/S5
Vermivora virginiae	Virginia's Warbler	G5/S3
Wilsonia pusilla	Wilson's Warbler	G5/S4
Vermivora luciae	Lucy's Warbler	G5
Dendroica coronata	Yellow-rumped Warbler	G5
Passeridae		
Passer domesticus	House Sparrow	G5/Exotic

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
	Pelecanidae	
Pelecanus erythrorhynchos	American White Pelican	G3/S2
Pelecanus occidentalis	Brown Pelican	G4/S3
Phalacrocorax auritus	Double-Crested Cormorant	G5
	Phoenicopteridae	
Phoenicopterus minor	Lesser Flamingo	No NS Record
Phoenicopterus chilensis	Chilean Flamingo	No NS Record
	Picidae	
Colaptes auratus	Northern Flicker	G5/S3
Melanerpes lewis	Lewis' Woodpecker	No NS Record
Nuthatch Sitta canadensis	Red-breasted Woodpecker	G5/S5
Melanerpes erythrocephalus	Red-headed Woodpecker	G5/S3
Melanerpes formicivorus	Acorn Woodpecker	G5/S4
Melanerpes uropygialis	Gila Woodpecker	G5
Picoides scalaris	Ladder-backed Woodpecker	G5/S5
Sphyrapicus nuchalis	Red-naped Sapsucker	G5/S3
Sphyrapicus varius	Yellow-bellied Sapsucker	G5
	Procellariidae	
Puffinus bulleri	Buller's Shearwater	G3
Puffinus griseus	Sooty Shearwater	G5
Puffinus griseus	Sooty Shearwater	G4G5
	Ptilogonatidae	
Phainopepla nitens	Phainopepla	G5/S4
	Rallidae	
Fulica Americana	American Coot	G5/S4
Gallinula chloropus	Common Moorhen	G5/S4
Laterallus jamaicensis	Black Rail	G4/S2
Rallus longirostris	Clapper Rail	G5
Porzana Carolina	Sora	G5/S3
Rallus limicola	Virginia Rail	G5/S3
	Recurvirostridae	
Himantopus mexicanus	Black-necked Stilt	G5/S5
Recurvirostra Americana	American Avocet	G5/S4
	Regulidae	
Regulus calendula	Ruby-crowned Kinglet	G5/S5
Regulus satrapa	Golden-crowned Kinglet	G5
	Remizidae	
Auriparus flaviceps	Verdin	G5/S4
	Scolopacidae	
Actitis macularia	Spotted Sandpiper	G5/S3

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
	Scolopacidae (continued)	
Arenaria interpres	Ruddy Turnstone	G5/S5
Arenaria melanocephala	Black Turnstone	G5
Calidris alba	Sanderling	G5/S5
Calidris alpine	Dunlin	G5/S4
Calidris bairdii	Baird's Sandpiper	G5/S3
Calidris canutus	Red Knot	G4
Calidris ferruginea	Curlew Sandpiper	G5
Calidris fuscicollis	White-rumped Sandpiper	G5/S3
Calidris himantopus	Stilt Sandpiper	G5/S3
Calidris mauri	Western Sandpiper	G5/S5
Calidris melanotos	Pectoral Sandpiper	G5/S4
Calidris minutilla	Least Sandpiper	G5/S5
Calidris pusilla	Semipalmated Sandpiper	G5/S5
Catoptrophorus semipalmatus	Willet	G5/S5
Heteroscelus incanus	Wandering Tattler	G5
Limnodromus griseus	Short-billed Dowitcher	G5/S3
Limnodromus scolopaceus	Long-billed Dowitcher	G5/S4
Limosa fedoa	Marbled Godwit	G5/S4
Limosa haemastica	Hudsonian Godwit	G4/S2
Numenius Americanus	Long-billed Curlew	G5/S3
Numenius phaeopus	Whimbrel	G5/S4
Philomachus pugnax	Ruff	G5
Calidris or *Erolia minuta*	Little Stint	No NS Record
Tringa flavipes	Lesser Yellowlegs	G5/S5
Tringa melanoleuca	Greater Yellowlegs	G5/S5
Tringa solitaria	Solitary Sandpiper	G5/S5
Tringa erythropus	Spotted Redshank	No NS Record
Aphriza virgata	Surfbird	G5
	Sittidae	
Sitta Canadensis	Red-breasted Nuthatch	G5/S2
Sitta carolinensis	White-breasted Nuthatch	G5
	Strigidae	
Asio flammeus	Short-eared Owl	G5
Asio otus	Long-eared Owl	G5/S2
Megascops kennicottii	Western Screech-Owl	G5
Athene cunicularia	Burrowing Owl	G4/S3
Bubo virginianus	Great Horned Owl	G5/S5
Otus flammeolus	Flammulated Owl	G4/S3
Aegolius acadicus	Northern Saw-Whet Owl	G5

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
	Sturnidae	
Sturnus vulgaris	European Starling	G5/Exotic
	Sylviidae	
Polioptila caerulea	Blue-gray Gnatcatcher	G5/S3
Polioptila melanura	Black-tailed Gnatcatcher	G5/S4
	Thraupidae	
Piranga ludoviciana	Western Tanager	G5/S4
Piranga rubra	Summer Tanager	G5/S5
	Threskiornithidae	
Eudocimus albus	White Ibis	G5/S4
Platalea ajaja	Roseate Spoonbill	G5/S4
Plegadis chihi	White-faced Ibis	G5/S4
	Trochilidae	
Archilocus alexandri	Black-chinned Hummingbird	G5/S5
Calypte anna	Anna's Hummingbird	G5
Calypte costae	Costa's Hummingbird	G5
Stellula calliope	Calliope Hummingbird	G5
Selasphorus sasin	Allen's Hummingbird	G5
Sealsphorus rufus	Rufous Hummingbird	G5
	Troglodytidae	
Campylorhynchus brunneicapillus	Cactus Wren	G5/S4
Cistothorus palustris	Marsh Wren	G5/S4
Catherpes mexicanus	Canyon Wren	G5
Salpinctes obsoletus	Rock Wren	G5/S5
Thryomanes bewickii	Bewick's Wren	G5/S5
Troglodytes aedon	House Wren	G5/S2
Troglodytes troglodytes	Winter Wren	G5
	Turdidae	
Catharus guttatus	Hermit Thrush	G5/S4
Catharus ustulatus	Swainson's Thrush	G5/S4
Ixoreus naevius	Varied Thrush	G5
Myadestes townsendi	Townsend's Solitaire	G5
Sialia currucoides	Mountain Bluebird	G5/S3
Sialia mexicana	Western Bluebird	G5
Turdus migratorius	American Robin	G5/S4
	Tytonidae	
Tyto alba	Barn Owl	G5/S5
	Tyrannidae	
Contopus cooperi	Olive-sided Flycatcher	G4/S3
Contopus pertinax	Greater Pewee	G5

BIRDS OF IMPERIAL VALLEY (RECORDS FROM SALTON SEA)		
Scientific Name	**Common Name**	**Natureserve Rankings**
Tyrannidae (continued)		
Contopus sordidulus	Western Wood-Pewee	G5/S4
Empidonax oberholseri	Dusky Flycatcher	G5
Empidonax wrightii	Gray Flycatcher	G5
Empidonax traillii	Western Flycatcher	
Empidonax hammondii	Hammond's Flycatcher	G5/S3
Empidonax minimus	Least Flycatcher	G5/S5
Empidonax traillii	Willow Flycatcher	G5/S1
Myiarchus cineruscens	Ash-throated Flycatcher	G5/S3
Myiarchus tuberculifer lawrencei	Dusky-capped Flycatcher	G5
Myiarchus tyrannulus	Brown-crested Flycatcher	G5/S4
Pyrocephalus rubinus	Vermilion Flycatcher	G5/S4
Sayornis nigricans	Black Phoebe	G5/S4
Sayornis phoebe	Eastern Phoebe	G5/S4
Sayornis saya	Say's Phoebe	G5/S4
Tyrannus forficatus	Scissor-tailed Flycatcher	G5/S3
Tyrannus melancholicus	Tropical Kingbird	G5/S1
Tyrannus tyrannus	Eastern Kingbird	G5/S4
Tyrannus verticalis	Western Kingbird	G5/S3
Tyrannus vociferans	Cassin's Kingbird	G5/S3
Vireonidae		
Vireo bellii	Bell's Vireo	G5/S3
	Solitary Vireo	
Vireo gilvus	Warbling Vireo	G5/S3
Vireo olivaceus	Red-eyed Vireo	G5/S5
Vireo huttoni	Hutton's Vireo	G5

Source: United States Geological Society
http://www.npwrc.usgs.gov/resource/birds/chekbird/r1/salton.htm

AMPHIBIANS AND REPTILES OF THE IMPERIAL SAN DUNES, IMPERIAL COUNTY, CA	
Common Name	**Scientific Name**
Amphibians	
Arizona Southwest Toad	*Bufo microscaphus microscaphus*
Couch's spadefoot Toad	*Scaphiopus couchii*
San Sebastian Leopard Frog	Rana yavapaiensis
Reptiles	
Chuckwalla	*Sauromalus obesus*
Colorado Desert fringe-toed Lizard	*Uma notata*
Desert Iguana	*Dipsosaurus doralis*
Desert Tortoise	*Gopherus agassizii*
Flat-tailed horned Lizard	*Phrymosoma mcallii*
Rosy Boa	*Lichanura trivirgata gracia*
Side-blotched Lizard	*Uta stansburiana*
Sidewinder Lizard	*Crotalus cerastes*
Western whiptail Lizard	*Cnemidophorus tigris*
Zebra-Tailed Lizard	*Callisaurus draconoides*

Source: BLM Imperial Sand Dunes Recreation Area Management Plan

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX E

Biological Resources Plan

BIOLOGICAL RESOURCES PLAN

FOR

CONSTRUCTION, OPERATION, AND MAINTENANCE OF TACTICAL INFRASTRUCTURE

FOR

EL CENTRO SECTOR, CALIFORNIA
YUMA SECTOR, ARIZONA

U.S. DEPARTMENT OF HOMELAND SECURITY
U.S. CUSTOMS AND BORDER PROTECTION
U.S. BORDER PATROL El CENTRO SECTOR
U.S. BORDER PATROL YUMA SECTOR

Prepared by

Solutions Today for a Sustainable Tomorrow

MAY 2008

ABBREVIATIONS AND ACRONYMS

°F	Degrees Fahrenheit
BMP	Best Management Practice
CBP	U.S. Customs and Border Protection
CFR	Code of Federal Regulations
CITES	Convention of International Trade in Endangered Species
DHS	U.S. Department of Homeland Security
FEMA	Federal Emergency Management Agency
INS	Immigration and Naturalization Service
PEIS	Programmatic Environmental Impact Statement
PUPS	Pesticide Use Proposals
RVSS	Remote Visual Surveillance System
T&E	Threatened and Endangered
USBP	U.S. Border Patrol
USIBWC	U.S. Section, International Boundary and Water Commission
USFWS	U.S. Fish and Wildlife Service

EXECUTIVE SUMMARY

The U.S. Department of Homeland Security (DHS), Customs and Border Protection (CBP), U.S. Border Patrol (USBP) plans to construct, operate, and maintain tactical infrastructure consisting of primary pedestrian and vehicle fencing, supporting patrol roads, lights, and other infrastructure in seven sections along the U.S./Mexico international border in Imperial County, California, and Yuma County, Arizona.

Table ES-1 outlines federally listed species and federally designated critical habitats known to occur or to potentially occur within or adjacent to the Project area and the determination of effects resulting from the Project.

Of the species listed in **Table ES-1**, the Project could affect, but is not likely to adversely affect Peninsular bighorn sheep (*Ovis canadensis*) and its designated critical habitat in Imperial County, California, in Section B-1. The Project is likely to adversely affect Peirson's milk-vetch (*Astragalus magdalenae* var. *peirsonii*) in Yuma County, Arizona, in Section C-1. The remaining species, desert tortoise (*Gopherus agassizii*), southwestern willow flycatcher (*Empidonax traillii extimus*), least Bell's vireo (*Vireo bellii pusillus*), and Yuma clapper rail (*Rallus longirostris yumanensis*) will not be affected by the Project, and therefore will not be discussed in detail in this Biological Resources Plan (BRP).

Since the construction, operation, and maintenance of pedestrian and vehicle barrier fence in Sections B-2, B-4, B-5A, B-5B, and C-2B and the construction, operation, and maintenance of permanent lighting in Section B-3 were determined to have no effect on federally listed species and federally designated critical habitats, these project sections are not addressed in detail in this BRP. This BRP analyzes the effects on Peninsular bighorn sheep and its designated critical habitat and the Peirson's milk-vetch associated with the construction, operation, and maintenance of new tactical infrastructure in Sections B-1 and C-1, respectively.

Table ES-1. Determination of Effects on Federally Listed Species and Critical Habitats within Sections B-1, B-4, B-5A, C-1, and C-2B

Species	Project Section	Listing Status	Year Listed, Proposed or Designated	Determination
Peninsular bighorn sheep, *Ovis canadensis*	B-1	Endangered (63 FR 13134-13150)	1998	Not likely to adversely affect
Peninsular bighorn sheep, *Ovis canadensis*, Critical Habitat	B-1	Designated (66 FR 8649-8677)	2001	Not likely to adversely affect
	B-1	Revised proposed designation (72 FR 57740-57780)*	2007*	No effect
Desert tortoise, *Gopherus agassizii*	None	Threatened (55 FR 12178-12191)	1990	No effect
Southwestern willow flycatcher, *Empidonax traillii extimus*	C-2B	Endangered (60 FR 10693-10715)	1995	No effect
Least Bell's vireo, *Vireo bellii pusillus*	None	Endangered (51 FR 16474-16482)	1986	No effect
Yuma clapper rail, *Rallus longirostris yumanensis*	B-4, B-5A, C-1, C-2B	Endangered (32 FR 4001)	1967	No effect
Peirson's milk-vetch, *Astragalus magdalenae* var. *peirsonii*	C-1	Threatened (63 FR 53596-53615)	1998	Likely to adversely affect
Peirson's milk-vetch, *Astragalus magdalenae* var. *peirsonii*, Critical Habitat	C-1	Designated (73 FR 8748-8785)	2008	No effect

Note: * The U.S. Fish and Wildlife Service anticipates the revised final critical habitat designation for Peninsular bighorn sheep will be published in the Federal Register in October 2008.

BIOLOGICAL RESOURCES PLAN
USBP EL CENTRO AND YUMA SECTORS

TABLE OF CONTENTS

FIGURES

TABLES

1. PROJECT DESCRIPTION

The U.S. Customs and Border Protection (CBP), U.S. Border Patrol (USBP) plans to construct, operate, and maintain 225 miles of pedestrian and vehicle fence (PF 225 Project) along the U.S./Mexico international border with construction expected to be completed by December 31, 2008.

1.1 LOCATION

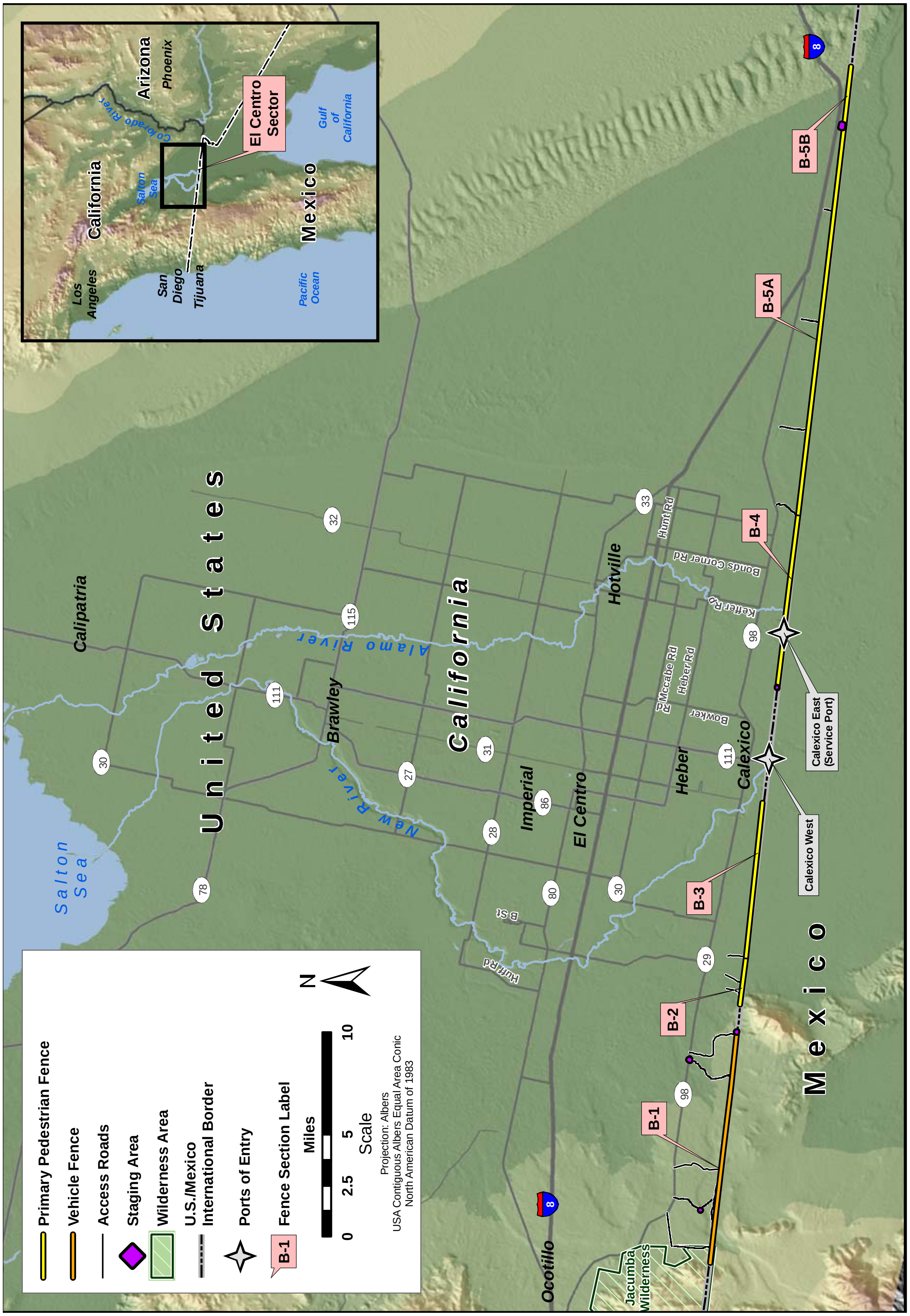
CBP plans to construct, operate, and maintain tactical infrastructure consisting of primary pedestrian and vehicle fence and road improvements in five discrete sections (Sections B-1, B-2, B-4, B-5A, and B-5B) and one section of new lighting (Section B-3) in the El Centro Sector in Imperial County, California (see **Figure 1-1**). CBP also plans to construct, operate, and maintain tactical infrastructure consisting of primary pedestrian and vehicle fence in two discrete sections within the Yuma Sector: one section in Imperial County, California (Section C-1), and one section in Yuma County, Arizona (C-2B) (see **Figure 1-2**). The Project includes the construction, operation, and maintenance of tactical infrastructure along approximately 52 miles of the U.S.-Mexico international border in Imperial County, California (see **Figures 1-1** and **1-2**); and approximately 14 miles in Yuma County, Arizona.

The majority of the land in and adjacent to Sections B-2 and B-3 have been previously impacted by urban or agricultural development and no longer provide habitat for federally listed species. While undisturbed habitat remains in Sections B-4, B-5A, and B-5B, no federally listed species are known to occur or to potentially occur in or adjacent to these sections.

Since the construction, operation, maintenance of pedestrian and vehicle barrier fence in Sections B-2, B-4, B-5A, B-5B, and C-2B and the construction, operation, and maintenance of permanent lighting in Section B-3 were determined to have no effect on federally listed species and federally designated critical habitats, these Project sections are not addressed further in this Biological Resources Plan (BRP). This BRP analyzes the potential effects on Peninsular bighorn sheep and its designated critical habitat and the Peirson's milk-vetch associated with the construction, operation, and maintenance of new tactical infrastructure in Sections B-1 and C-1.

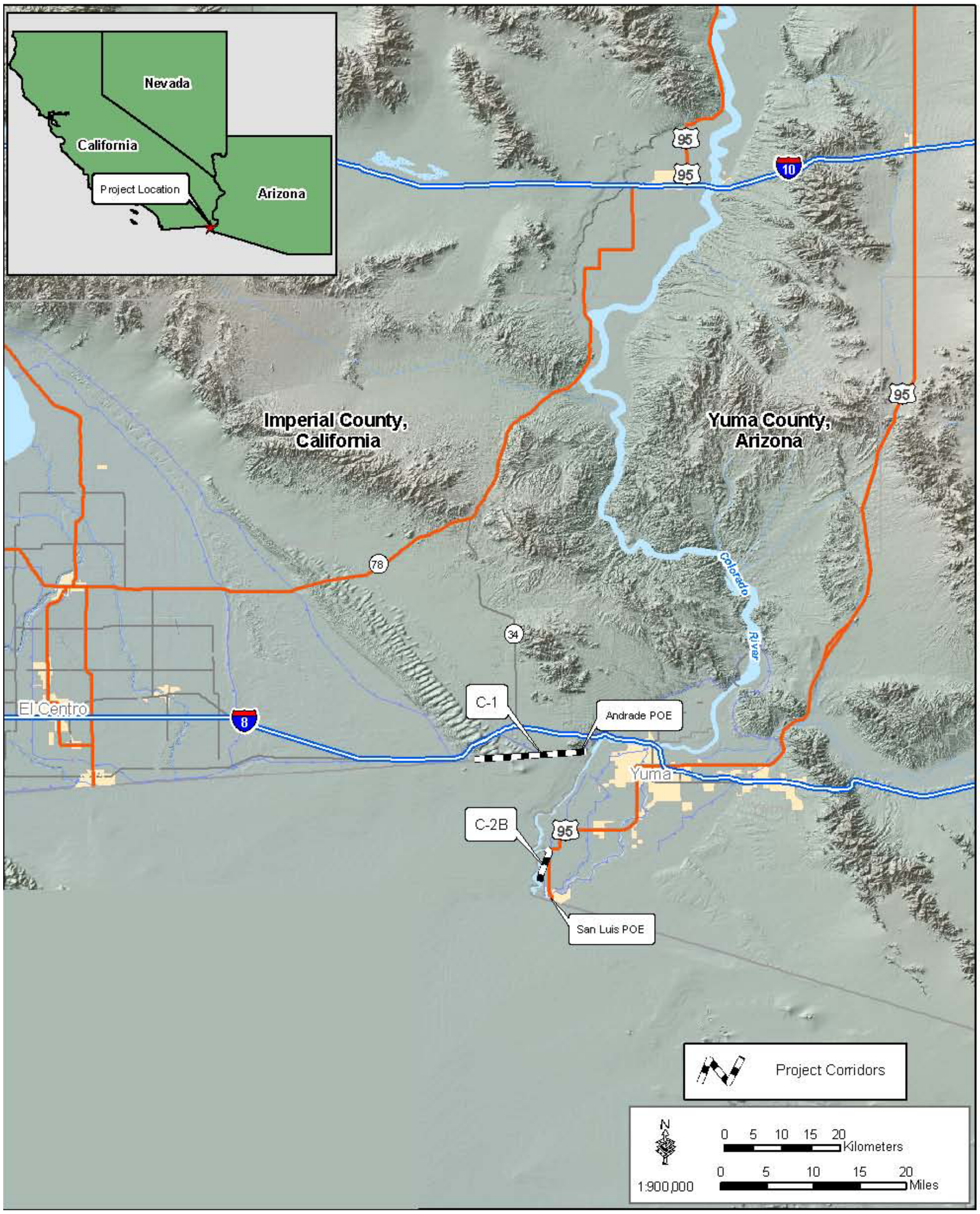
1.2 CONSTRUCTION, OPERATION, AND MAINTENANCE

The Project construction consists of the following Project components: (1) the construction, operation, and maintenance of primary pedestrian and vehicle barrier fence along the U.S./Mexico international border, (2) road improvements to existing roads to improve access for construction, operation, and maintenance, and (3) the development of temporary construction staging areas.



Source: ESRI StreetMap USA 2005

Figure 1-1. Map of Project Area (Sections B-1, B-2, B-3, B-4, B-5A, and B-5B) in Imperial County, California



Source: GSRC 2008

Figure 1-2. Map of Project Area (Sections C-1 and C-2B) in Imperial County, California, and Yuma County, Arizona

Tactical Infrastructure in Sections B-1 and C-1 include the construction of a total of approximately 21.6 miles of new primary pedestrian and vehicle barrier fence. Three fence types are planned: Vehicle Fence Type 2 (VF-2), Vehicle Fence Type 4 (VF-4), and Personnel-Vehicle Fence Type 1 (PV-1). See **Figures 1-3**, **1-4**, and **1-5** for visual representations of the three fence types.

Figure 1-3. Personnel-Vehicle Fence Type 1 (PV-1)

Figure 1-4. Schematic and Photograph of Vehicle Fence Type-2 (VF-2)

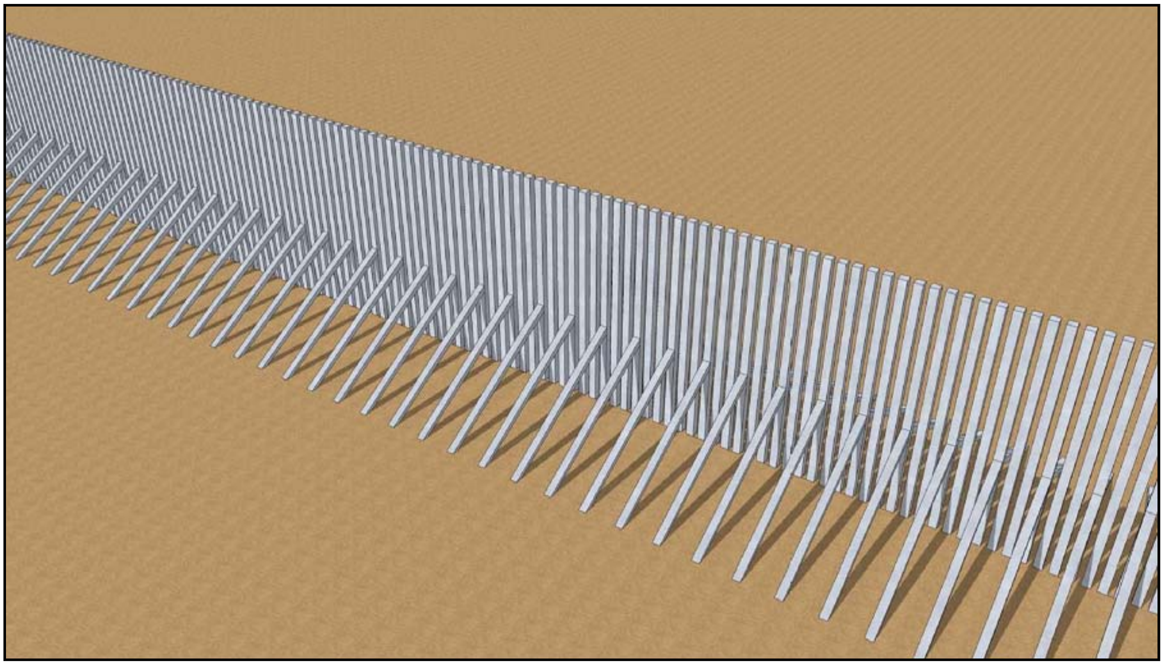


Figure 1-5. Vehicle Fence Type 4 (PV-4) Design

The VF-2 fence is Normandy-barrier fence designed to prevent vehicle passage in Section B-1. Sections of VF-2 fence will be transported to the site by small trucks with lowboy trailers. Depending on the soil type encountered, fence sections will be permanently installed using a small truck with an auger or a hydraulic driver. No pile driving will be required for construction of VF-2 fence.

The PV-4 fence is a floating fence designed to prevent vehicle passage in the western 6.3 miles of Section C-1. Sections of PV-4 fence will be transported to the site by small trucks with lowboy trailers. Fence sections will be installed on site using a fork lift to set the sections on the surface of the sand. The PV-4 was specially designed to sit on the surface of the sand and will be lifted and repositioned using a fork lift on the sand surface as necessary due to sand accumulation along the fence. Construction will be completed using a fork lift. No pile driving will be required for construction of PV-4 fence.

The PV-1 fence is an anchored, 18-foot (above ground) grout-filled steel bollard-style fence designed to prevent passage by both people and vehicles in the eastern 4 miles of Section C-1. Panels of PV-1 fence will be welded together off site and transported to the site by small trucks with lowboy trailers. Using a crane, fence panels will be anchored in concrete. Construction of new fence will be completed using equipment such as a trencher, a cement mixer, and a crane. No pile driving will be required for construction of PV-1 fence.

New fence construction will occur approximately 3 feet north of the international border within the 60-foot-wide Roosevelt Reservation, owned by the Bureau of Land Management (BLM). This 60-foot-wide area constitutes the project corridor in which all construction, operation, and maintenance activities will be conducted. See **Figure 1-6** for a schematic of the 60-foot project corridor. Routine maintenance will occur, as needed, to preserve the integrity of the new and existing barrier fence. The barrier fence will be repaired, as needed, using welders and all vegetation and debris within the 60-foot project corridor will be removed, as needed, to maintain visibility and mobility. This 60-foot project corridor also serves as an access/patrol road along the international border.

There will be no change in overall USBP Sector operations. The fences will be made from non-reflective steel. No painting will be required. Fence maintenance will include removing any accumulated debris on the fence after a rain event to avoid potential future flooding. Sand that builds up against the fence and brush will also be removed as needed. Periodically, if sand drifts build up against the PV-4 fence section in the Algodones Dunes and the USBP makes an operational determination that the sand build up poses a risk, the fence segments will be physically lifted and then reset on the sand again. Brush removal could include mowing, removal of small trees and application of herbicide if needed. During normal patrols, Sector personnel will observe the condition of the fence. Any destruction or breaches of the fence will be repaired, as needed, by a contractor.

Section B-1 (West of Pinto Wash to Monument 225, El Centro Station). Section B-1 will be approximately 11.3 miles in length and will extend from approximately 1.5 miles west of Pinto Wash, at the easternmost boundary of the Jacumba Mountains, east to international border Monument marker 225. Normandy vehicle fence is currently deployed sporadically across Section B-1. New vehicle fence (VF-2) in this section will be installed within the 60-foot project corridor and will fill in the gaps between the existing vehicle barrier fence. The existing vehicle barrier fence in this section will not be replaced as part of the Project. Existing roads will provide access from Interstate Highway 98 to the 60-foot project corridor during construction of new barrier fence and provide access for future maintenance of barrier fence. From Highway 98, Coyote 2 Road will be used to access an unpaved road (herein referred to as Access Road #1) that extends to the western end of the project corridor in this section. A second unpaved road off of Highway 98 (herein referred to as Access Road #2), approximately 3.75 miles east of Coyote 2 Road, will serve as a second access point to the project corridor along this section. These roads will not be widened as part of the Project but will be compacted by spraying water on the road to provide safe driving conditions during construction, operation, and maintenance activities. No new access roads or temporary staging areas are planned for this section. Also, no new, permanent lighting fixtures will be installed in this section as part of the Project.

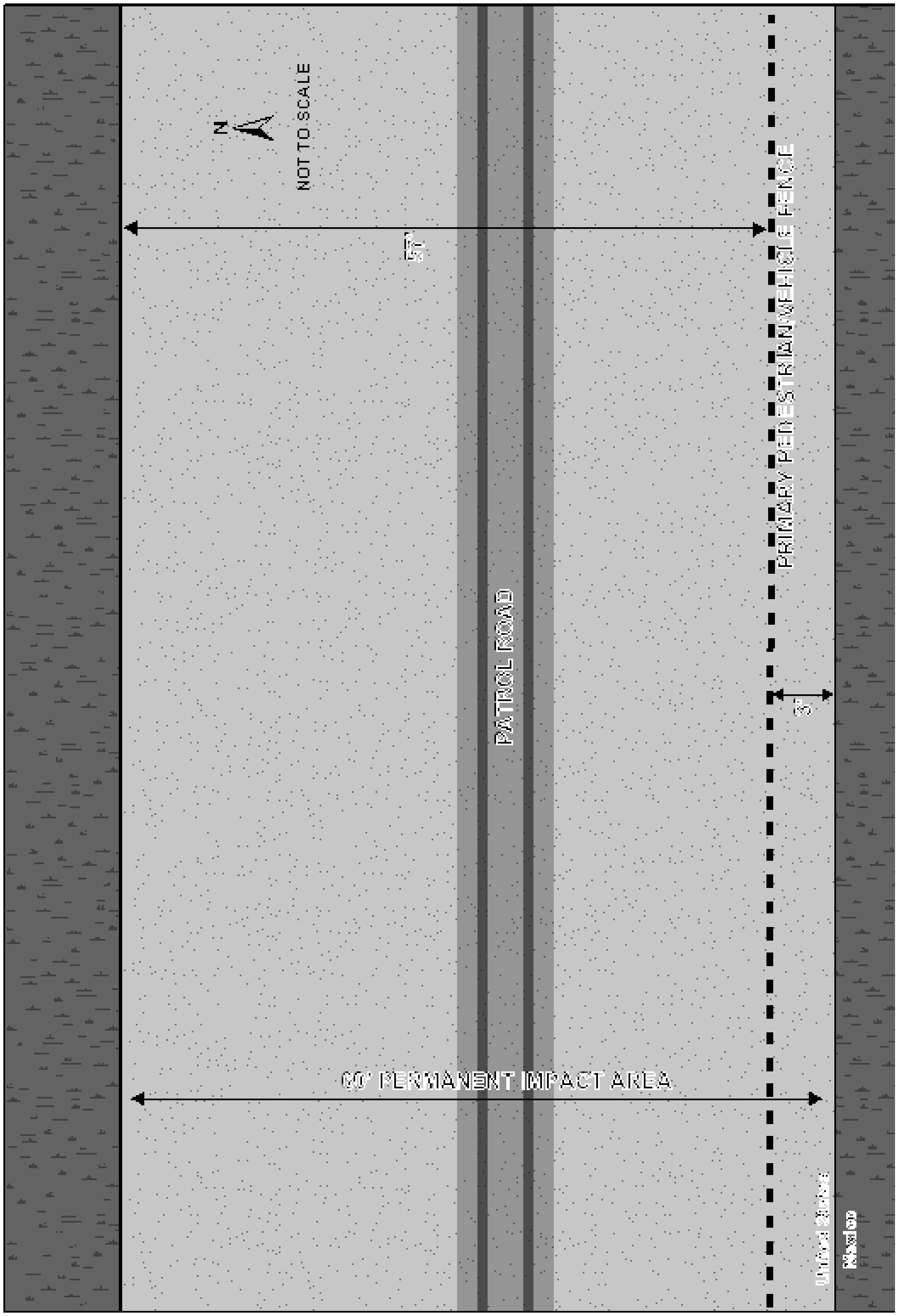


Figure 1-6. Schematic of the Permanent Impact Area within the 60-foot Project Corridor

Section C-1 (Algodones Dunes to Andrade Point-of-Entry, Yuma Station). Section C-1 will be approximately 10.3 miles in length and will extend from the Algodones Dunes area (east of Grays Well Road) to approximately 0.5 miles west of the Andrade Port-of-Entry (POE) near the Arizona-California border. There is no existing fence along the international border in Section C-1. The new 10.3-mile fence will consist of 6.3 miles of vehicle fence (VF-4) across the Algodones Dunes and 4 miles of personnel-vehicle fence (PV-1) extending to the Andrade POE and will be constructed within the 60-foot project corridor. The existing sand road crossing the Algodones Dunes along the international border will be permanently improved by topping it with 12 inches of aggregate road material to provide safe driving conditions during fence construction, operation, and maintenance activities. A second existing road in the eastern half of this section will provide access from the All American Canal access road to the project corridor. This existing access road will not be widened as part of the Project but will be compacted by spraying water on the road to provide safe driving conditions during construction, operation, maintenance activities. A temporary staging area will be established in a previously disturbed area between the All American Canal and the international border within the eastern 3.5 miles of Section C-1. No new, permanent lighting fixtures will be installed in this section.

The construction, operation, and maintenance of a total of 21.6 miles of barrier fence in Sections B-1 and C-1 will impact 153 acres of vegetation within the 60-foot project corridor. Additionally, approximately 4 acres of vegetation will be impacted by the establishment of one staging area in Section C-1 (see **Table 1-1**).

1.2.1 Roads

Multiple unpaved roads currently exist along the international border. These roads are used by CBP for patrol roads and access roads. Patrol roads are needed to provide a safe driving surface along the border and generally parallel the international border. Construction access roads allow construction equipment to access the Project site. New access roads, no wider than 30 feet, will provide access to the international border in Section B-1. Vegetation will be cleared and grading and placement of aggregate will occur where needed.

The Project includes improvements to existing patrol roads and access roads in Section B-1 and the construction of a new patrol road in Section C-1 for use during fence construction, operation, and maintenance activities. In Section B-1, some vegetation within the 60-foot project corridor has been previously cleared for operation and maintenance of the patrol road that parallels the majority of the international border, or to support other facilities such as the All-American Canal. However, improvement of existing patrol roads will include the clearing of all remaining vegetation within the 60-foot project corridor to provide access for fence construction, operation, and maintenance. There are no roads in the area of Section C-1; therefore, a new patrol road will be constructed within the 60-foot project corridor, which will also serve for construction access. While the entire 60-foot corridor will be utilized, little or no vegetation occurs on the ridges/hills of Section C-1, but vegetation will be removed in some of the washes. Access roads and patrol roads, including the one within the project corridor, will also be improved and regularly maintained to provide safe driving conditions during construction, operation, and maintenance activities.

Table 1-1. Approximate Acres of Vegetation or Land Use Type Within the 60-foot Project Corridors and Staging Areas

Vegetation Community/Land Use	Acres in 60-Foot Project Corridor	Acres in 60-Foot Project Corridor	Acres in Staging Areas
Section	B-1*	C-1	
Bermuda Grass - Heliotrope - Alkali Mallow Nonnative Herbaceous Vegetation	0	6	0
Creosotebush / Sparse Understory Shrubland	12	0	4
Creosotebush - White Bursage - Mixed Shrubs Shrubland	58	0	0
Creosotebush - Honey Mesquite - Ironwood - Desert Wash Shrub	9	0	0
Creosotebush - Longleaf Jointfir - Stabilized Dunes Shrub	0	1	0
Active Desert Dunes and Sand Fields	0	65	0
Tamarisk (*Tamarix chinensis*, *T. aphylla*) / Arrow Weed Shrubland	0	2	0
Roads, trails, canal banks, or berms	3	0	0
Other bare ground	0	0	0
Total Project Acreage	**82**	**74**	**4**

Note: * No staging areas are planned for Section B-1.

1.2.2 Staging Areas

The Project includes the establishment of one 4-acre staging area in Section C-1 to accommodate construction equipment and stockpile materials. No staging areas are planned for Section B-1. The staging area in Section C-1 will be established in a previously disturbed area adjacent to the All American Canal along the eastern 3.5 miles of Section C-1.

1.2.3 Fence Maintenance Operations

There will be no change in overall USBP Sector operations resulting from the Project. The pedestrian and vehicle fences will be made from nonreflective steel and will not require any painting. Fence maintenance will include removing any accumulated debris on the fence after a rain event to avoid potential future flooding. Sand that builds up against the fence and brush will also be removed as needed. Brush removal could include mowing, removal of small trees, and application of herbicide, if needed. During normal patrols, Sector personnel will observe the condition of the fence. Any destruction or breaches of the fence will be repaired, as needed.

1.3 BEST MANAGEMENT PRACTICES

1.3.1 Project Pre-Construction

Cultural, geotechnical, and biological surveys were necessary prior to new fence construction and have been reviewed by U.S. Fish and Wildlife Service (USFWS). Numerous measures were provided to CBP and their consultants to minimize and avoid adverse effects on federally listed species during geotechnical surveys. The following subset of those measures applicable to the habitats and species found in the Project area are project objectives and will be implemented to the extent possible or may be mitigated:

Vegetation

1. Survey activities will avoid wetlands as practicable or will be mitigated.
2. Survey activities will avoid all federally threatened plant species as much as possible or will be mitigated.

General

1. To the extent practicable, conduct geotechnical surveys outside of the bird breeding season (February 15 to August 31) and Peninsular bighorn sheep (*Ovis canadensis*) lambing season (January 1 to May 31) when working within habitat occupied by these species or within 100 meters of habitat occupied by these species.
2. Survey activities will avoid destroying native trees and shrubs. If native vegetation must be impacted, the vegetation should be crushed versus cut.
3. Areas outside the 60 foot construction corridor or designated access roads or staging areas where native vegetation was crushed by drill rigs or other machinery will be recorded with GPS and included in the project report.

4. Areas impacted by drill rigs or other machinery during geotechnical activities that are outside of the PF 225 construction footprint will be assessed by the Project proponent. Adverse effects identified will be off set (e.g., access trail restoration, barricades).
5. All pits and trenches related to geotechnical activities will be covered when idle and refilled with parent material when geotechnical activities are completed.
6. Construction of or improvement to access roads was not planned and therefore is not part of this discussion.

1.3.2 Construction, Operation, and Maintenance

General BMPs

The following best management practices (BMPs) should be implemented to avoid or minimize impacts associated with the Project. These represent project objectives for implementation to the extent possible and will be incorporated into construction and monitoring contracts.

1. The perimeter of all areas to be disturbed during construction or maintenance activities in Sections B-1, B-2, B-5A, B-5B, C-1, and C-2B shall be clearly demarcated using flagging or temporary construction fence, and no disturbance outside that perimeter should be authorized.
2. CBP will develop (in coordination with USFWS) a training plan regarding Trust Resources for USBP and construction and maintenance personnel. At a minimum, the program will include the following topics: occurrence of the federally listed and sensitive species in the area, their general ecology, sensitivity of the species to human activities, protection afforded these species, and Project features designed to reduce the impacts on these species and promote continued successful occupation of the Project area environs. Included in this program will be color photos of the federally listed species, which should be shown to the employees. Following the education program, the photos will be posted in the contractor and resident engineer office, where they should remain through the duration of Project construction. CBP, the construction contractor, and the designated biological monitor will be responsible for ensuring that employees are aware of the known and potential presence of federally listed species in the Project area.
3. CBP will designate a qualified biologist who will serve as the designated biological monitor (biological monitor) responsible for overseeing compliance with protective measures for federally listed species during construction activities within Sections B-1, B-2, B-5A, B-5B, C-1, and C-2B. The biological monitor will immediately notify CBP's designated representative to halt all associated Project activities in accordance with the ESP. In such an event, CBP will halt those construction activities until

the violation is rectified. All such actions will be documented and included in the Project Report. If an individual of a federally listed species is found in the designated Project area, work will cease in the area of the species until either a qualified biological monitor can safely remove the individual, or it moves away on its own. The biological monitor shall have the authority to temporarily suspend the specific construction activities if necessary to ensure compliance with the BMPs. This authority must be provided to the biological monitor by the USACE construction manager in the worker orientation training.

4. To the extent practicable and as the schedule permits, the biological monitor will monitor construction activities within Sections B-1, B-2, B-4, B-5A, B-5B, C-1, and C-2B during critical times such as breeding seasons and vegetation removal to ensure BMPs, perimeter fencing, and all avoidance and minimization measures are properly constructed and followed.

5. Construction speed limits in Sections B-1, B-2, B-4, B-5A, B-5B, C-1, and C-2B and associated access roads will not exceed 35 mph on major unpaved roads (graded with ditches on both sides) and 25 mph on all other unpaved roads.

6. Transmission of disease vectors and invasive nonnative aquatic species can occur if vehicles cross infected or infested streams or other waters and water or mud remains on the vehicle. If these vehicles subsequently cross or enter uninfected or infested waters, the disease or invasive species could be introduced to the new area. The biological monitor will determine if any streams or other waters that will be crossed during construction are potentially infected or infested. If infected/infested waters are found, the crossing of streams or marsh areas with flowing or standing water will be avoided if possible. If avoidance is not possible, then the vehicle will be sprayed with a 10% bleach solution or allowed to dry completely to kill any organisms.

7. For construction purposes, infrastructure sites shall only be accessed using existing roads identified for use in the Project description. This will limit the development of multiple trails to such sites and reduce the effects on federally listed species habitats in the vicinity.

8. All equipment maintenance, laydown, and dispensing of fuel, oil, or any other such construction activities, will occur in staging areas identified for use in the Project description, to the maximum extent possible. The designated staging areas will be located in such a manner as to prevent any runoff from entering waters of the United States, including wetlands.

9. Typical erosion-control measures, BMPs, throughout the Project area will be employed in accordance with the Project Storm Water Pollution Prevention Plan (SWPPP).

10. No off-road vehicle activity by construction workers or Project contractors will occur outside of Project perimeter or existing access roads identified for use in the Project description.
11. No pets owned or under the care of CBP personnel or any and all construction workers or Project contractors will be permitted inside the project corridor in any Project section, adjacent native habitats, or other associated work areas. Use of CBP working dogs during CBP operations are excluded from this BMP.
12. Light poles and other pole-like structures used in Sections B-1, B-2, B-3, B-4, B-5A, B-5B, C-1, and C-2B will be designed to discourage roosting by birds, particularly ravens or other raptors that might use the poles for hunting perches, by installing bird control products (e.g., those manufactured by Bird-B-Gone).
13. To prevent entrapment of wildlife species during the construction of the Project in Sections B-1, B-2, B-3, B-4, B-5A, B-5B, C-1, and C-2B, all excavated, steep-walled holes or trenches will be covered at the close of each working day by plywood. Each morning before the start of construction and before such holes or trenches are filled, they will be thoroughly inspected for trapped animals. Any animals so discovered will be allowed to escape voluntarily (by temporary structures), without harassment, before construction activities resume, or removed from the trench or hole by the biological monitor or other qualified biologist and allowed to escape unimpeded.
14. Potential for erosion off the designated roadbed into federally listed species habitat will be avoided or minimized.
15. Potential for entrapment of surface flows within the roadbed due to incisement or edging berms created by grading will be avoided or minimized.
16. Widening of existing or created roadbed beyond the design parameters due to improper maintenance and use will be avoided or minimized.
17. Water for construction use shall be from wells or irrigation water sources at the discretion of the landowner. If local groundwater pumping is an adverse effect on aquatic, marsh, or riparian federally listed species, treated water from outside the immediate area will be utilized.
18. All construction will follow CBP management directive 5100 for waste management.
19. A CBP-approved spill protection plan will be developed and implemented at construction and maintenance sites to ensure that any toxic substances are properly handled and escape into the environment prevented. Agency standard protocols will be used. Drip pans underneath equipment, containment zones used when refueling vehicles or equipment, and other measures will be included as appropriate.

20. Waste materials and other discarded materials will be removed from the site as quickly as possible.
21. Waste water (water used for Project purposes that is contaminated with construction materials, was used for cleaning equipment and thus carries oils or other toxic materials or other contaminants in accordance with state regulations) will be stored in closed containers on site until removed for disposal. Concrete wash water will not be dumped on the ground, but will be collected and moved offsite for disposal.
22. During construction and maintenance activities, the minimum amount of personnel and equipment will be used to reduce the amount of activity. This can be adjusted if additional personnel and equipment would complete the work faster and thus reduce the time the disturbance is in effect.
23. To prevent entrapment of wildlife species during placement of vertical posts/bollards along the project corridor, all vertical fence posts/bollards that are hollow (i.e., those that will be filled with a reinforcing material such as concrete), shall be covered. As much as possible, covers will be deployed from the time the posts or hollow bollards are erected to the time they are filled with reinforcing material.

BMPs for Temporary Impacts

The following apply as off-setting conservation measures for temporary impacts.

1. All generally native areas, as opposed to generally developed areas, temporarily impacted by construction activities (e.g., staging areas, temporary access roads) will be revegetated with native plant species using a standardized restoration plan provided to USFWS prior to planting if possible**.** The restoration plan will describe revegetating all temporarily disturbed areas within the scope of the Project All native seed and plant stock should be from seed and propagules collected within a 5-mile radius of the work area to the extent practicable. All seeding should occur during the first winter or fall following completion of the work.
2. No invasive exotic plant species should be seeded or planted adjacent to or near sensitive vegetation communities or waters of the United States. Impacted areas will be reseeded with plant species native to local habitat types, and will avoid the use of species listed as High or Moderate in the California Invasive Plant Council's Invasive Plant Inventory (Revision 2005) to the extent practicable. Areas hydroseeded for temporary erosion-control measures should use native plant species.
3. Temporary impact areas will be restored in-kind, except temporary impacts on disturbed habitat and nonnative grassland in generally native areas should be revegetated with the most appropriate native plant palette following completion of the work.

Species-Specific BMPs

In addition to the General Conservation Measures outlined above, the following measures will be implemented to the maximum extent possible, to avoid, minimize, or offset impacts associated with the Project on the federally listed Peninsular bighorn sheep and Peirson's milk-vetch.

Peninsular bighorn sheep. During any construction activities in Section B-1 and along associated access roads identified for use in the Project description, if a sheep is seen within 1 mile of the activity, any work that could disturb the sheep will cease. For vehicle operations, this will entail stopping the vehicle until the sheep moves away. Vehicles can continue on at reduced speeds (10–15 miles per hour) once the sheep has moved away. For construction, the biological monitor will request that work be suspended until the sheep moves out of the area. As the schedule permits, construction crews will wait up to 3 hours from the initial sighting for the sheep to move beyond 1 mile away from the Project activity or vehicle. After that, if the construction schedule permits, project personnel may retreat from the area in the direction from which they came.

Peirson's milk-vetch.

1. Using funds contributed to the mitigation fund by CBP, USFWS may offset direct and indirect impacts on approximately 46 acres of Peirson's milk-vetch habitat (6.3 miles of new fence x 60-foot Project area) in Section C-1 based upon a standard 3:1 mitigation ratio. USFWS may assign the equivalent funds needed to adaptively manage and monitor 138 acres of Peirson's milk-vetch habitat to the BLM. BLM may use these monies to fund conservation actions benefitting Peirson's milk-vetch in the Buttercup Management Area.
2. Prior to disturbance in all areas known to be occupied by Peirson's milk-vetch within the 60-foot project corridor in Section C-1, the Peirson's milk-vetch seed bank will be harvested. At least the top 10 centimeters of sand will be removed from the dune bowls and placed atop an adjacent dune outside of the impact area.
3. Soil used for filling dune bowls will consist of only dune sand from the immediate area. Material other than dune sand will not be used for filling.
4. The risk of spreading invasive plant species will be reduced by cleaning heavy equipment prior to use in the dunes and removing invasive species from the work areas prior to disturbance to avoid incorporating seeds of these species into the seed bank.
5. In the area where soils will be stored temporarily, any oil, hazardous material, or other material that could negatively impact long-term dune vegetation, will be placed and used in a designated area and protective measures will be in place to ensure no material is spilled.

6. No aggregate road material will be applied outside of the 60-foot project corridor in Section C-1.

2. DESCRIPTION OF THE SPECIES AND THEIR HABITAT

2.1 PENINSULAR BIGHORN SHEEP

The population of bighorn sheep in the United States Peninsular Ranges was listed as endangered on March 18, 1998.

2.1.1 Distribution

The current population is approximately 334 animals, distributed in 8 known ewe groups (subpopulations) in Riverside, Imperial, and San Diego counties from the San Jacinto Mountains south to the Mexican border (USFWS 2000).

2.1.2 Habitat Requirements

The Peninsular bighorn sheep is restricted to the east-facing, lower elevation slopes [typically below 1,400 meters (4,600 feet)] of the Peninsular Ranges along the northwestern edge of the Sonoran Desert. Bighorn sheep are wide-ranging animals that require a variety of habitat characteristics related to topography, visibility, water availability, and forage quality and quantity. Steep topography is required for lambing and rearing habitat and for escaping from predators. Open terrain with good visibility is critical because bighorn sheep primarily rely on their sense of sight to detect predators. In their hot, arid habitat, water availability in some form is critical, especially during the summer. A wide range of forage resources and vegetation associations is needed to meet annual and drought-related variations in forage quality and availability (USFWS 2000).

2.1.3 Threats

Limiting factors apparently vary with each ewe group and are not well understood in all cases. The range of factors appears to include predation, urban-related sources of mortality, low rates of lamb recruitment, disease, habitat loss, and human-related disturbance (USFWS 2000).

Human disturbance has the potential to disrupt normal bighorn sheep social behaviors and use of essential resources, and cause bighorn sheep to abandon traditional habitat. Human disturbance in the form of construction activities has been found to cause bighorn sheep to abandon traditional habitat. While they eventually returned to the area following cessation of construction activities, ewes have been observed abandoning lambing habitat while construction activities were ongoing within their home range (Etchberger and Krausman 1999).

Human disturbance in other essential habitats, including foraging habitat, could also cause bighorn sheep to abandon habitat. The Peninsular bighorn sheep use alluvial fans and washes in spring and summer (March through August) or during any period of limited forage availability, such as times of drought, since wash vegetation remains green longer than vegetation in other areas (Andrew 1994). Alluvial fans and wash areas are also important during the reproductive season (March through August), because nursing ewes often concentrate their foraging efforts in areas with higher forage quality. Alluvial fans contain more productive soils and support greater herbaceous growth than steeper, rockier soils, during this nutritionally demanding period. In the Peninsular Ranges, bighorn sheep have been frequently observed within 0.5 miles from mountainous habitat feeding in or moving across washes and alluvial fans (DeForge and Scott 1982).

2.2 PEIRSON'S MILK-VETCH

Peirson's milk-vetch was listed as threatened species on October 6, 1998.

2.2.1 Distribution

Peirson's milk-vetch is only known to occur in the Algodones Sand Dunes (also called the Imperial Sand Dunes) of Imperial County, California. Within the Algodones Dunes, Peirson's milk-vetch generally occurs in the interior portions of the dunes (USFWS 2007a).

2.2.2 Habitat Requirements

Peirson's milk-vetch is a perennial herb, which blooms from December to April, requires dune areas, at elevations of 55–250 meters above sea level and is known only from the Algodones Sand Dunes in California.

2.2.3 Threats

The primary threat to the only known existing population of Peirson's milk-vetch is the destruction of existing plants and habitat by off-road vehicle (ORV) usage in the Algodones Dunes (USFWS 2005). Recreational ORV activity and associated recreational development impact the species by crushing standing plants, decreasing seedling establishment, and reducing reproductive output; potentially disrupting dune formation, movement, and structure; causing the collapse of dune faces and ridges; disturbing surface sand, thereby decreasing soil moisture needed for individual and population growth; and degrading the psammophytic scrub plant community that provides habitat for pollinators required for reproduction.

Vehicles can crush individual plants and reduce the reproductive output of those that survive. Several recent studies have attempted to assess ORV damage to Peirson's milk-vetch: Phillips et al. (2001), Phillips and Kennedy (2003 and 2005), McGrann et al. (2005), and Willoughby (2005). However, the results of these studies were inconclusive since they were conducted late in the season when there were fewer standing plants due to high temperatures or conducted well after peak holidays with high dune visitation.

Due to the transient nature of the surface structure of dunes, most quantitative measures of ORV impacts are given in terms of numbers of plants impacted. However, using numbers of plants might not accurately quantify impacts. Phillips et al. (2001) anecdotally observed that nearly all plants that were run over were resilient and “popped back up” with no damage to the stems or flowers and that “as soon as the wind obliterated the tracks, there was no sign of any effect.” Wind will also likely obliterate any evidence of damage to plants by blowing away broken branches and burying broken stems in sand. Therefore, studies making one-time observations that assume that the only direct evidence of any “effect” is a tire track in the sand that can be directly associated with a damaged plant, could under estimate damage. These observations of impact and resilience were made without determining the persistence or the productivity of the plants damaged. Additionally, no follow-up visits were noted, and no measures of impact on the habitat, description of type of damage, or effects on plant reproductive capacity were provided.

Phillips et al. (2001) further suggested that the number of damaged plants was minimal because ORV drivers avoid vegetated basins, where Peirson’s milk-vetch often grows in proximity to shrubs, to prevent potential tire damage. However, they provided no information on plants observed outside of bowls with woody stems, nor did they discuss the potential damage to plants from four–wheel quads or motorcycles that can traverse woody basins without damaging equipment.

Groom et al. (2007) is the first study to date to monitor individual plant fates through a growing season. Peirson’s milk-vetch Global Positioning System (GPS) coordinates were acquired on randomly selected plants marked in an experiment conducted from February until June 2005. Some plants (i.e., “treatment plants”) in an area closed to ORV activity were purposefully struck with an ORV and their reproductive capacity and fate were tracked with repeated monthly visits. Results indicate that small plants less than 18 inches had a 33 percent lower survival rate than plants in the control group that were not struck (Groom et al. 2007). Service biologists continued to track survivorship in a follow-up study conducted from December 2005 until June 2006. No germination occurred during the 2006 growing season, indicating that all live plants encountered were greater than 1 year old. In this study, GPS coordinates were acquired for Peirson’s milk-vetch plants in two 618-acre study areas, one in an ORV-open area and one in an ORV-closed area. Every plant was revisited monthly to monitor health, reproductive state, biometrics, and seed pod production. As a follow-up to Groom et al. (2007) study, USFWS biologists conducted a study comparing survival of Peirson’s milk-vetch over the growing season in areas open to ORVs with survival in areas closed to ORVs. Plants in the ORV-open area were 20 percent less likely to survive the entire study period than plants in the ORV-closed area (USFWS 2007b).

Most of the studies, and in particular Groom et al. (2007) and the follow-up Service study (USFWS 2007b); indicate that Peirson's milk-vetch plants can be damaged by ORV activity. In fact, the observation by Phillips et al. (2001) that "the occurrence of dune plants and heavy use areas for vehicles is, to a large extent, mutually exclusive," describes similar findings by WESTEC (1977), Lukenbach and Bury (1983), ECOS (1990, and McGrann et al. (2005), and Willoughby (2006). While little or no documentation exists of the graded effects of medium- and low-use areas for vehicles, by the time the vehicle use level can be described as "heavy," the area is generally devoid of plants. The exact process is not understood, but could include repeated depletion of pre-flowering seedlings depleting the seed bank, eliminating standing seed-producing plants that diminish and eventually extinguish input to the seed bank, or untimely or excessive scarification of the seeds by the grinding actions of sand moved by ORVs causes the seeds to desiccate.

3. ACTION AREA

The action areas associated with the Project are different for Peninsular bighorn sheep and Peirson's milk-vetch because their ranges do not overlap and the Project affects them in different ways. For Peninsular bighorn sheep, the action area includes Section B-1, encompassing the area between Interstate Highway 8 and the international border extending from the east-facing slopes of the Jacumba Mountains (adjacent to Section B-1), eastward approximately 0.6 miles (1 kilometer) from the toe of the slope. This area corresponds with those lands most likely to be used by Peninsular bighorn sheep in the area directly and indirectly affected by the Project. For Peirson's milk-vetch, the action area includes Section C-1, encompassing the area between Interstate Highway 8 and the international border extending from the west end of Section C-1 eastward approximately 5.75 miles (ending at the C-1 staging area). This area corresponds with those lands known to be occupied and potentially occupied by Peirson's milk-vetch in the area directly and indirectly affected by the Project. Maps depicting the location of vehicle fence, access roads, staging areas relative to federally listed species or designated critical habitat in Sections B-1 and C-1 are provided in **Figures 3-1** and **3-2** below.

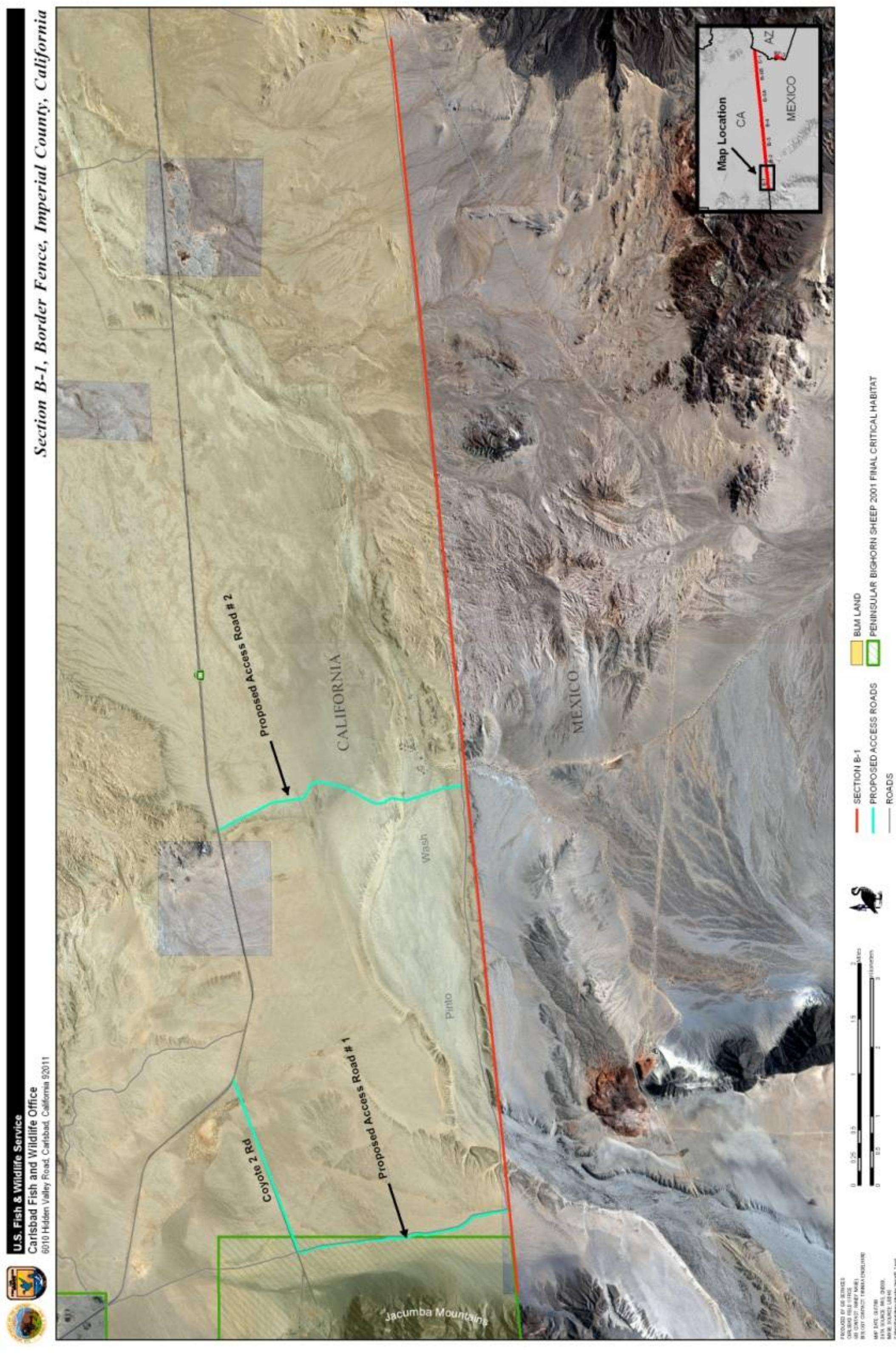


Figure 3-1. Section B-1 Project Area

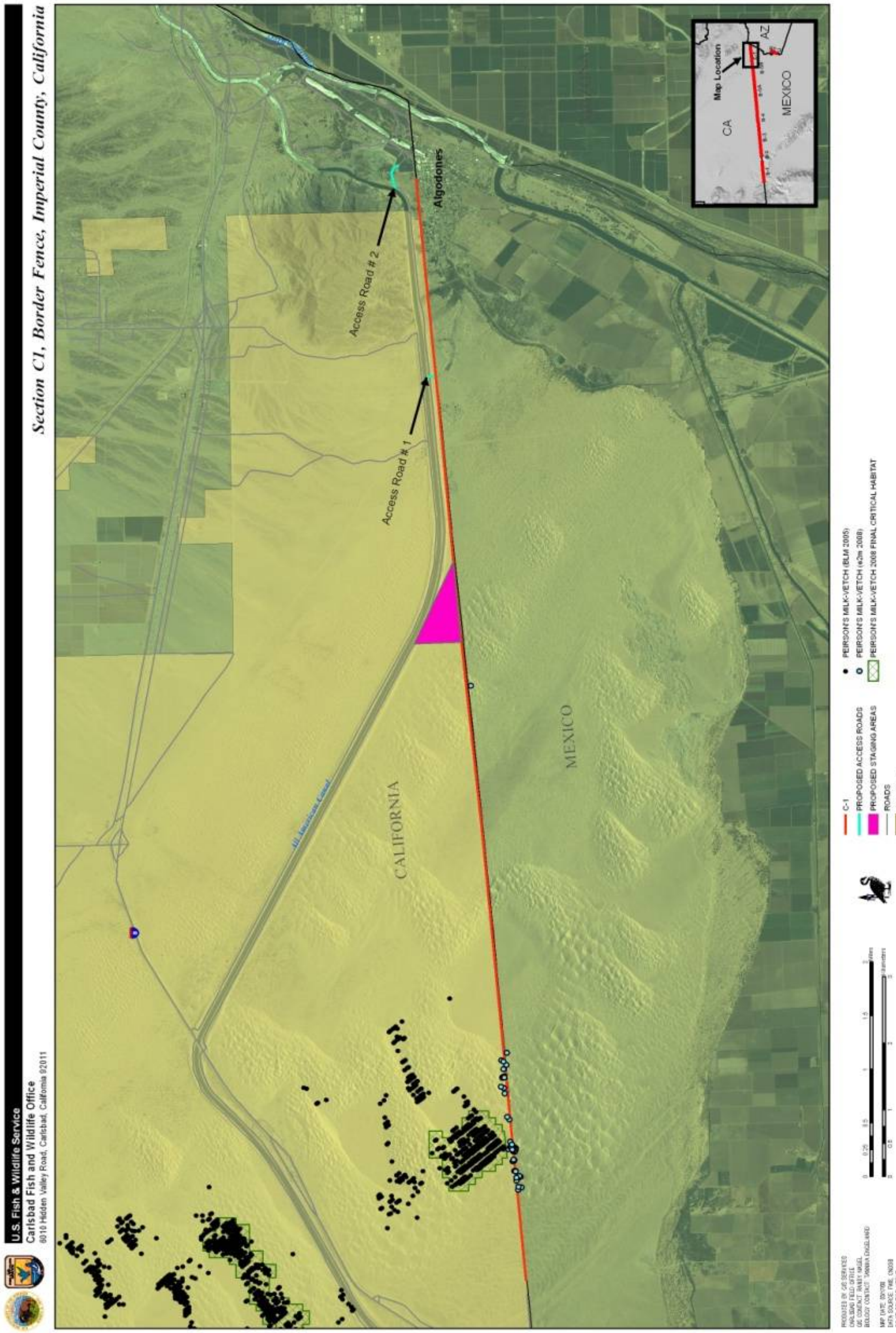


Figure 3-2 Section C-1 Project Area

THIS PAGE INTENTIONALLY LEFT BLANK

4. EFFECTS OF THE PROJECT

The following analysis of the effects of the Project on Peninsular bighorn sheep and Peirson's milk-vetch and designated critical habitat is based on literature and information contained in Carlsbad Fish and Wildlife Service files.

4.1 PENINSULAR BIGHORN SHEEP

Coyote 2 Road to Access Road #1 is one of two routes that will be used to access Section B-1. Access Road #1 is roughly parallel to the Jacumba Mountains and is approximately 0.5 to 0.75 miles from the base of the mountains. The western end of Coyote 2 Road and the northern end of Access Road #1 are also within designated critical habitat. Both Coyote 2 Road and Access Road #1 cross portions of Pinto Wash. Since increased traffic on roads apparently make bighorn sheep, especially ewes, hesitant to cross these roads (Rubin et al. 1998, Epps et al. 2005), use of these access roads, particularly Access Road #1, associated with construction, operation, and maintenance activities could deter Peninsular bighorn sheep from using flatter terrain more distant from escape cover, and thereby decrease the extent of Pinto Wash available for foraging.

Increased human disturbance might also result in physiological effects, such as elevated heart rate or the additional energy expended in moving away from perceived danger. Also, Project timing coincides with the reproductive period, which could result in increased impacts on ewes with lambs, which are typically more sensitive to disturbance (Light and Weaver 1973, Wehausen 1980). While bighorn sheep have evolved to deal with occasional disruptions of their usual behavioral patterns, such as the presence of a predator, it appears that beyond a certain level of human activity, bighorns can simply be overwhelmed, and subsequently alter their behavior.

Since fence construction in Section B-1 is anticipated to be completed by December 2008, the majority of the impacts associated with the use of Coyote 2 Road and Access Road #1 for construction access to Section B-1 are anticipated to be temporary, occurring within the 9-month construction period (April to December 2008). However, continued and frequent human use of an area can cause Peninsular bighorn sheep to eventually avoid the area, interfering with use of resources.

Therefore, given the importance of alluvial fans and washes for foraging habitat and the proximity of Access Road #1 to occupied mountainous habitat, the use of Coyote 2 Road and Access Road #1 for daily access by work crews and equipment/supply deliveries would be anticipated to prevent use of habitat within 0.25 miles of Access Road #1 by Peninsular bighorn sheep in Pinto Wash and along the toe of the slope between Highway 8 and the international border, during the construction period. Maintenance activities, depending on their frequency and magnitude, could extend habitat avoidance into the long term. Avoidance of preferred foraging habitat would have adverse nutritional consequences.

Impacts on Peninsular bighorn sheep habitat due to construction-related disturbance and avoidance of foraging habitat within 0.25 miles west of Access Road #1 will be minimized through use of the conservation measures (see **Species-Specific Conservation Measures** in **Section 1.3.2**). The conservation measures requiring that any work that could disturb the bighorn sheep cease as soon as individuals are observed within a mile of any construction activities or along associated access roads will minimize the extent to which individuals avoid use of the Project area for foraging.

Construction and operation of tactical infrastructure will increase border security in Section B-1 and may result in a change to illegal traffic patterns. However, changes to illegal alien traffic patterns result from a myriad of factors in addition to Border Patrol Operations and therefore are considered unpredictable and beyond the scope of this BRP. Attempts to illegally cross this section of the international border are usually in vehicles, as opposed to on foot. Therefore, the Project could benefit Peninsular bighorn sheep by decreasing the number of illegal vehicle crossings in Section B-1, and subsequently decreasing the extent of human disturbance in Pinto Wash.

4.2 PEIRSON'S MILK-VETCH

Potential impacts on Peirson's milk-vetch associated with the construction, operation, and maintenance of 6.3 miles of vehicle fence (VF-4) and 4.0 miles of personnel-vehicle fence (PV-1) within a 60-foot project corridor across the Algodones Dunes in Section C-1 are similar to those associated with recreational ORV use and include crushing of standing plants and decreasing seedling establishment; disturbing surface sand, thereby decreasing soil moisture; and degrading the psammophytic scrub plant community that provides habitat for pollinators required for reproduction.

Since all construction, operation, and maintenance activities will occur linearly along a previously established "sand highway" within the 60-foot project corridor, the Project will not result in the collapse of dune faces or ridges. Also, since the vertical fence bollards of the VF-4-type fence will be spaced apart, dispersal of fruits and seeds across the fence is not likely to be significantly altered as a result of the Project. The fence structure could cause shifts in the localized wind patterns, resulting in a subsequent shift in sand movement. However, the significance of these shifts in wind and sand patterns on the Peirson's milk-vetch on either side of the fence is unknown. The addition of a 12-inch layer of aggregate road material on top of the existing "sand highway" across the active dunes during fence construction can also cause shifts in the localized wind patterns, resulting in subsequent shifts in sand or seed movement. Also, seeds blown toward the road could be trapped in the aggregate layer and unable to establish. However, given the extent of sand movement occurring within these active dunes, the impact on sand movement associated with the permanent addition of 12 inches of aggregate road material is anticipated to be temporary as sand is likely to accumulate and cover this aggregate layer in a relatively short period of time.

The timing of the fence construction would likely coincide with the spring period of seed germination, growth, and flowering of Peirson's milk-vetch, potentially reducing reproductive success of plants in the project corridor because plants or branches are damaged or destroyed prior to seed-set. Aside from the direct crushing of the delicate seedlings, ORV use in close proximity to the seedlings could indirectly affect germinating seedlings by accelerating soil desiccation that can result in root desiccation (Lathrop and Rowlands 1983). The roots of Peirson's milk-vetch seedlings are especially sensitive to drying out if the plants or sand surface are disturbed. Seedling death could result from both types of impacts. Seedlings damaged but not killed might produce fewer flowers and seeds than undamaged seedlings, leading to a gradual diminishment of the seed bank (Pavlik 1979).

However, seedlings germinating in response to late winter rains (e.g., in January or February), as the seedlings in the project corridor did in 2008, are less likely to flower and set seeds before the onset of desiccating summer heat and often die during summer drought in significant numbers, probably because such plants lack a sufficiently developed root system to tap water at lower horizons. While some portion, maybe even a significant portion, of seedlings in the project corridor might not survive even in the absence of the Project, construction, operation, and maintenance activities are likely to destroy all seedlings in the project corridor, thereby eliminating any potential contribution of seedlings to the seed bank. While smaller first season specimens, if flowering, produce relatively few flowers and contribute little to the seed bank of Peirson's milk-vetch compared with larger, older individuals that have more flowers (Romspert and Burk 1979, Phillips and Kennedy 2005), given the greater number of younger plants following wet years, both older and younger plants that flower and set seed likely are needed to maintain the population. Therefore, the Project would likely result in a decrease in the seed back for Peirson's milk-vetch within the affected area.

Along with impacts associated with crushing of plants and decreased seedling establishment, the Project could impact the associated co-adapted psammophytic scrub plant community within 46 acres of the project corridor. This plant community is important for population growth of Peirson's milk-vetch, because it provides habitat for insect pollinators required by the species for fruit production (Porter et al. 2005). A decrease in available psammophytic scrub decreases available habitat for the white-faced digger bee, the only effective pollinator of Peirson's milk-vetch. The amount of habitat needed to sustain the white-faced digger bee is currently unknown. Therefore, it is not possible at this time to analyze the impacts on Peirson's milk-vetch of decreasing white-faced digger bee habitat in the project corridor.

Impacts on Peirson's milk-vetch plants within the project corridor will be offset or minimized through use of the conservation measures (see **Species-Specific Conservation Measures** in **Section 1.3.2**). Specifically, the measures to harvest the seed bank within the 60-foot corridor in the western 6.3 miles of Section C-1 and to provide the equivalent funds to the BLM needed to adaptively manage and monitor 138 acres of Peirson's milk-vetch habitat will offset direct and indirect impacts on Peirson's milk-vetch plants and seedlings.

Construction and operation of tactical infrastructure will increase border security in Section C-1 and may result in a change to illegal traffic patterns. However, changes to illegal alien traffic patterns result from a myriad of factors in addition to Border Patrol Operations and therefore are considered unpredictable and beyond the scope of this BRP. Attempts to illegally cross this section of the international border are usually conducted in vehicles, as opposed to on foot. Therefore, the Project might benefit Peirson's milk-vetch by decreasing the number of illegal vehicle crossings occurring within occupied habitat, thereby decreasing the number of plants damaged by vehicles and the amount of habitat impacted in lesser-used areas of the BLM Buttercup Management Area. And, since personnel-vehicle fence is being installed westward from Section C-1 and the eastern terminus of this section ends at the Andrade POE, additional illegal vehicle crossings are not likely to increase at the ends of Section C-1.

5. DETERMINATION OF EFFECT

Six federally listed species are known to occur or potentially occur within the El Centro and Yuma tactical infrastructure sections. Of these six species, the Project could affect but is not likely to adversely affect Peninsular bighorn sheep (*Ovis canadensis*) and its designated critical habitat and is likely to adversely affect Peirson's milk-vetch (*Astragalus magdalenae* var. *peirsonii*). The remaining four species, desert tortoise (*Gopherus agassizii),* southwestern willow flycatcher (*Empidonax traillii extimus*), least Bell's vireo (*Vireo bellii pusillus*), and Yuma clapper rail (*Rallus longirostris yumanensis*) will not be affected by the Project. **Table 5-1** outlines federally listed species and federally designated critical habitats known to occur or to potentially occur within or adjacent to the Project area and the determination of effects resulting from the Project.

No federally listed species are known to occur or to potentially occur within Project Sections B-2, B-3, B-4, B-5A, or B-5B. The determination of no effect for impacts on the desert tortoise, least Bell's vireo, and southwestern willow flycatcher was based on the absence of known occurrences or suitable habitat in any sections of the Project. The determination of no effect for impacts on the Yuma clapper rail was based on sufficient distance of potential habitat and occurrences from project activities to avoid impacts to the species.

The determination of no effect for impacts on Peninsular bighorn sheep 2007 revised critical habitat and Peirson's milk-vetch designated critical habitat is based on the fact that construction or maintenance activities will not occur within these critical habitat areas. At its closest points, revised critical habitat Unit 3 for the Peninsular bighorn sheep is more than 12 miles east and north from the western end of Section B-1. The Project in Section C-1 is approximately 324 feet south of the southern boundary of critical habitat Unit 4 for Peirson's milk-vetch. However, all construction or maintenance activities are planned to occur within the 60-foot project corridor and not within designated Peirson's milk-vetch critical habitat. Also, the VF-4 fence planned in this section is a floating fence that is not anticipated to significantly alter sand movement between dune bowls on opposite sides of the fence.

Table 5-1. Determination of Effects on Federally Listed Species and Critical Habitats within Sections B-1, B-4, B-5A, C-1, and C-2B

Species	Project Section	Listing Status	Year Listed, Proposed or Designated	Determination
Peninsular bighorn sheep, *Ovis canadensis*	B-1	Endangered (63 FR 13134-13150)	1998	Might affect but not likely to adversely affect
Peninsular bighorn sheep, *Ovis canadensis*, Critical Habitat	B-1	Designated (66 FR 8649-8677)	2001	Might affect but not likely to adversely affect
	B-1	Revised proposed designation (72 FR 57740-57780)*	2007*	No effect
Desert tortoise, *Gopherus agassizii*	None	Threatened (55 FR 12178-12191)	1990	No effect
Southwestern willow flycatcher, *Empidonax traillii extimus*	C-2B	Endangered (60 FR 10693-10715)	1995	No effect
Least Bell's vireo, *Vireo bellii pusillus*	None	Endangered (51 FR 16474-16482)	1986	No effect
Yuma clapper rail, *Rallus longirostris yumanensis*	B-4, B-5A, C-1, C-2B	Endangered (32 FR 4001)	1967	No effect
Peirson's milk-vetch, *Astragalus magdalenae* var. *peirsonii*	C-1	Threatened (63 FR 53596-53615)	1998	Likely to adversely affect
Peirson's milk-vetch, *Astragalus magdalenae* var. *peirsonii*, Critical Habitat	C-1	Designated (73 FR 8748-8785)	2008	No effect

* The U.S. Fish and Wildlife Service anticipates the revised final critical habitat designation for Peninsular bighorn sheep will be published in the Federal Register in October 2008.

6. REFERENCES

Andrew 1994	Andrew, N. G. 1994. Demography and habitat use of desert-dwelling mountain sheep in the east Chocolate Mountains, Imperial County, California. M.S. Thesis, University of Rhode Island. 135 pp.
DeForge and Scott 1982	DeForge, J. R., and J. Scott. 1982. Ecological investigations into high lamb mortality. Desert Bighorn Counc. Trans. 26:65-76.
ECOS 1990	ECOS, Inc. 1990. Habitat Characterization and Sensitive Species Monitoring Plan for Vegetation in the Algodones Dunes, Imperial County, California. Unpublished report submitted to Bureau of Land Management, El Centro, California.
Epps et al. 2005	Epps, C. W., P. J. Palsboll, J. D. Wehausen, G. K. Roderick, R. R. Ramey II, and D. R. McCullouch. 2005. Highways block gene flow and cause a rapid decline in genetic diversity of desert bighorn sheep. Ecology Letters 8:1029-1038.
Etchberger and Krausman 1999	Etchberger, R. C. and P. R. Krausman. 1999. Frequency of birth and lambing sites of a small population of mountain sheep. The Southwestern Naturalist 44(3):354-360.
Groom et al. 2007	Groom, J.D., L.B. McKinney, L.C. Ball, C.S. Winchell. 2007. Quantifying off-highway vehicle impacts on density and survival of a threatened dune-endemic plant. Biological Conservation 135:119–134
Lathrop and Rowlands 1983	Lathrop, E.W., and P.G. Rowlands. 1983. Plant Ecology in Deserts: An Overview. In R.H. Webb and H.G. Wilshire, eds. Environmental Effects of Off-Road Vehicles. Springer Verlag, New York.
Light and Weaver 1973	Light, J. T. and R. Weaver. 1973. Report on bighorn sheep habitat study in the areas for which an application was made to expand the Mt. Baldy winter sports facility. U .S. For. Serv. Cajon Ranger Dist., San Bernardino Nat. For. 39 pp.
Lukenback and Bury 1983	Lukenbach, R.A., and R.B. Bury. 1983. Effects of off-road vehicles on the biota of the Algodones Dunes, Imperial County, California. J. Applied Ecology 20:265-286.

McGrann et al. 2005	McGrann, A.M., M.C. McGrann, and R. Dial. 2005. Off-highway vehicle impact on *Astragalus magdalenae* var. *peirsonii*, and other critical plant species of the Algodones Dunes, California. California Fish and Game 91(2):61-82.
Pavlik 1979	Pavlik, B.M. 1979. The biology of endemic psammophytes, Eureka Valley, California, and its relation to off-road vehicle impacts. California Desert Plan, BLM Contract No. CA-060-CT8-000049.
Phillips and Kennedy 2003	Phillips, A.M., III and D.J. Kennedy. 2003. The ecology of *Astragalus magdalenae* var. *peirsonii*: Germination and survival. Unpublished report prepared for the American Sand Association.
Phillips and Kennedy 2005	Phillips, A.M., III and D.J. Kennedy. 2005. The life history of Peirson's milkvetch (*Astragalus magdalenae* var. *peirsonii*) in the Algodones Dunes, California 2004-05. Unpublished report prepared for the American Sand Association.
Phillips et al. 2001	Phillips, A.M., D.J. Kennedy, and M. Cross. 2001. Biology, distribution, and abundance of Peirson's milkvetch and other special status plants of the Algodones Dunes, California: Final Report. Unpublished report prepared Thomas Olsen Associates, Inc. for the American Sand Association.
Porter et al. 2005	Porter, J.M., O. Mistretta, and S. Hobbs. 2005. Studies of the natural history of *Astragalus magdalenae* var. *peirsonii* (Peirson's milkvetch); final report. Unpublished report prepared for California Department of Fish and Game.
Romspert and Burk 1979	Romspert, A. and J. Burk. 1979. Algodones Dunes sensitive plant project 1978-1979. Unpublished report prepared for the Bureau of Land Management (project number 1510(C-961.1).
Rubin et al. 1998	Rubin, E. S., W. M. Boyce, M. C. Jorgensen, S. G. Torres, C. L. Hayes, C. S. O'Brien, and D. A. Jessup. 1998. Distribution and abundance of bighorn sheep in the Peninsular Ranges, California. The Wildlife Society Bulletin 26(3):539-551.
USFWS 2000	U.S. Fish and Wildlife Service. 2000. Recovery plan for bighorn sheep in the Peninsular Ranges, California. U.S. Fish and Wildlife Service, Portland, OR. xv+251 pp.

USFWS 2005	USFWS. 2005. Endangered and Threatened Wildlife and Plants: 90-Day Finding on a Petition To Delist the *Astragalus magdalenae var. peirsonii* (Peirson's milk-vetch) *Federal Register*: November 30, 2005 (Volume 70, Number 229), Proposed Rules, Page 71795-71799.
USFWS 2007a	USFWS. 2007. Peirson's Milk Vetch Fact Sheet. Accessed online: <*http://www.fws.gov/carlsbad/Rules/PMV/pmv_fact.pdf*>.
USFWS 2007b	USFWS 2007. Report of Investigations. Algodones Dunes 2006 Field Season: Estimates of off-highway vehicle impacts on the demography and survival of a threatened species. U.S. Fish and Wildlife Service, Carlsbad Fish and Wildlife Office. Unpublished interim report.
Wehausen 1980	Wehausen, J.D. 1980. Sierra Nevada bighorn sheep: history and population ecology. Ph. D. Thesis, Univ. Michigan, Ann Arbor. 243 pp.
WESTEC 1977	WESTEC 1977. Survey of the sensitive plants of the Algodones Dunes. Unpublished report prepared for the Bureau of Land Management.
Willoughby 2005	Willoughby, J.W. 2005. 2005 Monitoring of Peirson's Milk-vetch in the Algodones Dunes, Imperial County, California. Unpublished report prepared for the Bureau of Land Management, California State Office.
Willoughby 2006	Willoughby, J.W. 2006. 2006 Monitoring of Peirson's Milk-vetch in the Algodones Dunes, Imperial County, California. Unpublished report prepared for the Bureau of Land Management, California State Office.

THIS PAGE INTENTIONALLY LEFT BLANK