

## CHAPTER 2.0 ALTERNATIVES

### 2.1 INTRODUCTION

#### 2.1.1 SCOPE OF THE ALTERNATIVES ANALYSIS

This chapter summarizes the screening analysis conducted to identify the range of reasonable and practicable alternatives that were considered and selected for full environmental evaluation in this Environmental Assessment (EA). This summary of the alternatives analysis presents the following:

- A description of the requirements for the analysis of alternatives under the National Environmental Policy Act of 1969 (NEPA) and the Clean Water Act (CWA) - **Sections 2.1.2 and 2.1.3**;
- A description of the alternatives screening process and criteria – **Sections 2.1.4 and 2.2**;
- A description of off-airport, non-construction Runway Safety Area (RSA) solution alternatives – **Section 2.3**;
- A description of on-airport Federal Aviation Administration (FAA) RSA improvement concepts – **Section 2.4**;
- A description and screening level evaluation of all alternatives considered – **Sections 2.5 and 2.6**;
- A descriptions of the components that comprise the Proposed Action and Project Alternative A – **Sections 2.7 and 2.8**;
- A description of the No Action Alternative – **Section 2.9**;
- A listing of applicable laws, regulations, executive orders and associated permits, licenses, and/or reviews – **Sections 2.10 and 2.11**.

#### 2.1.2 REQUIREMENTS OF THE NATIONAL ENVIRONMENTAL POLICY ACT

The Council on Environmental Quality Regulations (Title 40, Code of Federal Regulations [CFR] Parts 1500-1508) for implementing the National Environmental Policy Act of 1969 (NEPA) require that federal agencies perform the following tasks:

- Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives that were eliminated from detailed study, briefly discuss the reasons for their having been eliminated;
- Devote substantial treatment to each alternative considered in detail, including the Proposed Action, so that reviewers may evaluate their comparative merits;
- Include reasonable alternatives not within the jurisdiction of the lead agency; and
- Include the alternative of no action.

As stated in **Chapter 1, Section 1.4**, the purpose of the Oakland International Airport (OAK or Airport) RSA Improvement Project is to improve the existing RSAs at the Airport to comply with the RSA standards included in FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, as required by PL 109-115, while concurrently complying with all other applicable design standards of the AC (e.g., those for Navigational Aid Systems [NAVAIDS]). Specifically, the Proposed Action must either implement specific RSA safety improvements as defined in FAA AC 150/5300-13, *Airport Design*, as required by PL 109-115, or provide an equivalent level of safety in accordance with FAA Orders 5200.8, *Runway*

*Safety Area Program*, and 5200.9, *Financial Feasibility and Equivalency of Runway Safety Area Improvements and Engineered Materials Arresting Systems (EMAS)* (FAA, 1999; FAA, 2004a). RSAs are defined and standard RSA dimensional requirements are included in Chapter 3 and Table 3-3 of FAA AC 150/5300-13, *Airport Design*. Reasonable alternatives that accomplish the stated purpose and need of the project have been identified and evaluated in this EA, which satisfies NEPA requirements.

### **2.1.3 REQUIREMENTS OF THE CLEAN WATER ACT**

Implementation of the Proposed Action or Project Alternative A would require issuance of a Section 404 Permit by the United States Army Corps of Engineers (USACE) under the CWA. One requirement of the USACE permitting process is to evaluate alternatives to the Proposed Action pursuant to the U.S. Environmental Protection Agency's Section 404(b)(1) guidelines to establish that the Proposed Action Alternative is the "least environmentally damaging practicable alternative," taking into account cost, logistics, and technology (40 CFR Part 230 *et seq.*). The chapter provides background information relevant to the 404(b)(1) guidelines.

### **2.1.4 ALTERNATIVES SCREENING PROCESS OVERVIEW**

The screening of alternatives for this EA is based primarily on information developed in two RSA planning studies completed for the Airport:

- Oakland International Airport, Runway Safety Area Studies, Final Report, October 2005; and
- Oakland International Airport, Runway Safety Area Project, Re-Evaluation of Alternatives Study, Final Report, December 2011.

A three-step screening process, developed through consultation with the FAA, was used to evaluate runway-specific RSA Alternatives. This EA screening process is depicted on **Figure 2-1**. A detailed description of these screening criteria is provided in **Section 2.2**.

As shown in **Figure 2-1**, the first step in the three-step process was to determine whether or not a candidate runway-specific RSA Alternative would enhance the Airport's RSA consistent with FAA AC 150/5300-13, *Airport Design* (see **Section 1.4**).

If a candidate runway-specific RSA Alternative satisfied the Step 1 criterion, it was carried forward for evaluation under Step 2. The criteria applied under Step 2 determined whether the candidate runway-specific RSA Alternative being screened would be practicable and consistent with FAA Order 5200.8, *RSA Program*, considering existing technology and logistics in light of the overall project purpose, including implementation and completion by December 31, 2015, as specified in Public Law (PL) 109-115. The candidate runway-specific RSA Alternatives that passed Step 2 evaluation were then carried forward to the Step 3 evaluation. Under Step 3, runway-specific RSA Alternatives that were found to satisfy both the Step 1 and Step 2 criteria were further evaluated to determine whether each would result in a safe and efficient use of navigable airspace, and would minimize impacts on existing airfield operations, consistent with the purpose and need.

### Step 1

Would the Alternative enhance the airport's Runway Safety Areas consistent with FAA Advisory Circular 150/5300-13, *Airport Design*?

NO

Eliminated from further consideration

YES

### Step 2

Would the Alternative be practicable and consistent with FAA Order 5200.8 considering existing technology and logistics in light of overall project purpose, including implementation and completion by December 31, 2015 as specified in Public Law 109-115?

NO

Eliminated from further consideration

YES

### Step 3

Would the Alternative result in a safe and efficient use of navigable airspace and minimize airfield operational impacts?

NO

Eliminated from further consideration

YES

### Draft EA

Retain for detailed analysis of environmental impacts within Chapter 4.0, Environmental Consequences of this EA.

#### ALTERNATIVE SCREENING PROCESS

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Oakland International Airport  
Oakland, California

FIGURE 2-1



The runway-specific RSA Alternatives that were found to meet all the criteria of this three-step process, along with the No Action Alternative, were carried forward for evaluation of potential environmental impacts as described in **Chapter 4** of this EA.

## 2.2 ALTERNATIVES SCREENING CRITERIA

### 2.2.1 STEP 1 CRITERIA – PURPOSE AND NEED

The Step 1 criterion determined whether a runway-specific RSA Alternative would improve the Airport's RSAs so they would comply with the FAA design standards required by 14 CFR Part 139, and described in FAA AC 150/5300-13, *Airport Design*, Paragraph 305. As defined in FAA AC 150/5300-13, *Airport Design*, an RSA is "a defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway." The standard RSA dimensions of the primary runways at OAK, serving large commercial aircraft in approach Categories C and D, as identified in Table 3-3 of FAA AC 150/5300-13, *Airport Design*, are listed below.

RSA Standard Dimensions	Approach Category C and D (feet)
RSA Width	500
RSA Length Prior to Landing	600
RSA Length Beyond the Runway	1,000

FAA's design standards require a 600-foot RSA prior to landing on a runway, but because all runways at OAK can be used in either direction, depending on wind conditions or other operational considerations, standard RSAs would extend 1,000 feet from each runway end. The RSAs also have clearing, grading, and drainage requirements, which are described in FAA AC 150/5300-13, *Airport Design*.

FAA standards require that the terrain within the RSAs be capable of supporting aircraft rescue and firefighting equipment, and the occasional passage of aircraft, without causing structural damage to the aircraft. The FAA standards also require that an RSA must be free of objects, except for those that must be located in the RSA because of their function, such as lighting and NAVAIDS. Objects more than 3 inches above the ground must be frangible-mounted structures (i.e., breakable) at the lowest practical height, with the frangible point no higher than 3 inches above the ground. The dimensional standards remain in effect regardless of the presence of natural or manmade objects, or surface conditions that might create a hazard to aircraft leaving the runway surface.

FAA Order 5200.8 – *RSA Program*, Appendix 2 (*Supporting Documentation for RSA Determinations*), establishes five basic concepts that the FAA considers acceptable means for resolving RSA issues. These concepts are described in **Section 2.4**. RSA alternatives that are developed using these five concepts would generally result in RSA solutions that meet the purpose and need. However, the Order also implies a sequence of development and a hierarchy of acceptability, specifically expressing the preference to resolve RSA issues by creating a dimensionally standard RSA. The Order allows the application of dimensionally non-standard RSA solutions for circumstances where dimensional compliance is not practicable. Specifically, the Order states: "At any time when it is not practicable to create an RSA that meets current dimensional standards, an airport may give consideration to enhancing

the safety of the area beyond the runway end with the installation of an EMAS meeting the requirements of AC 150/5220-22A – *Engineered Materials Arresting Systems for Aircraft Overruns.*”

A description of an EMAS is provided in **Section 2.4.5**. The EMAS consists of crushable concrete blocks, and must be designed to stop the runway’s design aircraft at exit speeds of 70 knots without significant damage to the aircraft or injuries to the passengers, and the runway must provide either instrument or visual vertical guidance for planes approaching in the opposite direction, which would pass over the EMAS installation when landing. Per AC 150/5220-22A, the FAA considers a standard-sized EMAS bed to provide a level of safety generally equivalent to a full RSA built to the dimensional standards in FAA AC 150/5300-13, *Airport Design* (FAA, 1989). However, as noted above, EMAS solutions are not preferred when other dimensionally compliant solutions are available.

Any runway-specific RSA Alternative that would result in RSAs at OAK meeting the FAA design standards was carried forward for assessment under Step 2.

## **2.2.2 STEP 2 CRITERIA – PRACTICABILITY AND IMPLEMENTATION SCHEDULE**

The criteria used in the Step 2 evaluation addressed several key considerations:

- Could the runway-specific RSA Alternative realistically be developed and implemented no later than December 31, 2015, as specified in PL 109-115?
- Would the runway-specific RSA Alternative be feasible and prudent, considering existing technology, as well as design and construction challenges, environmental permitting requirements, and potential total costs, when compared to other runway-specific RSA Alternatives?
- Does the runway-specific RSA Alternative provide the maximum practical benefit to aviation safety in accordance with the guidance of the FAA Order 5200.8, *RSA Program – Appendix 2 (Supporting Documentation for RSA Determinations)*?

### **Implementation Schedule**

The ability to successfully plan, design, obtain necessary permits for, and construct each runway-specific RSA Alternative by the December 31, 2015, deadline, as specified in PL 109-115, is a key criterion in this step of the evaluation process. Implementation of some runway-specific RSA Alternatives would be unavoidably delayed by particular constraints. For example, the design and construction delays associated with relocating major existing infrastructure such as Harbor Bay Parkway in the City of Alameda would be expected to make a runway-specific RSA Alternative infeasible under this criterion.

The FAA screening criteria do not explicitly address environmental impacts as part of the screening process. However, environmental factors were brought into the screening process by considering the amount of time it would take to complete each alternative relative to the December 31, 2015, deadline mandated by PL 109-115. Implementation of some alternatives before the December 31, 2015, deadline could not be achieved due to the time required to develop designs and environmental documentation and to obtain required permits. The likely time needed to gain approvals for any substantial fill in San Francisco Bay is more than is available for OAK to meet the PL 109-115 deadline. Such alternatives

were judged to be impractical because of the inability (or lack of certainty) to complete the construction process prior to the December 31, 2015, deadline.

### ***Construction and Cost Practicality***

These criteria addressed the relative engineering design and construction complexity of each runway-specific RSA Alternative, along with the projected cost of both construction and environmental mitigation requirements. For example, some alternatives include placing fill into San Francisco Bay, requiring protracted agency consultation and substantial costs for mitigation.

### ***Provision of Maximum Practical Benefit to Aviation Safety***

An explicit goal of FAA Order 5200.8, *RSA Program*, is to encourage airports to provide the maximum practical benefit to aviation safety in developing their RSA program, when provision of standard RSAs specified in FAA AC 150/5300-13, *Airport Design* (FAA, 1989) is not practical. The Order recommends consideration of a sequence of possible improvements, as listed in **Section 2.4**, and recommends that for each alternative improvement, the greatest practical conformance with the standard RSA dimensions and/or performance (for installations such as EMAS) be implemented.

Any runway-specific RSA Alternative that was practical and consistent with FAA Order 5200.8, and could be implemented and completed by December 31, 2015, was carried forward for assessment under Step 3.

### ***2.2.3 STEP 3 CRITERIA – SAFE AND EFFICIENT USE OF NAVIGABLE AIRSPACE AND IMPACT ON AIRFIELD OPERATIONS***

The final step of the evaluation process considered these two criteria:

- Is the runway-specific RSA Alternative consistent with the FAA's statutory mission to ensure the safe and efficient use of navigable airspace?
- Would the runway-specific RSA Alternative minimize the impact of the RSA improvements on the operation of the Airport, including the ability to effectively serve the aircraft fleet expected to use the Airport?

### ***Safe and Efficient Use of Navigable Airspace***

The first Step 3 criterion involved evaluation of whether a runway-specific RSA Alternative reaching the Step 3 evaluation would enhance or degrade the ability of the FAA to maintain and use acceptable airspace procedures, ensuring the safe and efficient operation of aircraft in arriving at or departing from the Airport. This criterion considered whether the runway-specific RSA Alternative would require significant changes to local and/or regional airspace procedures, as well as potential conflicts with operations associated with other airports in the region.

## ***Airport Operations***

The second Step 3 criterion involved evaluation of whether, and to what extent, a runway-specific RSA Alternative would reduce the efficiency of existing operations at the Airport. Examples of such impacts would be increases in taxi distances and times due to changes in runway length or relocation of runway thresholds, which would affect fuel usage and Airport operational capacity. Of particular importance under this criterion was the impact a runway-specific RSA Alternative would have on the maximum takeoff weight, and therefore the payload (fuel, passengers, and cargo), of specific key aircraft in common use at the Airport.

An additional important component of this criterion was whether the necessary modification of existing NAVAIDS could be accomplished in accordance with FAA AC 150/5300-13, *Airport Design*.

Any runway-specific RSA Alternative that resulted in a safe and efficient use of navigable airspace and minimized Airport operational impacts was retained and carried forward for evaluation of environmental impacts.

### **2.3 EVALUATION OF OFF-AIRPORT NON-CONSTRUCTION RSA SOLUTIONS**

The focus of this EA is on physical on-airport construction projects that could be implemented to address and resolve the RSA deficiencies at OAK. However, to comply with the requirements of NEPA, this document also considers off-Airport, non-construction RSA solutions that could potentially accomplish the purpose and need. These off-Airport solutions are developed and evaluated in the following sections.

#### **2.3.1 USE OF ALTERNATIVE MODES OF TRANSPORTATION**

As stated in **Section 1.4**, the purpose of the Proposed Action is to enhance aviation safety by providing RSAs at OAK that meet FAA design standards consistent with FAA AC 150/5300-13, *Airport Design*, as required by PL 109-115. The use of alternative modes of transportation to replace some of the air transportation activity at OAK does not meet this purpose because the RSAs would still not meet applicable FAA standards at OAK, and safety would not be enhanced. Furthermore, neither the FAA nor the Port of Oakland (Port) has the authority to compel Airport users to employ other modes of transportation. This alternative was therefore dropped from further consideration in this EA.

#### **2.3.2 USE OF OTHER AREA PUBLIC AIRPORTS**

Shifting some of the air transportation activity at OAK to other area public airports does not meet the purpose of and need of the Proposed Action because the current RSAs would still not meet applicable FAA standards, and safety would not be enhanced. Furthermore, neither the FAA nor the Port has the authority to compel Airport users to use other area airports. This alternative was therefore dropped from further consideration in this EA.

#### **2.3.3 USE OF ALTERNATIVE AIRCRAFT**

The purpose of the Proposed Action is to enhance safety by providing RSAs at OAK that meet FAA design standards consistent with FAA A/C 150/5300-13, *Airport Design*, as required by PL 109-115. The

use of alternative aircraft to replace some or all of the air transportation at OAK does not meet the purpose and need of the project because the RSAs at OAK would still not meet applicable FAA standards, and safety would not be enhanced as required by PL 109-115. In addition, FAA and the Port do not have the authority to compel airlines and other airport users to use alternative aircraft. Therefore, this alternative has been eliminated from further consideration in this EA.

#### **2.3.4 CONCLUSION**

None of the off-Airport, non-construction RSA solutions were found to meet the Step 1 criteria, and none are considered further in this EA.

### **2.4 DESCRIPTION OF FAA ON-AIRPORT RSA IMPROVEMENT CONCEPTS**

FAA Order 5200.8 – *RSA Program, Appendix 2 (Supporting Documentation for RSA Determinations)*, establishes a sequence of improvement concepts to be considered for correcting existing deficiencies with RSA standards. The applicability of these concepts will vary, depending on the location. These improvement concepts are as follows:

- Construction of traditional graded area surrounding the runway;
- Relocation, shifting, or realignment of the runway;
- Reduction in runway length where the existing runway length exceeds that which is required for the existing or projected design aircraft;
- A combination of runway relocation, shifting, grading, realignment, or reduction;
- Declared distances; and
- EMAS

This section includes a description of five basic concepts for correcting RSA deficiencies. Because concept 4 is a combination of other concepts, it is not specifically discussed below.

#### **2.4.1 CONSTRUCTION OF TRADITIONAL GRADED AREA SURROUNDING THE RUNWAY**

The first design concept for establishing an RSA that meets the current FAA design standards is to consider creating, improving, and/or grading a safety area of standard RSA dimensions surrounding the existing runway. Land acquisition, fill requirements, soil improvement requirements, and grading considerations are part of the development process. Relative to other alternatives, constructing standard-dimension RSAs may involve the greatest unavoidable impacts on natural resources, and therefore, the greatest potential costs for environmental mitigation and potential of not complying with the December 31, 2015, deadline due to environmental permitting delays.

#### **2.4.2 RELOCATION, SHIFTING, OR REALIGNMENT OF THE RUNWAYS**

If obtaining a standard RSA is not practicable through conventional means (such as land acquisition, grading, or fill), other alternatives must be explored. For some airports, it may be feasible to relocate, realign, shift, or change a runway in such a way that the standard RSA dimensions may be obtained.

- Relocate Runways – Relocation of a runway entails moving the centerline of one or more runways to provide adequate space for a standard RSA. This option may be feasible where there is enough vacant land available to the sides of the runway in which relocation can be undertaken.
- Shift Runways – Shifting the runways involves moving one or more runway end along the existing centerline. This option can be accomplished by either physically relocating the runway end, or implementing displaced thresholds on one or more runway end to provide enough area for a standard RSA.
- Realign Runways – Realigning the runways entails changing the heading for one or more runway end to provide enough area for standard RSAs. This option may be feasible where adequate space is available to accommodate the realignment.

The FAA recognizes that the costs associated with these kinds of RSA improvement may only be justified in unique situations; however, alternatives developed using these concepts should be analyzed to determine feasibility.

#### **2.4.3 REDUCTION IN RUNWAY LENGTH WHERE THE EXISTING RUNWAY LENGTH EXCEEDS THAT WHICH IS REQUIRED FOR THE EXISTING OR PROJECTED DESIGN AIRCRAFT**

For this third design concept, standard RSA dimensions may be obtained by shortening the length of the runways (i.e., reduce the physical length of the runway pavement) to achieve the required RSA length. This may be feasible where the design aircraft require less runway length than what is currently available, or where the runway length and/or RSA requirements for a particular runway may be reduced by diverting larger aircraft to other runways at the Airport without impacting Airport operations.

#### **2.4.4 DECLARED DISTANCES**

Declared distances are defined in Chapter 1 of FAA AC 150/5300-13, *Airport Design*, as “the distances the Airport operator declares available and suitable for satisfying an aircraft’s takeoff run, takeoff distance, accelerate-stop distance, and landing distance requirements.” Typically, this concept involves declaring that some portion of the existing runway pavement is unavailable for specific operations, and is instead used to provide an RSA meeting applicable FAA design standards. Declared distances are also used where different runway lengths are defined for each direction of operation (i.e., when displaced thresholds are present).

A simplified illustration of declared distances is provided in **Appendix A**. Pilots use these declared distances, along with weather data and aircraft performance characteristics, to make determinations such as the maximum allowable takeoff or landing weight of the aircraft, or the maximum payload and range for a flight. Declared distances at airports are considered in the Operations Specifications of commercial aircraft operators that are part of the air carrier certificates and operations certificates issued by FAA under 14 CFR Part 119: Certification – Air Carriers and Commercial Operators, as well as in the internal operations manuals of those operators. Pilots of commercial aircraft are required to comply with such specifications and manuals. In this situation, the specified distance available for a particular operation

such as landing may be different from the two different directions on the same runway pavement. FAA AC 150/5300-13, *Airport Design*, Appendix 14 defines four declared distances:

- Takeoff Run Available (TORA) – the runway length declared available and suitable for satisfying takeoff run requirements.
- Takeoff Distance Available (TODA) – the TORA plus the length of any remaining runway or clearway beyond the far end of the TORA for satisfying takeoff distance requirements. The usable TODA length is controlled by obstacles present in the departure area vis-à-vis aircraft performance. As such, the usable TODA length is determined by the aircraft operator before each takeoff and requires knowledge of the location of each controlling obstacle in the departure area. Extending the usable TODA lengths requires the removal of existing objects limiting the usable TODA lengths.
- Accelerate-Stop Distance Available (ASDA) – the length of the runway plus stopway declared available and suitable for satisfying accelerate-stop distance requirements.
- Landing Distance Available (LDA) – the runway length that is declared available and suitable for satisfying aircraft landing distance requirements.

#### **2.4.5 ENGINEERED MATERIALS ARRESTING SYSTEMS**

When it is not practicable to establish an RSA meeting the standard dimensions in FAA AC 150/5300-13, *Airport Design*, by other means, an airport sponsor may decide to improve the RSA to meet current FAA Airport Design Standards using an EMAS located beyond the end of the runway and centered on the extended runway centerline. Use of a standard EMAS designed to stop the design aircraft at an exit speed of 70 knots, coupled with the approach end of the runway providing vertical guidance (visual or electronic) for landing aircraft and having at least 600 feet of distance between the runway threshold and the far end of the EMAS bed, meets the current FAA design standards. (See FAA AC 150/5300-13, *Airport Design*, Tables 3-1, 3-2, and 3-3 and FAA AC 150/5220-22A *Engineered Materials Arresting Systems [EMAS] for Aircraft Overruns*.)

An EMAS is a specialized system installed in the RSA beyond the runway end, made of high-energy-absorbing materials such as crushable concrete. An EMAS is designed to stop an overrunning aircraft by exerting predictable deceleration forces on its landing gear as the EMAS material crushes. It must be designed to minimize the potential for structural damage to aircraft, because such damage could result in injuries to passengers and/or affect the predictability of deceleration forces. Photographs of EMAS installations are provided on **Figure 2-2**.

FAA AC 150/5220-22A describes an EMAS as being located beyond the end of the runway and centered on the extended runway centerline. This AC defines an EMAS as having two components, the “EMAS Bed,” where the EMAS blocks are placed, and the “Setback,” which is the distance from the runway threshold to the start of the EMAS bed. Figure A1-1 of this AC describes a “standard” EMAS as having a 600-foot dimension (parallel to the runway extended centerline), which includes the EMAS bed and the Setback. Figure A1-2 of this AC indicates that the Setback distance varies and Figure A2-1 indicates that a minimum Setback distance of 35 feet can be used for installations with short safety areas.

If the area available is longer than required for installation of a standard EMAS designed to stop the design aircraft at an exit speed of 70 knots, a greater Setback decreases the possibility of damage to the system from aircraft landing short of the runway threshold (undershoots), or from short excursions beyond the runway end (overshoots). For installations that have a large Setback, it is possible to reduce the size of the EMAS blocks and still achieve the required stopping performance. This provides a more economical system by considering the deceleration capabilities of the existing runway safety area between the end of the runway pavement and the EMAS facility.

An additional consideration for EMAS as an alternative to other RSA options is the need to periodically close the runway for maintenance of the EMAS installation. Because EMAS blocks are crushable, they would need to be replaced in case an aircraft was stopped by the EMAS or when EMAS becomes damaged. In addition, the current estimated design life on EMAS blocks is 10 years, implying a complete replacement of the EMAS bed on that cycle. This factor is particularly problematic for OAK Runway 11-29 because of operational constraints at the Airport. To address these considerations, the FAA Order 5200.8 – *RSA Program, Appendix 2 (Supporting Documentation for RSA Determinations)* advises airport sponsors to consider EMAS only when it is not practicable to establish an RSA meeting the standard dimensions by other means.

## **2.5 DEVELOPMENT AND SCREENING-LEVEL EVALUATION OF ON-AIRPORT RUNWAY-SPECIFIC ALTERNATIVES**

### **2.5.1 INTRODUCTION**

This section presents the development and screening-level evaluation of runway-specific RSA Alternatives. Specifically, the 16 runway-specific RSA Alternatives that were developed, analyzed and judged feasible by prior planning studies (URS, 2005b, 2011) were carried forward to this section for screening-level evaluation. The screening process that was used for these evaluations is described in **Section 2.2.**<sup>1</sup>

The prior RSA planning studies developed 20 runway-specific RSA Alternatives and only 16 were judged by the Port to be feasible. For Runway 15-33, one runway-specific RSA Alternative was developed and it is presented and discussed herein. For Runways 9R-27L and 9L-27R, 8 of 10 RSA alternatives considered in the 2011 RSA study are considered in this EA.

This EA does not consider Alternative 4 or Alternative 5 from the 2011 RSA study. Alternative 4 included the use of a non-standard EMAS, and therefore would not meet FAA RSA airport design standards or pass Step 1 of the alternatives screening process. Alternative 5 included substantial reductions in existing runway length, which the 2011 RSA study concluded were so large that they would preclude using Runway 9R-27L as an alternative runway to Runway 11-29, and therefore did not pass Step 3 of the alternatives screening process. For Runway 11-29, 7 of 9 RSA alternatives considered in the 2011

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<sup>1</sup> The terms “wetlands” and “waters of the U.S.” used in this discussion refer to wetlands and waters within Clean Water Act jurisdiction.



Source:  
Engineered Arresting Systems Corporation

- Notes:
1. Upper photo shows typical installation during construction.
  2. Lower photo portrays actual incident at Charleston Yeager Airport.

**SAMPLE INSTALLATIONS –  
ENGINEERED MATERIALS ARRESTING SYSTEM**

Oakland International Airport  
Oakland, California

28067867

**FIGURE 2-2**



RSA study are considered in this EA. Alternatives 5 and 7 for Runway 11-29 in the 2011 RSA study included substantial reductions in existing runway length, which would adversely affect payload capacity for passengers and cargo at OAK.

As noted above, Runways 9R-27L, 9L-27R and 11-29 had multiple alternatives that were considered. The sequence of presentation for these runways is to first present the description and evaluation of the runway-specific RSA Alternatives that were found to be most favorable with respect to the screening criteria. This is followed by a description and evaluation of the runway-specific RSA Alternatives that were found to be less favorable, in the numerical sequence that matches the alternatives numbering scheme that was used in the prior planning studies (URS, 2005b and URS, 2011). This approach will aid the reader in understanding the relative merits of each alternative.

For the remainder of **Section 2.5**, the sequence of presentation is to first present findings for the North Field Runways 15-33, 9R-27L and 9L-27R. This is followed by findings for South Field Runway 11-29.

### **2.5.2 DEVELOPMENT AND SCREENING OF RUNWAY-SPECIFIC RSA ALTERNATIVE FOR RUNWAY 15-33 – NORTH FIELD**

Runway 15-33 is used by small aircraft such as those shown in **Figure 1-3**. The proposed components of the RSA enhancements to Runway 15-33 are limited to shifting the runway by 75 feet to the southeast by repainting threshold markings, as described in **Section 1.3**. The RSA evaluation conducted in 2005 determined that these proposed RSA improvements would fully meet current FAA design standards. The only alternatives considered in this EA for this runway are the No Action Alternative and the alternative of repainting threshold markings.

### **2.5.3 DEVELOPMENT AND SCREENING OF RUNWAY-SPECIFIC RSA ALTERNATIVE FOR RUNWAYS 9L-27R AND 9R-27L – NORTH FIELD**

#### **Common Features of North Field Runway-Specific RSA Alternatives**

The following discussion presents a description of improvement features that are common to all runway-specific RSA Alternatives for 9R-27L and 9L-27R.

All runway-specific RSA Alternatives for Runways 9R-27L and 9L-27R would require soil stabilization and drainage improvements to allow the RSAs to support the occasional passage of an aircraft and emergency vehicles, and re-grading to meet FAA criteria. Soil stabilization would involve excavating existing soils (depth ranging from 1 foot to 4 feet below current ground surface); mixing the excavated soil with materials such as lime, cement, and gravel to improve its material properties; and re-placing the soil, with compaction and possibly with layers of reinforcing geotextile materials. Unused pavement between runways would be removed to allow the placement of soil fill. The soil fill is excess material that would be cut from other parts of the North Field RSAs as part of the overall plan to achieve compliant grades throughout the RSAs.

Drainage improvements include the installation of stormwater collection and conveyance features, including drains and pipes, and operating and maintaining existing and new features in accordance with the Airport's Stormwater Management Implementation Plan (Kimley Horn, 2009b). Some of these types

of drainage improvements have already been developed and evaluated in previous drainage studies for North Field at OAK (Port of Oakland, 1997; Port of Oakland, 2008; Kimley Horn, 2009a; Kimley Horn, 2009b). Extensive re-grading of existing RSAs is also needed as part of all of the alternatives for Runways 9R-27L and 9L-27R. The grading is needed to comply with FAA standards for terrain and to correct existing deficiencies that currently allow standing water to collect within the RSAs. Large portions of the RSAs on the North Field have uneven surfaces and do not drain readily to existing drainage channels, including areas which do not drain at all and retain ponded water after rains.

All of the runway-specific RSA Alternatives for Runways 9R-27L and 9L-27R also require relocation of existing on-Airport vehicle services roads to route these roads outside of the RSAs. The extent of relocation varies slightly and is shown on the appropriate figures. Also, all would include removal of abandoned pavements between Runways 9R-27L and 9L-27R.

These soil stabilization, drainage, and grading improvements, vehicle service road relocation, and pavement removal aspects are common to all alternatives. These improvements are only briefly discussed in the following sections of **Chapter 2**. However, the impacts of these common components are considered in the environmental consequences described in **Chapter 4** of this EA.

### **2.5.3.1 Runway-Specific RSA Alternative 7B for Runways 9R-27L and 9L-27R**

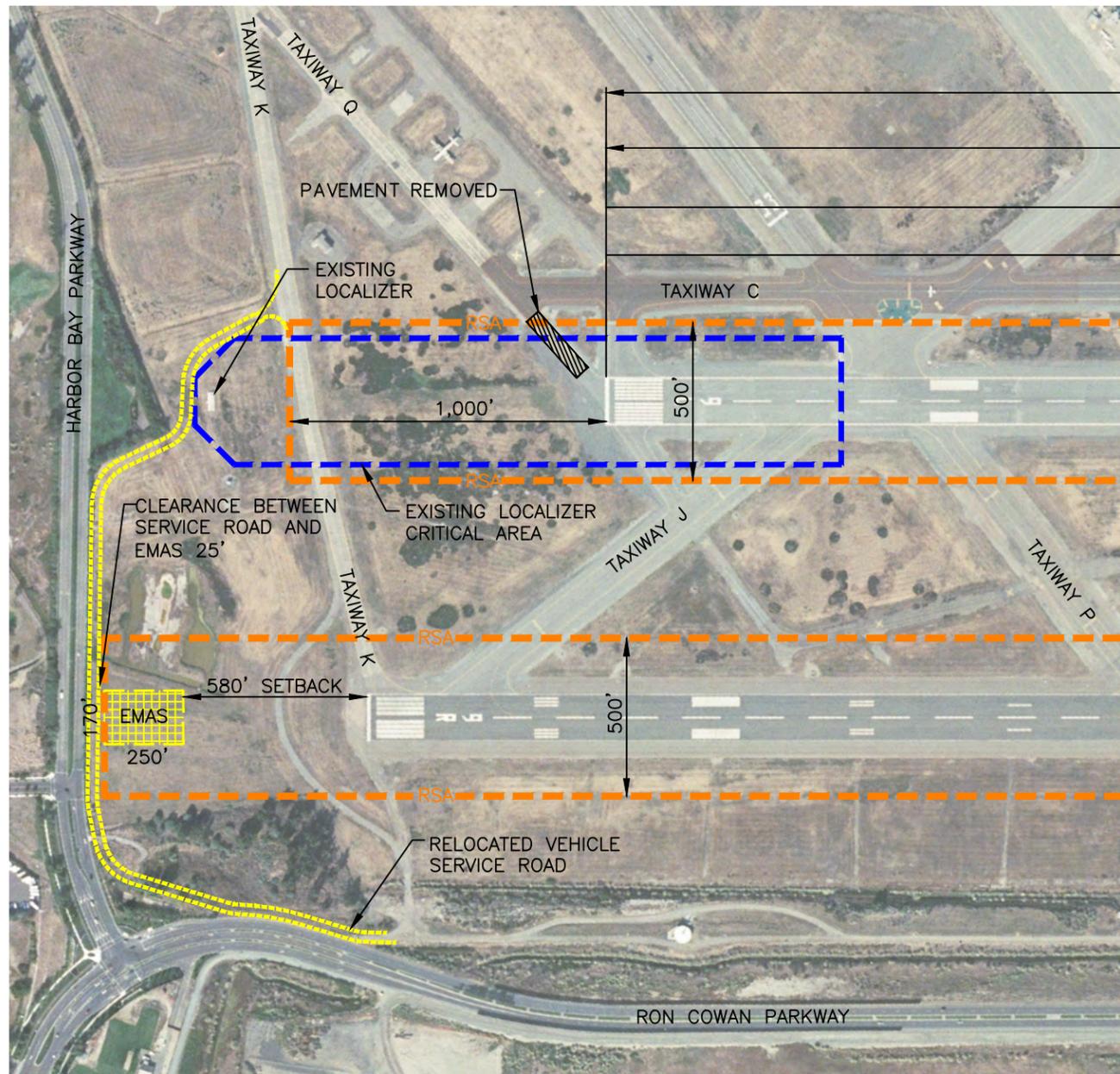
#### **Description**

Runway-specific RSA Alternative 7B is illustrated on **Figure 2-3**.<sup>2</sup> In addition to the aforementioned soil stabilization, drainage, grading, vehicle service road relocation, and pavements removal, runway-specific RSA Alternative 7B features an EMAS installation in the Runway 9R approach RSA, and implements declared distances for departures and landings on Runway 9L. The EMAS bed would be approximately 250 feet in length and 170 feet in width, and would be set back 580 feet from the landing threshold of Runway 9R. This size for the EMAS was determined because the design aircraft for this runway pursuant to the OAK Airport Layout Plan is a B-747. The proposed EMAS on the Runway 9R end would be shifted as far west as possible to provide maximum protection for any aircraft that undershoots Runway 9R on arrival. The western end of the EMAS would be approximately 25 feet from a proposed vehicle service road adjacent to Harbor Bay Parkway. The 25-foot separation would provide adequate space for proper grading and drainage, as well as the relocated vehicle service road.

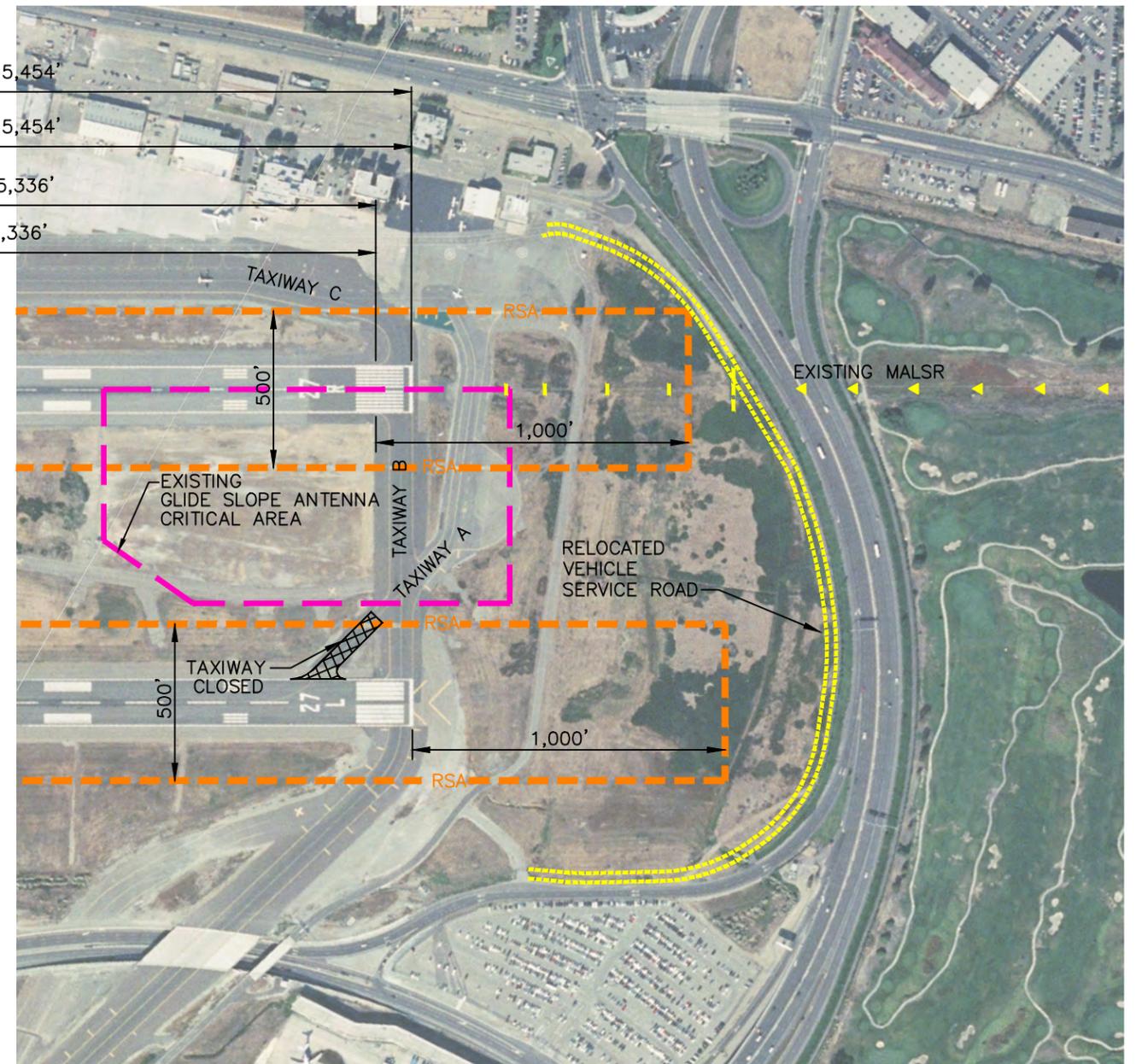
The resulting EMAS installation would provide 70-knot exit-speed stopping capability for a B-747 departing or landing on Runway 27L. The performance of this configuration has been modeled by ESCO (the EMAS vendor) and determined to have required performance characteristics. It would also provide the maximum practical distance between the EMAS and the Runway 9R landing threshold.

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<sup>2</sup> The figures presented in this document are intended to describe the overall nature and intent of the Proposed Action and other alternatives and technical information of environmental impacts. These figures show dimensions of project elements at a planning level of detail. The subsequent design of these elements will result in dimensional refinement. The final design of project elements may result in dimensional requirements that vary slightly from those shown herein.



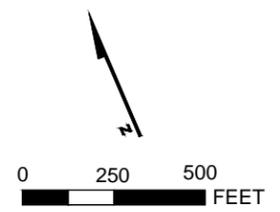
TORA 5,454'  
 TODA 5,454'  
 ASDA 5,336'  
 LDA 5,336'



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 7B  
 INSTALL STANDARD EMAS (SOUTH PARALLEL)**

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 7B**

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Oakland International Airport  
 Oakland, California

**FIGURE 2-3**

Feb 07, 2012 - 4:15pm T:\Port of Oakland\_RSA\Figures\_EA\FIGURE 2-3.dwg

XREFS: Figures TB.dwg\ FIG\_XSite\_North ALT 7B.dwg\ XPVMT-RMVE.dwg\ XTopo\_Aerial\_HA2006.dwg



Declared distances would be used to reduce the operational length of Runway 9L by 118 feet, resulting in an increase of 118 feet in the space available at the Runway 27L approach end RSA. This additional space would be used to accommodate a dimensionally compliant RSA and eliminate the existing tapered corner which is also associated with other alternatives for Runway 9L-27R (e.g., runway-specific RSA Alternative 7).

Runway-specific RSA Alternative 7B also includes rerouting the vehicle service road near the approach ends of Runways 9R, 9L, 27R and 27L, removing non-tidal wetlands in the approaches to Runways 27L and 27R, and improving soft soils where needed throughout the RSAs of both runways. This alternative would partially fill the ponds (non-tidal waters of the U.S.) located in the approach end RSA of Runway 9R. This alternative would result in fully compliant RSAs on both ends of both runways.

### Evaluation

Runway-specific RSA Alternative 7B meets the Step 1 screening-level evaluation because it would provide fully compliant RSAs for arrivals and departures on all runways on North Field. Furthermore, runway-specific RSA Alternative 7B provides dimensionally compliant RSAs for runway ends 9L, 27R, and 27R. As mentioned in **Sections 2.2** and **2.4**, RSA solutions that provide fully dimensional compliance are always preferred over other solutions, where practical. Runway-specific RSA Alternative 7B provides an EMAS installation for runway 9R. In this case, providing a dimensionally standard RSA without EMAS would require relocating Harbor Bay Parkway, which is considered not practical. Therefore, EMAS was judged to be the preferred method for providing RSA compliance for the approach end of Runway 9R for runway-specific RSA Alternative 7B.

Furthermore, runway-specific RSA Alternative 7B would reduce the runway length using declared distances (i.e., pavement is not physically removed) for aircraft landing or departing on Runway 9L. This approach to RSA compliance is typically not favored because of the operational constraints that it presents. In this case, however, the Port considers this approach acceptable in light of the other less desirable options for achieving a fully compliant RSA at the east end of Runway 9L.

Runway-specific RSA Alternative 7B also passes Step 2 screening-level evaluation. It is the lowest-cost, fully compliant alternative for Runways 9R-27L and 9L-27R. The construction challenges and environmental impacts of this alternative are comparable to several other alternatives considered. Also comparable are the permitting requirements and the potential for regulatory delays. There appear to be no substantial issues that would prevent it from being completed by December 31, 2015. Therefore, runway-specific RSA Alternative 7B meets the Step 2 screening-level evaluation regarding practicability and implementation schedule.

Runway-specific RSA Alternative 7B would be consistent with the FAA's purpose to ensure the safe and efficient use of navigable airspace, and would maintain existing runway capacity and minimize the impact of the RSA improvements on the future operation of the Airport. Therefore, this alternative meets the Step 3 screening-level evaluation. Runway-specific RSA Alternative 7B passes all screening criteria and has been carried forward for further evaluation in **Chapter 4** of this EA.

### 2.5.3.2 Runway-Specific RSA Alternative 1 for Runways 9R-27L and 9L-27R

#### Description

**Figure 2-4** depicts runway-specific RSA Alternative 1 for Runways 9R-27L and 9L-27R. Runway-specific RSA Alternative 1 consists of creating standard 1,000-foot-long by 500-foot-wide RSAs for both runways by relocating Harbor Bay Parkway to the west and Airport Drive to the east, while maintaining the existing runway ends. The relocation of these major roadways is the primary feature that distinguishes this alternative from other alternatives for Runways 9R-27L and 9L-27R.

In the existing condition, the portion of dimensionally required RSA west of the approach end of Runway 9R does not provide 1,000 feet of clear, graded ground. Harbor Bay Parkway passes through the dimensionally required RSA, as does the Airport perimeter fencing. A small non-tidal water of the U.S. is also located within the RSA, and the topography west of the existing vehicle service road rises and does not meet FAA grading standards for RSAs. This runway-specific RSA Alternative proposes to resolve these issues by relocating Harbor Bay Parkway, filling the jurisdictional waters, and re-grading the topography inside the proposed RSA. The vehicle service road on the western end of the runways would be relocated out of the RSA.

On the eastern end of the runways, runway-specific RSA Alternative 1 proposes the relocation of the vehicle service road, relocation of a portion of Airport Drive, and re-grading of ground inside the proposed RSA, including areas of non-tidal wetlands.

Runway-specific RSA Alternative 1 also includes removing non-tidal wetlands in the approaches to Runways 27L and 27R, and improving soft soils where needed throughout the RSAs of both runways. This alternative would partially fill the non-tidal waters of the U.S. located in the approach end RSA of Runway 9R.

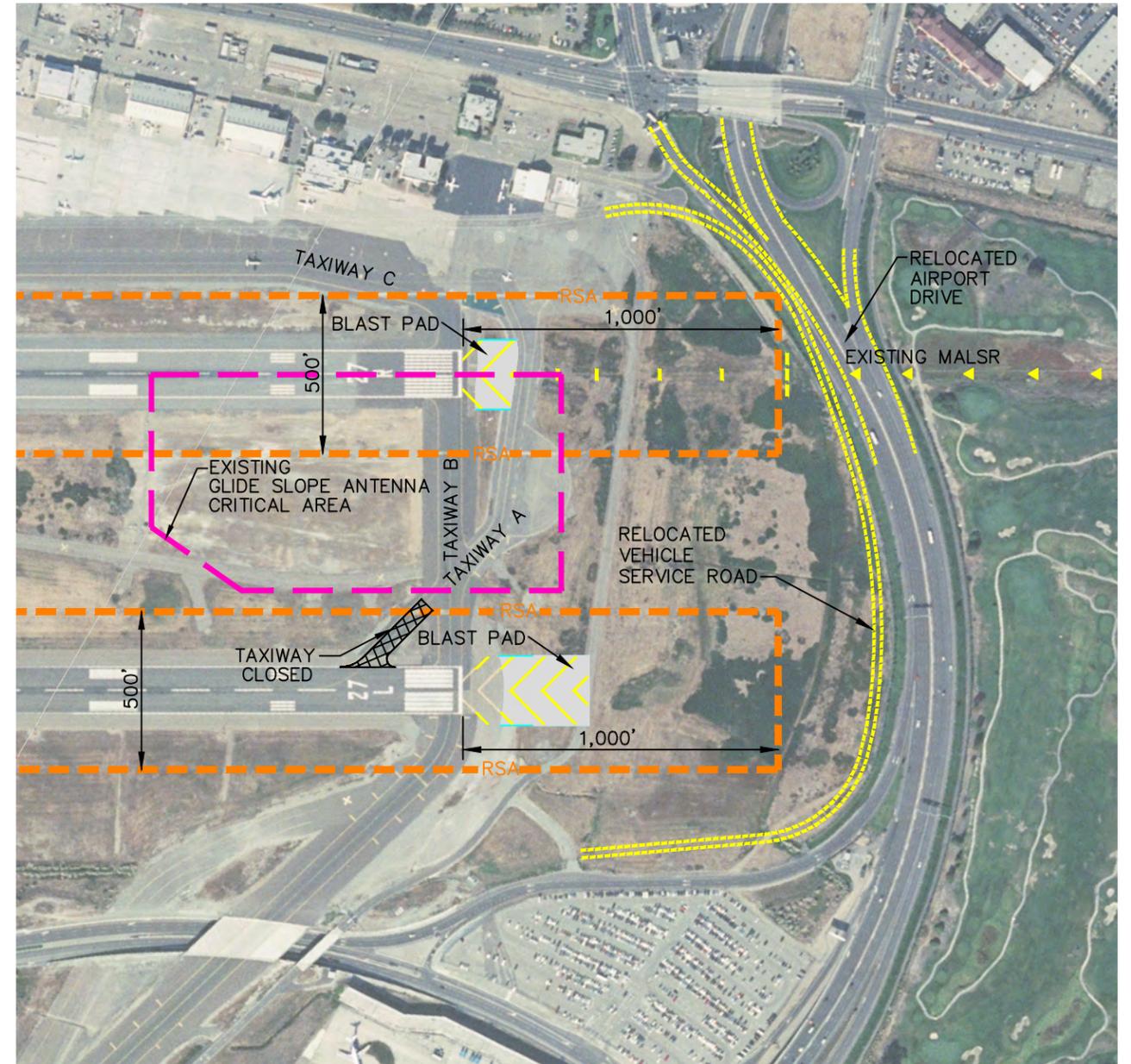
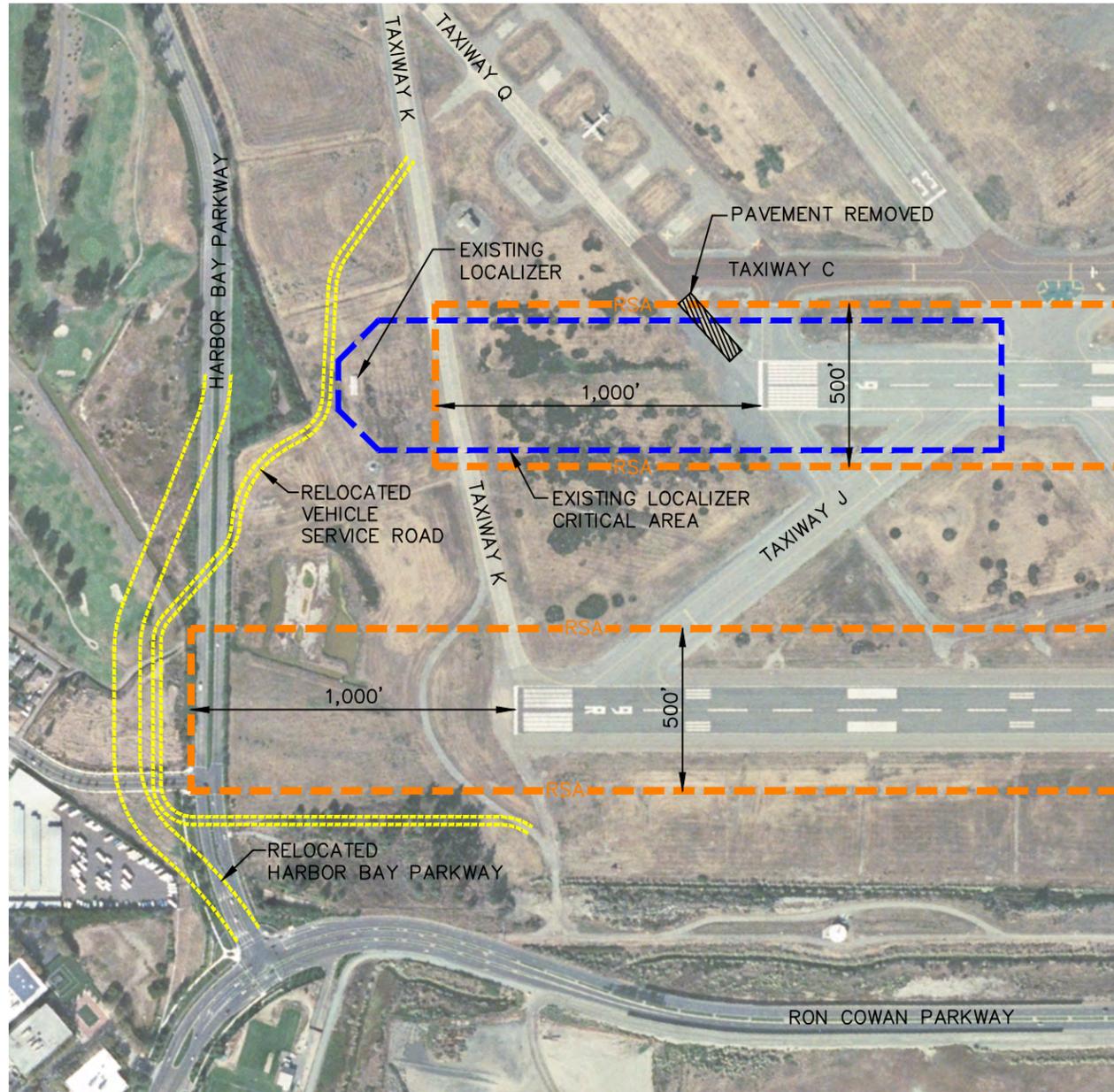
All of these actions would together provide standard RSAs for Runways 9R-27L and 9L-27R.

#### Evaluation

Runway-specific RSA Alternative 1 would provide, at all ends of Runways 9R-27L and 9L-27R, RSAs that meet both FAA Airport Design Standards and the Step 1 screening-level evaluation. With regard to the Step 2 screening-level evaluation for implementation schedule and practicability, runway-specific RSA Alternative 1 would involve substantial periods for design and construction, as well as large additional costs associated with relocating two major roadways. This runway-specific RSA alternative also requires acquisition of property adjacent to the Airport, and modification of the adjacent golf course. The total cost of this alternative was estimated to be substantially greater than that estimated for Alternative 7B and other North Field alternatives.

In addition, the construction of this runway-specific RSA Alternative would not likely meet the December 31, 2015, deadline as required by PL 109-115 due to the lengthy process for approvals, design and construction that would be required to relocate major public roads. There are only marginal environmental benefits, in terms of reduced impacts or regulatory process, for runway-specific RSA

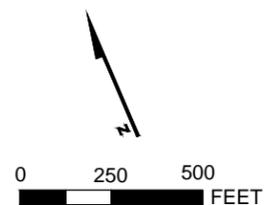
Feb 07, 2012 - 4:16pm T:\Port of Oakland\_RSA\Figures\_EA\Figure 2-4.dwg  
dohila\_mendoza



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 1  
CREATE STANDARD RSA - ELIMINATE NONCOMPLYING ITEMS**

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 1**

Oakland International Airport  
Oakland, California

28067867

**FIGURE 2-4**



Alternative 1 as compared to other alternatives. Because of these considerations, and the substantially high cost of this alternative, it does not meet the Step 2 screening-level evaluation, and was not carried forward for further evaluation in this EA.

### **2.5.3.3 Runway-Specific RSA Alternative 2 for Runways 9R-27L and 9L-27R**

#### **Description**

**Figure 2-5** depicts runway-specific RSA Alternative 2 for Runways 9R-27L and 9L-27R. Runway-specific RSA Alternative 2 proposes creating dimensionally compliant standard RSAs. However, rather than move infrastructure such as Harbor Bay Parkway and Airport Drive (as proposed under runway-specific RSA Alternative 1), this runway-specific RSA Alternative proposes that Runway 9R-27L and Runway 9L-27R be shifted to fit their RSAs within existing Airport property. The shifting of these runways is a primary feature that distinguishes this alternative from other alternatives for Runway 9R-27L and 9L-27R. Runway-specific RSA Alternative 2 proposes shifting Runway 9R-27L (the south parallel) by 225 feet to the east. Likewise, this alternative proposes shifting Runway 9L-27R (the north parallel) by 175 feet to the west. The shift of Runway 27R included as part of this alternative would require shifting of the runway's Instrument Landing System (ILS), including the glide slope antenna, and approach lighting system. The shift of Runway 27L would require realignment of Taxiway B. Both runway shifts would also require runway lighting, marking, and signage changes, and would change holding positions for taxiing aircraft.

Runway-specific RSA Alternative 2 would also require removal of non-tidal wetlands east of the runways, and non-tidal waters of the U.S. west of Runway 9R-27L.

Other actions proposed under runway-specific RSA Alternative 2 include the relocation of vehicle service roads on both ends of the runways. The vehicle service road on the eastern end of the runways would be relocated outside of the RSAs by moving it to the fence line along Airport Drive. The vehicle service road on the western end of the runways would be relocated out of the RSA while still remaining on Airport property. Runway-specific RSA Alternative 2 also includes improving soft soils where needed throughout the RSAs of both runways.

All of these actions would together provide standard RSAs for Runways 9R-27L and 9L-27R.

#### **Evaluation**

Runway-specific RSA Alternative 2 would provide, at all ends of Runways 9R-27L and 9L-27R, RSAs that meet both FAA Airport Design Standards and the Step 1 screening-level evaluation. Although runway-specific RSA Alternative 2 had one of the lowest projected costs, it was considered not to meet the Step 2 screening-level evaluation for implementation schedule and practicability relative to other available alternatives, in light of community concerns over the impact of potential changes in noise contours toward residential areas. Furthermore, runway-specific RSA Alternative 2 offers no substantial environmental benefits as compared to runway-specific RSA Alternative 7B. Therefore, it was not carried forward for further evaluation in this EA.

### 2.5.3.4 Runway-Specific RSA Alternative 3 for Runways 9R-27L and 9L-27R

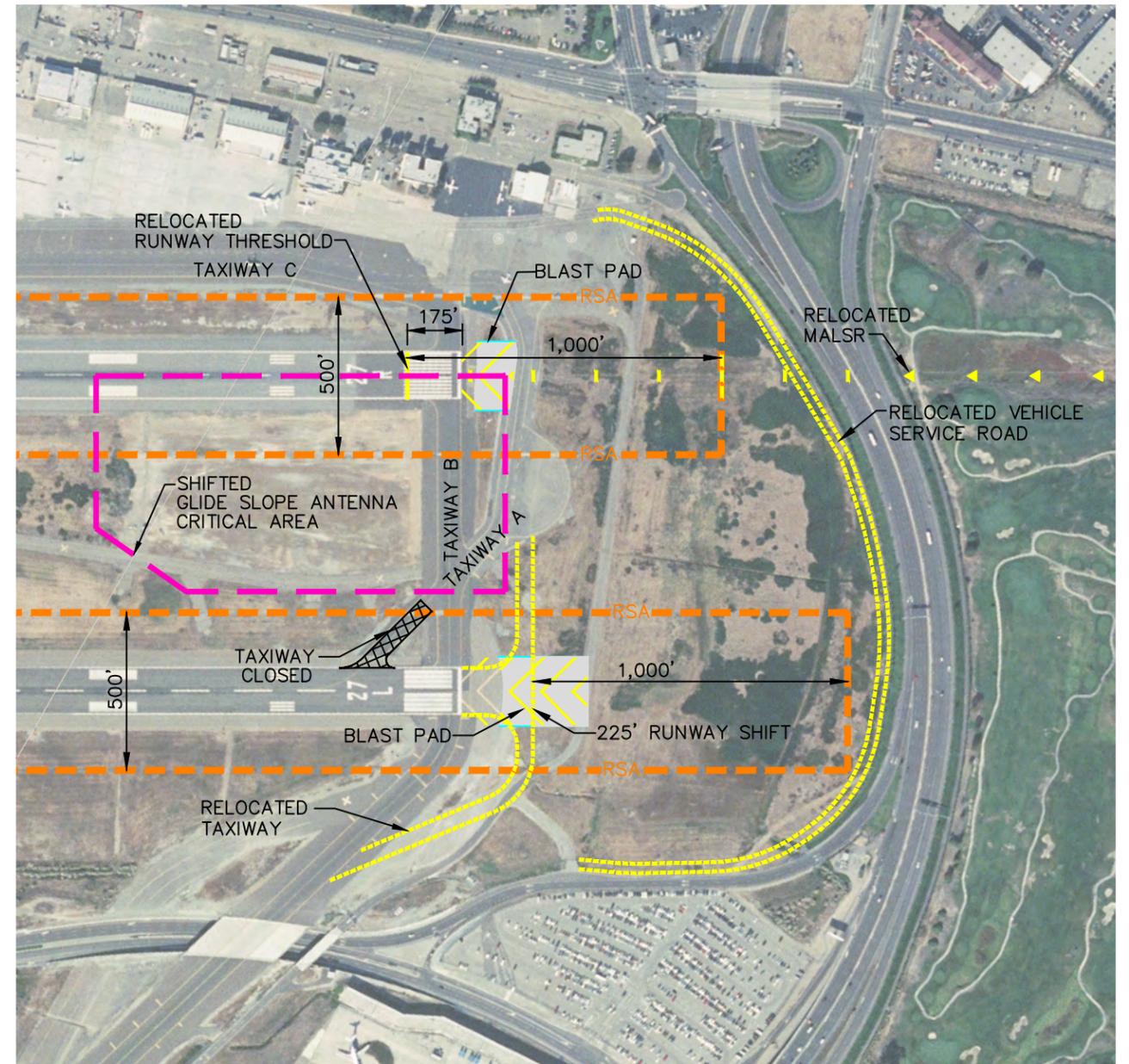
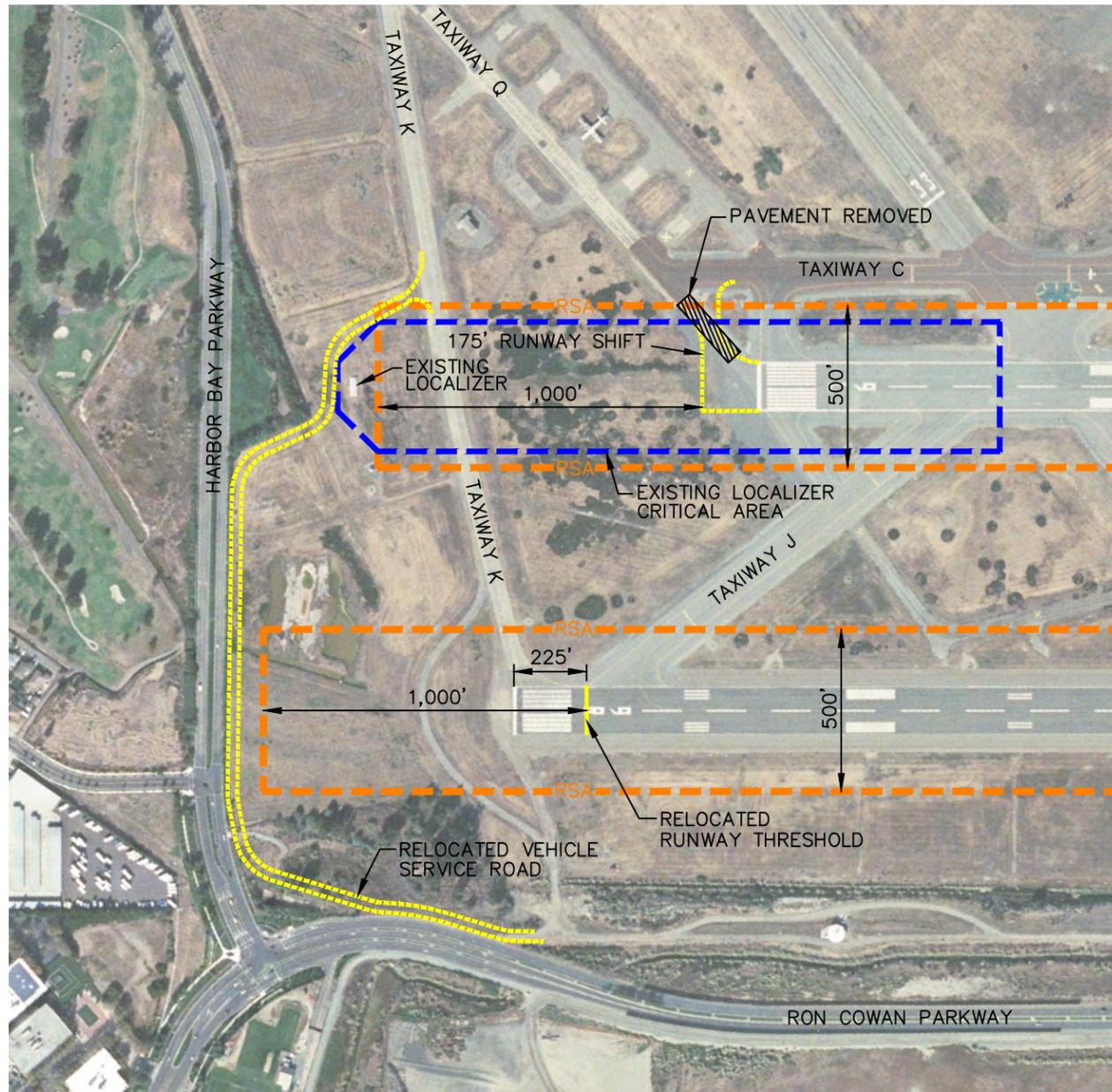
#### Description

Runway-specific RSA Alternative 3 proposes an EMAS installation on both ends of Runway 9R-27L (the southern parallel) and the approach end of Runway 27R (the northern parallel), as depicted on **Figure 2-6**. EMAS would not be required on the approach (western) end of Runway 9L because the current RSA extends 1,000 feet beyond the threshold, in accordance with FAA design standards. Each EMAS would consist of a bed length of 250 feet with a Setback of 580 feet. This would provide a total length of greater than 600 feet for undershoot protection, in conjunction with the vertical guidance provided on these runways (i.e., Visual Approach Slope Indicators on Runway 9R-27L and ILS on Runway 27R). The proposed EMAS have been modeled by the EMAS vendor, and it has been determined that the installation described above is capable of stopping a B-747 exiting the runway at a speed of 70 knots. Runway-specific RSA Alternative 3 also proposes the same relocation of vehicle service roads on the eastern and western ends of the runway, as proposed by runway-specific RSA Alternative 2, and the filling of the non-tidal waters of the U.S. existing within the Runway 9R approach-end RSA. Runway-specific RSA Alternative 3 also includes improving soft soils where needed throughout the RSAs of both runways.

#### Evaluation

Runway-specific RSA Alternative 3 would provide a dimensionally standard RSA at one runway end (Runway 9L), and EMAS facilities at the other three runway ends of this parallel runway pair. This alternative would provide EMAS facilities capable of stopping the design aircraft for Runways 27R and 9R-27L at an exit speed of 70 knots. Therefore, this runway-specific RSA Alternative was considered to meet the Step 1 screening-level evaluation.

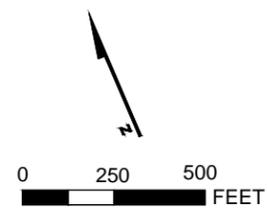
Runway-specific RSA Alternative 3 involves the relocation of the vehicle service road west of the parallel runway pair, but avoids relocation of major roadways, and could be implemented by the December 31, 2015, deadline of the Step 2 screening-level evaluation. Although runway-specific RSA Alternative 3 avoids the need to relocate the ILS and approach lighting system on Runway 27R, the requirement to construct three EMAS facilities makes this the most costly alternative, particularly when considering lifecycle maintenance costs. Furthermore, as mentioned in **Sections 2.2.1** and **2.4.5**, EMAS solutions are only preferred when it is not practical to create a dimensionally compliant RSA by other means. With respect to runway-specific RSA Alternative 3, there are other alternatives (e.g., runway-specific RSA Alternative 7B) that achieve RSA compliance without extensive use of EMAS. Also, there are only marginal environmental benefits associated with Alternative 3 as compared to runway-specific RSA Alternative 7B. For these reasons, runway-specific RSA Alternative 3 does not meet the Step 2 screening-level evaluation. It does not provide the maximum benefit to aviation safety because there are other alternatives (specifically runway-specific RSA Alternative 7B) that achieve full RSA compliance with less use of EMAS and greater use of dimensionally compliant RSAs. Runway-specific RSA Alternative 3 was not carried forward for further evaluation in this EA.



**RUNWAY 9R-27L AND 9L-27R - RSA ALTERNATIVE 2  
CREATE STANDARD RSA - SHIFT RUNWAY**

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



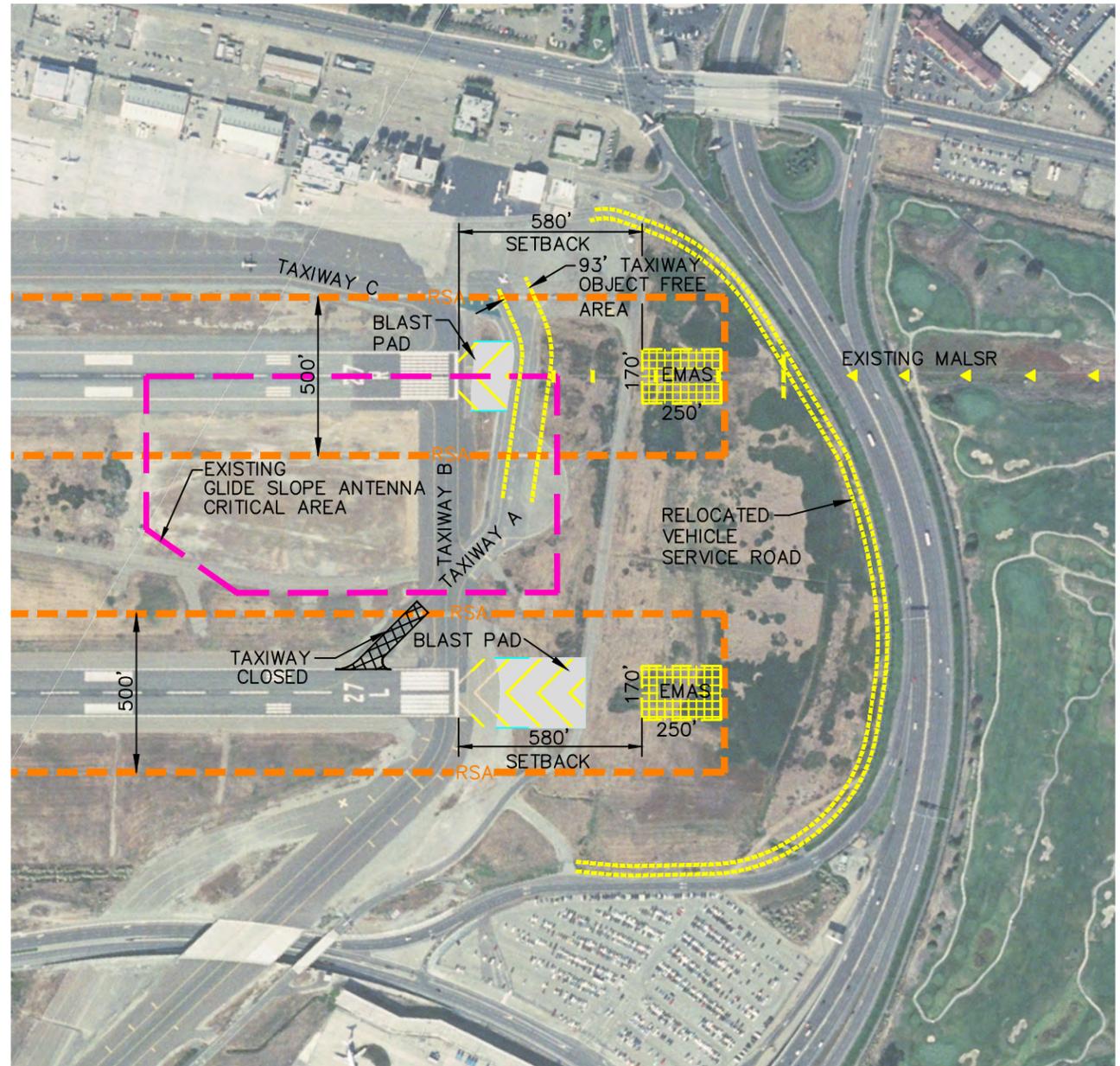
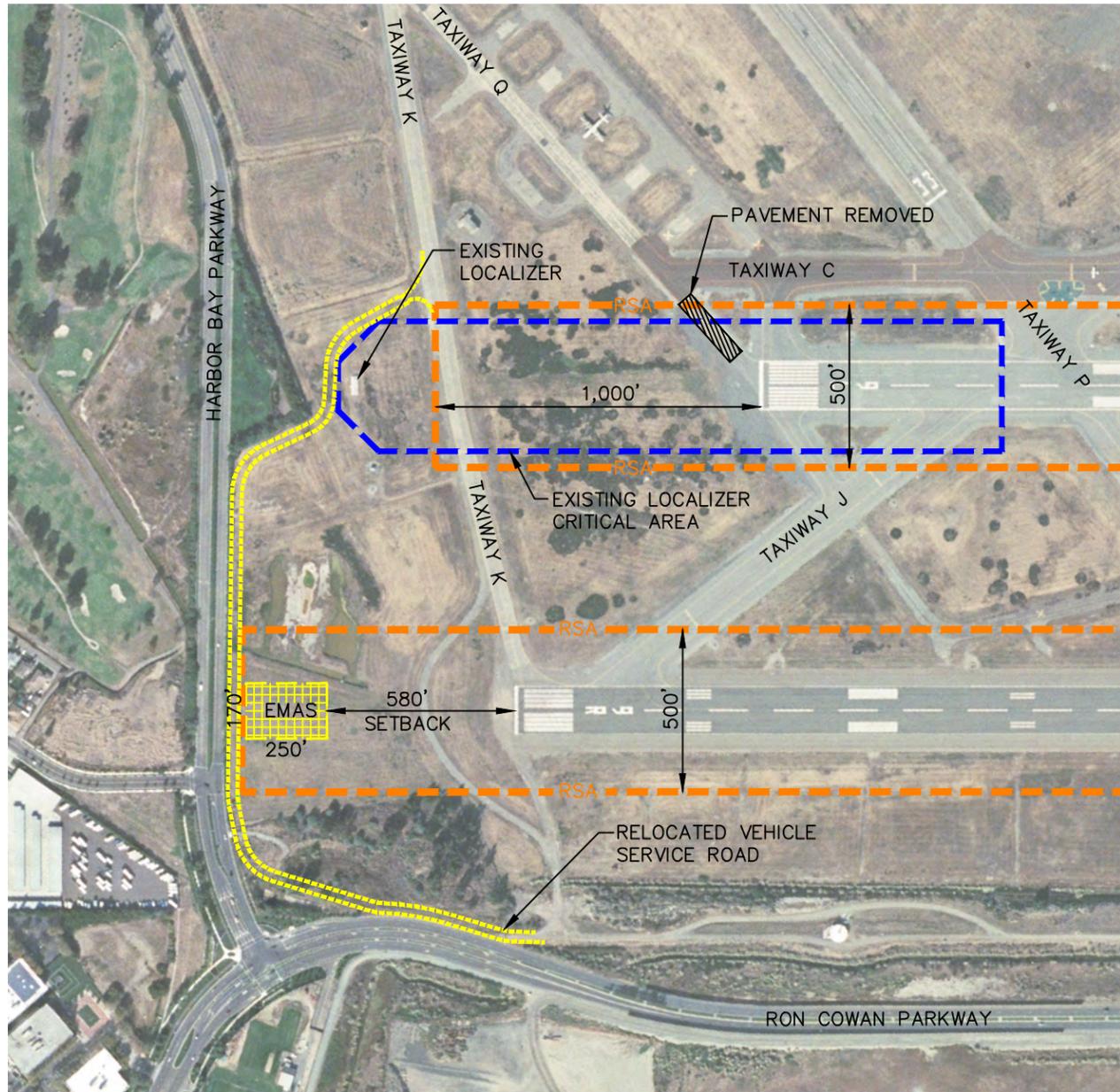
**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 2**

Oakland International Airport  
Oakland, California

28067867

**FIGURE 2-5**

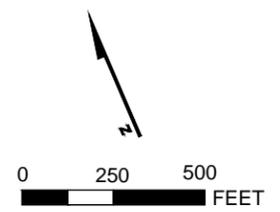




**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 3  
INSTALL EMAS**

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 3**

Oakland International Airport  
Oakland, California

28067867

**FIGURE 2-6**



### 2.5.3.5 Runway-Specific RSA Alternative 6 for Runways 9R-27L and 9L-27R

#### Description

Runway-specific RSA Alternative 6 proposes to maximize the existing RSAs by eliminating non-complying items (e.g., relocating vehicle service roads), but does not propose the relocation of major roads such as Harbor Bay Parkway or Airport Drive. **Figure 2-7** depicts this alternative. Many of the actions proposed by Runway-specific RSA Alternative 6 are the same as those proposed in the preceding alternatives, including removing non-tidal waters of the U.S. existing within the Runway 9R approach-end RSA, removing non-tidal wetlands in the approaches to Runways 27L and 27R, and improving soft soils where needed throughout the RSAs of both runways. Other actions proposed under runway-specific RSA Alternative 6 include the relocation of vehicle service roads on both ends of the runways. However, runway-specific RSA Alternative 6 would result in two non-standard conditions. The RSA dimensions would be only 780 feet beyond the approach (western) end of Runway 9R, and an RSA tapering from a standard RSA width of 500 feet to a width of 300 feet, starting 880 feet beyond the approach (eastern) end of Runway 27R. Because of these issues, runway-specific RSA Alternative 6 does not provide full compliance with RSA standards.

#### Evaluation

Runway-specific RSA Alternative 6 would result in only 780 feet of RSA beyond the approach (western) end of Runway 9R, and an RSA tapering from a standard RSA width of 500 feet to a width of 300 feet starting 880 feet beyond the approach (eastern) end of Runway 27R. Alternative 6 does not offer any environmental benefits as compared to runway-specific RSA Alternative 7B. Because two of the RSAs would not meet the standard FAA dimension criteria, it was determined that runway-specific RSA Alternative 6 does not meet the Step 1 screening-level evaluation, and it was not carried forward for evaluation in this EA.

### 2.5.3.6 Runway-Specific RSA Alternative 7 for Runways 9R-27L and 9L-27R

#### Description

Runway-specific RSA Alternative 7 is illustrated on **Figure 2-8**. Runway-specific RSA Alternative 7 proposes maximizing the available standard, graded RSA on the eastern end of Runway 9L-27R (the northern parallel runway), and installing an EMAS bed on the western end of Runway 9R-27L (the southern parallel runway). For the western end of the northern parallel runway and the eastern end of the southern parallel runway, fully dimensional compliance with FAA design standards would be achieved with standard RSAs, graded to meet FAA standards. This runway-specific RSA Alternative would maintain existing runway threshold locations and existing runway lengths on North Field.

Many of the actions proposed by runway-specific RSA Alternative 7 are the same as those proposed in the preceding alternatives, including removing non-tidal waters of the U.S. existing within the Runway 9R approach-end RSA; relocating the vehicle service roads on both ends of the runways, and removing non-tidal wetlands in the approaches to Runways 27L and 27R, and improving soft soils where needed throughout the RSAs of both runways.

The proposed EMAS bed would be located on the western end of the southern parallel runway, and would be approximately 250 feet in length and 170 feet in width. The EMAS would be set back 580 feet from the landing threshold of Runway 9R to provide protection for any aircraft that undershoots Runway 9R on arrival. The proposed EMAS has been modeled by the EMAS vendor, and it has been determined that the installation described above is capable of stopping a B-747 exiting the runway at a speed of 70 knots. This alternative would result in fully compliant RSAs at the eastern end of the southern parallel runway and at the western end of the northern parallel runway. The RSA extending beyond the eastern end of the northern parallel runway would provide a full 1,000 feet of standard RSA along the extended runway centerline but would have a portion of the northeastern corner tapered by a relocated vehicle service road and the Airport perimeter fence, as shown on **Figure 2-8**.

This alternative does not comply with RSA standards due to the tapered corner.

### **Evaluation**

Runway-specific RSA Alternative 7 would provide standard-dimension RSAs for two of the North Field runway ends. The EMAS bed for runway-end 9R would meet applicable FAA design criteria for stopping a B-747 that exits the runway at 70 knots. However, the tapered RSA corner at the eastern end of Runway 9L-27R does not meet applicable FAA standards. For this reason, this runway-specific RSA Alternative does not meet the Step 1 screening-level evaluation, and was not carried forward for evaluation in this EA.

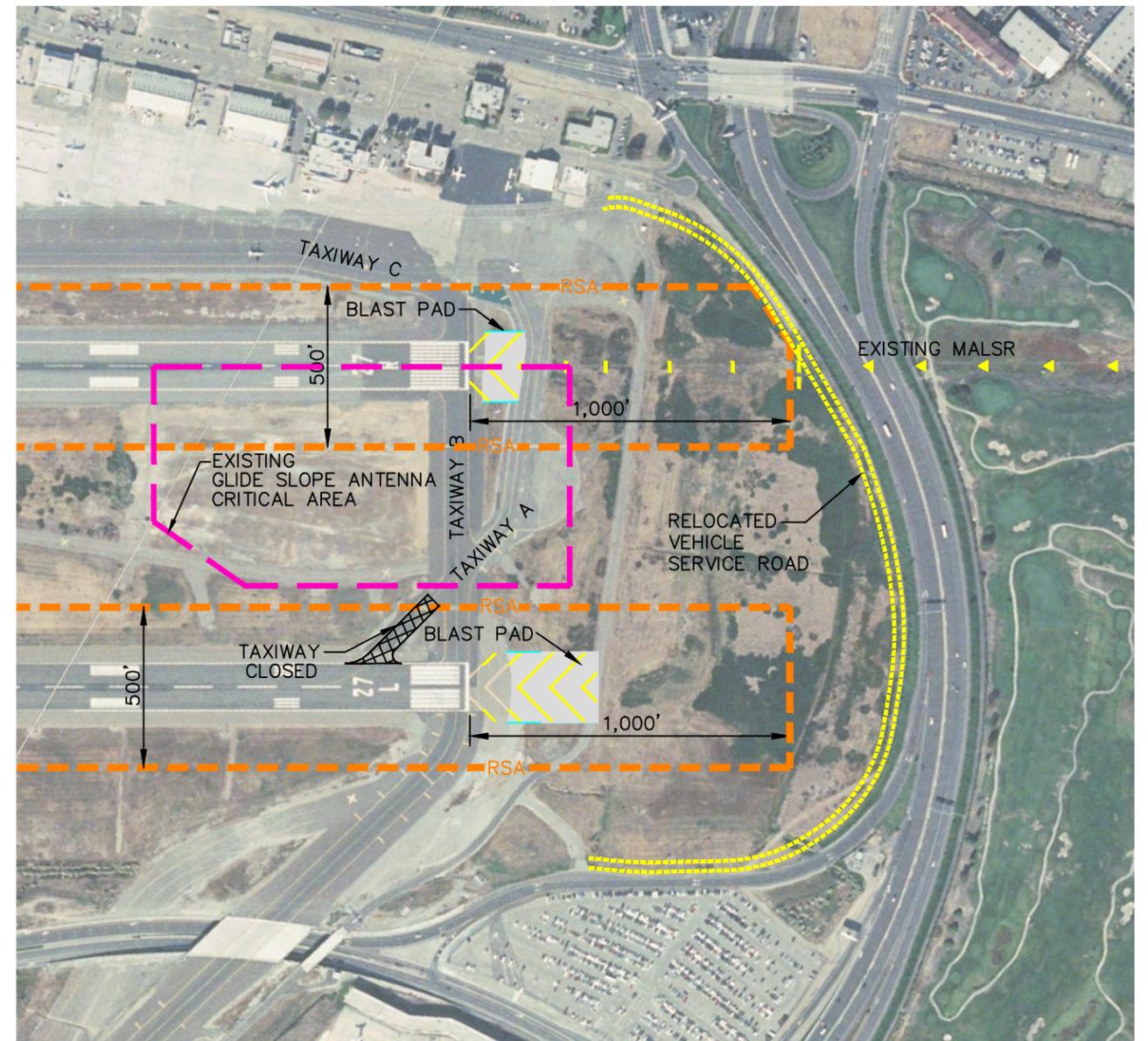
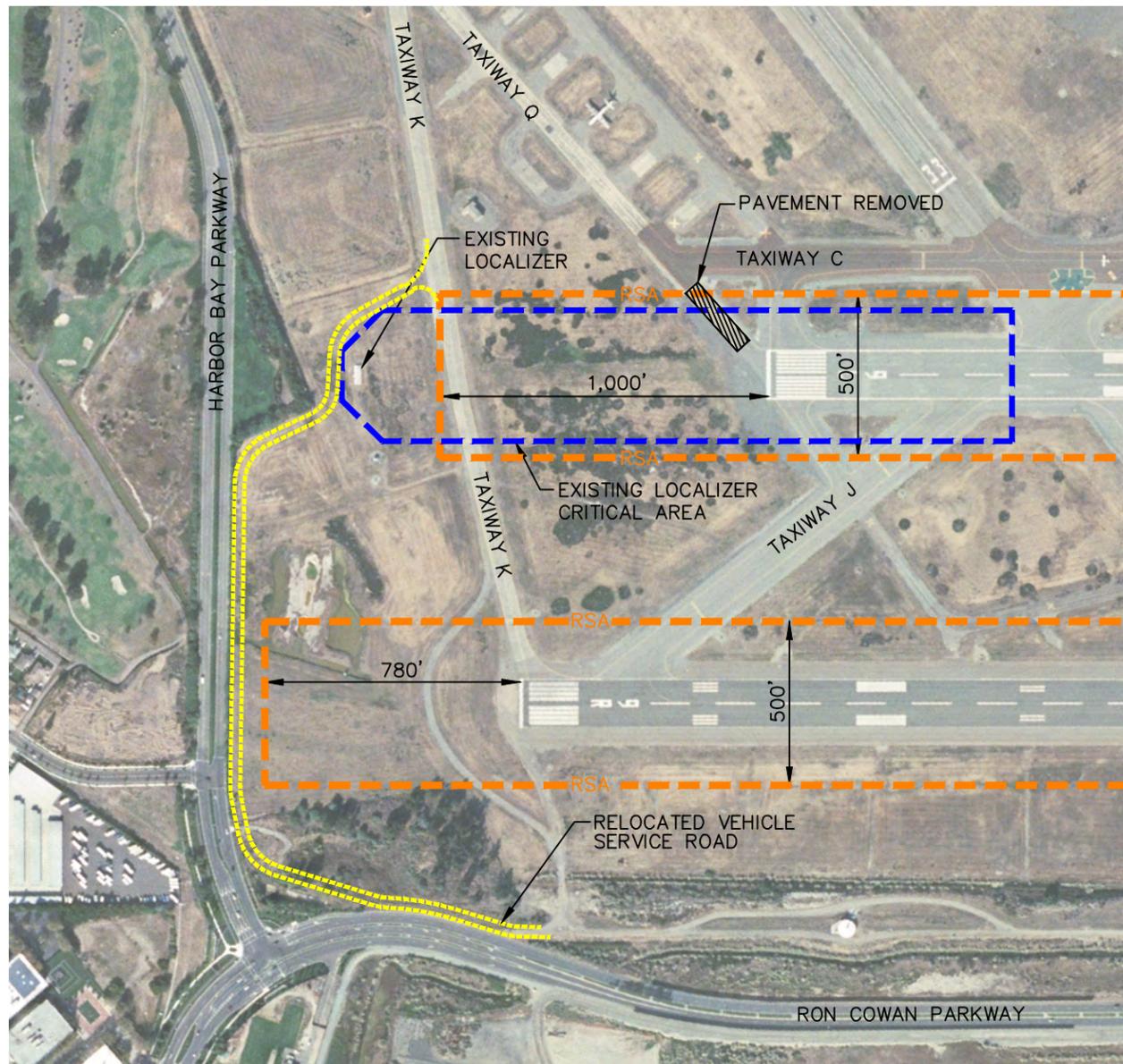
#### **2.5.3.7 Runway-Specific RSA Alternative 7A for Runways 9R-27L and 9L-27R**

### **Description**

Runway-specific RSA Alternative 7A is illustrated on **Figure 2-9**. This runway-specific RSA Alternative is very similar to runway-specific RSA Alternative 7 described above, with the same improvements at three runway ends. However, for this alternative, the RSA configuration at the eastern end of Runway 9L-27R (the northern parallel runway) would consist of an EMAS installation of the same dimensions proposed for the western end of Runway 9R-27L (the southern parallel runway). The proposed EMAS have been modeled by the EMAS vendor, and it has been determined that the installation described above is capable of stopping a B-747 exiting the runway at a speed of 70 knots. This design has the benefit of marginally reducing wetland impacts as compared with runway-specific RSA Alternative 7, and eliminating the non-compliance created by the tapered corner.

### **Evaluation**

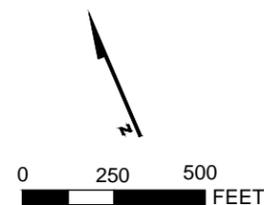
Runway-specific RSA Alternative 7A meets the Step 1 screening-level evaluation because it would provide standard-dimension RSAs for two of the North Field runway ends. For the other two runway ends, the EMAS beds of runway-specific RSA Alternative 7A would be capable of stopping a B-747 exiting the runway at 70 knots.



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 6**  
**MAXIMIZE EXISTING RSA**  
**ELIMINATE NONCOMPLYING ITEMS WITHOUT RELOCATING ROADS**

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



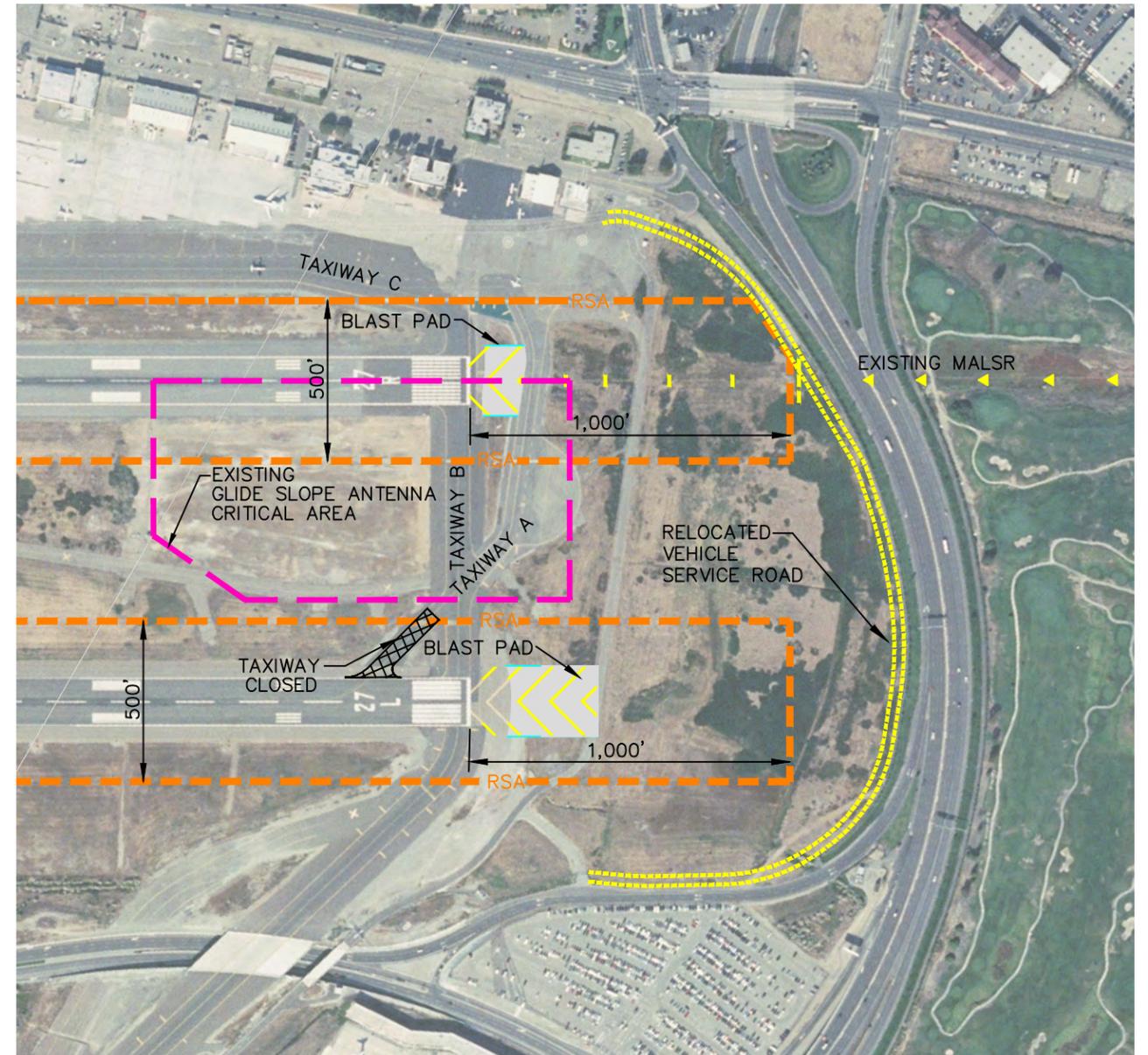
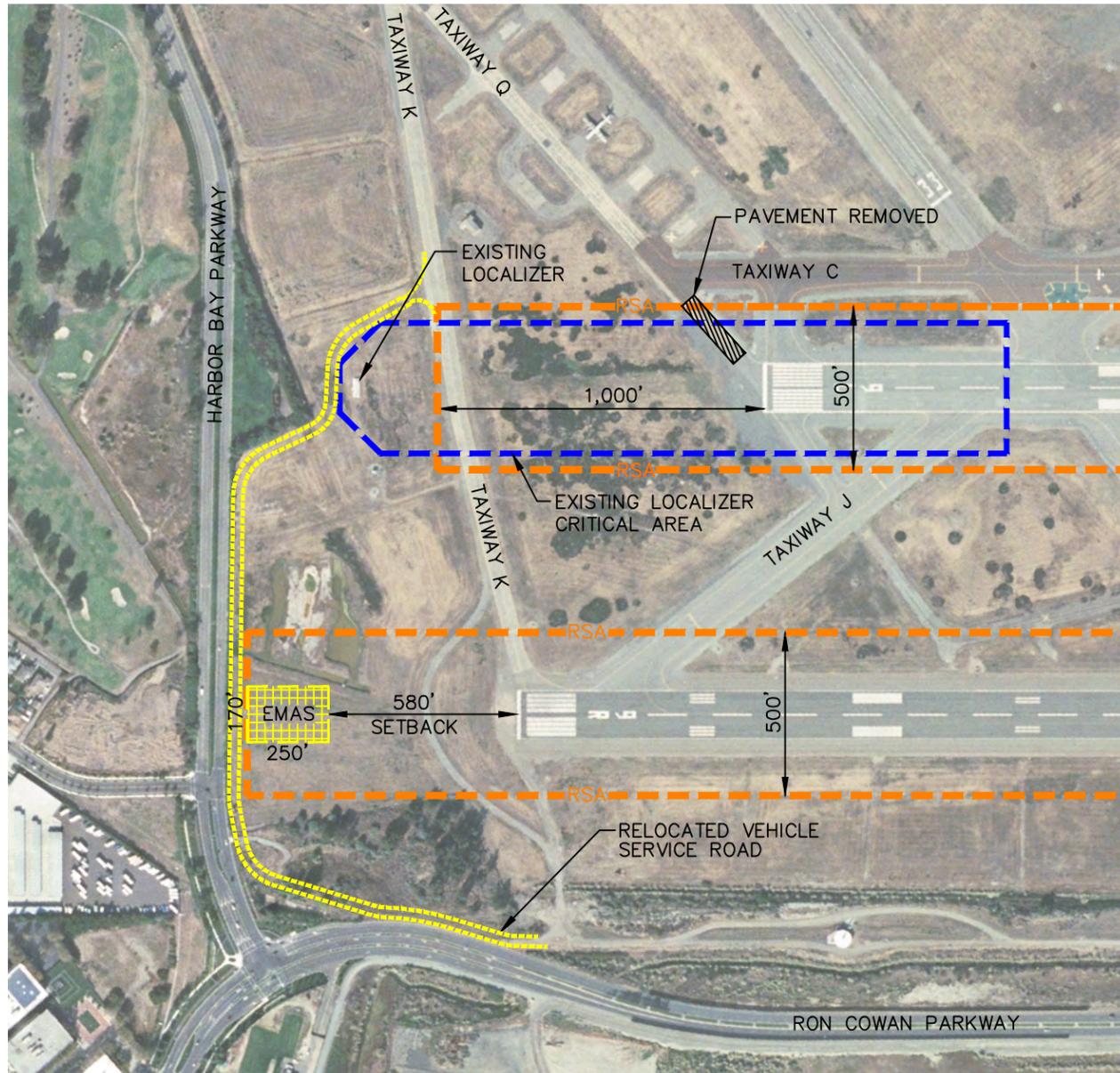
**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 6**

Oakland International Airport  
 Oakland, California

28067867

**FIGURE 2-7**

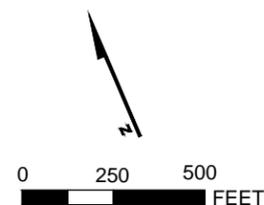




**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 7  
MAXIMIZE EXISTING RSA (NORTH PARALLEL) AND  
INSTALL EMAS (SOUTH PARALLEL)**

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 7**

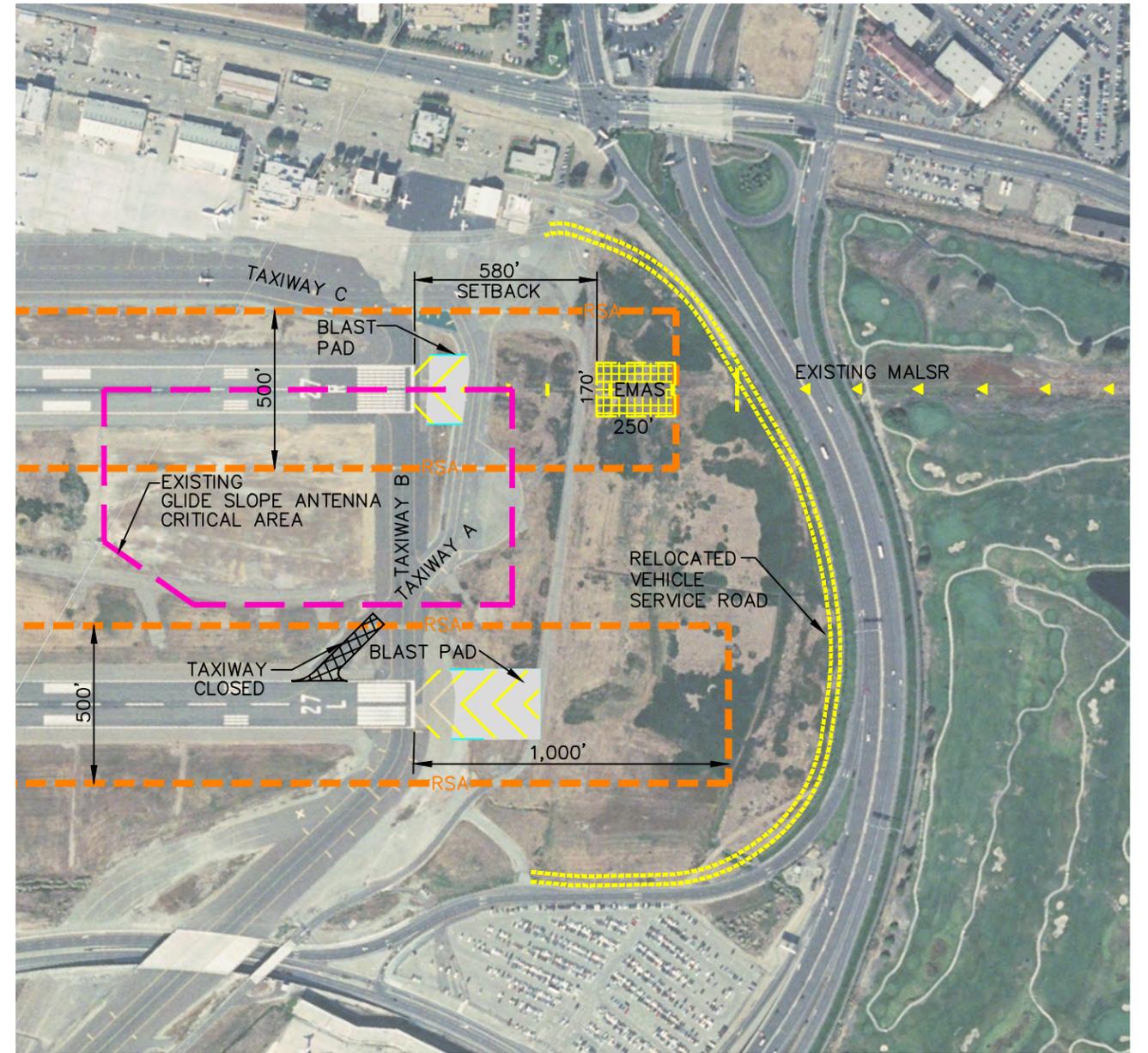
Oakland International Airport  
Oakland, California

28067867

**FIGURE 2-8**



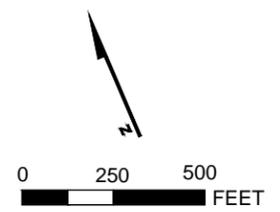
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dahlia\_mendoza



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 7A  
INSTALL STANDARD EMAS (NORTH PARALLEL) AND INSTALL  
STANDARD EMAS (SOUTH PARALLEL)**

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 7A**

Oakland International Airport  
Oakland, California

28067867

**FIGURE 2-9**



With regard to the Step 2 screening-level evaluation, it is projected that runway-specific RSA Alternative 7A could be accomplished by the December 31, 2015, deadline, but it is also projected that this alternative would have a total cost greater than other fully compliant alternatives. As mentioned in **Sections 2.2.1** and **2.4.5**, EMAS solutions are only preferred when it is not practical to create a dimensionally compliant RSA by other means. With respect to runway-specific RSA Alternative 7A, there is at least one other alternative (e.g., runway-specific RSA Alternative 7B) that achieves RSA compliance with more limited use of EMAS. Also, runway-specific RSA Alternative 7A offers only marginal environmental benefits as compared to runway-specific RSA Alternative 7B. For these reasons, runway-specific RSA Alternative 7A was considered not to meet the Step 2 screening-level evaluation. It does not provide the maximum benefit to aviation safety because there are other alternatives (specifically runway-specific RSA Alternative 7B) that achieve full RSA compliance with less use of EMAS and greater use of dimensionally compliant RSAs. Runway-specific RSA Alternative 7A was not carried forward for further evaluation in this EA.

### **Runway-Specific RSA Alternative 8 for Runways 9R-27L and 9L-27R**

#### **Description**

Runway-specific RSA Alternative 8 is shown on **Figure 2-10**. Runway-specific RSA Alternative 8 is similar to runway-specific RSA Alternative 6; however, this alternative would shift the Runway 9R threshold east by 150 feet, and relocate the Runway 27L threshold 225 feet east to obtain fully compliant RSAs on the Runway 9R and 27L ends. The configuration for Runway 9L-27R for runway-specific RSA Alternative 8 would be the same as shown for runway-specific RSA Alternative 6. A fully standard RSA would be obtained on the Runway 9L end and, similar to Alternative 6, a tapered RSA would be provided on the Runway 27R end.

This alternative is non-compliant with RSA standards due to the tapered corner.

#### **Evaluation**

Runway-specific RSA Alternative 8 would provide standard-dimension graded RSAs at three runway ends. However, the RSA provided at the eastern end of Runway 9L-27R under this alternative does not meet applicable FAA standards due to the tapered corner. Therefore, this runway-specific RSA Alternative does not meet the Step 1 screening-level evaluation, and was not carried forward for evaluation in this EA.

### **2.5.4 DEVELOPMENT AND SCREENING OF RUNWAY-SPECIFIC RSA ALTERNATIVES FOR RUNWAY 11-29 – SOUTH FIELD**

#### **Common Features of South Field Runway-Specific RSA Alternatives**

This section describes features that are common to one or more South Field runway-specific RSA Alternatives.

A common requirement for all alternatives on South Field is the need to improve soil conditions by filling and grading existing wetland areas inside the RSA to meet FAA design standards. These improvements

are required to enable the soil to support the occasional passage of an aircraft or emergency vehicle. These requirements are similar in nature to, but less extensive and invasive than those proposed for the North Field.

A common feature for all South Field alternatives is the requirement to have Runway 11-29 operational, albeit with reduced runway lengths, during the construction period (except for regular Sunday night/Monday morning closures and runway closures for NAVAIDS flight checks). A minimum runway length of 8,000 feet during construction is needed to minimize restrictions on aircraft operations such as payload reduction during construction, although brief reductions of runway length to 7,000 feet may be accommodated. In the event that aircraft are not able to fly with a full payload when the demand for a full payload is available, the amount of passengers and cargo carried would have to be reduced.

Four of the South Field runway-specific RSA Alternatives include an EMAS. Three of these are described as “standard” EMAS and one is described as “non-standard.” As described in **Section 2.4** and FAA Advisory Circular 150/5220-22A, an EMAS has two components, the “EMAS Bed,” where the EMAS blocks are placed, and the “Setback,” which is the distance from the runway threshold to the start of the EMAS bed. For the South Field, this EA (and the prior planning studies URS, 2005b and URS, 2011) consider a standard EMAS installation as being comprised a 35-foot Setback and a 565-foot EMAS bed. A non-standard EMAS is defined as one that maintains the 35-foot Setback and has a reduced EMAS bed dimension.

#### **2.5.4.1 Runway-Specific RSA Alternative 2A for Runway 11-29**

##### **Description**

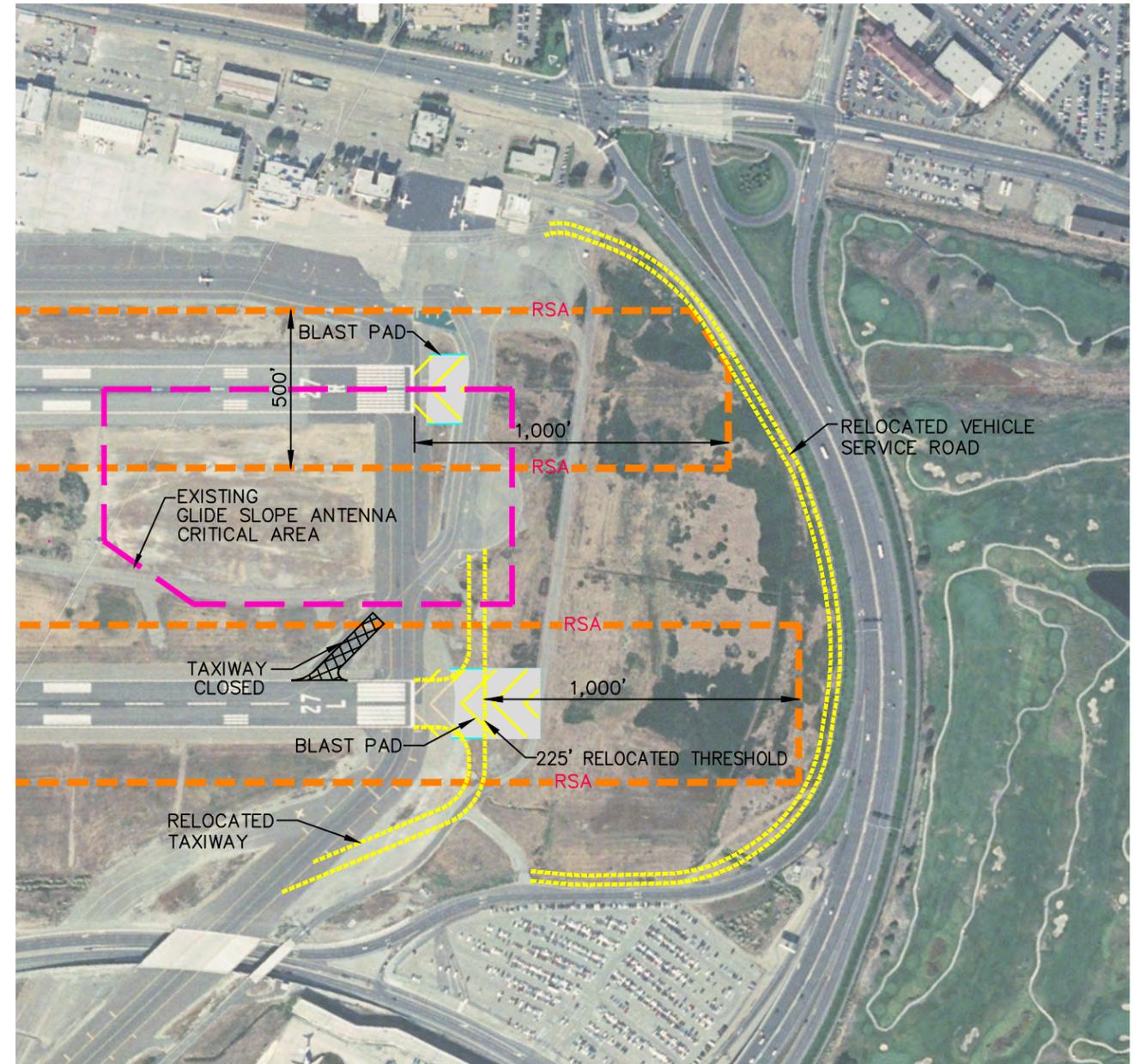
Runway-specific RSA Alternative 2A is illustrated on **Figures 2-11** and **2-12**. Runway-specific RSA Alternative 2A implements a variety of RSA solutions to achieve full compliance.

**Runway Thresholds:** The Runway 29 landing threshold would be displaced 115 feet towards the northwest to provide the 600-foot RSA required for landing aircraft. The physical southeast end (i.e., the end of full strength pavement) of Runway 11-29 would remain in its current location.

The Runway 11 end threshold for landing and departure would be relocated 520 feet to the northwest. New, full-strength pavement would be added. The primary purpose for the threshold relocation is to create the required RSA length on the Runway 29 end to allow aircraft landing or departing on Runway 11 to have a full 1,000-foot RSA. The current dimension is 485 feet. A 515-foot Runway 11 threshold relocation would provide full compliance. An additional 5 feet were added to minimize the impacts on the existing runway in-pavement lights.

**NAVAIDS:** The glide slope antenna and critical area for Runway 29 would be shifted 115 feet to the northwest and would remain on the southwestern side of the runway. The existing Approach Lighting System with Sequenced Flashing Configuration 2 (ALSF-2) for Runway 29 consists of 24 stations, located at 100-foot on-centers, starting from the runway threshold and extending into San Francisco Bay. There are a total of 24 stations. Five existing stations are on land and 19 are in San Francisco Bay. There is a pedestrian bridge (also called a trestle) structure that connects each in-the-Bay station to the

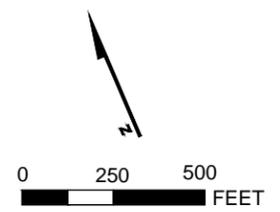
dahlia\_mendoza Feb 07, 2012 4:24pm T:\Port of Oakland\_RSA\Figures\_EA\FIGURE 2-10.dwg



**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 8  
MAXIMIZE EXISTING RSA (NORTH PARALLEL) AND  
SHIFT RUNWAY (SOUTH PARALLEL)**

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



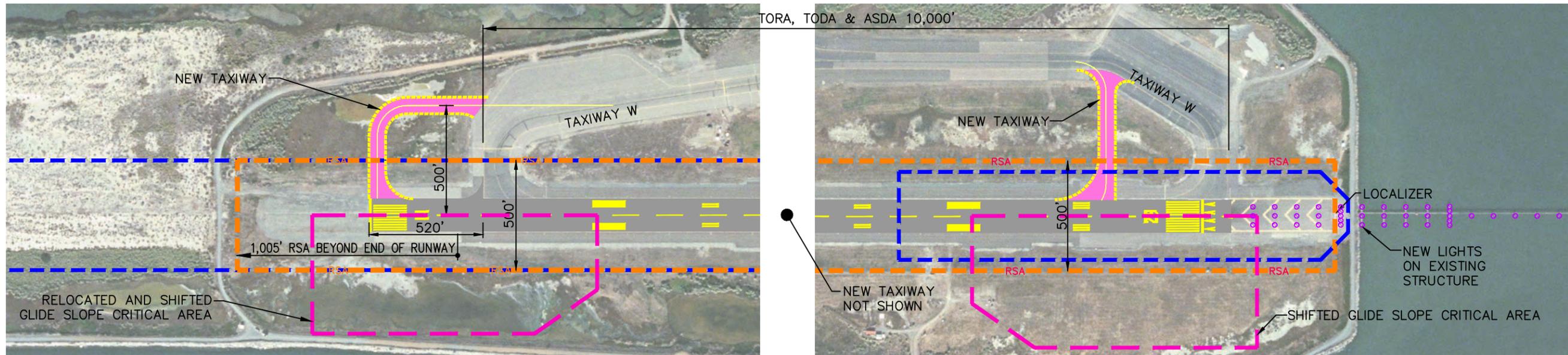
**RUNWAYS 9R-27L AND 9L-27R - RSA ALTERNATIVE 8**

Oakland International Airport  
Oakland, California

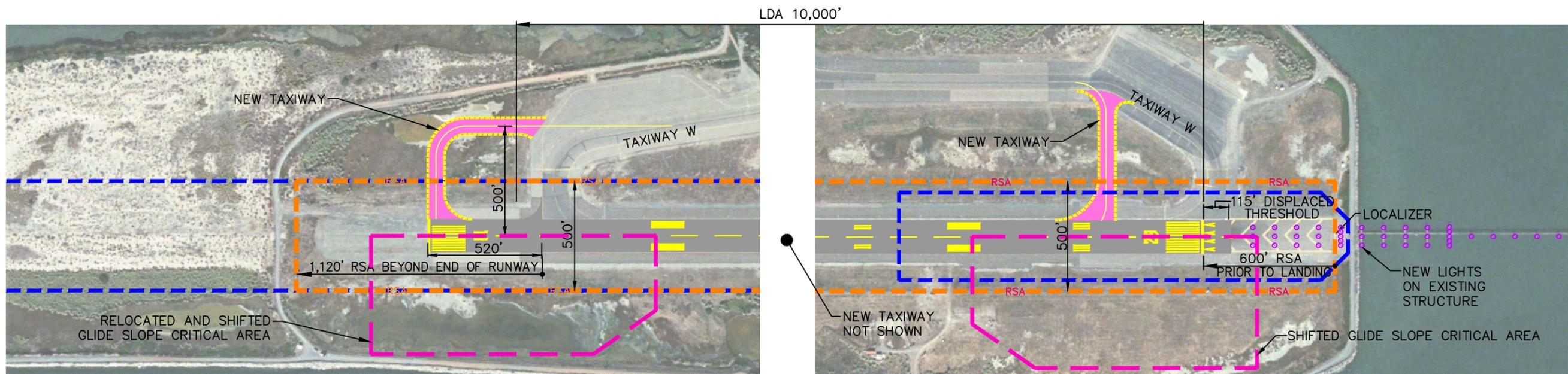
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**FIGURE 2-10**





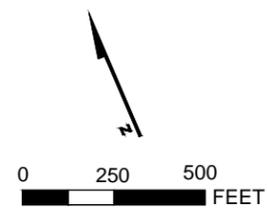
DEPARTURES ON RUNWAY 29



ARRIVALS ON RUNWAY 29

**LEGEND**

- NEW APPROACH LIGHTING
- RUNWAY SAFETY AREA
- LOCALIZER CRITICAL AREA
- GLIDE SLOPE CRITICAL AREA
- NEW TAXIWAY PAVEMENT



**RUNWAY 11-29 - RSA ALTERNATIVE 2A  
(DEPARTURES AND ARRIVALS ON RUNWAY 29)**

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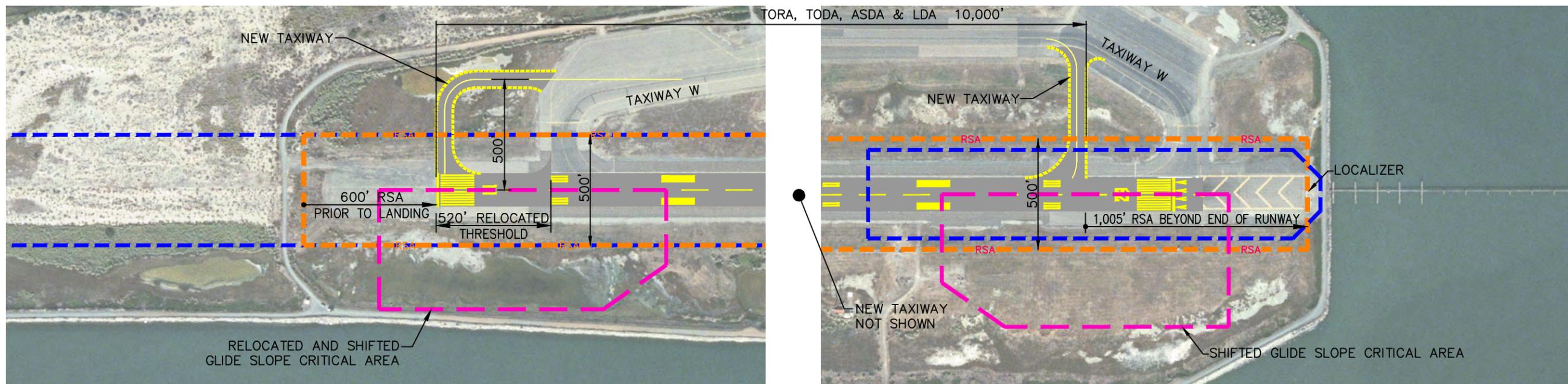
Oakland International Airport  
Oakland, California

**FIGURE 2-11**

Mar 08, 2012 - 11:28am T:\Port of Oakland\_RSA\Figures\_EA\Figure 2-11.dwg

XREFS: Figures TB.dwg\ FIG\_XSite\_South ALT 2A.dwg\ XGlide Slope\_South\_Capture Effect.dwg\ XTopo\_Aerial\_HA2006.dwg\ XALP\_South Field Improvement.dwg

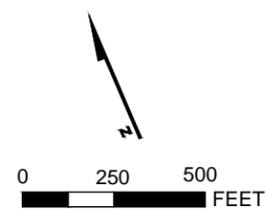




DEPARTURES AND ARRIVALS ON RUNWAY 11

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE CRITICAL AREA



**RUNWAY 11-29 - RSA ALTERNATIVE 2A  
(DEPARTURES AND ARRIVALS ON RUNWAY 11)**

Oakland International Airport  
Oakland, California

28067867

**FIGURE 2-12**



adjacent stations and to land. At in-the-Bay Stations 6 through 10, the lights are mounted on a structure that is oriented perpendicular to the pedestrian bridge. All of these structures are constructed of heavy timber and are supported by timber piles driven into the bottom of San Francisco Bay. As part of this alternative, the ALSF-2 for Runway 29 would be modified to accommodate the displaced landing threshold on Runway 29. The ALSF-2 equipment would be removed from ALSF-2 Station 10, the ALSF-2 station furthest from the Runway threshold. The structure of the current Station 9 (which will become Station 10 in the new configuration) would need to be widened by approximately 5 feet on each side, and new equipment would be installed. However, driving new piles in the San Francisco Bay would not be required. The widening can be accomplished by a cantilever extension on both ends of the existing structure. New land-based ALSF-2 light stations would need to be added.

The glide slope antenna and Glide Slope Critical Area serving Runway 11 would be relocated from the northeastern side of the runway to the southwestern side of the runway, and shifted 520 feet to the northwest, to comply with FAA standards for placement of glide slope facilities (FAA AC 5300-13, *Airport Design*, Section 602). The possibility of shifting the glide slope antenna 520 feet to the northwest on the northeastern side of the runway was investigated. However, doing so would require extending Taxiway W to the northwest and relocating a portion of Taxiway W to the northeast. This construction could possibly require filling of tidal wetlands (depending on the final alignment of Taxiway W), and would result in a configuration that would not meet FAA design standards regarding aircraft passage through the Glide Slope Critical Area.

In addition, as part of these proposed RSA improvements, the approach lighting system for Runway 11 — Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) — would be replaced and shifted 520 feet to the northwest. The condition of the existing equipment was evaluated by FAA personnel and judged not likely capable of functioning after relocation. Therefore, a new MALSR would be needed. The new equipment would need to be shifted northwest to accommodate the new landing threshold for Runway 11.

**Taxiways:** Three new connector taxiways (designated for this EA as W1, W3, and W4) would be needed as part of this alternative. New connector Taxiways W1 and W4 would be constructed to align with the relocated Runway 11 threshold and displaced Runway 29 thresholds, respectively. New connector Taxiway W3 would be located approximately 2,000 feet from the existing Runway 11 end threshold to provide access for aircraft during and after construction.

**Runway Lengths:** After construction of the RSA improvements, the future physical length of Runway 11-29 would be 10,520 feet. However, with the application of declared distances, the usable runway length for takeoffs and landings on Runway 11-29 would remain at the current length of 10,000 feet. The declared distances would designate a portion of Runway 11-29 pavement as providing standard RSAs meeting FAA design standards, while designating the remaining 10,000 feet of pavement as available for takeoff and landing operations, as described under Runway 29 and Runway 11 operations. No additional runway capacity is created by this project alternative.

**Runway 29 Operations:** Figure 2-11 depicts the proposed runway configuration for operations on Runway 29. Under this alternative, aircraft departing on Runway 29 would begin their takeoff roll at the

same point they do today. The distance available for departures on Runway 29 would remain 10,000 feet, through the use of declared distances. The resulting RSA on the northwestern end of the runway would meet the FAA standard of 1,000 feet beyond the departure end of the runway.

For arrivals on Runway 29, the landing threshold would be displaced by 115 feet northwest. This displacement would provide a standard 600 feet of clearance between the landing threshold and the localizer antenna on the southeastern end of the runway. Arrivals on Runway 29 would therefore land 115 feet northwest of their current location. The landing length on Runway 29 would remain 10,000 feet through the use of declared distances.

**Runway 11 Operations:** **Figure 2-12** depicts the proposed runway configuration for operations on Runway 11. Departures would begin their takeoff roll 520 feet northwest of their current location, and would have 10,000 feet of runway available for takeoffs. A full 1,000-foot RSA would be provided at the far end of the runway, between the end of the runway and the localizer antenna. Arrivals on Runway 11 would have a standard 600 feet of RSA prior to the landing threshold, and would also have 10,000 feet of runway available for landing.

**Other:** Runway-specific RSA Alternative 2A proposes the removal of a small portion of non-tidal wetlands and of vegetation within the limits of the RSA. These actions are needed to comply with FAA RSA design requirements, as stated in FAA AC 150/5300-13.

Runway-specific RSA Alternative 2A would provide fully compliant RSAs for Runway 11-29.

## Evaluation

Runway-specific RSA Alternative 2A provides dimensionally compliant RSA at both ends of Runway 11-29, an approach favored by the FAA screening criteria. Therefore, runway-specific RSA Alternative 2A meets the Step 1 screening-level evaluation.

Runway-specific Alternative 2A would allow all aircraft departures on Runway 29 to operate in the same manner as they currently do, thereby avoiding potential community concerns regarding new aircraft noise impacts and the associated risk of delay in the RSA implementation schedule. Furthermore, this alternative is estimated to be among the least costly alternatives considered for Runway 11-29. Therefore, this alternative meets the Step 2 screening-level evaluation.

Runway-specific RSA Alternative 2A would be consistent with the FAA's purpose to ensure the safe and efficient use of navigable airspace, and would maintain existing runway capacity and minimize the impact of the RSA improvements on the future operation of the Airport. Therefore, runway-specific RSA Alternative 2A meets the Step 3 screening-level evaluation, and it has been carried forward for evaluation in this EA.

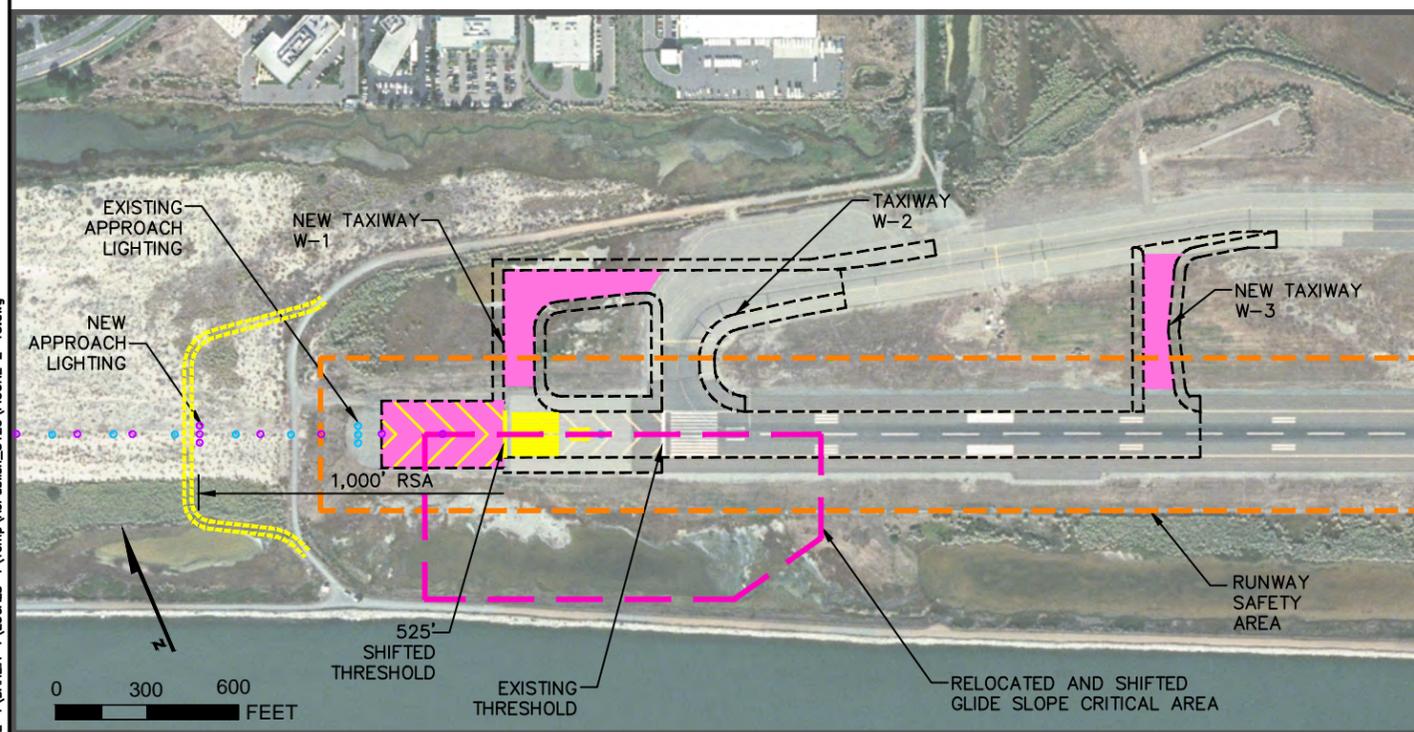
### 2.5.4.2 Runway-Specific RSA Alternative 2 for Runway 11-29

#### Description

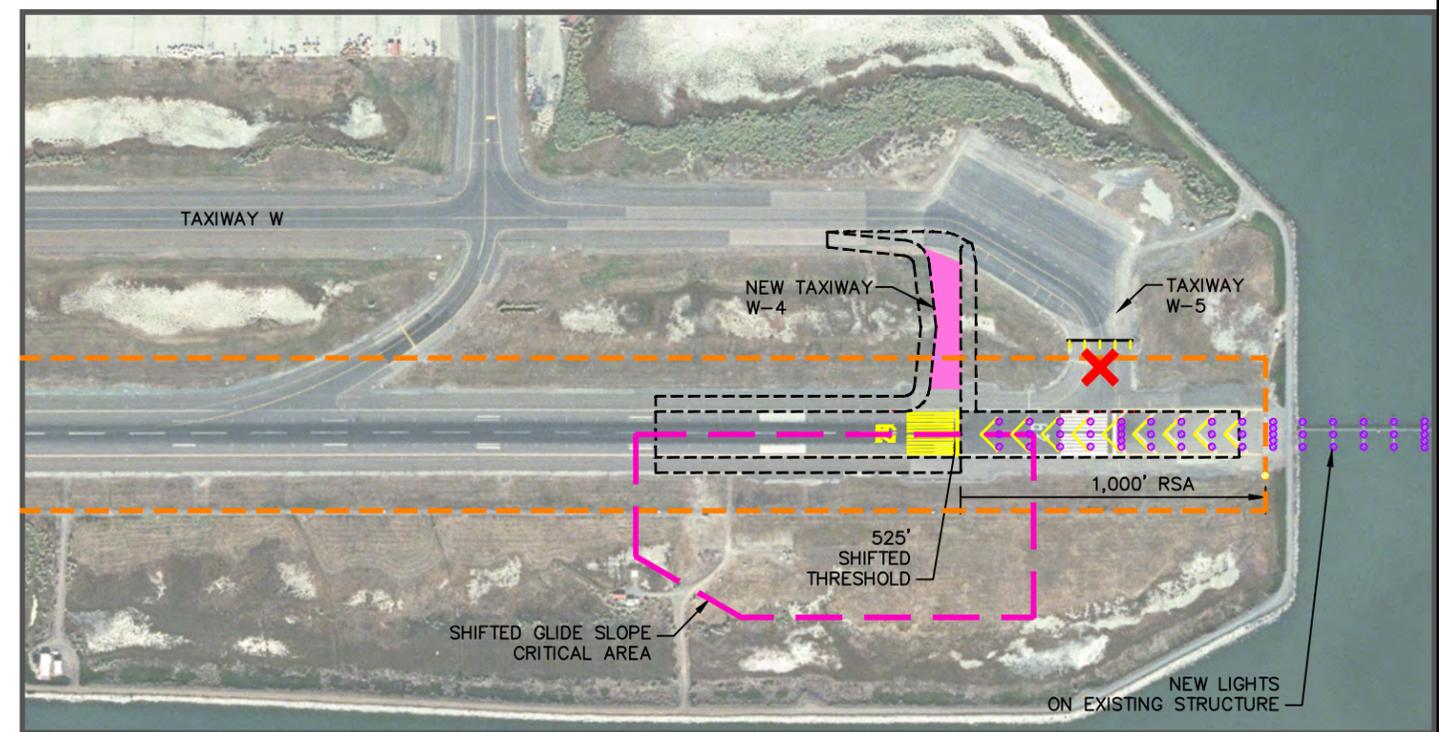
Runway-specific RSA Alternative 2 is shown on **Figure 2-13**.



OVERVIEW



RUNWAY 11



RUNWAY 29

**LEGEND**

- |  |                            |  |                               |
|--|----------------------------|--|-------------------------------|
|  | EXISTING APPROACH LIGHTING |  | RUNWAY SAFETY AREA            |
|  | NEW APPROACH LIGHTING      |  | GLIDE SLOPE CRITICAL AREA     |
|  | RELOCATED THRESHOLD        |  | NEW OR RECONSTRUCTED PAVEMENT |
|  | CLOSED TAXIWAY             |  | NEW TAXIWAY OR RSA PAVEMENT   |

**NOTE:**

1. TAXIWAY DESIGNATIONS W-1, W-2, W-3, W-4, & W-5 USED FOR THE PURPOSE OF THIS ANALYSIS ONLY.

**ALTERNATIVE 2 FOR RUNWAY 11-29**

Oakland International Airport  
Oakland, California

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FIGURE 2-13

Mar 09, 2012 - 3:03pm C:\DOCUMENTS\1\LOCALS\1\DAHLIA\1\Temp\AcPublish\_5120\FIGURE 2-13.dwg



**Runway Thresholds:** Runway-specific RSA Alternative 2 proposes the establishment of a standard RSA by shifting the existing thresholds of both Runway 11 and Runway 29 by 525 feet to the northwest to provide a full 1,000 feet of RSA at both ends of Runway 11-29. New, full-strength pavement would be added on the Runway 11 end. Equal shifting of both thresholds is the primary feature that distinguishes runway-specific RSA Alternative 2 from 2A. For RSA compliance, an additional 515 feet of RSA are required at the Runway 29 end. This alternative allows an additional 10 feet between the localizer and the southeastern end of the RSA to allow maintenance of the localizer without impinging on the RSA, resulting in a total shifting of 525 feet.

**NAVAIDS:** The glide slope antenna and critical area for Runway 29 would be shifted 525 feet to the northwest, and would remain on the southwestern side of the runway, similar to Alternative 2A. The existing ALSF-2 for Runway 29 consists of 24 stations, located at 100-foot on-centers, starting from the runway threshold and extending into San Francisco Bay. There are a total of 24 stations. Five existing stations are on land and 19 are in San Francisco Bay. There is a pedestrian bridge (also called a trestle) structure that connects each in-the-Bay station to the adjacent stations and to land. At in-the-Bay Stations 6 through 10, the lights are mounted on a structure that is oriented perpendicular to the pedestrian bridge. All of these structures are constructed of heavy timber and are supported by timber piles driven into the bottom of San Francisco Bay. As part of this alternative, the ALSF-2 for Runway 29 would be modified to accommodate the displaced landing threshold on Runway 29. Existing lights would be removed from ALSF-2 Stations 6 through 10 (Station 10 is the farthest from the Runway threshold).

Depending on the condition of the existing equipment, either existing lights or new lights would be installed at the current ALSF-2 Station 5 (which will become Station 10 in the new configuration). The structure supporting these lights at this location would need to be widened. Driving new piles in the San Francisco Bay would not be required. Indeed, no in-water construction would be necessary for this proposed upgrade. The widening can be accomplished by a cantilever extension on both ends of the existing structure. New land-based ALSF-2 light stations would need to be added.

The glide slope antenna and Glide Slope Critical Area serving Runway 11 would be relocated from the northeastern side of the runway to the southwestern side of the runway, and shifted 525 feet to the northwest, to comply with FAA standards for placement of glide slope facilities (FAA AC 5300-13, *Airport Design*, Section 602). The possibility of shifting the glide slope antenna 525 feet to the northwest on the northeastern side of the runway was investigated. However, doing so would require extending Taxiway W to the northwest and relocating a portion of Taxiway W to the northeast. This construction could possibly require filling of tidal wetlands (depending on the final alignment of Taxiway W), and would result in a configuration that would not meet FAA design standards regarding aircraft passage through the Glide Slope Critical Area.

In addition, as part of these proposed RSA improvements, the approach lighting system (MALSR) for Runway 11 would be replaced and shifted 525 feet to the northwest. The condition of the existing equipment was evaluated by FAA personnel and judged not likely capable of functioning after relocation. Therefore a new MALSR would be needed. The new equipment would need to be shifted northwest to accommodate the new landing threshold for Runway 11.

**Taxiways:** Three new connector taxiways (designated for this EA as W1, W3, and W4) would be needed as part of this alternative and one existing connector Taxiway, W5, would be taken out of service. Taxiway W5 must be taken out of service in this alternative because it leads to and from the RSA. As the RSA would no longer be used for movement of aircraft under this alternative, there would be no further use for Taxiway W5, and it would need to be remarked to show it is not available for use.

New connector Taxiways W1 and W4 would be constructed to align with the shifted Runway 11 threshold and displaced Runway 29 thresholds. Taxiway W4 would replace Taxiway W5, and Taxiway W5 would be removed from service by being remarked at the conclusion of RSA Improvement work on Runway 11-29. New connector Taxiway W3 would be located approximately 2,000 feet southeast from the existing Runway 11 end threshold. The Runway 11 threshold would be temporarily relocated approximately 2,000 feet to the southeast during construction. This taxiway is needed to provide aircraft access to the temporarily relocated threshold and would remain after construction is completed. Runway 11-29 would remain operational during the construction of the RSA improvements, albeit with reduced runway lengths.

**Runway Lengths:** Upon completion of these RSA improvements, runway lengths for all Runway 11-29 landings and takeoffs would remain at 10,000 feet.

**Runway 29 Operations:** Aircraft would land and take off at a point 525 feet to the northwest of the current location.

**Runway 11 Operations:** Aircraft would land and take off at a point 525 feet to the northwest of the current location.

**Other:** Similar to runway-specific RSA Alternative 2A, runway-specific RSA Alternative 2 proposes the removal of a small portion of non-tidal wetlands and of vegetation within the limits of the RSA. These actions are needed to comply with FAA RSA design requirements, as stated in FAA AC 150/5300-13. Field observations indicate that these areas are confined to the sides of the RSA near the southeastern and northwestern ends of the RSA. The perimeter road around the northwestern end of Runway 11-29 would be relocated to the northwest, outside of the RSA and into the sand area northwest of the runway.

Runway-specific RSA Alternative 2 would provide fully compliant RSAs for Runway 11-29.

## Evaluation

Runway-specific RSA Alternative 2 would provide fully compliant standard-dimension RSAs at both ends of Runway 11-29, and therefore meets the Step 1 screening-level evaluation.

As part of the public scoping process for this EA, the public expressed concern regarding whether RSA improvement alternatives would increase noise impacts on noise sensitive areas in the vicinity of OAK. Although an initial evaluation of the small runway shift proposed for runway-specific RSA Alternative 2 suggests such noise impacts would be unlikely, the potential of this alternative to produce significant noise impacts on noise sensitive areas in the vicinity of OAK was evaluated in detail in this EA. For this reason, runway-specific RSA Alternative 2 was judged feasible relative to the December 31, 2015, implementation deadline. Although runway-specific Alternative 2 includes the replacement or

modification of the ILS and approach lighting systems on both ends of the runway, as well as modification of the touchdown zone, centerline, and runway edge lighting systems, this alternative does not involve any significant design or construction constraints. It is among the least costly alternatives considered for Runway 11-29. Based on these considerations, this alternative meets the Step 2 screening-level evaluation.

Runway-specific RSA Alternative 2 would be consistent with the FAA's purpose to ensure the safe and efficient use of navigable airspace, and would maintain existing runway capacity and minimize the impact of the RSA improvements on the future operation of the Airport. Therefore, this runway-specific RSA Alternative meets the Step 3 screening-level evaluation and has been carried forward for further evaluation in this EA.

### **2.5.4.3 Runway-Specific RSA Alternative 1 for Runway 11-29**

#### **Description**

Runway-specific RSA Alternative 1 is illustrated on **Figure 2-14**. Runway-specific RSA Alternative 1 would create a dimensionally standard RSA at the southeastern end of Runway 11-29 by expanding the Airport's earth platform into the San Francisco Bay. An area of approximately 8.3 acres of San Francisco Bay would be filled. This would provide the land needed for 1,000 feet of RSA beyond the approach end of Runway 29. The area of expansion into the San Francisco Bay is predicated on providing sufficient land to site a localizer antenna beyond the RSA, and allowing a dike and perimeter road to remain clear of the localizer antenna's critical area. Runway-specific RSA Alternative 1 proposes the removal of a small portion of non-tidal wetlands and vegetation within the limits of the RSA. Field observations indicate that these areas are confined to the sides of the RSA near the southeastern and northwestern ends of the RSA.

Runway-specific RSA Alternative 1 would result in fully compliant RSAs for Runway 11-29.

#### **Evaluation**

Runway-specific RSA Alternative 1 would provide fully compliant standard RSAs at both ends of Runway 11-29, and therefore meets the Step 1 screening-level evaluation.

This alternative includes the expansion of the Airport earth platform into San Francisco Bay. Considering the time necessary to develop the preliminary design, process the necessary permit applications, and develop the required mitigation programs, it was estimated highly unlikely that construction of this runway-specific RSA Alternative could be completed by December 31, 2015. Furthermore, the anticipated public concern associated with this alternative would add to the risk of not meeting the RSA schedule deadline. Filling 8.3 acres of the Bay was projected to cause substantially higher environmental impacts, which would result in higher mitigation costs than other alternatives, such as runway-specific RSA Alternatives 2A and 2. This runway-specific RSA Alternative did not, therefore, meet the Step 2 evaluation criteria and was not carried forward for evaluation in this EA.

#### **2.5.4.4 Runway-Specific RSA Alternative 3 for Runway 11-29**

##### **Description**

Runway-specific RSA Alternative 3 is illustrated on **Figure 2-15**. Runway-specific RSA Alternative 3 is similar to runway-specific RSA Alternative 2. It includes shifting the runway 525 feet to the northwest. However, this alternative also proposes the installation of an EMAS at the northwestern end of the runway to avoid the relocation of the perimeter road and intrusion into the sand area northwest of the runway.

This EMAS is considered standard because it provides 600 feet between the northwestern end of the EMAS bed and the runway threshold, and has vertical guidance for undershoot protection. The Setback dimension is 35 feet, the minimum allowable. This Setback dimension was chosen to avoid intrusion into the sand area northwest of the runway. The Setback dimension needed to stop a B-747 exiting the runway at 70 knots is a value greater than 75 feet. Specific modeling of the EMAS for runway-specific RSA Alternative 3 by ESCO (the vendor of the EMAS system) confirmed that this EMAS is not capable of stopping the design aircraft (a B-747) that exits the runway at 70 knots. Although this installation meets dimensional standards, it fails to meet the performance requirements of the RSA Improvement Project. Therefore, it is non-compliant with RSA requirements.

Runway-specific RSA Alternative 3 would be identical to runway-specific RSA Alternative 2 in terms of its impacts on NAVAIDS, taxiways, runway lengths, Runway 11 and 29 operations, and other impacts. The only difference between runway-specific RSA Alternatives 3 and 2 in these categories is that runway-specific RSA Alternative 3 does not require relocation of the perimeter road around the northwestern end of Runway 11-29.

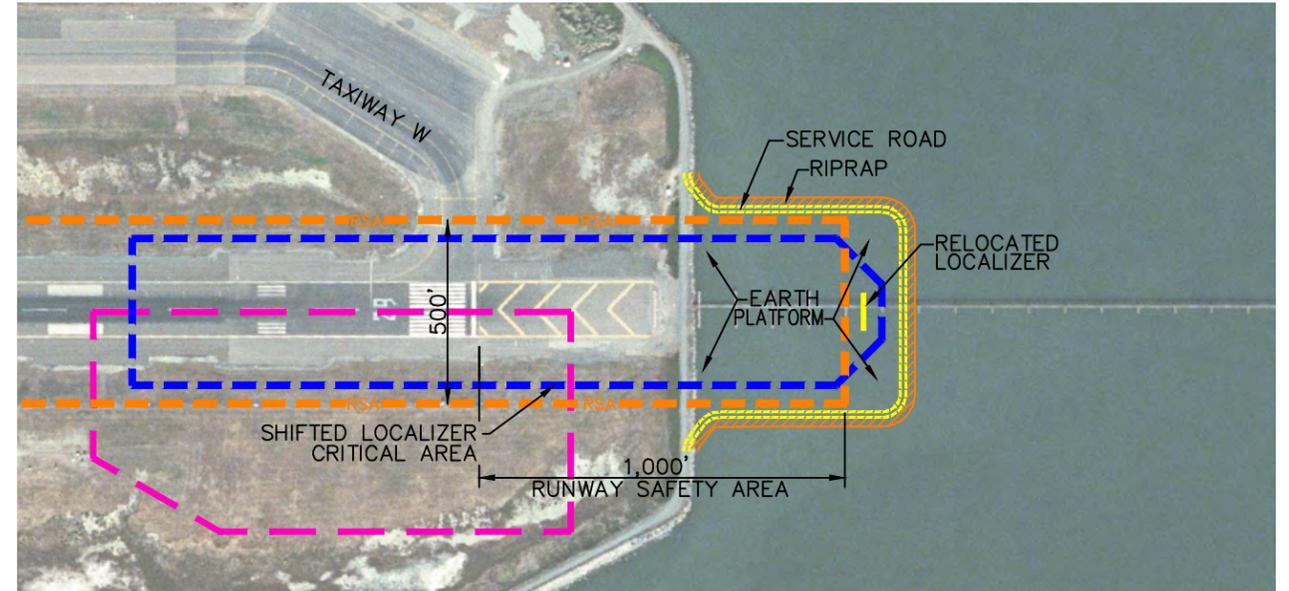
##### **Evaluation**

Runway-specific RSA Alternative 3 would provide a dimensionally standard RSA at the southeastern end of Runway 11-29, and a dimensionally standard EMAS at the northwestern end. However, the performance of this EMAS installation is deficient. This alternative would not provide an EMAS that would stop the design aircraft for this runway at an existing speed of 70 knots. This runway-specific RSA Alternative was considered not to meet the Step 1 screening-level evaluation, and was not carried forward for evaluation in this EA. In addition, this alternative would fail the Step 2 criteria by not providing the maximum benefit to aviation safety. Other alternatives (specifically runway-specific RSA Alternatives 2 and 2A) would achieve full RSA compliance without use of EMAS. As described in **Sections 2.2.1** and **2.4.5**, EMAS is not preferred when other alternatives could provide full compliance with standards.

#### **2.5.4.5 Runway-Specific RSA Alternative 4 for Runway 11-29**

##### **Description**

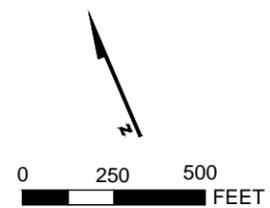
Runway-specific RSA Alternative 4 is illustrated on **Figure 2-15**. Runway-specific RSA Alternative 4 proposes the installation of a 565-foot EMAS on the approach end of Runway 29, with a Setback of



**RUNWAY 11-29 - RSA ALTERNATIVE 1  
CREATE STANDARD RSA - ELIMINATE NONCOMPLYING ITEMS**

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



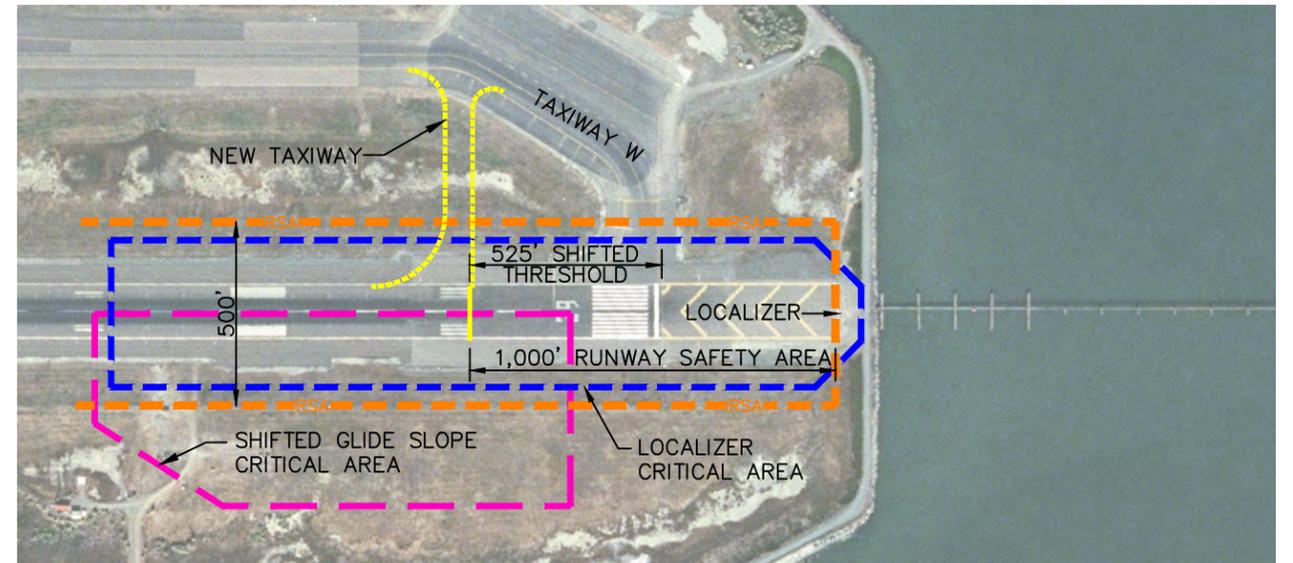
**RUNWAY 11-29 - RSA ALTERNATIVE 1  
(DEPARTURES AND ARRIVALS ON RUNWAY 29)**

Oakland International Airport  
Oakland, California

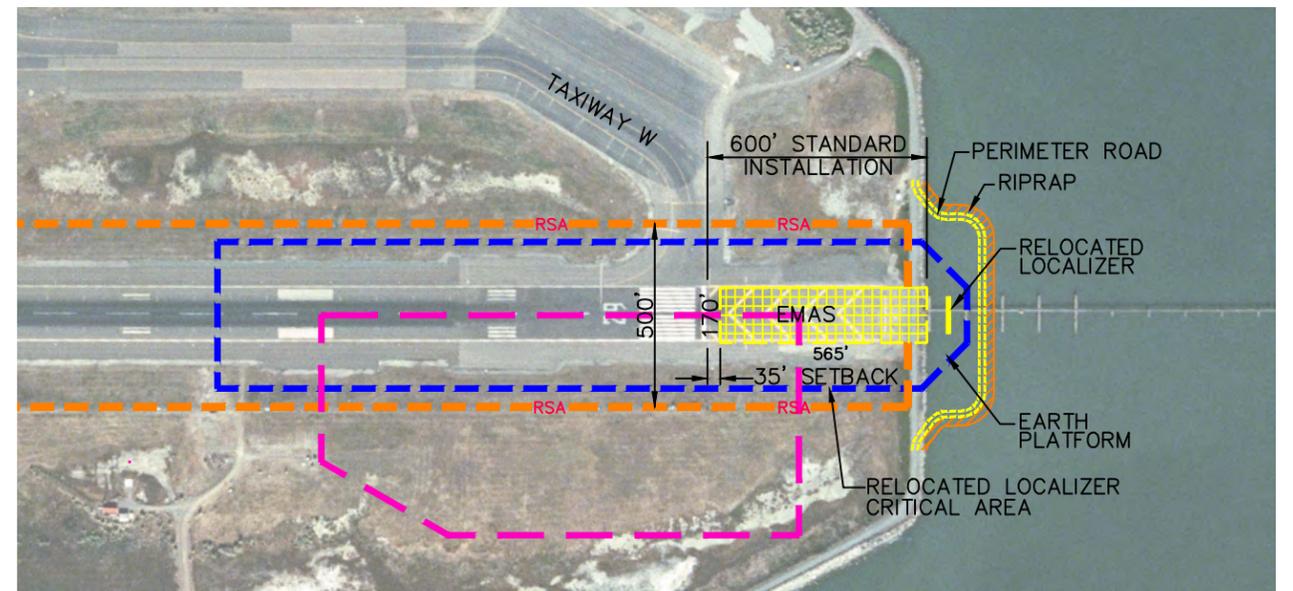
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**FIGURE 2-14**





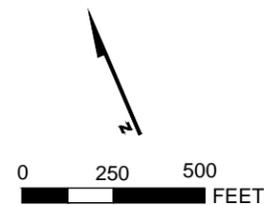
**RUNWAY 11-29 - RSA ALTERNATIVE 3**  
**INSTALL EMAS \*(WEST END) - SHIFT RUNWAY 525' WEST**  
 \* THE EMAS WILL NOT STOP B-747 EXITING THE RUNWAY AT 70 KNOTS.



**RUNWAY 11-29 - RSA ALTERNATIVE 4**  
**INSTALL EMAS \*(EAST END) - EXTEND INTO SAN FRANCISCO BAY**  
 \* THE EMAS WILL NOT STOP B-747 EXITING THE RUNWAY AT 70 KNOTS.

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



**RUNWAY 11-29 - RSA ALTERNATIVES 3 AND 4**  
**(DEPARTURES AND ARRIVALS ON RUNWAY 29)**

28067867

Oakland International Airport  
 Oakland, California



35 feet from the landing threshold of Runway 29, thereby creating a dimensionally standard EMAS. The Airport's earth platform would be extended into San Francisco Bay, as shown, to accommodate the relocation of the Runway 11 localizer antenna, and the rerouting of the dike and perimeter road outside of the localizer critical area. The northwestern end of the runway would not be moved, and a standard RSA would be provided within the existing vehicle service road.

Similar to the EMAS described for runway-specific RSA Alternative 3, this EMAS is considered standard because it provides 600 feet between the southeastern end of the EMAS bed and the runway threshold, and has vertical guidance for undershoot protection. The Setback dimension is 35 feet, the minimum allowable. This Setback dimension was chosen to minimize construction in San Francisco Bay. The Setback dimension needed to stop a B-747 exiting the runway at 70 knots is a value greater than 75 feet.

Specific modeling of the EMAS for runway-specific RSA Alternative 4 by ESCO (the vendor of the EMAS system) confirmed that this EMAS is not capable of stopping a B-747 that exits the runway at 70 knots. Therefore, the EMAS for runway-specific RSA Alternative 4 is deficient in that it is unable to provide 70-knot exit-speed performance for the design aircraft (a B-747). Although this installation meets dimensional standards, it fails to meet the performance requirements of the RSA Improvement Project. Therefore, it is non-compliant with RSA requirements.

Runway-specific RSA Alternative 4 proposes the removal of a small portion of non-tidal wetlands and vegetation within the limits of the RSA. Field observations indicate that these areas are confined to the sides of the RSA near the southeastern and northwestern ends of the RSA.

## Evaluation

Runway-specific RSA Alternative 4 would provide an RSA meeting the required dimensional standards at the northwestern end of Runway 11-29, and a dimensionally standard EMAS at the southeastern end. However, the performance of this alternative would not provide an EMAS that would stop the design aircraft for this runway at an existing speed of 70 knots. Therefore, this runway-specific RSA Alternative was considered to not meet the Step 1 screening-level evaluation, and was not carried forward for evaluation in this EA. In addition, this alternative would fail the Step 2 criteria by not providing the maximum benefit to aviation safety. Other alternatives (specifically runway-specific RSA Alternatives 2 and 2A) would achieve full RSA compliance without use of EMAS. As described in **Sections 2.2.1** and **2.4.5**, EMAS is not preferred when other alternatives could provide full compliance with standards.

### **2.5.4.6 Runway-Specific RSA Alternative 6 for Runway 11-29**

#### Description

Runway-specific RSA Alternative 6 is illustrated on **Figure 2-16**. Runway-specific RSA Alternative 6 is similar to runway-specific RSA Alternative 4, but proposes the installation of a 480-foot EMAS bed with a 35-foot Setback dimension in front of the localizer on the approach end of Runway 29. This length of EMAS bed would not be capable of stopping a B-747 with an exit speed of 70 knots, and therefore would be non-compliant with RSA Improvement Project requirements. Runway-specific RSA Alternative 6 would not require relocation of the localizer antenna or enlargement of the Airport's earth platform into

San Francisco Bay. The northwestern end of the runway would not be moved, and a standard RSA would be provided within the existing vehicle service road. The relocation of the glide slope antennae, Glide Slope Critical Areas, the ALSF-2, and MALSR are not included in this alternative because the thresholds of Runway 11-29 would not be changed.

Runway-specific RSA Alternative 6 proposes the removal of a small portion of non-tidal wetlands and vegetation within the limits of the RSA. Field observations indicate that these areas are confined to the sides of the RSA near the southeastern and northwestern ends of the RSA.

Runway-specific RSA Alternative 6 is not compliant with RSA Improvement Project requirements.

## Evaluation

This alternative would not provide an EMAS that meets FAA dimensional design requirements for a standard EMAS. FAA design standards require a 565-foot EMAS bed with a 35-foot Setback, whereas the EMAS for this alternative is only 480 feet. Furthermore, a 480-foot EMAS would not be capable of stopping the design aircraft (B-747) for Runway 11-29. Therefore, this runway-specific RSA Alternative does not meet the Step 1 criterion, and was not carried forward for evaluation in this EA. This alternative would fail the Step 2 criteria by not providing the maximum benefit to aviation safety. Other alternatives (specifically runway-specific RSA Alternatives 2 and 2A) would achieve full RSA compliance without use of EMAS. As described in **Sections 2.2.1** and **2.4.5**, use of EMAS is not preferred when other alternatives could provide full compliance with standards.

### 2.5.4.7 Runway-Specific RSA Alternative 8 for Runway 11-29

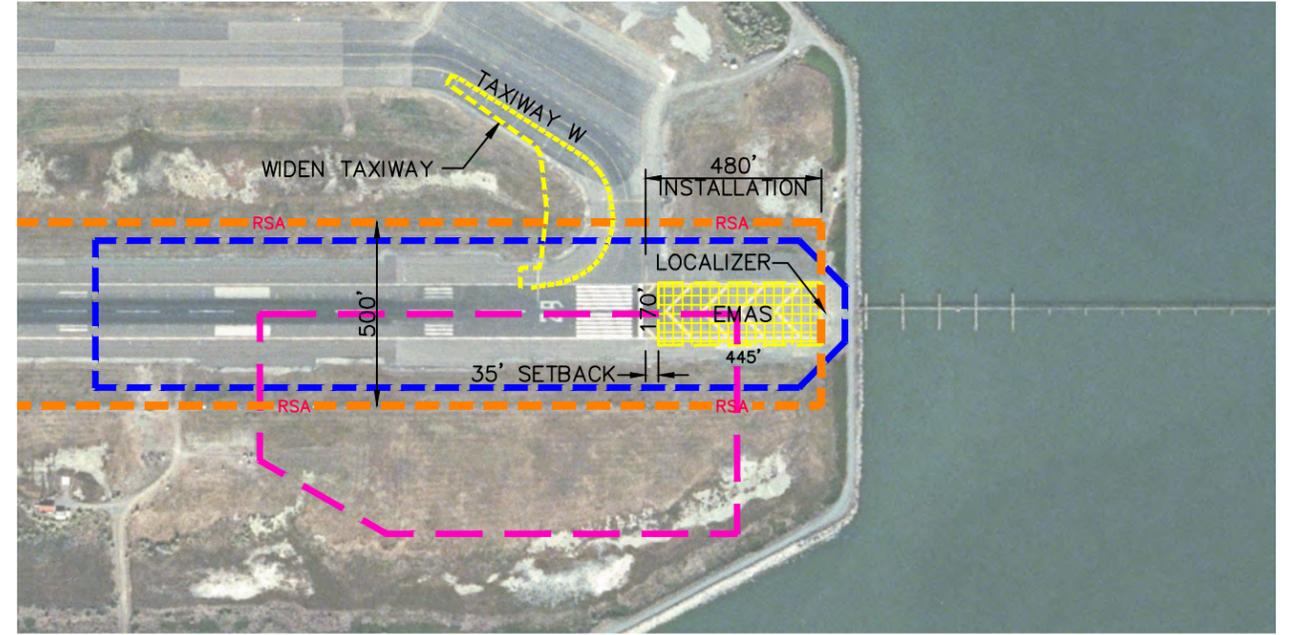
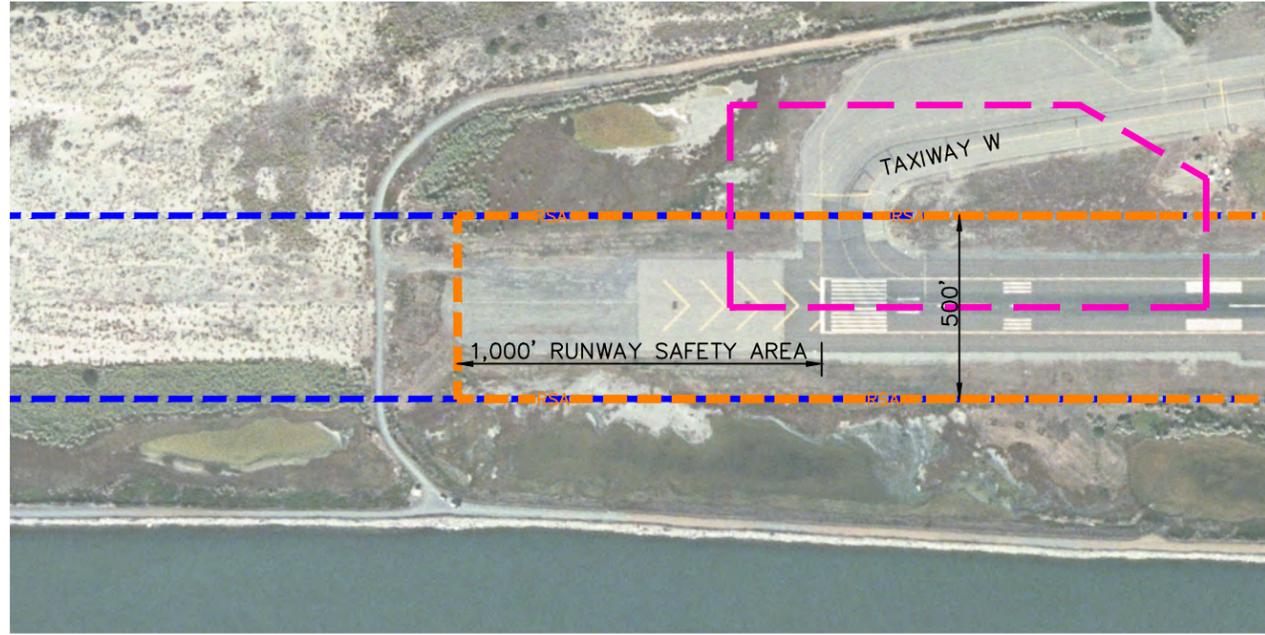
#### Description

Runway-specific RSA Alternative 8 is illustrated on **Figure 2-17**. Runway-specific RSA Alternative 8 is similar to runway-specific RSA Alternative 6, except that it includes the installation of a dimensionally standard 600-foot EMAS installation (comprising a 35-foot Setback and a 565-foot bed) in front of the localizer on the approach end of Runway 29. This EMAS is considered standard because it provides 600 feet between the southeastern end of the EMAS bed and the runway threshold, and has vertical guidance for undershoot protection. The Setback dimension is 35 feet, the minimum allowable. This Setback dimension was chosen to maintain a 10,000 foot runway length and to avoid intrusion into the sand area northwest of the runway. The Setback dimension needed to stop a B-747 exiting the runway at 70 knots is a value greater than 75 feet.

Specific modeling of the EMAS for runway-specific RSA Alternative 8 by ESCO (the vendor of the EMAS system) confirmed that this EMAS is not capable of stopping a B-747 that exits the runway at 70 knots. Therefore, the EMAS for runway-specific RSA Alternative 8 is deficient in that it is unable to provide 70-knot exit-speed performance for the design aircraft (a B-747). Although this installation meets dimensional standards, it fails to meet the performance requirements of the RSA Improvement Project. Therefore, it is non-compliant with RSA requirements.

Runway-specific RSA Alternative 8 requires the shift of Runway 11-29 by 115 feet to the northwest, and would shift the standard RSA at the northwestern end of the runway by 115 feet to the northwest.

dohila\_mendoza Feb 07, 2012 5:12pm T:\Port of Oakland\_RSA\Figures\_EA\FIGURE 2-16.dwg

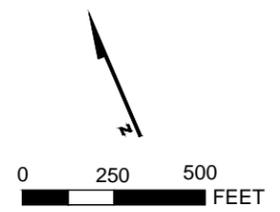


**RUNWAY 11-29 - RSA ALTERNATIVE 6  
INSTALL EMAS \***

\* THE EMAS WILL NOT STOP B-747 EXITING THE RUNWAY AT 70 KNOTS.

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



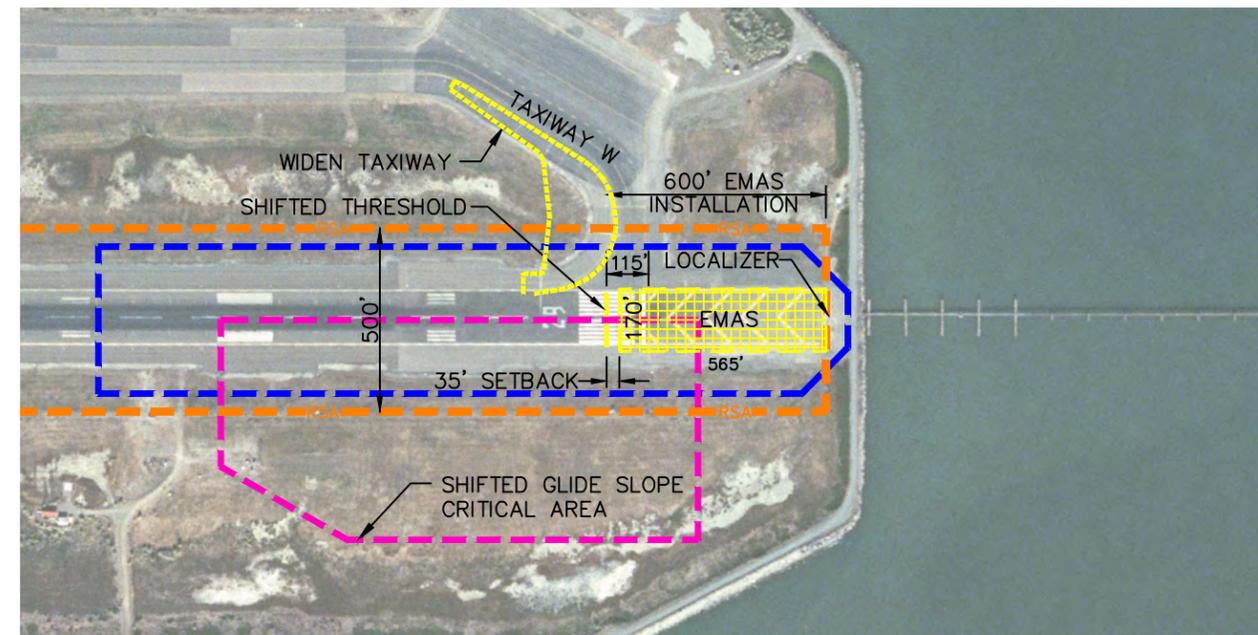
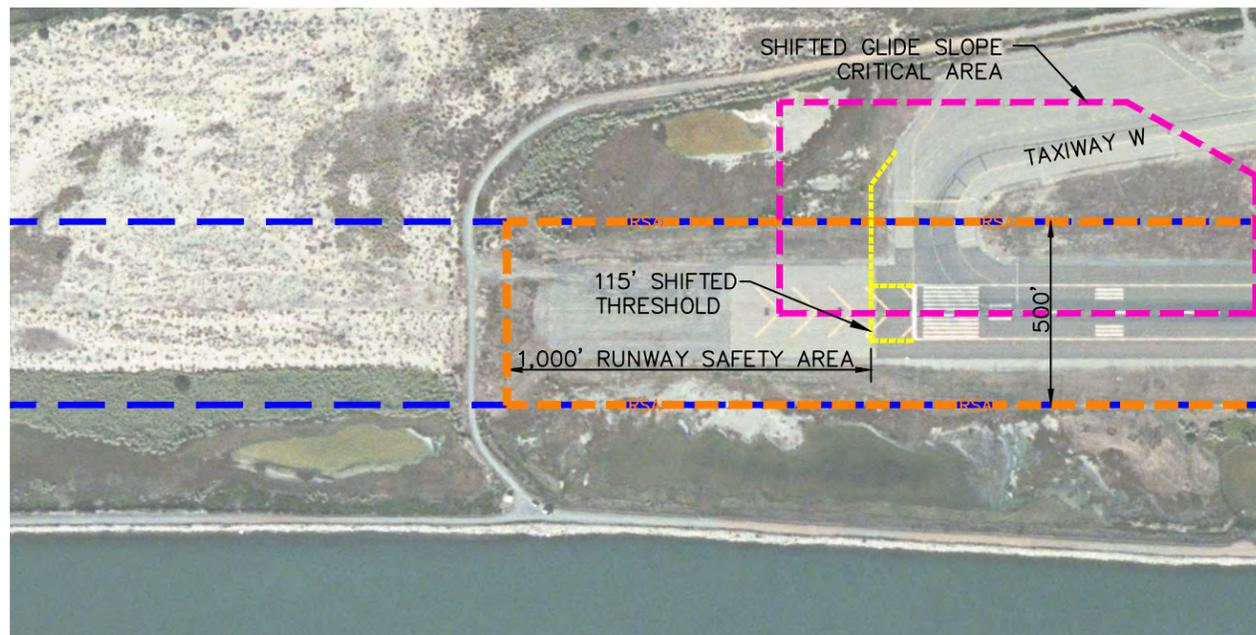
**RUNWAY 11-29 - RSA ALTERNATIVE 6**

Oakland International Airport  
Oakland, California

28067867

**FIGURE 2-16**

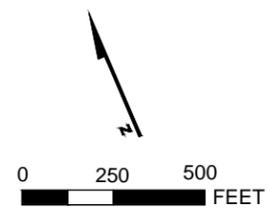




**RUNWAY 11-29 - RSA ALTERNATIVE 8**  
**INSTALL EMAS \*(EAST END) - SHIFT RUNWAY 115' WEST**  
 \* THE EMAS WILL NOT STOP B-747 EXITING THE RUNWAY AT 70 KNOTS.

**LEGEND**

-  RUNWAY SAFETY AREA
-  LOCALIZER CRITICAL AREA
-  GLIDE SLOPE ANTENNA CRITICAL AREA



**RUNWAY 11-29 - RSA ALTERNATIVE 8**

Oakland International Airport  
 Oakland, California

28067867

**FIGURE 2-17**



NAVAIDS relocation for runway-specific RSA Alternative 8 would be identical to those for runway-specific RSA Alternative 2A, except that the shift of the Runway 11 NAVAIDS would be 115 feet northwest as compared to 520 feet for runway-specific RSA Alternative 2A.

Existing taxiways at the Runway 11 and 29 ends would need to be widened by approximately 115 feet to align with the new thresholds. A new connector (designated elsewhere as Taxiway W3) would be needed, located approximately 2,000 feet from the existing Runway 11 end threshold. The Runway 11 threshold would be temporarily relocated approximately 2,000 feet to the southeast during construction. This taxiway is needed to provide aircraft access to the temporarily relocated threshold.

Runway-specific RSA Alternative 8 proposes the removal of a small portion of non-tidal wetlands and vegetation within the limits of the RSA. Field observations indicate that these areas are confined to the sides of the RSA near the southeastern and northwestern ends of the RSA.

## **Evaluation**

Runway-specific RSA Alternative 8 would provide a standard RSA at the northwestern end of Runway 11-29, and a dimensionally standard EMAS at the southeastern end. However, this alternative would not provide an EMAS that is capable of stopping the design aircraft for this runway at an existing speed of 70 knots. Therefore, this runway-specific RSA Alternative was considered not to meet the Step 1 screening-level evaluation, and was not carried forward for evaluation in this EA. This alternative would fail the Step 2 criteria by not providing the maximum benefit to aviation safety. Other alternatives (specifically runway-specific RSA Alternatives 2 and 2A) would achieve full RSA compliance without use of EMAS. As described in **Sections 2.2.1** and **2.4.5**, EMAS is not preferred when other alternatives could provide full compliance with standards.

## **2.6 SUMMARY OF SCREENING-LEVEL RESULTS OF RSA ALTERNATIVES**

### **2.6.1 INTRODUCTION**

**Table 2-1** presents a summary of the screening results of the off-airport non-construction alternatives, as well as runway-specific RSA Alternatives for Runways 15-33, the 9R-27L and 9L-27R pair, and 11-29. This table also shows how the Proposed Action and Project Alternative A were derived from these screening-level results.

### **2.6.2 SUMMARY OF RESULTS FOR OFF-AIRPORT NON-CONSTRUCTION RSA SOLUTIONS**

As indicated in **Table 2-1**, none of the off-airport non-construction alternatives passes the screening criteria.

### **2.6.3 SUMMARY OF RESULTS FOR RUNWAY 15-33**

For Runway 15-33 only one alternative was developed, specifically shifting the runway 75 feet to the southeast. As shown in **Table 2-1**, this alternative passes all the screening criteria and is included as part of the Proposed Action and Project Alternative A.

**Table 2-1  
Summary of Alternatives Screening Process**

<b>Location</b>	<b>Alternative</b>	<b>Step 1 – Provides RSA Meeting Standards</b>	<b>Step 2 – Practicability and Implementation Schedule</b>	<b>Step 3 – Safe and Efficient Use of Airspace and Impact on Airfield Operations</b>	<b>Included in Proposed Action</b>	<b>Included in Project Alternative A</b>
Off-Airport	Other Modes of Transportation	No				
Off-Airport	Other Airports	No				
Off-Airport	Smaller Aircraft	No				
Runway 15-33	Shift Thresholds	Yes	Yes	Yes	Yes	Yes
Runways 9L-27R and 9R-27L	Runway-specific RSA Alternative 1	Yes	No			
	Runway-specific RSA Alternative 2	Yes	No			
	Runway-specific RSA Alternative 3	Yes	No			
	Runway-specific RSA Alternative 6	No				
	Runway-specific RSA Alternative 7	No				
	Runway-specific RSA Alternative 7A	Yes	No			
	Runway-specific RSA Alternative 7B	Yes	Yes	Yes	Yes	Yes
Runway 11-29	Runway-specific RSA Alternative 8	No				
	Runway-specific RSA Alternative 1	Yes	No			
	Runway-specific RSA Alternative 2	Yes	Yes	Yes	No	Yes
	Runway-specific RSA Alternative 2A	Yes	Yes	Yes	Yes	No
	Runway-specific RSA Alternative 3	No <sup>2</sup>				
	Runway-specific RSA Alternative 4	No <sup>2</sup>				
	Runway-specific RSA Alternative 6	No <sup>2</sup>				
Runway-specific RSA Alternative 8	No <sup>2</sup>					
No Action Alternative	No Action Alternative	No <sup>1</sup>			N/A	N/A

Notes:

1 The No Action Alternative is retained for analysis of environmental consequences per Council on Environmental Quality regulations (40 Code of Federal Regulations § 1502.14).

2 Meets applicable dimensional standard but does not meet performance standard for design aircraft.

N/A = not applicable

RSA = Runway Safety Area

Yes – meets screening criteria

No – does not meet screening criteria

#### **2.6.4 SUMMARY OF RESULTS FOR RUNWAYS 9R-27L AND 9L-29R**

Eight runway-specific RSA Alternatives have been screened in this **Chapter 2** for providing RSAs that would meet applicable FAA design criteria for Runways 9L-27R and 9R-27L. Three of these runway-specific RSA Alternatives—6, 7, and 8—were found not to meet the Step 1 screening-level evaluation, and were dropped from further consideration in this EA.

This analysis of alternatives found that runway-specific RSA Alternatives 1 and 2 passed Step 1 screening, but had the highest risk of not being implemented by the deadline established by PL 109-115 due to requirements for major road relocations, or community opposition to possible changes in noise contours related to runway shifts. These runway-specific RSA Alternatives were dropped from further consideration in light of the Step 2 screening criterion regarding implementation schedule.

The remaining three runway-specific RSA Alternatives, 3, 7A and, 7B, provide equivalent improvement in aviation safety that met the Step 1 screening criterion, and it is anticipated that any of the three could be implemented before the end of 2015. Runway-specific Alternatives 3, 7A, and 7B are very similar in the amount of ground disturbance they produce and so they have very similar environmental effects. However, Alternatives 3 and 7A make greater use of EMAS than does Alternative 7B and are therefore more costly. Also, FAA Order 5200.8 discourages the use of EMAS when other alternatives are practical to implement.

Runway-specific RSA Alternatives 3 and 7A do not meet the Step 2 screening-level evaluation. They do not provide the maximum benefit to aviation safety because there are other alternatives, specifically runway-specific RSA Alternative 7B, which achieve full RSA compliance with less use of EMAS and greater use of dimensionally compliant RSAs. Runway-specific RSA Alternatives 3 and 7A are not carried forward for further evaluation in this EA.

Runway-specific RSA Alternative 7B was found to meet the Step 3 screening criterion regarding safe and efficient use of airspace, and would minimize future impacts on airfield operations. No other alternative for the Runway 9R-27L and 9L-27R pair passes all three criteria. Therefore, runway-specific RSA Alternative 7B has been carried forward as part of the Proposed Action and Project Alternative A.

#### **2.6.5 SUMMARY OF RESULTS FOR RUNWAY 11-29**

Seven runway-specific RSA Alternatives have been screened in this **Chapter 2** for providing RSAs that would meet applicable FAA design criteria for 11-29. Runway-specific RSA Alternatives 3, 4, 6, and 8 all involve EMAS installations. As stated elsewhere in this chapter, EMAS is not favored when other dimensionally compliant solutions are available. Furthermore, none of these alternatives is capable of stopping a B-747 exiting the runway at 70 knots. Therefore, Runway-specific RSA Alternatives 3, 4, 6, and 8 were eliminated from further consideration because they do not meet the Step 1 screening-level evaluation. These alternatives would also fail the Step 2 criterion by not providing the maximum benefit to aviation safety. Other alternatives, runway-specific RSA Alternatives 2 and 2A, would achieve full RSA compliance without use of EMAS.

Runway-specific RSA Alternatives 1 and 4 involve construction in San Francisco Bay and carry significant schedule risk. These alternatives were dropped from further consideration because they did not meet the implementation schedule criterion of Step 2 screening-level evaluation. The screening level evaluation of

runway-specific RSA Alternatives for this EA indicated that either runway-specific RSA Alternative 2 or runway-specific RSA Alternative 2A could create a full-compliance RSA for Runway 11-29. These alternatives are preferable to the other options in terms of implementation schedule and cost. These runway-specific RSA Alternatives would also avoid use of an EMAS, and would therefore allow for areas with greater pervious surfaces at the ends of Runway 11-29 than runway-specific RSA Alternatives incorporating an EMAS.

As a result of this analysis, runway-specific RSA Alternative 2A and 2 have been carried forward for evaluation in this EA. Runway-specific Alternative 2A is evaluated in detail as part of the Proposed Action, and runway-specific Alternative 2 is evaluated as part of Project Alternative A.

## **2.7 THE PROPOSED ACTION**

The Proposed Action is composed of the runway-specific RSA alternatives that best comply with the screening criteria.

### **2.7.1 RUNWAY 15-33**

The primary components of the RSA enhancements to Runway 15-33 associated with the Proposed Action include:

- Shift Runway 15-33 by 75 feet to the southeast, or towards the terminal complex, through repainting threshold markings on existing pavement.

### **2.7.2 RUNWAYS 9R-27L AND 9L-27R**

Runway-specific RSA Alternative 7B is part of the Proposed Action and Project Alternative A. The primary components of the RSA enhancements to Runways 9R-27L and 9L-27R associated with the Proposed Action and Project Alternative A include:

- Relocate the vehicle service road west of both runways westward to a location adjacent to the Airport perimeter fence and Harbor Bay Parkway;
- Relocate the vehicle service road east of the runways eastward to a location adjacent to the Airport perimeter fence and Airport Drive;
- Reduce the ASDA and LDA from 5,454 feet to 5,336 feet by establishing declared distances. The Takeoff Run Available and Takeoff Distance Available for both Runways 9L and 27R would remain 5,454 feet, as depicted on **Figure 1-6**. Also, the ASDA and LDA for Runway 27R would be 5,454 feet (declared distances are explained in **Section 2.4.4** and **Appendix A**);
- Fill portions of non-tidal waters of the U.S. located at the western end of the Runway 9R-27L RSA beyond the Runway 9R end to comply with FAA standards for RSAs;
- Fill and grade non-tidal wetland areas in the RSAs beyond the ends of Runways 27L and 27R to comply with FAA standards for RSAs;

- Install an EMAS measuring approximately 250 feet long by 170 feet wide, with a Setback of approximately 580 feet, west of the approach end of Runway 9R (a description of EMAS is provided in **Section 2.4.5**);
- Correct various non-compliant conditions regarding surface grades, soil conditions, and frangibility of signs and NAVAIDS in the lateral RSAs and the RSAs beyond the runway ends;
- Remove unused pavement between runways. The removal of this pavement is needed to allow the placement of soil fill. The soil fill is excess material that would be cut from other parts of the North Field RSAs as part of the overall plan to achieve compliant grades throughout the RSAs; and
- Install improvements to the stormwater collection and conveyance systems to ensure proper drainage of the RSAs.

### 2.7.3 RUNWAY 11-29

Runway-specific RSA Alternative 2A is part of the Proposed Action. The primary components of the RSA enhancements to Runway 11-29 associated with the Proposed Action include:

- Relocate the Runway 11 approach threshold 520 feet to the northwest;
- Displace the Runway 29 landing threshold 115 feet to the northwest;
- Extend Taxiway W to the northwest to the relocated Runway 11 approach threshold;
- Construct new connector Taxiway W1 between the extended Taxiway W and relocated Runway 11 threshold;
- Construct new connector Taxiway W4 between Taxiway W and displaced Runway 29 threshold;
- Construct new connector Taxiway W3 located at approximately 2,000 feet southeast of the existing threshold of Runway 11;
- Establish a declared distance of 10,000 feet for both takeoffs and landings on Runway 11-29. After construction of the RSA improvements, the future physical length of Runway 11-29 would be 10,520 feet. However, with the application of declared distances, the usable runway length for takeoffs and landings on Runway 11-29 would remain at the current length of 10,000 feet. The declared distances would designate a portion of Runway 11-29 pavement as providing standard RSAs meeting FAA design standards, while designating the remaining 10,000 feet of pavement as available for takeoff and landing operations (declared distances are explained in **Section 2.4.4** and **Appendix A**). No additional runway capacity is created by this project alternative.
- Relocate the glide slope antenna for Runway 11, which provides vertical guidance to arriving aircraft, from the northeastern side of the runway to the southwestern side and shifted 520 feet to the northwest, including the glide slope antenna critical area, in accordance with FAA design standards contained in FAA AC 150/5300-13, *Airport Design*;
- Shift the glide slope antenna for Runway 29, including the glide slope antenna critical area, by 115 feet to the northwest;

- Fill portions of non-tidal ponded areas within CWA Jurisdiction within the lateral and runway-end RSAs and new Runway 11 glide slope antenna critical area end to comply with FAA standards for RSAs;
- Replace and shift the Runway 11 MALSR approach lights 520 feet to the northwest;
- Relocate portions of the Runway 29 ALSF-2 on the existing trestle structure in San Francisco Bay (see Photo 9, **Appendix D, Biological Assessment**); and
- Correct various non-compliant conditions regarding surface grades, soil conditions, and frangibility of signs and NAVAIDS within the RSA.

## **2.8 PROJECT ALTERNATIVE A**

For Runways 15-33, 9R-27L and 9L-27R, Project Alternative A is identical to the Proposed Action. For Runway 11-29, Project Alternative A adopts runway-specific RSA Alternative 2 whereas the Proposed Action adopts runway-specific RSA Alternative 2A. These two alternatives are quite similar. The main difference is that Project Alternative A shifts the Runway 11 and 29 thresholds 525 feet to achieve dimensionally compliant RSAs on both ends of the runway, thereby shifting the entire runway 525 feet to the northwest. The Proposed Action relocates the Runway 11 threshold by 520 feet, displaces the Runway 29 threshold by 115 feet and implements declared distances to maintain a 10,000-foot-long runway in both directions. **Table 2-2** presents a comparison between the Proposed Action and Project Alternative A.

## **2.9 THE NO ACTION ALTERNATIVE**

In addition to the Proposed Action and Project Alternative A, the No Action Alternative has been included in the evaluation of the potential environmental consequences in this EA, as required by 40 CFR § 1502.14(d). Under this alternative, none of the proposed RSA improvements would be implemented, and the Airport would not comply with the requirements of PL 109-115. This alternative has been included to provide a basis for comparing the environmental consequences of the Proposed Action and Project Alternative A. The No Action Alternative (existing condition) for Runways 15-33, 9R-27L, 9L-27R and 11-29 is shown on **Figures 1-4** and **1-5**. Under the No Action Alternative, there would be no fill placed into wetlands and waters of the U.S. (refers to wetlands and waters within CWA Jurisdiction).

## **2.10 PERMITS REQUIRED**

As required under paragraph 405d(4) of FAA Order 1050.1E, a preliminary list of permits that would be required for implementation of the Proposed Action and Project Alternative A is provided in **Table 2-3**.

## **2.11 LISTING OF FEDERAL LAWS AND REGULATIONS CONSIDERED**

**Table 2-4** includes a list of federal statutes, executive orders, and regulations; FAA and Federal Department of Transportation orders; and FAA ACs considered in the development of the alternatives evaluation and the preparation of this EA.

**Table 2-2  
Comparison of Proposed Action and Project Alternative A**

Proposed Action	Project Alternative A
<b>Runway 15-33</b>	
Shift Runway 15-33 by 75 feet to the southwest, or towards the terminal complex, through repainting threshold markings on existing pavement	Same
<b>Runways 9R-27L and 9L-27R</b>	
Relocate the vehicle service road west of both runways westward to a location adjacent to the Airport perimeter fence and Harbor Bay Parkway	Same
Relocate the vehicle service road east of the runways eastward to a location adjacent to the Airport perimeter fence and Airport Drive	Same
Reduce the usable Runway 9L-27R length (ASDA = LDA = 5,336 feet) by implementing declared distances, as depicted on <b>Figure 1-6</b> (declared distances are explained in <b>Section 2.4.4</b> and <b>Appendix A</b> )	Same
Fill portions of non-tidal waters of the U.S. located at the western end of the Runway 9R-27L RSA beyond the Runway 9R end to comply with FAA standards for RSAs	Same
Fill and grade non-tidal wetland areas in the RSAs beyond the ends of Runways 27L and 27R to comply with FAA standards for RSAs	Same
Install an EMAS measuring approximately 250 feet long by 170 feet wide, with a Setback of approximately 580 feet west of the approach end of Runway 9R (a description of EMAS is provided in <b>Section 2.4.5</b> )	Same
Correct various non-compliant conditions regarding surface grades, soil conditions, and frangibility of signs and NAVAIDS in the lateral RSAs and the RSAs beyond the runway ends	Same
Remove unused pavement between runways. The removal of this pavement is needed to allow the placement of soil fill. The soil fill is excess material that would be cut from other parts of the North Field RSAs as part of the overall plan to achieve compliant grades throughout the RSAs.	Same
Install improvements to the stormwater collection and conveyance systems to ensure proper drainage of the RSAs	Same

<b>Table 2-2 Comparison of Proposed Action and Project Alternative A (Continued)</b>	
<b>Proposed Action</b>	<b>Project Alternative A</b>
<b>Runway 11-29</b>	
Relocate the Runway 11 approach threshold <b>520 feet</b> to the northwest	Relocate the Runway 11 approach threshold <b>525 feet</b> to the northwest
Displace the Runway 29 landing threshold <b>115 feet</b> to the northwest	Displace the Runway 29 landing threshold <b>525 feet</b> to the northwest
Extend Taxiway W to the northwest to the relocated Runway 11 approach threshold	Same
Construct new connector Taxiway W1 between the extended Taxiway W and relocated Runway 11 threshold	Same
Construct new connector Taxiway W4 between Taxiway W and displaced Runway 29 threshold	Construct new connector Taxiway W4 between Taxiway W and displaced Runway 29 threshold and remove existing Taxiway W5 from service by remarking
Construct new connector Taxiway W3 located at approximately 2,000 feet southeast of the existing threshold of Runway 11	Same
Establish a declared distance of 10,000 feet for both takeoffs and landings on Runway 11-29. After construction of the RSA improvements, the future physical length of Runway 11-29 would be 10,520 feet. However, with the application of declared distances, the usable runway length for takeoffs and landings on Runway 11-29 would remain at the current length of 10,000 feet. The declared distances would designate a portion of Runway 11-29 pavement as providing standard RSAs meeting FAA design standards, while designating the remaining 10,000 feet of pavement as available for takeoff and landing operations (declared distances are explained in <b>Section 2.4.4</b> and <b>Appendix A</b> ). No additional runway capacity is created by this project alternative.	N/A
Relocate the glide slope antenna for Runway 11, which provides vertical guidance to arriving aircraft from the northeastern side of the runway to the southwestern side and shifted <b>520 feet</b> to the northwest, including the glide slope antenna critical area, in accordance with FAA design standards contained in FAA AC 150/5300-13, Airport Design	Relocate the glide slope antenna for Runway 11, which provides vertical guidance to arriving aircraft from the northeastern side of the runway to the southwestern side and shifted <b>525 feet</b> to the northwest, including the glide slope antenna critical area, in accordance with FAA design standards contained in FAA AC 150/5300-13, Airport Design
Shift the glide slope antenna for Runway 29, including the glide slope antenna critical area, by <b>115 feet</b> to the northwest	Shift the glide slope antenna for Runway 29, including the glide slope antenna critical area, by <b>525 feet</b> to the northwest

**Table 2-2  
Comparison of Proposed Action and Project Alternative A (Continued)**

Proposed Action	Project Alternative A
Fill portions of non-tidal wetlands and non-tidal waters of the U.S. within the lateral and runway-end RSAs and new Runway 11 glide slope antenna critical area end to comply with FAA standards for RSAs	Same
Replace and shift the Runway 11 MALSR approach lights <b>520 feet</b> to the northwest	Replace and shift the Runway 11 MALSR approach lights <b>525 feet</b> to the northwest
Relocate portions of the Runway 29 ALSF-2 on the existing trestle structure; and	Similar. Project Alternative A requires more ALSF-2 stations to be modified as compared to the Proposed Action
Correct various non-compliant conditions regarding surface grades, soil conditions, and frangibility of signs and NAVAIDS within the RSA	Same

## Notes:

AC = Advisory Circular

ALSF-2 = Approach Lighting System with Sequenced Flashing Configuration 2

ASDA = Accelerate-Stop Distance Available

EMAS = Engineered Materials Arresting Systems

FAA = Federal Aviation Administration

LDA = Landing Distance Available

MALSR = Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights

NAVAIDS = Navigational Aid Systems

RSA = Runway Safety Area

**Table 2-3  
Preliminary List of Permits/Consultations Required  
for the Proposed Action and Project Alternative A  
Oakland International Airport**

Issuing Agency	Permit/Consultation Name/Type
<b>Federal</b>	
National Marine Fisheries Service	Section 7 of the Federal Endangered Species Act Compliance, as necessary
U.S. Army Corps of Engineers	Section 404 dredge and fill permit under the Clean Water Act
U.S. Fish and Wildlife Service	Biological Opinion
<b>State</b>	
Bay Conservation and Development Commission	Non-Material Amendment to Bay Conservation and Development Commission Permit M1989.075 under McAteer-Petris Act and consistency determination under the Coastal Zone Management Act.
California Office of Historic Preservation	Concurrence on historic, architectural, archaeological, and cultural resources
California Department of Transportation	Amended Airport Permit
San Francisco Regional Water Quality Control Board/State Water Quality Control Board	General Construction Permit under Section 402 of the Clean Water Act for construction activities.
San Francisco Regional Water Quality Control Board	Section 401 Water Quality Certification and associated Waste Discharge Requirements under the Clean Water Act and the Porter-Cologne Act, respectively.

## Notes:

With the exception of the No Action Alternative, all other alternatives likely would require the same suite of environmental permits to authorize construction.

**Table 2-4  
List of Federal Laws and Regulations Considered  
Oakland International Airport RSA EA**

<b>Federal Laws and Statutes</b>
Subtitle VII, Title 49, USC – “Aviation Programs” (Section 40101 et seq.) recodified from, and formerly known as, the “Federal Aviation Act of 1958” as amended (PL 85-726)
The Airport and Airway Improvement Act of 1982 (PL 97-248)
Aviation Safety and Capacity Expansion Act of 1990 (PL 101-508, as amended)
Airport and Airway Revenue Act of 1987 (PL 100-223, Title IV)
The National Environmental Policy Act of 1969 (NEPA, PL 91-190; 42 USC §4321 et seq.)
The Clean Air Act of 1977 (as amended) (42 USC §7409 et seq.)
The Transportation, Treasury, Housing and Urban Development, the Judiciary, The District of Columbia, and Independent Agencies Appropriations Act of 2006 (PL 109-115)
The Noise Control Act of 1972 (PL 92-574; 42 USC §4901)
The Aviation Safety and Noise Abatement Act of 1979 (PL 96-193; 49 USC App. 2101)
Policy on lands, wildlife and waterfowl refuges, and historic sites (49 USC §303 [formerly known as Section 4(f) of the Department of Transportation Act of 1966])
Section 106, National Historic Preservation Act of 1966 (16 USC §470[f]; PL 89-665)
The Archaeological and Historic Data Preservation Act of 1974 (PL 93-291, as amended by PL 93-291, 16 USC §469)
The Endangered Species Act of 1973 (PL 93-672; 16 USC §§661, 664 note, 1008 note)
Section 404, Federal Water Pollution Control Act Amendments for 1972 (33 USC §1344; PL 92-500), as amended by the Clean Water Act of 1977 (33 USC §1251; PL 95-217)
Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 USC §4601; PL 91-528)
Farmland Protection Policy Act (PL 97-98; 7 CFR Part 658)
Section 201(a), Federal Land Policy and Management Act of 1976 (43 USC §1701 et seq.; PL 94-579)
Resource Conservation and Recovery Act of 1976 (42 USC §6901, et seq.; PL 94-580, as amended by the Solid Waste Disposal Act of 1980 [PL 96-482]; and the 1984 Hazardous and Solid Waste Amendments [PL 98-616])
Comprehensive Environmental Response, Compensation, and Liability Act (42 USC §9601; PL 96-510)
Community Environmental Resource Facilitation Act (42 USC §9601, et seq.)
<b>Executive Orders</b>
Executive Order 11593, <i>Protection and Enhancement of the Cultural Environment</i> (dated May 13, 1971)
Executive Order 11988, <i>Floodplain Management</i> (43 FR 6030) and DOT Order 5650.2 – <i>Floodplain Management and Protection</i> (dated April 23, 1979)
Executive Order 11990, <i>Protection of Wetlands</i> and DOT Order 5660.1A, <i>Preservation of the Nation’s Wetlands</i> (dated August 24, 1978)

**Table 2-4**  
**List of Federal Laws and Regulations Considered**  
**Oakland International Airport (Continued)**

President's 1979 Environmental Message Directive on Wild and Scenic Rivers (dated August 2, 1979)
Executive Order 11514, <i>Protection and Enhancement of Environmental Quality</i> (dated March 4, 1970)
Executive Order 11296, <i>Flood Hazard Evaluation Guidelines</i> (dated August 10, 1966)
Executive Order 12898, <i>Federal Actions Address Environmental Justice in Minority Populations and Low-Income Populations</i> (February 11, 1994)
<b>Federal Regulations</b>
40 CFR Parts 1500-1508, <i>CEQ implementation of NEPA procedural provisions, establishes uniform procedures, terminology, and standards for implementing the procedural requirements of NEPA's section 102(2)</i>
14 CFR Part 95, <i>Instrument Flight Rules Altitudes</i>
40 CFR Part 230 <i>et seq.</i> , CWA Section 404(b)(1) Guidelines
36 CFR Part 800, <i>Protection of Historic Properties</i>
7 CFR Part 657 (43 FR 4030, January 31, 1978), <i>Prime and Unique Farmlands</i>
49 CFR Part 24 (March 2, 1989), <i>Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally Assisted Programs</i>
14 CFR Part 36, <i>Noise Standards Type and Airworthiness Certificates</i>
14 CFR Part 75, <i>Establishment of Jet Routes and Area High Routes</i>
14 CFR Part 77, <i>Objects Affecting Navigable Airspace</i>
14 CFR Part 91, <i>General Operations and Flight Rules</i>
14 CFR Part 97, <i>Standard Instrument Approach Procedures</i>
14 CFR Part 139, <i>Airport Operations Specifications</i>
14 CFR Part 150, <i>Airport Noise Compatibility Planning</i>
14 CFR Part 151, <i>Federal Aid to Airports</i>
14 CFR Part 152, <i>Airport Aid Program</i>
14 CFR Part 153, <i>Acquisition of U.S. Land for Public Airports</i>
14 CFR Part 154, <i>Acquisition of U.S. Land for Public Airports under the Airport and Airway Development Act of 1970</i>
14 CFR Part 155, <i>Release of Airport Property from Surplus Property Disposal Restrictions</i>
14 CFR Part 157, <i>Notice of Construction, Alteration, Activation, and Deactivation of Airports</i>
14 CFR Part 169, <i>Expenditures of Federal Funds for Non-Military Airports or Air Navigational Facilities Thereon</i>

**Table 2-4  
List of Federal Laws and Regulations Considered  
Oakland International Airport (Continued)**

<b>FAA/U.S. Department of Transportation Orders</b>
DOT Order 5610.1C, <i>Procedures for Considering Environmental Impacts</i> (44 FR 56420, October 1, 1979) and Order DOT 5610.1C, Change 1 (July 13, 1982)
DOT Order 5660.1, <i>Preservation of the Nation's Wetlands</i> (August 24, 1978)
FAA Order 1050.1E, <i>Environmental Impacts: Policies and Procedures</i> , Change 1 (March 20, 2006)
FAA Order 5050.4B, <i>National Environmental Policy Act Implementing Instructions for Airport Actions</i> (April 28, 2006)
FAA Order 5200.5A, <i>FAA Guidance Concerning Sanitary Landfills on or Near Airports</i> (January 31, 1990)
FAA Order 5200.8, <i>Runway Safety Area Program</i> (October 1, 1999)
FAA Order 5200.9, <i>Financial Feasibility and Equivalency of Runway Safety Area Improvements and Engineered Materials Arresting Systems</i> (March 15, 2004)
<b>FAA Joint Order 7110.65T, Air Traffic Control</b>
<b>FAA Advisory Circulars</b>
AC 150/5020-1, <i>Noise Control and Compatibility Planning for Airports</i> (August 5, 1983)
AC 150/5070-6B, <i>Airport Master Plans</i> (May 1, 2007)
AC 150/5070-7, <i>Airport System Planning Process</i> (November 10, 2004)
AC 150/5150-2B, <i>Federal Surplus Personal Property for Public Airport Purposes</i> (October 1, 1984)
AC 150/5200-33B, <i>Hazardous Wildlife Attractants On or Near Airports</i> (August 28, 2007)
AC 150/5220-22A, <i>Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns</i> (September 30, 2005)
AC 150/5300-13, <i>Airport Design</i> (September 29, 1989)
AC 150/5320-6E, <i>Airport Pavement Design and Evaluation</i> (September 30, 2009)
AC 150/5370-10E, <i>Standards for Specifying Construction of Airports</i> (September 30, 2009)
AC 70/7460-21, <i>Proposed Construction or Alteration of Objects that May Affect the Navigable Airspace</i> (January 1, 1996)
AC 91-53A, <i>Noise Abatement Departure Profile</i> (July 22, 1993)

## Notes:

AC = Advisory Circular  
 CEQ = Council on Environmental Quality  
 CFR = Code of Federal Regulations  
 DOT = U.S. Department of Transportation  
 FAA = Federal Aviation Administration  
 FR = Federal Register  
 NEPA = National Environmental Policy Act  
 PL = Public Law  
 USC = United States Code

