Madras Municipal Airport
Airport Master Plan Update

December 2010

CENTURY WEST
ENGINEERING CORPORATION

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CHAPTER ONE
INTRODUCTION

The preparation of this document may have been supported, in part, through the Airport Improvement Program financial assistance from the Federal Aviation Administration as provided under Title 49, United States Code, section 47104. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable with appropriate public laws.

Introduction

The City of Madras is preparing an Airport Master Plan Update for Madras Municipal Airport (S33) in cooperation with the Federal Aviation Administration (FAA). The master plan update also includes preparation of an updated airport layout plan (ALP) drawing set.

Funding for the project is being provided through an FAA Airport Improvement Program (AIP) grant (95%) with a local match (5%) provided by the City. The AIP is a dedicated fund administered by FAA with the specific purpose of maintaining and improving the nation's public use airports. The AIP is funded exclusively through fees paid by users of general aviation and commercial aviation.

The purpose of the master plan update is to define the current, short-term and long-term needs of the airport through a comprehensive evaluation of conditions and Federal Aviation Administration (FAA) airport planning and design standards.

The master plan will provide specific guidance in making the improvements necessary to maintain a safe and efficient airport that is economically, environmentally, and socially sustainable. The master plan update will:

- *Provide an updated assessment of existing facilities and activity;*
- *Forecast airport activity measures (based aircraft, aircraft operations, etc.) for the current 20-year planning period;*

- *Examine previous planning recommendations (1997 Airport Layout Plan) as appropriate, to meet the current and projected airport facility needs, consistent with FAA airport design standards;*
- *Determine current and future facility requirements for both demand-driven development and conformance with FAA design standards;*
- *Prepare an updated airport layout plan drawing set for the airport to reflect current conditions and master plan facility recommendations; and*
- *Develop an Airport Capital Improvement Program (ACIP) that will prioritize improvements and estimate project development costs and funding eligibility for the 20-year planning period.*

The most recent FAA-approved ALP for Madras Municipal Airport was completed in 1997.[1] The 1997 ALP and associated drawings, and updated (summer 2009) aerial photography and mapping for the airport will be used as primary information sources for preparing the updated master plan and supporting drawings.

National Airport System

Madras Municipal Airport is included in the National Plan of Integrated Airport Systems (NPIAS). Participation in the NPIAS is limited to public use airports that meet specific FAA activity criteria. NPIAS airports are eligible for federal funding of improvements through FAA programs such as the current Airport Improvement Program (AIP). There are more than 3,300 NPIAS airports, of which more than 75 percent are general aviation airports similar to Madras. Madras Municipal Airport is the only NPIAS airport in Jefferson County. In the Central Oregon area, Prineville and Redmond are the next nearest NPIAS airports to Madras Municipal Airport (approximately 30 driving miles from Madras).

The FAA has recognized NPIAS airports as being vital to serving the public needs of air transportation. In doing so, the FAA recognizes that access to the nation's air transportation system is not limited to commercial air service. The FAA requires that all NPIAS airports periodically update their airport plans to maintain effective long-term planning. This project will enable the City to meet the FAA's requirement to maintain an up-to-date plan.

[1] Airport Layout Plan Report and ALP drawings (dated October, 1997). Aron Faegre & Associates.

State Airport System

Madras Municipal Airport is identified as a "Category IV- Local General Aviation" public use airport in the current Oregon Aviation System Plan.

Public Involvement

The public involvement element of the planning process provided opportunities for all interested individuals, organizations, or groups to participate in the project. The Madras Airport Advisory Committee provided local review and input into the planning process. The committee reviewed and commented on draft work products and provided local knowledge and expertise to the planning process. Several project meetings were held to provide information to interested citizens and allow the committee, the Consultant, City staff, ODA, and FAA to meet and discuss key project issues.

SUMMARY OF PRELIMINARY FINDINGS

1. Madras Municipal Airport is owned and operated by the City of Madras.
2. The Airport is located approximately 3 miles northwest of Madras, West of U.S. Highway 26. Surface access to the Airport is provided by NW Cherry Lane, which connects to Highway 26.
3. The Airport consists of approximately 2,091 acres, as noted on the current Exhibit "A" property plan (last revised 2/08). The Airport is located partially within the Madras city limits and urban growth boundary (UGB).
4. The Airport is included in the National Plan of Integrated Airport System (NPIAS), making it eligible for federal funding through the Federal Aviation Administration (FAA).
5. The Airport has a "Local General Aviation" service level designation in the current Oregon State Aviation System Plan.
6. The Airport has two paved runways, with the primary runway (16/34) oriented in a north-south direction and the secondary runway (4/22) oriented in a northeast-southwest direction. Runway 16/34 (5,089 feet x 75 feet) is paved and lighted, and has basic (visual) markings. Runway 16/34 is served by a full-length parallel taxiway located on its east side. Runway 4/22 (2,701 feet x 50 feet) is paved with basic (visual) markings. Runway 4/22 is not lighted.
7. The airfield facilities are capable of accommodating a wide variety of general aviation aircraft activity and limited transport category aircraft activity. The design standards for the primary runway and taxiway are generally consistent with FAA Airport Design Group II (ADG-II). ADG II aircraft have wingspans from 49 feet to less than 79 feet. The design

standards for the secondary runway are generally consistent with FAA Airport Design Group I (ADG-I). ADG I aircraft have wingspans less than 49 feet.

8. The published pavement strength for Runway 16/34 is 75,000 pounds for aircraft with single wheel landing gear (FAA 5010 and A/FD data). The published pavement strength for Runway 4/22 is 16,000 pounds for aircraft with single wheel landing gear. However, historic pavement data (section thicknesses, composition, etc.) and published weight bearing capacities for the runways and main taxiways are not consistent, and the pavement strengths may be significantly lower than published (see Inventory chapter). Additional testing and evaluation may be required to accurately calculate pavement strength.

9. Airfield lighting currently includes a rotating beacon and a lighted wind cone. Runway 16/34 is equipped with medium-intensity runway edge lighting (MIRL), threshold lights, and a 4-light visual approach slope indicator (VASI) on Runway 34. The runway lighting and VASI are pilot-activated (radio). The rotating beacon and lighted wind cone operate on a photo-cell switch.

10. All landside facilities (aircraft parking, hangars, etc.) at the airport are located on the east side of Runway 16/34. The Airport has a main paved aircraft apron located between the south end and the middle of Runway 16/34. The main apron accommodates aircraft fueling, the fixed base operator (FBO), and aircraft parking. Other smaller aprons are used to support aerial applicator operations. The airport also has a small airplane wash rack located north of the main apron.

11. In summer 2010, the airport had 8 hangars (various sizes) located on the east side of the runway. The hangars include two 9-unit T-hangars, two 3-unit hangars, two WWII-vintage Quonset hangars, conventional hangar, and one large commercial hangar. Other airport (aviation related) buildings include the general aviation terminal and aerial applicator operations buildings.

12. The Airport operates under day and night visual flight rules (VFR) and instrument flight rules (IFR). The airport has two nonprecision instrument approaches.

13. The Airport does not currently have on-site weather observation.

14. Aviation fuel (jet fuel and 100LL AVGAS) is available at the Airport.

15. Prior to the master plan update, the most recent estimates of activity for Madras Municipal Airport were included in the February 2008 Oregon Aviation System Plan Forecast Update: 40 based aircraft and 10,066 operations in 2005. The current FAA 5010 form lists 50 based aircraft and 10,735 annual operations (for the 12 months ending 07/09/07). An updated count (July 2009) of 62 based aircraft was provided by airport management for this project.

SUMMARY OF CONCLUSIONS & RECOMMENDATIONS

1. All federally-funded projects are subject to the environmental regulations contained in the National Environmental Policy Act (NEPA), including property acquisition, major facilities rehabilitation, and new construction.
2. A regular schedule of pavement maintenance (vegetation control, crack filling, fog seals, slurry seals, patching, etc.) should be conducted on airfield pavements to maximize the useful life and optimize life cycle maintenance expenditures. Runway and taxiway markings should be periodically repainted to maintain good visibility.
3. Current and future design standards for Runway 16/34 are based on FAA airport reference code (ARC) B-II for “larger than utility” runways (per FAR Part 77). Airspace planning for Runway 16/34 is based on nonprecision instrument approach capabilities.
4. Current and future design standards for the airport’s crosswind runway (current 4/22; new 5/23) are based on FAA airport reference code (ARC) A-I (small) for “utility” runways (per FAR Part 77). Airspace planning for the crosswind runways is based on visual approach capabilities.
5. **Runway 16/34**. Two runway extensions totaling 781 feet are recommended at the south end of Runway 16/34. Based on anticipated funding availability, the extensions are planned in two phases:
   - **Phase 1.** A 201-foot extension is recommended to accommodate the FAA-defined standard of 75 percent of the large airplane fleet with a 60 percent useful load described in the preliminary alternatives. The extension would increase the length of Runway 16/34 from 5,089 feet to 5,290 feet and allow the airport to accommodate the current mix of business jets under a broader range of weather conditions. A small turnaround area is proposed on the east side of the runway extension to allow aircraft to use the entire runway length for takeoff on Runway 34 and landing on Runway 16. Extend runway edge lights; relocate/replace visual approach slope indicator (VASI).
   - **Phase 2.** The second 580-foot extension corresponds to the length required to accommodate large aircraft weighing more than 60,000 pounds. The Douglas DC6 or Lockheed C-130 fire bomber aircraft are representative of this category of large aircraft expected to operate at Madras during the current twenty year planning period. The useable runway length is increased to 5,870 feet.
6. The pavement strength for Runway 16/34 and the parallel taxiway should be increased to accommodate existing large aircraft activity. A single wheel rating of 30,000 pounds is recommended, with a corresponding dual wheel rating of approximately 50,000 to 75,000

pounds. Occasional operations by heavier aircraft (above 100,000 pounds) should be considered in the pavement design to avoid premature deterioration.

7. The east parallel taxiway will be extended in conjunction with the second runway extension, or potentially an intermediate extension. A new aircraft hold area is recommended near the south end of the Runway 16/34 parallel taxiway.
8. A new aircraft hold area is recommended near the north end of the Runway 16/34 parallel taxiway to replace the current hold area that does not conform to FAA design standards (taxiway OFA).
9. The markings for Runway 16/34 will be upgraded from visual to nonprecision instrument, consistent with current/future instrument approach capabilities.
10. A second 90-degree midfield exit taxiway is recommended for Runway 16/34, approximately 1,400 feet north of the existing mid-runway exit taxiway. The new exit taxiway will improve runway operational efficiency and safety by reducing runway occupancy times, particularly for landing aircraft unable use the existing exit.
11. Based on several factors, it is recommended that the existing crosswind runway (4/22) be replaced and upgraded with a new runway (5/23) near the north end of Runway 16/34.
    - A 3,000 by 60-foot runway with a 050-230 degree alignment (Runway 5/23) to be constructed in an "Open-V" configuration. A runway visibility zone (RVZ) is recommended for the airfield, although the runways will not actually intersect.
    - Runway 5/23 will be accessed by a short connecting taxiway extending from the Runway 16 threshold and the north end of the east parallel taxiway. The access taxiway will be compatible with a future south side parallel taxiway for Runway 5/23.
    - Runway 5/23 and its taxiways will be designed to accommodate aircraft weighing 12,500 pounds or less.
12. The north access taxiway connecting Runways 16/34 and 4/22 will be eliminated after the new runway is constructed. In order to maintain current operations, a short bypass taxiway is recommended to connect the north access taxiway to the Runway 22 threshold (bypassing failed concrete pavement) until the runway is replaced.
13. The existing Runway 4/22 will be closed and the area will be available for redevelopment.
14. **Terminal Apron Reconfiguration & Expansion**. The main apron will be reconfigured and expanded to increase current aircraft parking capacity, improve aircraft circulation within the apron and meet FAA design standards.

- A main north-south access taxilane will provide access throughout the apron, with adequate clearance (ADG II) provided between taxiing aircraft and parked aircraft, aircraft fueling, etc.
- The two existing angled taxiways that connect the main apron and parallel taxiway will be replaced with 90-degree taxiways to increase aircraft parking space and facilitate aircraft movement. Addition taxiway connections to the parallel taxiway are provided north and south of the center section of the apron.
- An aircraft loading/unloading area is located directly in front of the general aviation terminal to accommodate short term parking for small single-engine or multi-engine aircraft.
- Four drive-through parking positions for business class aircraft are located near the general aviation terminal.
- The existing aircraft fueling area will be reconfigured in conjunction with replacement of the two old single wall fuel tanks. New above ground double wall fuel storage tanks are recommended to accommodate aviation gasoline (AVGAS) and jet fuel.
- Helicopter parking pads to be located north of the business aircraft parking; the area surrounding the helicopter parking pads will require surface treatments to control rotor wash (debris) in the vicinity of fixed wing aircraft parking.
- 12 light airplane tiedowns will be provided at the south end of the main apron, with additional expansion reserve provided.

15. **Landside Development**. The preferred alternative provides space to accommodate 25 to 30 additional aircraft in T-hangars and Conventional Hangars within the immediate terminal area. Additional hangar development reserves are available within the Runway 16/34 flightline area and in other areas of the airport.
    - The north hangar will accommodate additional T-hangar and small conventional hangar development.
    - The taxilanes serving the north hangar area will be upgraded/reconfigured to meet FAA taxilane object free area clearances.
    - The taxilanes surrounding the existing T-hangars will be resurfaced and designed to meet FAA standards.
    - Hangar sites will be developed adjacent to the expanded south tiedown apron.
16. Existing airport fencing and gates will be modified along NW Airport Way, with controlled access provided via pedestrian and automated vehicle gates located adjacent to the apron.

Public vehicle parking and a passenger pick-up/drop off area will be provided adjacent to landside areas (outside the fence). Automated access vehicle gates are recommended to provide tenant access to the north and south hangar areas. Interim use of future hangar sites may include vehicle parking.

17. The northern section of the Runway 16/34 flight line is reserved for future commercial aviation use, including several large hangar sites, fixed wing, and helicopter parking.
18. The Runway 16/34 parallel taxiway will be equipped with medium intensity taxiway edge lighting (MITL).
19. Airfield signage will be updated and upgraded to internally-illuminated units (mandatory instructional signs, location signs, direction signs, destination signs, runway distance remaining signs).
20. An Automated Weather Observation System (AWOS) will be located near mid-runway, on the west side of Runway 16/34. The addition of the AWOS is expected to significantly improve instrument approach minimums for the airport. The city should request FAA review of existing instrument procedures when the AWOS becomes operational.
21. Airport security fencing will be installed around the airport operations area that is defined by the runway-taxiway system and adjacent aviation use facilities. Controlled access points (gates) will be located based on specific operational requirements.
22. The City of Madras and Jefferson County should maintain airport overlay zoning based on the FAR Part 77 airspace surfaces (height and hazard) depicted in the updated Airport Layout Plan.
23. The City of Madras and Jefferson County should ensure through their comprehensive planning/zoning that development of lands in the vicinity of the airport is compatible with airport activities to the greatest extent possible.
24. It is recommended that any proposed changes in land use or zoning in the vicinity of the airport (within the boundaries of the FAR Part 77 airspace surfaces) be coordinated with Oregon Department of Aviation to ensure consistency with Oregon airport land use planning requirements.
25. The City of Madras should require all development proposals involving construction of structures on the airport to complete and submit FAA Form 7460-1 – Notice of Proposed Construction or Alteration, prior to approval of ground leases. Any development proposal that receives an objection by FAA should not be approved without first addressing FAA concerns.

26. City of Madras and/or Jefferson County planning and building officials should require that applicants for proposed development within the boundaries of the airport's FAR Part 77 imaginary surfaces (as defined by the Airport Airspace Plan) verify through coordination with the FAA Seattle Airports District Office (ADO) whether submittal of FAA Form 7460-1 is required for their proposal. This determination should be required prior to approval/issuance of building permits, approval of plats, binding site plans, etc. Any development proposal that receives an objection by FAA should not be approved without first addressing FAA concerns.
27. The City of Madras and FAA should approve/adopt the Airport Master Plan and Airport Layout Plan drawings in a timely manner to guide future airport development.
28. The City of Madras should initiate the recommended improvements and major maintenance items in a timely manner, requesting funding assistance under FAA and other federal or state funding programs for all eligible capital improvements.
29. As shown on the City of Madras Urban Area Comprehensive Plan and Zone Map, the majority of the airport is not located in the City of Madras Urban Growth Boundary (UGB) or city limits. The City of Madras should work with Jefferson County to extend the UGB to incorporate the entire airport and annex the area into the city. The airport should be zoned to permit and support aeronautical operations while limiting uses that are not consistent with airport uses and operations, as stipulated by the Oregon Department of Aviation (ODA) and the Federal Aviation Administration (FAA). Existing city zoning for aviation and non-aviation portions of the airport should be applied to the entire airport site.

Chapter Two
Inventory of Existing Conditions

CENTURY WEST
ENGINEERING CORPORATION

Madras Municipal Airport

CHAPTER TWO
INVENTORY OF EXISTING CONDITIONS

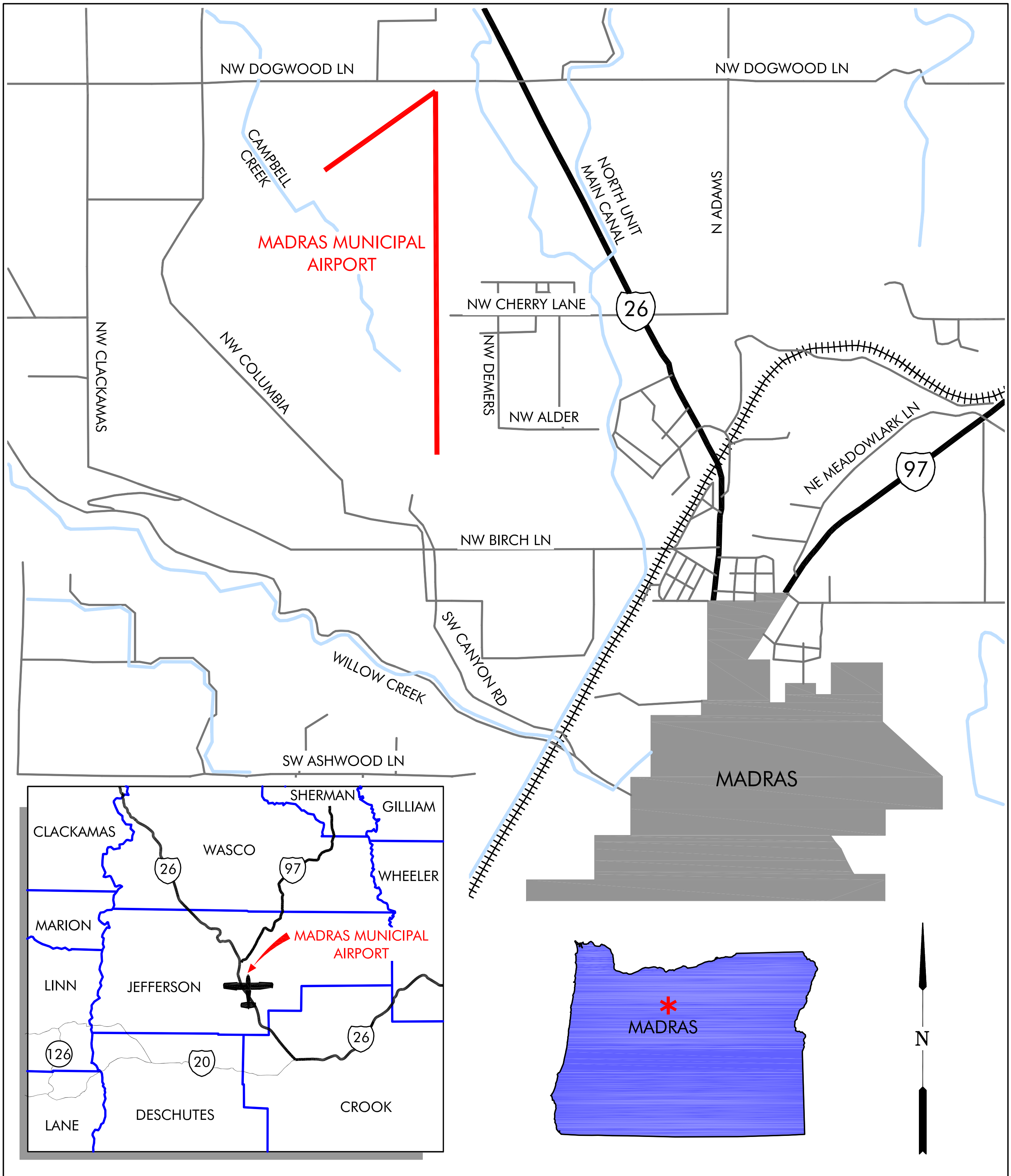
Introduction

This chapter documents existing conditions at the airport for the purpose of providing an accurate information base to support updated planning. Existing airfield facilities were examined during on-site inspections to update facility inventory data collected in prior planning efforts. A new aerial photograph was recently flown for the airport for use in this project. Data from a variety of sources are used in this evaluation:

- **Madras Municipal Airport– Individual Airport Report** (Oregon Department of Aviation, 2008)
- **Madras Municipal Airport - 2006 Pavement Management Report**
- **1997 Airport Layout Plan Report** (Aron Faegre & Century West)
- **FAA Airport Master Record Form (5010-1)**
- **Soil Survey of Upper Deschutes River Area, Oregon (**NRCS, 1999**)**
- **City of Madras Comprehensive Plan and Zoning Ordinance**
- **Jefferson County Comprehensive Plan and Zoning Ordinance**
- **FAA Airport/Facility Directory (A/FD); Seattle and Klamath Falls Sectional Aeronautical Charts; L-1/L-2 IFR Enroute Low Altitude Chart**
- **City of Madras Airport Documents**

AIRPORT LOCALE

Madras Municipal Airport is located approximately three miles northwest of the Madras city center. Madras is located approximately 118 miles southeast of Portland and 26 miles north of Redmond at the junction of U.S. Highways 26 and 97. A location map is provided in **Figure 2-1**. Highway 26 is a primary east-west travel route through central Oregon that extends from the Oregon coast and Portland to Madras, Prineville and points east into Idaho. Highway 97 extends north to Biggs then continues into Washington; and south to Redmond, Bend and Klamath Falls before continuing into California.



CENTURY WEST ENGINEERING CORPORATION

LOCATION MAP

FIGURE 2-1

MADRAS MUNICIPAL AIRPORT
AIRPORT MASTER PLAN UPDATE

Madras is the largest incorporated city and the county seat for Jefferson County. The airport site consists of approximately 2,107 acres located near the north end of the Madras city limits and urban growth boundary (UGB). Surface access to the airport is provided via Cherry Lane, which connects directly to U.S. Highway 26, a major east-west travel route through Oregon. Airport elevation is recorded (surveyed) at 2,437 feet above mean sea level (MSL).

AIRPORT HISTORY

The City of Madras website provides the following description of the airport's history:

"In 1938, the Madras Airport Association was organized and a small airstrip was built to accommodate one crop duster plane and the airplane which was to become the key element in the Civilian Air Patrol established at that time. By 1942, however, construction was underway to develop a large airbase for the United States Army to train B-17 bomber pilots. Because of the air traffic patterns and the ideal climate for year-round training, Madras was deemed the ideal location for such a site. With adequate flat land available for handling larger runways, the Madras Air Base went into full operation not just for B-17's but also a few B-22 Flying Fortresses. In 1944, this became a major location for P-63 fighter plane training as well."

The Exhibit "A" Airport Property Map (2008 update) notes that 2,112.03 acres comprising the airport was transferred through quitclaim deed from the United States to the City of Madras and Jefferson County, Oregon on July 16, 1948. The property map notes that nine parcels totaling 20.82 acres within the airport industrial park have been sold, reducing overall airport acreage (in fee ownership) to 2091.21 acres. In 2004, Jefferson County transferred its ownership rights for the airport property to the City of Madras by quitclaim deed (February 25, 2004). In consideration for the conveyance, the City sold the County approximately 20 acres on which the County Jail Facility is located within the airport industrial park.

The military-constructed airfield included three paved runways (N/S, NW/SE, and NE/SW) in a closed triangular configuration ranging from 7,200 to 8,500 feet long. According to historic airport planning documents, the current parallel taxiway for Runway 16/34 was converted from its original use as a taxiway to a runway in 1960; the runway was converted back to a taxiway in the early 1990s.

The 1974 Airport Layout Plan (CH2M Hill) depicted the three original runways and the fourth runway constructed in 1960: Runway 16/34 (then designated 16R/34L) 8,500' x 150'), Runway 3/21 (now designated 4/22) 7,270' x 150'), Runway 11/29 (7,200' x 150'), and Runway 16L/34R (now the parallel taxiway) 3,600' x 100'. The ALP indicated that each of the original runways was planned for shortening or closure and the shorter north-south parallel runway was "to be phased out by 1985." The ALP depicted a "future" NE/SW runway (designated 5/23 – 3,700' x 75') that would intersect with the north-south parallel runways (16/34) near their north ends. Runway 3/21 (now designated 4/22) was to be closed when the new runway was constructed.

The 1987 Airport Layout Plan (Tenneson) depicted three active runways with Runway 11/29 closed; Runway 16R/34L was shortened and narrowed (5,000' x 75'), Runway 16L/34R was identified "to be converted to taxiway," and Runway 3/21 (now designated 4/22) was shortened and narrowed (2,700' x 50'). The previous recommendation to construct Runway 5/23 was not maintained in the updated plan.

The 1997 Airport Layout Plan (Faegre) depicted the runway/taxiway system as it currently exists with the former Runway 16R/34L converted to a taxiway.

Recent airport improvements include construction of a new general aviation terminal building, auto parking and roadway improvements, apron improvements and construction of one conventional aircraft storage hangar. In 2009, construction began on a large commercial hangar north of the terminal area. The 40,000 square-foot hangar will accommodate Butler Aviation's aircraft maintenance facility, which is being relocated from Roberts Field in Redmond.

GEOGRAPHY/GEOLOGY

Madras is located in the north–central region of Oregon, adjacent to the eastern foothills of the Cascade Range in the lower Deschutes Valley. The airport is located north of the Madras city center in the area known as the Agency Plains, which is elevated about 200 feet above town. The terrain surrounding the airport rises from 2,000 feet to more than 3,300 feet within ten miles. Madras Municipal Airport has a published elevation of 2,437 feet MSL.

Maximum elevation figures (MEF) depicted on the Seattle and Klamath Falls Sectional Aeronautical Charts provide pilots information on the highest known terrain elevation (above mean sea level - MSL) within defined quadrangles. The MEFs surrounding Madras Municipal Airport range from 4,800 feet to the northwest and west to 6,400 feet to the southeast. Mount Jefferson (10,497 feet) is located approximately 27 miles west of the airport. The Warm Springs Indian Reservation is located northwest of Madras; the northern section of the Deschutes National Forest is located west of Madras; and the western section of the Ochoco National Forest is located southeast of Madras.

The Soil Survey of Upper Deschutes River Area[2] indicates that predominate soil type in the vicinity of Madras Airport is **Madras loam, with slopes of 0 to 3 percent.** The soil survey states: *"Madras soils are 22 to 40 inches deep to bedrock and are well drained. The surface layer is brown loam 0 to*

[2] Soil Survey of Upper Deschutes River Area, Oregon – U.S. Natural Resources Conservation Service (NCRS), 1999.

10 inches thick; underlying layers are yellowish brown loam and clay loam, with deeper layers of semi-consolidated sediment and basalt. Permeability is moderately slow. Native vegetation includes Western juniper, basin big sagebrush, antelope bitterbrush, bluebunch wheatgrass, and Idaho fescue. The average precipitation is 8 to 10 inches and elevations range from 2,000 to 3,000 feet."

CLIMATE

Weather conditions play an important role in the planning and development of the airport. Temperature and wind direction directly affect runway length and alignment; cloud coverage and precipitation affect visibility and are primary determinants for navigational aids and lighting.

Madras is located in the shadow of the Cascade Range which significantly reduces precipitation and results in a higher frequency of visual flight rules (VFR) weather conditions than found on the west side of the Cascade Range. The region experiences considerable thunderstorm activity during the warmer months, although precipitation averages less than 1 inch per month through the summer.

The nearest National Weather Service observation station is Madras 1NNW (Station # 355142), located approximately 1 mile north-northwest of Madras.[3] Based on data collected between 1952 and 2008 (56 years), annually precipitation averages 11.39 inches, with nearly half occurring during the four-month period from November through February. Annual snowfall accumulation averages 15 inches. The mean maximum temperature in July (warmest month) is 85.1 degrees F., and the mean minimum temperature in January (coldest month) is 24.5 degrees F.

Historic wind data collected at the airport in 1943-1944 estimated that Runway 16/34 was aligned with approximately 93.5 percent of local wind conditions based on a 12 mile per hour crosswind component. The overall percentage of wind coverage increased to 98.1 percent with a NE/SW runway. The wind data suggests than prevailing winds are generally north-south with periodic eastern and western variability.

AIRFIELD FACILITIES

Historically, Madras Municipal Airport has served predominantly small single-engine and twin-engine aircraft associated with transient and locally-based general aviation aircraft activity. The airport also accommodates turbine aircraft activity associated with business aviation aircraft (turboprop or business jet), aerial applicators, occasional military or government-related activity, and limited helicopter operations. It is noted that a large hangar currently under construction at the

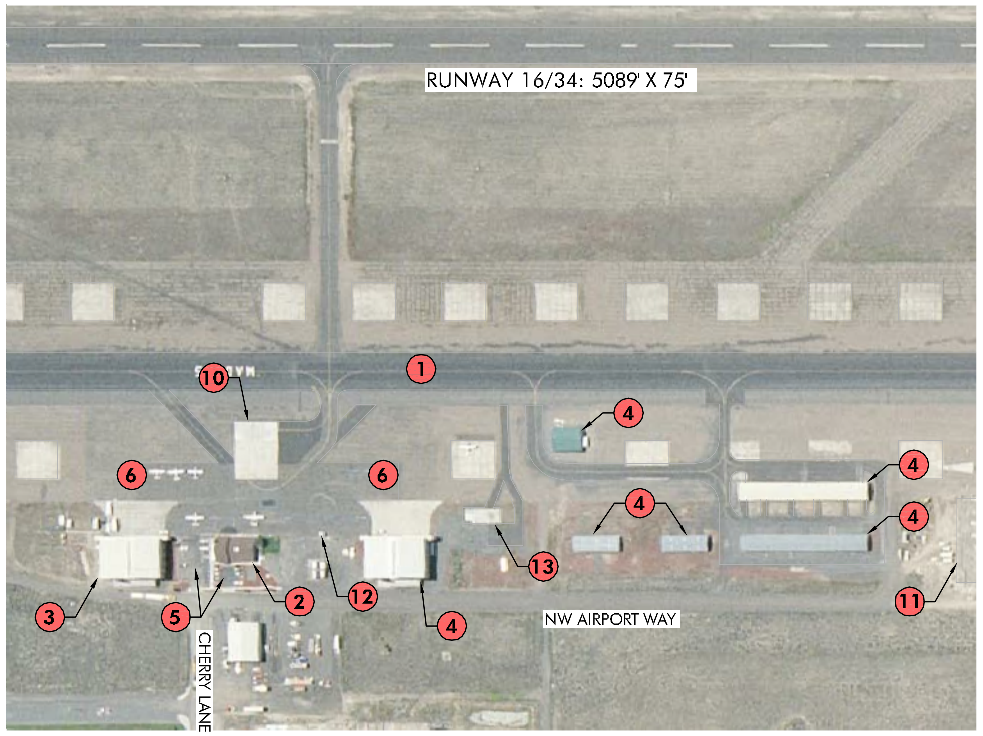
[3] Western Regional Climate Center (WRCC) Data, 2009

airport will accommodate maintenance operations for large firefighting aircraft (DC-7, C130, etc.). The potential effects of large aircraft activity at the airport will be addressed in subsequent sections of the master plan update.

Figure 2-2 illustrates existing facilities at the airport. All landside facilities at the airport (aircraft parking, hangars, fuel, etc.) are located on the east side of the main runway. Table 2-1 summarizes airport data.

TABLE 2-1: AIRPORT DATA

Airport Name / Designation	Madras Municipal Airport (S33)
Airport Owner	City of Madras and Jefferson County, Oregon
Date Established	1938 *(date of initial construction)*
Airport Category	• National Plan of Integrated Airport Systems (NPIAS): General Aviation • FAA Airport Reference Code (ARC): B-II *(as noted on the 1997 ALP)* • Oregon Aviation System Designation: Category IV – Local General Aviation Airport
Airport Acreage	2,091.21 acres (in fee). *(as depicted on current Exhibit "A" Property Plan)*
Airport Reference Point (ARP) Coordinates	N 44º 40' 12.6" W 121º 09' 18.6"
Airport Elevation	2,437 feet above Mean Sea Level (MSL)
Airport Traffic Pattern Configuration / Altitude	Left Traffic (Approximately 3,200 feet MSL)



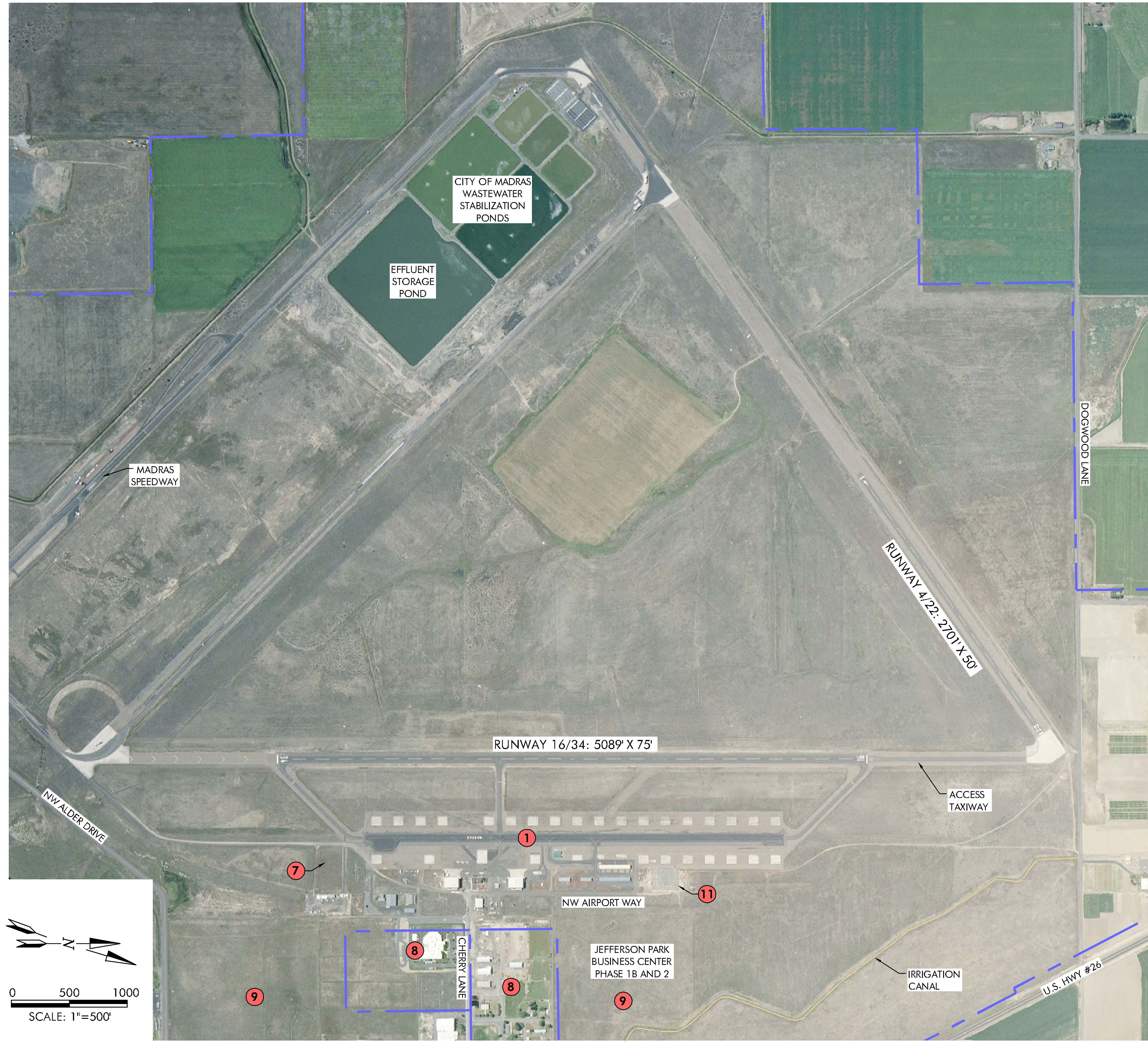
TERMINAL AREA

N

0 200 400
SCALE: 1"=200'

LEGEND

1 PARALLEL TAXIWAY	8 AIRPORT INDUSTRIAL PARK
2 TERMINAL BUILDING	9 PLANNED NON-AVIATION INDUSTRIAL PARK EXPANSION
3 MAINTENANCE HANGAR	10 BUSINESS AC PARKING
4 STORAGE HANGARS	11 CITY COMMERCIAL HANGAR SITE
5 AUTO PARKING	12 AIRCRAFT FUELING AREA
6 TIEDOWN APRON	13 AIRCRAFT WASH PAD
7 AGRICULTURAL AVIATION AREA	



N

0 500 1000
SCALE: 1"=500'

CENTURY WEST
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MADRAS MUNICIPAL AIRPORT
EXISTING CONDITIONS

FIGURE NO.
2-2

Runways & Taxiways

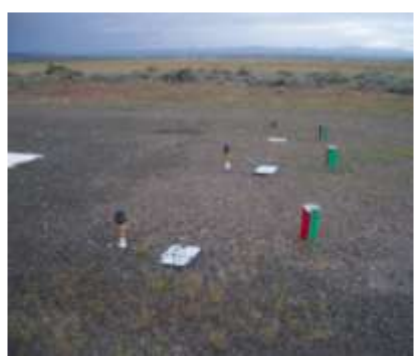
Table 2-2 summarizes existing runway and taxiway facilities at Madras Municipal Airport.

<u>Runways</u>

Madras Municipal Airport has two paved runways in a modified "open-V" configuration. The runways are connected by a single access taxiway that extends from the north ends of each runway. The primary runway (16/34) has a north-south orientation and the secondary runway (4/22) has a northeast-southwest orientation.

<u>Runway 16/34</u>

Runway 16/34 has a published length of 5,089 feet and a width of 75 feet. The runway has an asphalt surface, basic visual markings, and is in good condition. The effective gradient of the runway is 0.131 percent, with the high point (surveyed 2433.41 feet MSL) located at its south end. Runway 16/34 is served by a full length parallel taxiway on its east side. Runway markings consist of runway end numbers and centerline stripes. All runway markings are in white paint and are in good condition. The runway is lighted and is also equipped with reflective edge markers that were previously installed as part of a navigational aid testing program. As a result, the edge lights, taxiway exit location lights and threshold lights have equivalent reflectors installed adjacent to each light fixture. Runway 34 is equipped with a visual approach slope indicator (VASI).



The current FAA Airport Record Form 5010-1 and FAA Airport/Facility Directory (A/FD) identifies the following weight bearing capacity for Runway 16/34:

- 75,000 pounds for aircraft equipped with single-wheel (SW) landing gear
- 120,000 pounds for aircraft equipped with dual-wheel (DW) landing gear
- 180,000 pounds for aircraft equipped with dual tandem (DT) landing gear

Questions about the origin and accuracy of the published pavement strength data were recently raised by the airport sponsor. Century West Engineering was asked to evaluate available pavement data and calculate approximate pavement strength using the FAA's airfield pavement design software.

Based on a review of the historic pavement data summarized in the airport's 2006 Pavement Maintenance Plan (PMP), it appears that the published weight bearing capacity data for Runway 16/34 is not consistent with the pavement sections described for the runway.

According to the 2006 PMP report, Runway 16/34 has a 2-inch surface course of asphaltic concrete (AC) over 8-inch aggregate base. The connector taxiways have a similar section, and the parallel taxiway had a 5-inch AC surface course and a 14-inch aggregate base. Records indicate that the parallel taxiway was reconstructed in 2004 and the failing AC section was ground up. Approximately 2" of material were removed and 2" of AC was placed at the surface. For weight rating calculations, it can be considered to have 2" AC over 17" of subbase.

Based on these conditions and a CBR[4] rating value for the subgrade soils between 3 and 6, the FAA pavement design model was used to back-calculate pavement strengths. It appears that the runway and taxiway connectors should be rated at approximately 12,500 pounds for single wheel (SW) aircraft and the parallel taxiway approximately 20,000 pounds SW. Technical pavement testing may be required to verify the accuracy of the historic surface course, base and subbase section data described in the PMP.

Runway 4/22

Runway 4/22 has a published length of 2,701 feet and a width of 50 feet. The runway has an asphalt surface, basic visual markings, and is in good condition. The effective gradient of the runway is 0.277 percent, with the high point (surveyed 2424.4 feet MSL) located at its north end. The runway has a published weight bearing capacity of 16,000 pounds for aircraft with single wheel (SW)

[4] California Bearing Rating (CBR)

landing gear. However, as noted earlier, the surface and base course sections listed in the airport's PMP are consistent with a rating of approximately 12,500 pounds.

Runway markings consist of runway end numbers and centerline stripes (fair condition). All runway markings are in white paint. The runway is not lighted and is not equipped with visual guidance indicators (VGI).

Runway 4/22 is served by a single access taxiway that extends from the end of Runway 16 to a concrete apron/holding area located at the end of Runway 22.

Taxiways and Taxilanes

Madras Municipal Airport has a system of taxiways and taxilanes that provide aircraft access to airside and landside facilities. Runway 16/34 is served by a full length parallel taxiway on its east side connected with one 90-degree exit taxiway and two angled taxiways at each end of the runway. The parallel taxiway is 35 feet wide and the midfield exit taxiway is 25 feet wide. The runway to parallel taxiway separation (measured from centerline to centerline) is 680 feet. Aircraft holding/run-up areas are located at the south and north ends of the parallel taxiway. The markings on the parallel taxiway and connectors are in fair condition and include a centerline stripe and aircraft hold lines. The aircraft hold lines are located 200 feet from runway centerline, which coincides with the outer edge of the obstacle free zone (OFZ) for Runway 16/34.

The main apron is located south of mid-runway and has two direct taxiway connections to the parallel taxiway. Two small taxiways connect the parallel taxiway to the main apron. The taxiways are 30 and 35 feet wide and are in fair condition with centerline stripes. The north taxiway and the outer portion of the aircraft apron have blue edge reflectors; the south taxiway does not have edge reflectors. Portions of these taxiways were improved in 2005 in conjunction with expansion of the Portland cement concrete section of apron. A north-south taxilane extends through the main apron, adjacent to the aircraft tiedowns, the general aviation terminal, aircraft fueling area, and the two large Quonset hangars located at each end of the apron.

The north access taxiway is 35 feet wide and extends approximately 1,335 feet from the end of Runway 16 to a concrete aircraft holding apron at the end of Runway 22. The taxiway has an asphalt surface and is in good condition. The markings on the taxiway are in fair condition and include a centerline stripe and yellow arrow heads pointing to the Runway 16 threshold bar (white paint). White markings (centerline stripe and arrowheads) are used on the concrete apron leading to the Runway 22 end. By FAA standard, all taxiway markings should use yellow paint.

A single access taxiway is located north of the main apron and south of the north hangar area taxilanes. The taxiway connects an aerial applicator apron to the parallel taxiway.

The airport has several taxiways/taxilanes that provide access within the north hangar area. These taxiways/taxilanes vary in age (1943 to 1998), width (10 feet to 25 feet), and condition (failed to excellent). Several of the taxilanes have centerline stripe markings.

The major access taxiways have reflective edge markers installed along the outer edge of the pavement. The location of each exit taxiway along the runway is identified with edge lights with blue lenses. The taxiway exits at each end of the runway have two fixtures located on the interior side; the taxiway exit located near the middle of the runway has two sets of fixtures (each with two lights) located on each side which identify the exit from both directions along the runway.

TABLE 2-2: RUNWAY DATA

Runway 16/34	
Dimensions	5,089 x 75 feet
Effective Gradient	0.131%
Surface/Condition	Asphalt/Good
Weight Bearing Capacity*	Published Data (FAA 5010 airport record form): • 75,000 pounds (single wheel landing gear) • 120,000 pounds (dual wheel landing gear) • 180,000 pounds (dual tandem wheel landing gear) ** Note: pavement section data for main runways and taxiways suggests that actual weight bearing capacity ranges from 12,500 to 20,000 pounds SW.*
Marking	Basic (Visual) white paint: runway numbers, centerline stripe (good or fair condition); taxiway lead-in lines (yellow paint – worn/faded)
Lighting	Medium Intensity Runway Edge Lighting (MIRL) ; Threshold Lights Runway Edge Reflectors Visual Approach Slope Indicator (VASI) - Runway 34 Airport Beacon (mounted on roof of South Quonset hangar) Lighted Wind Cone (east side of runway)
Signage	None
Wind Coverage	Runway 93.5% @ 12 mph (based on 12 months data May 1943 to May 1944)
Runway 4/22	
Dimensions	2,701 x 50 feet
Effective Gradient	0.277%
Surface/Condition	Asphalt/Good
Weight Bearing Capacity*	Published Data (FAA 5010 airport record form): • 16,000 pounds (single wheel landing gear) ** Note: pavement section data for runway suggests that actual weight bearing capacity is approximately 12,500 pounds SW.*
Marking	Basic (Visual) white paint: runway numbers, centerline stripe
Lighting	None
Signage	None
Wind Coverage	N/A

TABLE 2-3: TAXIWAY DATA

Parallel Taxiway	• 5,537 x 35 feet (includes angled sections at each end of Runway 16/34) • Asphalt Surface (very good condition) • One 90-degree Exit Taxiway (35 x 610 feet) • Angled Taxiway connections at each runway end (937 and 1,000 feet long; 35 feet wide) • A/C Hold Areas at each runway end • Centerline Stripe and A/C Hold Lines on all taxiway connections to runway.
North Access Taxiway	• 1,355 x 35 feet • Asphalt Surface (good condition) • Centerline stripe and arrowheads identifying Runway 16 threshold (fair condition)
Hangar Taxilanes	• Asphalt Surface (very good to poor condition) • 10 to 25 feet wide, varying lengths • Centerline stripes on some hangar taxilanes
Main Apron Access Taxiways (2)	• Angled taxiways connecting the main apron to the parallel taxiway • Asphalt Surface (fair to good condition) • South Taxiway (185 x 30 feet); North Taxiway (172 x 35 feet) • Centerline stripe (good condition)
North AG Apron Access Taxiway	• Approximately 230 feet long; connects AG apron to parallel taxiway

Airport Lighting

Madras Municipal Airport accommodates day and night operations in visual flight rules (VFR) and instrument flight rules (IFR) conditions. All airport lighting systems appear to be in good condition and function normally.

Madras Municipal Airport has the following types of lighting systems:

- Airport Lighting – airport identification
- Runway Lighting – runway identification
- Visual Guidance Indicators (VGI) – visual landing aid
- Other Lighting - miscellaneous

Airport Lighting: The airport has a rotating beacon mounted on the roof of the south Quonset hangar near the main aircraft apron on the east side of the runway. A lighted wind cone is located on the east side of the runway near mid-field, between the runway and parallel taxiway. The beacon and wind sock lighting operate on photo-cell switches and reportedly function normally.

Runway Lighting: Runway 16/34 is equipped with medium intensity runway lighting (MIRL) system that includes edge lights and threshold lights. The MIRL is pilot-activated using the common traffic advisory frequency (CTAF) 122.8 MHz. As noted earlier, several edge light fixtures located at taxiway exits have blue lenses installed, providing a visual indication of taxiway exit locations along the runway. The threshold lights consist of two sets of three fixtures near each corner of the runway ends. The fixtures have split lenses (green/red) indicating the beginning and end of the runway. The runway lights reportedly function normally and appear to be in good condition. Runway 4/22 is not lighted.

Visual Guidance Indicators (VGI): Runway 34 is equipped with Visual Approach Slope Indicator (VASI) that is pilot-activated using the common traffic advisory frequency (CTAF) 122.8 MHz. The 4 box VASI is installed on the west side of the runway and has a standard 3-degree glide path. A VASI projects light along a standard glide path to a runway end, with red and white colored lights indicating the aircraft's vertical position (above, below, or on glide path) relative to the glide path. The system reportedly functions normally and is in good condition. Runways 16, 4 and 22 are not currently equipped with a VGI.

Other Lighting: Limited flood light is located near the apron and fueling area. Some hangars also have exterior wall-mounted flood lights.

Table 2-4 summarizes existing airfield lighting at Madras Municipal Airport.

TABLE 2-4: AIRPORT LIGHTING

Component	Type	Condition
Runway 16/34	Medium Intensity Runway Edge Lighting (MIRL) Threshold Lights Reflective Edge Markers (white)	Good
Taxiway Lighting	Taxiway Location Lights on Runway at each Exit Taxiway Edge Reflectors (blue)	Good
Lighted Airfield Signage	Instruction Signs [34-16] Reflective	Good
Runway Approach Lighting	None	N/A
Visual Guidance Indicators	4-Light VASI w/ 3-degree glide path (Rwy 34)	Good
Airport Lighting	Lighted Wind Cone; Rotating Beacon; Exterior Flood Lights	Good

Airfield Pavement Condition

As part of the Oregon Continuous Aviation System Plan, the Oregon Department of Aviation (ODA) manages a program of pavement evaluation and maintenance for Oregon's airports. This evaluation provides standardized pavement condition index (PCI) ratings[5], pavement features and current conditions. Through the use of MicroPAVER computer software, current pavement condition ratings are entered into the system with the specifics of each pavement section. The program is able to predict the future condition of the pavements if no action is taken (i.e., rate of

[5] PCI Rating Scale 0 to 100 (failed to excellent).

deterioration) while also identifying the recommended measures needed to extend the useful life of the pavement section.

According to the pavement maintenance plan's project history map, the majority of airfield pavements at Madras Municipal Airport were constructed in 1943.[6] Several original pavement sections have been reconstructed or rehabilitated, and the current runways have been shortened and narrowed from their original configuration. The 90-degree exit taxiway for Runway 16/34 was constructed in 1990; several north hangar taxiways/taxilanes were constructed in 1998; and the newer concrete and asphalt sections of the main apron were constructed in 2005.

Table 2-5 summarizes airfield pavement conditions for Madras Municipal Airport based on the data contained in the airport's 2006 pavement study. The 2006 study indicated that the airfield pavements (runway, taxiways, apron) totaled 1,073,092 square feet (24.6 acres).

In the 2006 inspection, most of the airfield pavements were rated "very good" or "excellent." Original Portland Cement Concrete sections of the main apron and the apron located adjacent to the end of Runway 22 were rated "failed." The southern connecting taxiway between the main apron and parallel taxiway was rated "fair." Some of the north hangar taxilanes were rated "fair or poor."

The numerical ratings for all pavements ranged from 5 to 100, with an average of 73 (very good), up from the average rating of 65 (good) during the 2003 inspection. The 2006 pavement inspection indicates "The primary distresses observed during the inspection of asphaltic concrete pavement were longitudinal and transverse cracking, blocking cracking, weathering/raveling, and joint reflection cracking with isolated occurrences of alligator cracking, depression, patching, rutting and swelling. The primary distresses observed during the inspection of Portland cement concrete were joint seal damage, joint spall, corner spall, durability crack, scaling, linear crack, shattered slab, and shrinkage crack with isolated occurrences of corner break, small patch, faulting, and blow up."

[6] Madras Municipal Airport October 2007 Pavement Management Report (field survey completed in October 2006).

TABLE 2-5: SUMMARY OF AIRFIELD PAVEMENT CONDITION (2006 PCI DATA)

Pavement	Section Design/Age	2006 PCI Rating[1]	2006 Condition
Runway 16/34	2” Asphalt (AC) Surface (1990); 3” Crushed Aggregate Base (1990); 5” Aggregate Base (1943)	71	Very Good
Parallel Taxiway (center section)	3” Asphalt (AC) Surface (1977); 2” Asphalt (AC) Surface (1943); 4” Aggregate Base (1943); 10” Aggregate Subbase (1943)	100	Excellent
Parallel Taxiway (north & south connectors)	2” Asphalt (AC) Surface (1990); 8” Crushed Aggregate Base (1943)	86 (south) 80 (north)	Excellent (south) Very Good (north)
Runway 16/34 – Midfield Exit Taxiway	2” Asphalt (AC) Surface (1990); 9” Crushed Aggregate Base (1990)	81	Very Good
South A/C Holding Area on Parallel Taxiway	3” Asphalt (AC) Surface (1977); 2” Asphalt (AC) Surface (1943); 4” Aggregate Base (1943); 10” Aggregate Subbase (1943)	100	Excellent
North A/C Holding Area on Parallel Taxiway	3” Asphalt (AC) Surface (1977); 2” Asphalt (AC) Surface (1943); 4” Aggregate Base (1943); 10” Aggregate Subbase (1943)	47	Fair
Runway 4/22	2” Asphalt (AC) Surface (1990); 8” Crushed Aggregate Base (1943)	74	Very Good
Connecting Taxiway (Rwy 16 end to Rwy 22 end)	2” Asphalt (AC) Surface (1990); 8” Crushed Aggregate Base (1943)	81	Very Good
AC Hold Area (@ Rwy 22 end)	9” PCC (1943); Unknown Subbase (1943)	5	Failed
Main Apron (main area)	2” Asphalt (AC) Surface (1990); 3” Asphalt (AC) Surface (1943); 4” Aggregate Base (1943); 10” Aggregate Subbase (1943)	81	Very Good
Main Apron (north & south original PCC sections)	Unknown PCC (1943); 3” Crushed Aggregate Base (1943); 4” Aggregate Base (1943); 10” Aggregate Subbase (1943)	80 (south) 61 (north)	Very Good (south) Good (north)
Main Apron (original PCC center section)	Unknown PCC (1943); 3” Crushed Aggregate Base (1943); 4” Aggregate Base (1943); 10” Aggregate Subbase (1943)	8	Failed
Main Apron (new PCC section)	9” PCC (2005); 6” Crushed Aggregate Base (2005); 6” Crushed Aggregate Subbase (2005)	100	Excellent
Main Apron (new asphalt section)	4” Asphalt (AC) Surface (2005); 6” Crushed Aggregate Base (2005); 12” Crushed Aggregate Subbase (2005)	100	Excellent
Main Apron Taxiway Connector (south)	3” Asphalt (AC) Surface (1977); 2” Asphalt (AC) Surface (1943); 4” Aggregate Base (1943); 10” Aggregate Subbase (1943)	51/54	Fair
Main Apron Taxiway Connector (north)	2” Asphalt (AC) Surface (1990); 9” Aggregate Base (1990)	60	Good
North Hangar Taxilanes	Various Sections: 2” AC (1998); Unknown Base (1998) 2” AC (1998); Unknown PCC (1943); Unknown Subbase (1943) Unknown AC; Unknown Base	21 to 100	Very Poor to Excellent

1. The Pavement Condition Index (PCI) scale ranges from 0 to 100, with seven general condition categories ranging from “failed” to “excellent.”

The condition of the airfield pavements observed during site visits conducted for this project in spring and summer 2009 was generally consistent with the 2006 evaluations, factoring in three additional years of use and recent pavement maintenance projects. During the recent site visits, areas of vegetation growth were observed in cracks on various pavement sections; recent crack filling was observed on the apron, parallel taxiway and runway; and small areas of edge cracking and distress were observed on some taxiway sections. Large amounts of debris (disintegrated asphalt and gravel) were observed on sections of the aircraft parking apron. Areas of deteriorating (abandoned) asphalt pavement located adjacent to the main apron and taxiways appear to be the source for the foreign object debris (FOD) on the main apron. Some aircraft tiedown anchors set in concrete have become significantly exposed above the asphalt surface of the apron. The PCC apron located adjacent to the end of Runway 22 had large amounts of loose aggregate on the surface, consistent with failed pavement.

LANDSIDE FACILITIES

Aircraft Apron

Table 2-6 summarizes existing apron facilities at the airport. The main aircraft apron at Madras Municipal Airport is located on the east side of Runway 16/34, south of mid-runway. The apron accommodates aircraft parking, aircraft fueling, and it provides access to the general aviation terminal and the two large hangars located at each end of the apron. The apron is approximately 560 feet by 160 feet, with 12 aircraft tiedowns currently in use. Additional tiedown anchors and cables observed in the gravel areas beyond the north and south ends of the apron do not appear to be in use. A business aircraft parking position is located on a concrete section of apron located in front of the general aviation terminal building. Aircraft access to the parking position is provided by the north connecting taxiway between the parallel taxiway and apron. The aircraft fueling area is located north of the terminal building at the back of the main apron.

An aerial applicator loading area is located near the north end of the main apron. It appears that this facility is not in regular use. The local aerial applicator has a separate gravel apron area located south of the terminal area, near the end of Runway 34.

TABLE 2-6: AIRCRAFT APRON DATA

Main Apron	• Approximately 560 x 160 feet (9,955 square yards) • Surface: Asphalt • 12 Aircraft Tiedowns (with concrete anchors) • 1 Business Aircraft Parking Position (Portland Cement Concrete)
Aerial Applicator Apron (north)	• Approximately 90 x 120 feet (1,200 square yards) • Surface: PCC/Asphalt • Aerial Applicator Operations and AC Parking
Aerial Applicator Apron (south)	• Surface: Gravel • Aerial Applicator Operations and AC Parking
Runway 22 Holding Area	• Approximately 313 x 255 feet (8,868 square yards) • Surface: Portland Cement Concrete

Hangars and Airport Buildings

Madras Municipal Airport has a variety of hangars including two WWII-vintage hangars that are used for aircraft maintenance and storage; two 9-unit T-hangars; two 3-unit hangars; one small/medium conventional hangar; and one large commercial hangar currently under construction.

The airport has a 3,500 square foot terminal building that was constructed in 2005. The building includes office space for the fixed base operator (FBO)/airport manager, pilot facilities, public restrooms, conference room, a reception area and a kitchen/vending area.

Two large conventional hangars are located south of the main apron, adjacent (east) to the access taxiway that extends from the south end of the apron to the parallel taxiway. Both hangars have west-facing doors. The northern hangar (3-unit conventional) has a small apron area between the building and access taxiway; the large hangar (single unit) has a small apron located adjacent to the south end of the access taxiway.

The hangars on the airport appear to be in good or fair condition. The two large Quonset hangars were constructed in 1943 and require considerable ongoing maintenance to maintain their

function. The small/medium conventional hangar, the airport terminal building, and the large commercial hangar currently under construction have been added since the plan update was completed in 1997. Existing airport buildings are summarized in **Table 2-7** and depicted in **Figure 2-2** earlier in the chapter.

TABLE 2-7: EXISTING AIRPORT BUILDINGS

Bldg. No.	Building
1	Terminal Building
2	South Quonset Hangar (aircraft maintenance and storage) Approximately 11,000 sf (main floor area)
3	North Quonset Hangar (aircraft storage) Approximately 11,000 sf (main floor area)
4	T-Hangar (9-unit) *North hangar area – (west building)*
5	T-Hangar (9-unit) *North hangar area – (east building)*
6	Hangar (3-unit) *North hangar area (south of T-hangars)*
7	Hangar (3-unit) *North hangar area (south of T-hangars)*
8	Conventional Hangar *North hangar area – (outer row)*
9	Large Conventional Hangar *North hangar area – (north of T-hangars)* Approximately 40,000 sf
10	Aerial Applicator Buildings *(south of terminal area)* *(4 buildings not currently in use, fenced to prevent access)*
11	Aerial Applicator Buildings *(near end of Runway 34)* *Active Operations Area*
12	Aircraft Fuel Pump Shed

AIRPORT SUPPORT FACILITIES

Aircraft Fuel

The airport has two single wall aboveground fuel storage tanks used for 100LL aviation gasoline (AVGAS) and Jet Fuel. The AVGAS tank has a useable capacity of 10,000 gallons and the jet fuel tank has a capacity of 20,000 gallons. The fuel pumps are located north of the terminal building near the northeast corner of the main apron. The system is equipped with cardlock system to allow 24-hour self fueling. Although the fuel tanks are older single wall designs, the fuel system is in good condition and no mechanical problems have been identified. The FBO also operates several small fuel trucks. The local aerial applicator has private fuel storage located south of the terminal area.

Security

The airport boundary has limited range fencing with limited chain link or other fencing adjacent to the terminal apron. The fencing in the terminal area has several pedestrian or vehicle gates. Some gates are padlocked. There are no controlled access points for the airfield with automated (electronic keypad) gates.

Utilities

Water, sewer, electrical, natural gas and telephone service are available in the vicinity of the airport. The airport's east development area and the airport industrial park are fully serviced with utilities. The City of Madras provides water and sewer service; Cascade Natural Gas provides natural gas service. Pacific Power & Light provides electrical service. Major utility lines extend along Cherry Lane and NW Airport Way, which parallels the terminal apron and hangars.

Vehicle Access and Parking

Surface access to the east side of the airport is provided via Cherry Lane, which connects to U.S. Highway 26. NW Airport Way connects to Cherry Lane and extends north to provide access to the north hangar area. Demers Drive extends south of Cherry Lane and serves facilities located south of the terminal area.

A designated automobile parking area is located adjacent to the terminal building with 28 paved spaces. Additional vehicle parking is available adjacent to individual hangars. The design for the commercial hangar currently being constructed in the north hangar area indicates that 36 paved parking spaces will be provided adjacent to the new hangar.

AIRSPACE AND NAVIGATIONAL AIDS

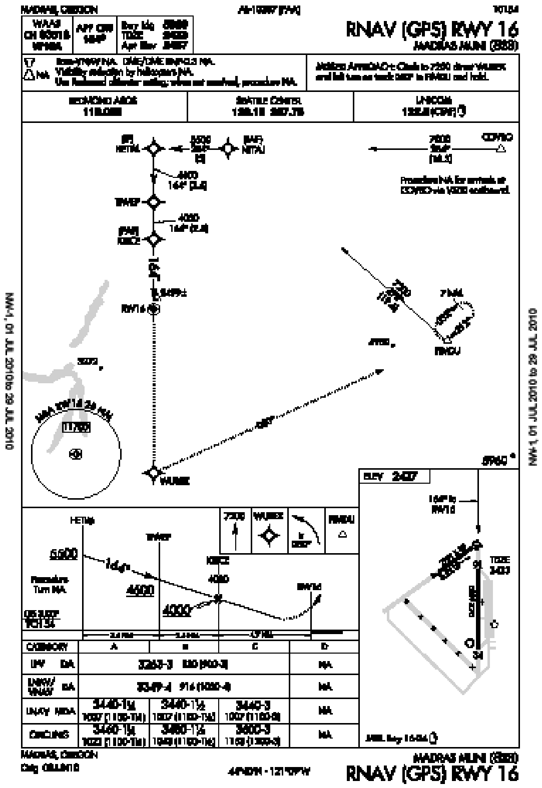
Madras Municipal Airport has two published instrument approaches and operates under visual flight rules (VFR) and instrument flight rules (IFR) conditions. The airport does not have on-site weather observation.

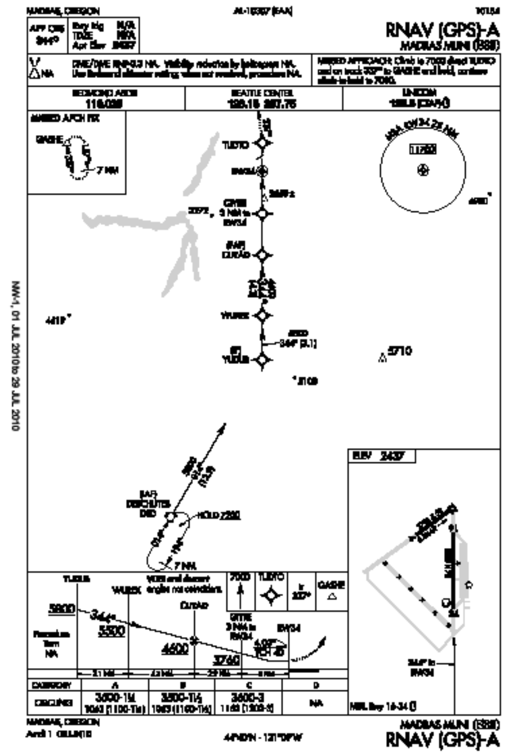
Madras Municipal Airport has two RNAV (GPS) instrument approaches. The RNAV (GPS) Runway 16 approach is a new straight-in procedure that was commissioned in 2010. The Runway 16 approach provides lower approach minimums than the RNAV (GPS) – A approach, which is classified as a “circling” approach, although the inbound course (341 degrees) is closely aligned with Runway 34. Both approaches have a “circling” procedures authorized, which allow aircraft to land on any runway upon establishing and maintaining visual contact with the airport environment. The instrument approach procedures are authorized for category A-C aircraft, with varying approach minima.

The minimum descent altitude (MDA) and minimum visibility requirements for the procedures vary by aircraft category (approach speed):

Aircraft Approach Category	**RNAV (GPS) Runway 16** ***(minimums listed for LPV procedure)***		**RNAV (GPS) – A**	
	Minimum Descent Altitude (MDA)	Minimum Visibility Required	Minimum Descent Altitude (MDA)	Minimum Visibility Required
A	3,263’ MSL 830’ AGL	3 miles	3,500’ MSL 1,063’ AGL	1 ¼ mile
B	3,263’ MSL 830’ AGL	3 miles	3,500’ MSL 1,063’ AGL	1 ½ mile
C	3,263’ MSL 830’ AGL	3 miles	3,600’ MSL 1,163’ AGL	3 miles
D	N/A	N/A	N/A	N/A

It is noted that the absence of local on-field weather data significantly increases the minimums for the instrument approaches. The planned addition of an Automated Weather Observation System (AWOS) is expected to improve existing approach minimums in the near term; longer term runway approach lighting improvements may be considered to reduce the approach visibility minimums.





The 1997 Airspace Plan Drawing depict visual airspace surfaces consistent with larger than utility runways for Runway 16/34 and utility runways for Runway 4/22.[7] **Table 2-8** summarizes existing navigational aids and related items in the vicinity of Madras Municipal Airport.

[7] FAR Part 77. Larger than Utility runways are designed to accommodate aircraft weighing more than 12,500 pounds. Utility runways are designed to accommodate aircraft weighing less than 12,500 pounds.

TABLE 2-8: NAVIGATIONAL AIDS AND RELATED ITEMS

Type	Facilities
Electronic Navigational Aids	None <u>Nearby Facilities:</u> • Deschutes VORTAC (DSD) Frequency: 117.6 MHz - (25.8 nm S) • Redmond ILS (I-RDM) Frequency: 109.1 MHz - (24 nm SE) • Bodey NDB (RD) Frequency: 411 KHz - (24 nm SE) • Klickitat VOR/DME (LTJ) Frequency: 112.3 MHz - (45 nm N) • Kimberly VORTAC (IMB); Frequency: 115.6 MHz - (61 nm E)
Instrument Approaches	RNAV (GPS) – A Circling Procedure Requires Redmond altimeter setting
Weather Observation	None on field <u>Nearby Facilities:</u> • Redmond ASOS (25 nm S) - 119.025 MHz (541) 504-8743 • Bend AWOS-3 (35 nm S) - 134.425 MHz (541) 382-1477 • The Dalles ASOS (57 nm N) - 135.175 MHz (509) 767-1726
Communication	Unicom/Common Traffic Advisory Frequency (CTAF) (122.8 MHz)

Table 2-9 summarizes notable obstructions, special airspace designations and IFR routes in the vicinity of Madras Municipal Airport, as identified on the Klamath Falls and Seattle Sectional Aeronautical Charts. **Figure 2-3** depicts the airspace surrounding Madras Municipal Airport.

TABLE 2-9:
AIRSPACE/INSTRUMENT ROUTES/LOCAL OBSTRUCTIONS/FEATURES

Airspace Item	*Description*	*Location*
Low Altitude Enroute Instrument Airways	Victor 25	Instrument route located approximately 3.5 miles west of airport. Minimum enroute altitude 7,000 feet MSL extending from Deschutes VORTAC to Klickitat VOR
Military Training Routes (MTR)	Low-altitude training routes (IR346) Surface Upward	30 miles north of airport
Electrical Transmission Line	Large overhead transmission lines; Towers +100 feet AGL	1 to 3 miles east and west of the airport
Towers (less than 1,000 feet above surface)	Individual Towers (types not specified)	11 miles NNW of airport (3,364' MSL/ 204' AGL) 10.5 miles SSW of airport – under construction (3,172' MSL/ 204' AGL)
Class E Airspace	700 feet AGL to 18,000 feet MSL associated with instrument approach and enroute airway.	Overhead (10 miles wide); extends NE/SW from Deschutes VORTAC to approximately 4.5 miles north of airport
Class D Airspace	Surface to 2,500 feet above airport elevation for airports with operational control tower.	Redmond – Roberts Field (5 mile radius); northern edge located approximately 20 nm SSE of Madras Municipal
Class G Airspace	Surface to 700 feet AGL.	Overhead and beyond limits of Class E airspace

Madras Municipal Airport is located in an area of Class E airspace that begins 700 feet above the surface. Class E airspace is associated with airports with instrument approaches and transitions from the enroute instrument airway system. VFR aircraft operating in Class E airspace are responsible to see and avoid air traffic. There are no mandatory radio communication requirements during visual flight rules (VFR) conditions in Class E airspace. An area of uncontrolled (Class G) airspace is located under the Class E airspace surrounding Madras Municipal Airport. Class G aircraft permits visual flight rules (VFR) operations only.

Roberts Field has an area of Class D airspace located approximately 20 miles southeast of Madras. Class D airspace requires two-way radio contact prior to entry when the airport's control tower is in operation.

A low altitude enroute instrument airway (Victor 25) passes approximately 3.5 miles west of the airport. The airway does not create any conflicts with terminal airport operations due to the minimum enroute or obstruction altitudes (MEA or MOA) of 7,000/6,500 feet above sea level. The standard airport traffic pattern altitude is 800 feet above ground level (AGL) or approximately 3,200 to 3,300 feet MSL.

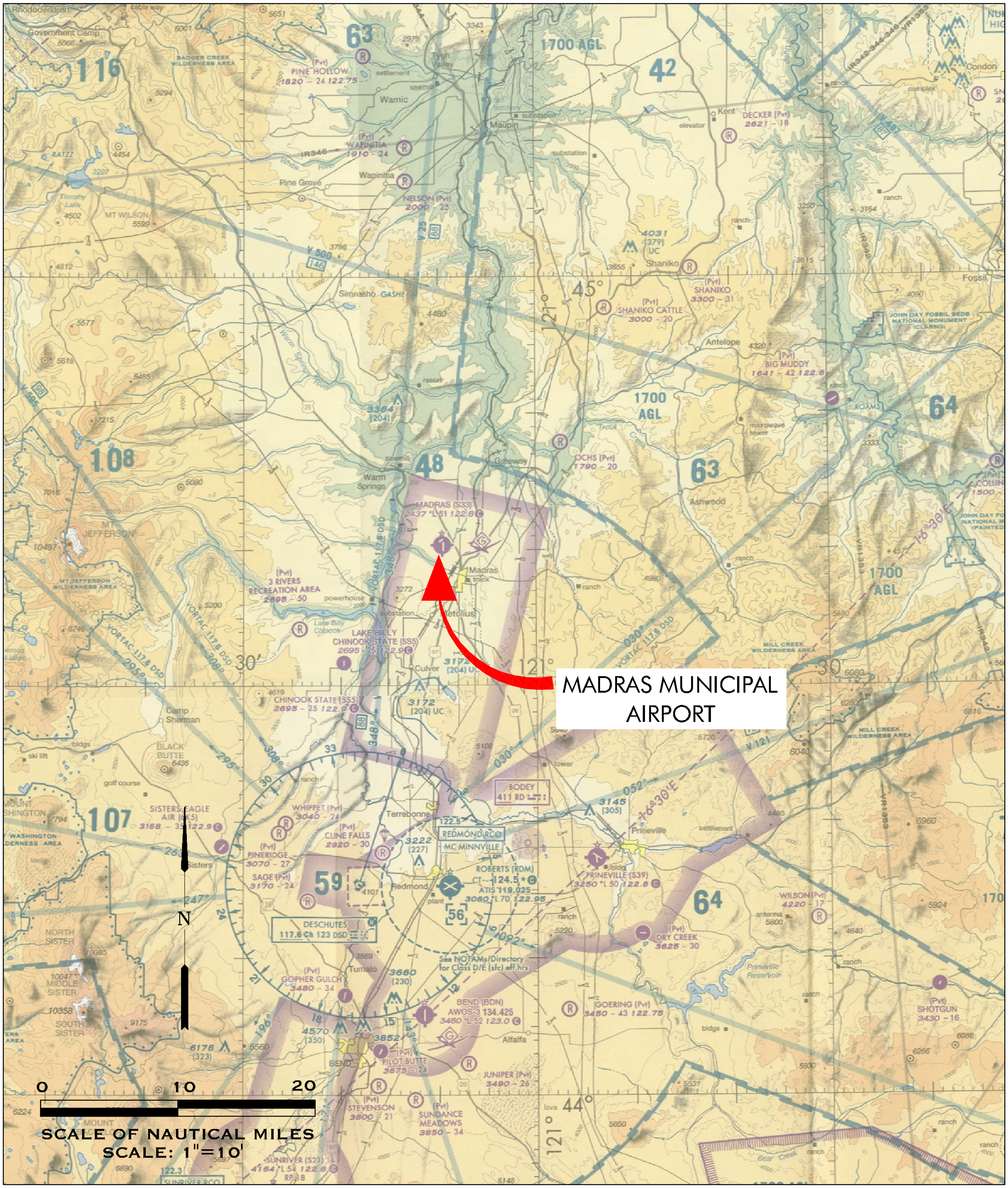
The nearest public-use airport is Lake Billy Chinook, located about 12 miles southwest. Several other airports are located within 20 to 40 miles (see Table 2-10).

AIRPORT SERVICE AREA

The airport service area refers to the area surrounding an airport that is directly affected by the activities at that airport. Normally a 30 or 60-minute surface travel time is used to approximate the boundaries of a service area. **Table 2-10** lists the public airports within a 50 nautical mile radius of Madras. The Madras Municipal Airport service area extends north and south along Highways 26 and 97, overlapping with service areas for several other central Oregon airports including Roberts Field, Prineville and Bend, which offer many comparable facilities and services.

TABLE 2-10: PUBLIC USE AIRPORTS IN VICINITY

Airport	Location	Runway Dimension (feet)	Surface	Lighted Runway?	Fuel Available?
Lake Billy Chinook State	12 NM SW	2,500 x 32	Asphalt	No	No
Prineville	25 NM SE	5,000 x 60 (primary runway)	Asphalt	Yes	Yes
Bend Municipal	35 NM S	5,200 x 75	Asphalt	Yes	Yes
Redmond – Roberts Field	25 NM S	7,038 x 150 (primary runway)	Asphalt	Yes	Yes
Sisters – Eagle Air	27 NM SW	3,550 x 30	Asphalt	No	No
Santiam Junction State	37 NM SW	2,800 x 150	Gravel	No	No
McKenzie Bridge State	49 NM SE	2,600 x 90	Turf	No	No
Sunriver	49 NM S	5,455 x 70	Asphalt	Yes	Yes



CENTURY WEST
ENGINEERING CORPORATION

AREA AIRSPACE

FIGURE
2-3

MADRAS MUNICIPAL AIRPORT

LAND USE PLANNING AND ZONING

Land use controls and zoning in the vicinity of the airport are administered by the City of Madras and Jefferson County. The eastern landside portion of the airport and the airport industrial park are located within the Madras city limits and urban growth boundary (UGB). The runways and taxiways and surrounding areas are located outside the Madras city limits and UGB and are subject to Jefferson County zoning.

The City of Madras Airport Development (AD) zone is in place for terminal area and the proposed Air Business Park that is bordered by Cherry Lane to the south, Highway 26 to the east, and the runway/taxiway system to the west. The airport industrial park is zoned Industrial (I). The portion of the airport under county jurisdiction is zoned Airport Management (AM).

Jefferson County and the City of Madras have adopted Airport Protections (County code – section 418) that define measures designed to protect Madras Municipal Airport from incompatible land uses.

Chapter Three
Aviation Activity Forecasts

CENTURY WEST
ENGINEERING CORPORATION

Madras Municipal Airport

CHAPTER THREE
AVIATION ACTIVITY FORECASTS

Introduction

The purpose of this chapter is to update the forecasts of aviation activity for the twenty year planning period addressed in the Airport Master Plan Update (2009-2029). The updated activity forecasts will provide the basis for estimating future facility needs at Madras Municipal Airport. The 1997 Airport Layout Plan Report; 2007 Oregon Department of Aviation (ODA) forecasts; and current Federal Aviation Administration (FAA) forecasts will be compared with current and historical activity at Madras Municipal Airport to determine their applicability for use in this planning update.

POPULATION AND ECONOMIC DATA

General aviation airports are often a reflection of the communities they serve. Although a large number of factors normally affect activities at general aviation airports, changes in population often reflect other economic conditions, which may affect airport activity more directly. However, since it is difficult to identify specific connections between airport activity and individual economic indicators such as growth in personal income, unemployment rates, or business spending, population often provides a general indication of an area's economic health. Regions with flat or declining populations often have weak underlying economic conditions. In contrast, higher rates of population growth often characterize a growing economy that can stimulate individual and business use of general aviation.

Historic Population

The Madras area population has grown considerably over the last several decades, consistently outpacing both Jefferson County and statewide population growth. Annual estimates of population for Oregon counties and incorporated cities are provided through the Portland State University (PSU) Population Research Center. The annual PSU estimates, coupled with the U.S. Census, conducted every ten years, provide an indication of local area population trends.[8] Historic

[8] Portland State University Population Research Center, July 1, 2009 estimate; 1990, 2000 U.S. Census.

population data are summarized in **Table 3-1**. The recent historic growth in county population and based aircraft depicted in **Figure 3-1** illustrates a similar, broad upward trend.

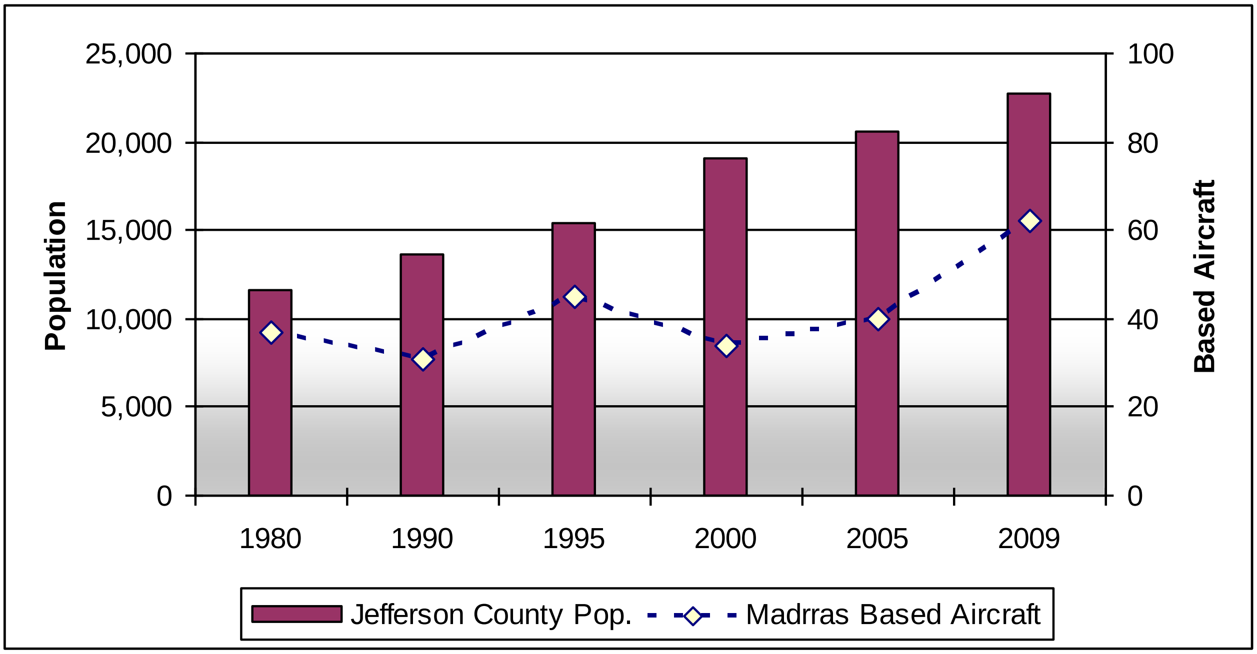
The July 1, 2009 PSU population estimate for Madras (within the city's incorporated area) was 6,650, an increase of 28.6 percent (+1,572 residents) above the 2000 Census (5,078). The average annual rate of growth in Madras between 2000 and 2009 was 3.04 percent, slightly slower than the growth experienced through recent decades. As indicated in the **Table 3-1**, the rate of population growth within Madras has consistently outpaced both Jefferson County and Oregon dating back to the 1960s.

TABLE 3-1: HISTORIC AREA POPULATION

Year	City of Madras*	Jefferson County	City % of County	Oregon
1960	1,515	7,130	21.3%	1,768,687
1970	1,689	8,548	19.8%	2,091,533
1980	2,235	11,599	19.3%	2,633,105
1990	3,443	13,676	25.2%	2,842,321
2000	5,078	19,009	26.7%	3,421,399
2009	6,650	22,715	29.3%	3,823,465
Average Annual Rates (AAR) of Growth	City of Madras*	Jefferson County		Oregon
1960-2009	3.07%	2.39%		1.59%
1970-2009	3.58%	2.54%		1.56%
1980-2009	3.83%	2.35%		1.30%
1990-2009	3.53%	2.71%		1.57%
2000-2009	3.04%	2.00%		1.24%

* Data does not include area within urban growth boundary (UGB).
Source: U.S. Census data 1960-2000; Portland State University estimate July 1, 2009.

FIGURE 3-1: HISTORIC POPULATION & BASED AIRCRAFT



Source: US Census data, PSU estimate (2009), current and historic based aircraft estimates

Local Population Forecasts (Comprehensive Plans)

The City of Madras Comprehensive Plan[9] and the Jefferson County Comprehensive Plan[10] were both recently updated using common population forecasts that extend from 2005 to 2056. The local comprehensive plan forecasts and related data are summarized in **Table 3-3**. The 2029 forecast (coinciding with the 20-year master plan horizon) population within the Madras urban growth boundary (UGB) is 14,148, which reflects an average annual growth rate of 3.94 percent. The 2029 county population forecast (37,799) reflects an average annual growth rate of 2.56 percent. The projected growth rates for the Madras UGB and the county considerably higher than the State of Oregon long term population forecasts described below. The comprehensive plans indicate that strong employment and housing growth are key factors in the more optimistic growth expectations for Madras and Jefferson County.

The comprehensive plans project that the Madras UGB population will account for approximately 37.4 percent of Jefferson County's population in 2029, up from 27.2 percent in 2005. The forecasts assume that nearly 60 percent of the Jefferson County's net increase in population will occur within the Madras UGB.

[9] City of Madras Comprehensive Plan (2003 update)
[10] Jefferson County Comprehensive Plan (as amended, 2008)

As noted in the Inventory chapter, the Madras Municipal Airport service area extends well beyond the City boundary to include rural Jefferson County and other outlying areas. It appears that county-wide population trends provide the best basis for evaluating the affect of local population on airport activity. The expectations for population growth and the accompanying economic expansion for the community and county suggest that future aviation demand at Madras Municipal Airport can also be expected to also increase in the coming years.

Oregon Office of Economic Analysis (OEA)

Jefferson County's sustained, moderate population growth is expected to continue and is reflected in the long-term (2000-2040) population forecasts prepared by the Oregon Office of Economic Analysis (OEA) for Oregon counties to support local long-term planning.[11] The annual growth projected by OEA for Jefferson County averages 1.6 percent between 2000 and 2030. The OEA forecasts and related data are summarized in **Table 3-2**.

TABLE 3-2: POPULATION FORECASTS

	2000	2005	2009	2014	2019	2024	2029
OEA Forecast Jefferson County *(1.6% AAR 2000-2029)* [1]	19,150	20,491	21,822	23,684	25,655	27,837	30,307
Jefferson County Comp Plan Forecast *(2.56% AAR 2005-2029)* [2]	--	20,600	23,366	26,799	30,320	34,305	37,799
City of Madras Comp Plan Urban Growth Boundary Forecast *(3.94% AAR 2005-2029)* [2]	--	5,592	6,669	8,192	9,966	12,125	14,148

1. Oregon Office of Economic Analysis (OEA) Forecasts (interpolated to coincide with master plan forecast years).
2. Interpolated from Jefferson County and City of Madras Comprehensive Plan Forecasts (2005-2056)

Socioeconomic/Employment Data:

Madras and the central Oregon are popular destinations for tourism, recreation and retirement. The local employment base is relatively diversified and includes retail trade, tourism, health services, government, manufacturing, and professional services. According to Oregon Department of Employment data, 32% of the region's employment in 2006 was in the retail trade and the leisure and hospitality sectors, with government accounting for another 14 percent. [12] Manufacturing, which includes the wood products industry, accounted for about 11 percent of the region's employment.

[11] Oregon Office of Economic Analysis (OEA), April 1, 2004 estimate.
[12] Region 10 – Jefferson, Crook and Deschutes counties.

The community's affordable housing and livability have attracted businesses and a mobile workforce that is able to access employment opportunities throughout the region. According to Economic Development for Central Oregon website, the leading private employers in Madras include Bright Wood, Keith Manufacturing, Warm Springs Composite Products, Mountain View Hospital, Shielding International, and Double Press. Local economic development efforts include attracting tenants to the City's 125-acre industrial park located adjacent to the airport. In addition to the employment component, the availability of affordable, fully-serviced, readily-developable industrial land adjacent to the airport also has the potential of contributing to airport activity through increased business air travel.

Agriculture remains an important segment of the region's rural economy. In 2008, Jefferson County was ranked 21st among Oregon counties in gross ranch and farm sales, with $69.7 million. Major production includes cereal grains, hay, livestock, field crops and seeds. Specialty products include Bluegrass seed, carrot seeds, mint leaves and mint oil.

Central Oregon has been particularly hard hit in the current economic recession with significantly higher unemployment than statewide or national levels. In October 2009, Jefferson County's unemployment rate was 16.3 percent, up from 11.9 percent in October 2008. Neighboring Crook and Deschutes counties have experienced similar or worse unemployment levels. In October 2009, the unemployment rate in Cook County was 18.1 percent and Deschutes County's was 15.4 percent. By contrast, Oregon's employment rate—one of the highest in the U.S.—was 11.3 percent in October 2009.

Historically, during periods of weakened economic conditions, downturns in general aviation activity often result. In contrast, growth in general aviation activity typically coincides with favorable economic conditions. It is reasonable to assume that the current economic climate has, and will continue to constrain general aviation activity locally, statewide and throughout national airport system in the near term. However, as indicated in the FAA's national long term aviation forecasts, the overall strength of the U.S. economy is expected to support sustained economic growth over the long-term, which will translate into modest to moderate growth in aviation activity.

With the nearest commercial air service available in Redmond, Madras Municipal Airport offers a full range of aviation services for both business and general aviation travelers. Madras provides a convenient, cost–effective transportation option for a wide range of users. The use of private aircraft for personal and business transportation positively affects the local economy, particularly for existing users and in support of attracting new businesses to the community.

AVIATION ACTIVITY FORECASTS

Introduction

This section contains existing and updated aviation activity forecasts for Madras Municipal Airport. These forecasts are summarized in this section and depicted in **Figures 3-4 and 3-5** at the end of the chapter.

National General Aviation Activity Trends

After an extended period of decline, the U.S. general aviation industry experienced a period of sustained growth between 1994 and 2000 (coinciding with the General Aviation Revitalization Act of 1994). During this period, the general aviation fleet increased by 25 percent overall, or about 3.2 percent per year. The fastest growing fleet segments during this period were business jets, helicopters and experimental aircraft, which increased between 7.5 and 9 percent per year. The general aviation industry experienced a significant downturn in 2001, which began with an economic slowdown and then accelerated following the events associated with September 11, 2001.

Over the last several years, a steep rise in aviation fuel prices combined with weak economic conditions has constrained the general aviation industry. The current Federal Aviation Administration (FAA) long term aviation activity forecasts[13] provide the following assessment *"High fuel prices and concerns about the economy are dampening the near-term prospects for the general aviation industry, but the long-term outlook remains favorable."* These expectations are generally in line with broad based measures of economic health such as long term forecasts of gross domestic product (GDP), consumer price index, fuel prices and interest rates. Although some segments of general aviation (primarily business aircraft usage) are expected to grow at moderately high rates, most conventional measures of the general aviation industry suggest modest, sustained growth in the range of 1 to 2 percent annually over the next 20 years. However, in the face of current economic conditions, the FAA notes several risks to the forecast assumptions including rising unemployment, uncertainty in the housing market, and a deeper economic downturn. These conditions have the potential of depressing real growth in general aviation, from aircraft manufacturing to operational activity, well into the future. Several of the FAA's general aviation activity growth assumptions are summarized in **Table 3-3.**

[13] FAA Aerospace Forecasts Fiscal Years 2009-2025.

The FAA's long term forecasts predict that the U.S. active general aviation aircraft fleet will grow modestly at an average annual rate of 0.96 percent between 2008 and 2025. During this period, the fleet is expected to increase from 234,015 to 275,230 aircraft (+41,215 or 17.6 percent).

Although single-engine piston aircraft (not including experimental or light sport aircraft) currently account for approximately 63 percent of the general aviation fleet, the rate of growth in business jets, turboprops, piston and turbine helicopters, experimental aircraft and sport aircraft has been two to four times greater than single engine aircraft over the last several years. The number of business jets in the general aviation fleet increased by 4,399 units (+63 percent) since 2000. Strong increases in the number of corporate aircraft operators, fractional ownership of business aircraft, and aircraft charter activity appear to represent a business response to current commercial air service options throughout the U.S.

The new category of light sport aircraft (LSA) has experienced substantial growth since 2005, increasing from just 170 aircraft to 6,965 aircraft in four years. Although the growth rate within the LSA category has been high, these aircraft currently account for approximately 3 percent of the total GA fleet.

The FAA expects some general aviation activity segments to experience flat or declining numbers during the forecast period. For example, the multi-engine piston fleet is forecast to decline by 1.0 percent annually through 2025. This downward trend is attributed to fleet attrition and the lack of multi engine piston aircraft production. Similarly, the single-engine piston fleet is expected to decline slightly through 2014, before gradually increasing through 2025. The FAA expects the fleet to lose approximately 1,500 aircraft per year to attrition. While renewed production of updated established designs or new aircraft designs is expected to help arrest the downward trend, overall growth of the general aviation fleet is expected to be nominal through 2025.

TABLE 3-3: FAA LONG RANGE FORECAST ASSUMPTIONS

Activity Component	Forecast Annual Average Growth Rate (2008-2025)
Active Pilots (All Ratings, excluding Airline Transport)	0.5%
Student Pilots (Indicator of flight training activity)	0.4%
Sport Pilots	12.9%
Private Pilots	0.0%
Commercial Pilots	0.6%
Instrument Rated Pilots	0.5%
Airline Transport Pilots	0.3%
Active GA Fleet (# of Aircraft)	1.0%
Hours Flown - GA Fleet (All AC Types)	1.8%
GA Operations at towered airports	0.6%
AVGAS (Gallons consumed - GA only)	-0.1%
Jet Fuel (Gallons consumed – GA only)	3.7%

Source: FAA Long Range Aerospace Forecasts (FY 2009-2025) March 2009

Very Light Jets (VLJ)

The FAA considers the ongoing development and deliveries of very light jets (VLJ) to be among the more significant events affecting business aviation activity over the next several years.[14] However, based on the events over the last year (bankruptcy of Eclipse Aviation, etc.), the FAA has tempered its expectations of growth slightly for this segment of activity. In 2008, VLJ deliveries totaled 262 compared to the previously-forecast level of 400. The updated (2009) FAA forecasts project the VLJ fleet will increase from about 600 aircraft in 2008 to 4,875 in 2025. The revised forecast is significantly reduced from the previous (2008) forecast of 8,145 in 2025. The current FAA forecast predicts that VLJ deliveries will average approximately 200 aircraft per year over the next two years then increase to 270 to 300 aircraft deliveries per year through 2025.

It is worth noting that new VLJ aircraft will not require significant upgrades in airfield capabilities (longer runways, etc.) for most airports currently able to accommodate twin engine piston or turboprop aircraft. However, increased activity within these categories could be expected to affect

[14] Very Light Jets (VLJ) are small jet-powered aircraft (weighing less than 12,500 pounds) with airport-related performance characteristics (takeoff weight, approach speed, runway length requirements, physical dimensions, passenger load, etc.) comparable to a high-performance light twin-engine aircraft.

based aircraft and transient aircraft fleet mix and stimulate demand for hangar space and aircraft services.

Light Sport Aircraft (LSA) & Experimental Aircraft

The ongoing development of new light sport aircraft (LSA) is expected to promote strong fleet growth through the forecast period, with a net increase of 8,900 aircraft (+128%). The LSA fleet is projected to grow from 6,985 aircraft (FAA estimate for 2008) to 15,865 in 2025, averaging 4.9 percent per year. By 2025, the FAA predicts that the number of sport aircraft will nearly equal the number of piston multi-engine aircraft in the fleet. The refinement of LSA designs is expected to significantly influence primary flight training activity as the industry retires its aging fleet of training aircraft.

The FAA predicts that the experimental aircraft fleet will also grow faster than traditional single-engine aircraft through 2025. The experimental fleet is projected to increase from 24,100 to 34,625 between 2008 and 2025. By 2025, the FAA expects sport and experimental aircraft to account for 18.3 percent of the general aviation fleet, up from 10.6 percent in 2005.

Pilot & Flight Activity

Growth in the number of conventional fixed-wing pilots is expected to be in the range of 0.4 to 0.6 percent annually through 2025. Sport pilots are expected to increase at a rate of approximately 12.9 percent annually. Rotorcraft pilots are projected to increase at an annual rate of 1.2 percent through 2025. The nominal growth projected for student pilots and private pilots reflects an industry-wide concern about the ability to sustain both general aviation and commercial aviation in future years.

The FAA's forecasts for general aviation hours flown reflect modest growth averaging about 1.8 percent annually, with varying levels within different categories. As indicated by production activity within specific aircraft categories, hours flown by turbine aircraft are expected to increase at an average rate of 3.9 percent and sport aircraft hours are expected to increase at 7.1 percent annually. Multi-engine aircraft hours flown are projected to decline at an average rate of 1.5 percent per year through 2025.

The FAA projections for general aviation fuel consumption are generally consistent with other activity indicators, with the largest increase expected for jet fuel (3.7 percent annually). Overall AVGAS consumption is projected to decline at an annual average rate of 0.1 percent between 2008 and 2025. It appears that a primary factor affecting AVGAS consumption is the anticipated decline in piston multi-engine hours flown. Total fuel consumption for all segments of general aviation is projected to increase at an average annual rate of 3.1 percent between 2008 and 2025.

Current and Historic Aviation Activity

Based Aircraft

Based on a recent count conducted by airport officials, there are currently 62 aircraft based at Madras Municipal Airport on a year-round basis. The majority of the fixed wing based aircraft weigh less than 12,500 pounds and are included in Airplane Design Group I (ADG I). In addition to a wide range of single-engine piston aircraft, the airport's based aircraft fleet includes two piston twin-engine aircraft and one helicopter.

Based on periodic estimates contained in state aviation system plans, airport master plans and data maintained by FAA, it appears that the based aircraft levels at Madras Municipal Airport have fluctuated between 25 and 45 dating back to the mid-1970s. The 1997 Airport Layout Plan estimated a based aircraft total of 45, including 41 single-engine; 3 multi-engine; and 1 "other." The updated counts were contained in the 1997 Oregon Continuous Aviation System Plan – Volume I - Inventory and Forecasts. Recent based aircraft counts have increased with 57 indicated for 2007 (base year) in the FAA's APO Terminal Area Forecast 2008 and 62 reported by airport management in July 2009. **Table 3-4** summarizes the based aircraft by type from the 2009 airport management count.

TABLE 3-4: BASED AIRCRAFT SUMMARY (JULY 2009)

Aircraft Type	Aircraft
Single Engine Piston	57
Multi-Engine Piston	2
Turboprop	1
Business Jet	0
Rotorcraft	1
Light Sport	0
Other (ultralights)	1
Total Based Aircraft	**62**

The long-term trend for based aircraft at Madras Municipal Airport reflects a gradual increase that includes periodic upward and downward fluctuations. **Table 3-5** summarizes the "existing" based aircraft counts used in the three airport master plans prepared for the airport since 1975. Annual growth has typically averaged between 2 to 3 percent, although the data indicates that the airport has also experienced periods of flat or mildly declining activity. The most recent increase in based aircraft (noted in recent counts) reflects a sharp upward fluctuation that is difficult to gauge. However, it is reasonable to assume that the factors that led to the recent increase may continue to contribute to growth over the long term.

TABLE 3-5: MADRAS BASED AIRCRAFT GROWTH TRENDS

"Existing" Based Aircraft Count	Average Annual Rate of Growth (%) since prior planning estimate	Source	Average Annual Rate of Growth (%) to 2009 (time period)
1974: 24	--	1975 Airport Master Plan (CH2M Hill)	2.75% (35 years)
1986: 37	3.67%	1987 Airport Master Plan (Tenneson/Brown)	2.27% (23 years)
1994: 45	2.48%	1997 Airport Layout Plan (Faegre/Century West)	2.16% (15 years)

Aircraft Operations

For Madras Municipal Airport, aircraft operational data (takeoffs and landings, touch and go landings, etc.) are limited to estimates. As a non-towered airport, no record of activity is regularly maintained. Statistical operations estimates for Madras Municipal Airport are available for six separate years since 1984 through the Oregon Department of Aviation (ODA) automated acoustical (RENS) activity counting program. In the absence of air traffic control tower records, RENS counts provide reliable estimates of activity for uncontrolled airports. The RENS program uses a counting device that is triggered by specific noise level (aircraft engine noise) normally associated with an aircraft takeoff. Four seasonal on-site data samples are normally collected over a twelve-month period (ODA uses an October to October schedule) for use in creating statistically-derived estimates of operations. **Table 3-6** summarizes the activity counts conducted at Madras Municipal Airport. The activity counts generally fluctuated between 9,000 and 12,000 annual aircraft operations over the twenty-year period. The activity for 2001 was significantly reduced, which is consistent with the poor economic conditions that existed throughout 2001 and activity restrictions that immediately followed 9/11/01.

Estimates of based aircraft, primarily from FAA Terminal Area Forecast (TAF) data, are also provided in **Table 3-6** for the sample years to approximate historic aircraft utilization ratios (the number of operations per based aircraft). However, it is important to note that the TAF based aircraft totals listed in the table reflect a nine-year period (1995-2003) where no changes were made in the data for Madras Municipal Airport. An extended period of static data within the TAF often indicates lack of data, rather than no change in activity. Although the resulting ratios are not precise, they provide a broad indication of activity, which is within the range typically found for low- to medium-activity general aviation airports. In general, it appears that the TAF underestimated based aircraft totals during this period. An increase in the number of based aircraft in any given year will reduce the aircraft activity ratios derived from the RENS activity counts. Based on available information, it appears that a ratio of approximately 180 to 250 operations per based aircraft represents a "typical" activity range for Madras Municipal Airport.

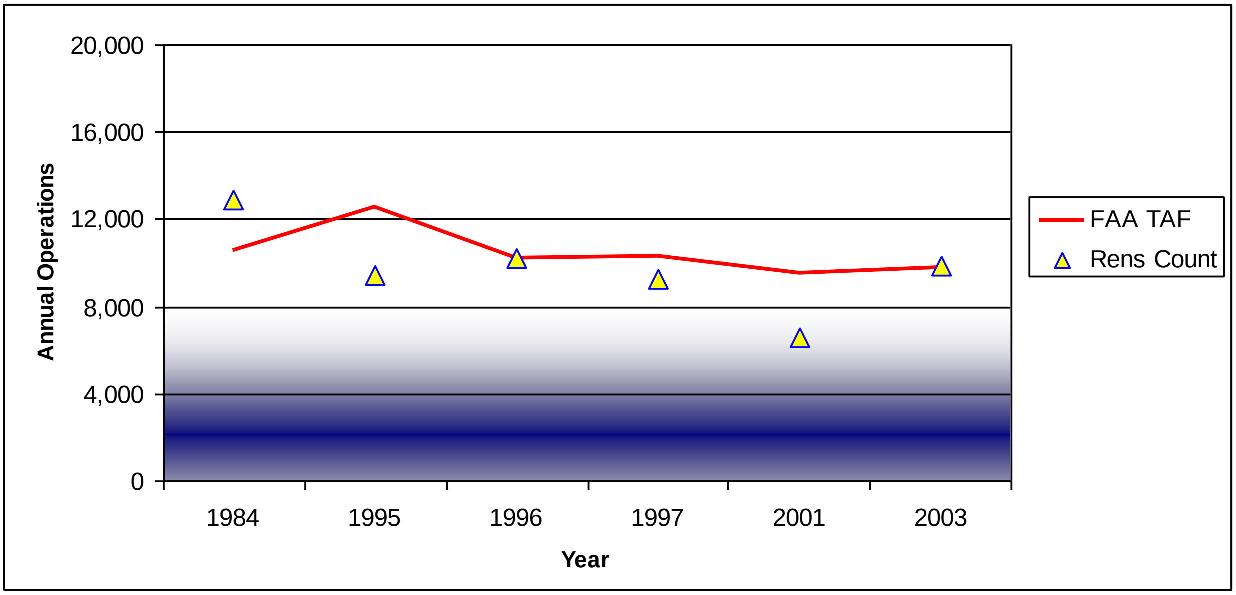
The historic TAF operations data for Madras Municipal Airport appear to be relatively consistent with the periodic RENS activity counts. **Figure 3-2** illustrates the recent RENS counts in relation to TAF operations estimates.

TABLE 3-6: ODA RENS AIRCRAFT ACTIVITY COUNTS (MADRAS MUNICIPAL AIRPORT)

	1984	1995	1996	1997	2001	2003
RENS Activity Count	12,888	9,396	10,196	9,289	6,603	9,912
Based Aircraft[1]	36	34	34	45[2]	34	34
Ratio of Operations per Based Aircraft	358	276	300	206	194	291

1. FAA TAF/ODA data.
2. Actual aircraft count (1997 ALP Report).

FIGURE 3-2: ODA RENS ACTIVITY COUNTS & FAA TAF ESTIMATES (MADRAS MUNICIPAL AIRPORT)



The most recent ODA estimate of activity at Madras Municipal Airport is contained in the 2007 ODA Oregon Aviation Plan Forecast. The forecasts established base year (2005) activity for Madras Municipal Airport at 40 based aircraft and 10,066 annual operations. These forecasts reflect an aircraft utilization ratio of 252 operations per based aircraft.

The most recent FAA Airport Record Form (5010-1) lists 50 based aircraft and 10,735 annual operations for Madras Municipal Airport (for the 12 months ending July 2007), which reflects a ratio of 215 operations per based aircraft.

The FAA Terminal Area Forecast (TAF) “2008 Scenario” lists 57 based aircraft and 10,316 operations for 2007, which reflects a ratio of 180 operations per based aircraft.

For the purposes of estimating current activity, using a ratio that falls between the most recent FAA TAF and ODA projections appears to be reasonable. A ratio of 210 operations per based aircraft (62) results in 13,020 operations for 2009.

<u>Local and Itinerant Operations</u>

The current FAA 5010-1 Airport Record Form for the airport estimates the air traffic distribution to be 56 percent local and 44 percent itinerant. Current and forecast operations in the FAA TAF use a 76 percent local and 24 percent itinerant split for Madras Municipal Airport. The 2007 Oregon

Aviation Plan forecasts do not identify the operations distribution by operational category (local versus itinerant).

Local operations are conducted in the vicinity of an airport and include flights that begin and end the airport. Local operations include local area flight training, touch and go landings, flightseeing, and other flights that do not involve a landing at another airport, such as aerial applicators.

For purposes of developing updated activity forecasts, it appears that a 60%/40% split between local and itinerant operations reflects the mix of air traffic typically accommodated at Madras Municipal Airport.

EXISTING FORECASTS

1997 Airport Layout Plan

The 1997 ALP Report utilized aviation forecasts from the 1994 Oregon Aviation System Plan (OASP). The forecasts projected based aircraft to increase from 45 to 56 (+11) by 2014. Annual aircraft operations were projected to increase from 9,323 to 11,570 during the period. The forecasts reflect average annual growth rates of approximately **1.1 percent**.

The base year and forecast operations reflected activity ratios of approximately 207 operations per based aircraft. A subsequent activity count (9,289) conducted by ODA in 1996-1997 was nearly identical to the estimated base year use in the forecasts. Two subsequent ODA activity counts in 2001 and 2003 are relatively consistent with earlier activity levels, although based on the limited based aircraft data (no change in TAF based aircraft (34) between 1995 and 2004), the corresponding activity ratios cannot be verified. A July 2009 airport management count of 62 based aircraft is 9 aircraft above the forecast level for 2009. The 1997 ALP forecasts are summarized in **Table 3-7.** Due to the age of the forecasts, they have limited use in evaluating future activity for current master planning purposes.

TABLE 3-7: 1997 AIRPORT LAYOUT PLAN FORECASTS (MADRAS MUNICIPAL AIRPORT)

	1994	**1999**	**2004**	**2009**	**2014**
Based Aircraft (1.1% AAR, 1994-2014)	45	47	49	53	56
Aircraft Operations (1.09% AAR, 1994-2014)	9,323	9,660	10,230	10,990	11,570

Oregon Department of Aviation – 2007 Oregon Aviation Plan

Updated Oregon State Aviation System Plan forecasts were developed in 2007 with projections made from 2005 to 2025. The forecasts of based aircraft and operations for Madras Municipal Airport reflect modest growth over the 20-year planning period. Based aircraft and annual operations were forecast to increase at an average annual rate of **1.27 percent.**

Based aircraft were projected to increase from 40 to 52 (+30%) between 2005 and 2025; annual aircraft operations were projected to increase from 10,066 to 12,961 (+29%) during the same period. The operations forecast reflect ratios of approximately 250 operations per based aircraft, which is slightly lower than last activity count conducted by ODA in 1997, but is generally consistent with FAA guidance on estimating general aviation activity at small and medium non-towered airports.

The ODA operations forecasts are considered reliable for use as a baseline projection in the airport master plan update, although the based aircraft forecasts do not represent current conditions or recent trends at the airport due to the low base year (2005) estimate that was used to develop the forecast. The 2007 ODA forecasts are summarized in **Table 3-8**.

Terminal Area Forecast (TAF)

The Federal Aviation Administration (FAA) maintains forecasts for Madras Municipal Airport in the Terminal Area Forecast (TAF). The TAF is used by FAA to track activity at airports included in the National Plan of Integrated Airport Systems (NPIAS). NPIAS airports are eligible for funding through the FAA. For Madras, the current TAF forecast increases based aircraft from 57 (estimated in 2007) to 67 in 2025. This projection reflects an overall increase of 17.5 percent, which equates to annual average growth of **0.90 percent** over the 18-year forecast period. The 2007 "actual" estimate of 57 based aircraft is comparable to an actual based aircraft count (62) conducted by airport management in July 2009.

The TAF projects aircraft operations to increase from 10,316 to 12,871 during the same period. This projection reflects an overall increase of 24.8 percent, which equates to annual average growth of **1.24 percent** over the 18-year forecast period. Like the ODA forecasts described earlier, the TAF provides a baseline projection that would be reliable for use in the airport master plan update. The TAF is summarized in **Table 3-8.**

TABLE 3-8: 2007 ODA & FAA TAF FORECASTS (MADRAS MUNICIPAL AIRPORT)

Forecast Elements	2005	2010	2015	2025
ODA 2007 Forecast Based Aircraft (1.27% AAR 2005-2025)	40	44	48	52
ODA 2007 Forecast Aircraft Operations (1.27% AAR, 2005-2025)	10,066	10,978	11,639	12,961
FAA TAF Forecast Based Aircraft (0.90% AAR 2007-2025)	57	58	62	67
FAA TAF Forecast Aircraft Operations (1.24% AAR, 2007-2025)	10,066	10,704	11,383	12,871

UPDATED AVIATION FORECASTS

Assessment of Local Airport Conditions

Hangar Construction

A review of aerial photography indicates that only one new aircraft storage hangar (small/medium conventional hangar, located north of the main apron) has been constructed at Madras Municipal Airport since the 1997 ALP was completed. During this same period the number of based aircraft at the airport has increased from 45 to 62 aircraft (+17). It appears that most of growth in based aircraft during this period is being accommodated in the airport's large Quonset hangars, on the aircraft parking apron, or through increased utilization of existing T-hangars.

Construction of a large (40,000 square feet) commercial hangar began in 2009 to accommodate the Butler Aviation aircraft maintenance operations being relocated from Roberts Field in Redmond. Initially, it is anticipated that Butler will base three large fire fighting aircraft at Madras for maintenance when the aircraft are not dispatched.

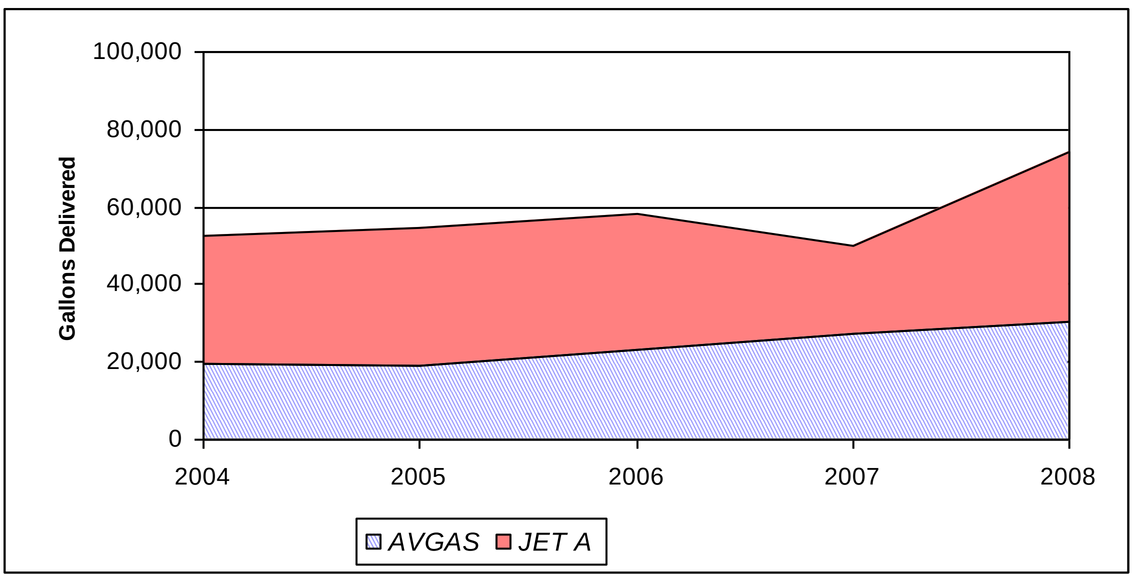
Airport Fuel Deliveries

A review of recent aviation fuel deliveries at the airport was conducted to help gauge current activity trends. The data summarized in **Table 3-9** and **Figure 3-3** illustrates an upward trend that is consistent with growth in aircraft activity. In particular, the volume of aviation gasoline (AVGAS) deliveries at the airport climbed steadily between 2003 and 2008 (+56%), with relatively small fluctuations from year to year. AVGAS volume increased from just less than 20,000 gallons to more than 30,000 gallons per year, which is consistent with the airport's growing based aircraft (piston) fleet. Jet fuel volumes fluctuated widely between 23,000 and 45,000 gallons during this period, with a near doubling in volume between 2007 and 2008. Year-to-date deliveries for 2009 for both jet fuel and AVGAS are well below 2008 levels, but comparable to other recent years.

TABLE 3-9: AIRPORT FUEL ACTIVITY (MADRAS MUNICIPAL AIRPORT) (GALLONS DELIVERED)

	2004	2005	2006	2007	2008
AVGAS (% of total volume delivered)	19,643 (37%)	19,196 (35%)	23,036 (39%)	27,073 (54%)	30,652 (41%)
Percent Increase/Decrease From Previous Year	--	*-2.2%*	*+20.0%*	*+17.5%*	*+13.2%*
Jet Fuel (% of total volume delivered)	32,900 (63%)	35,562 (65%)	34,459 (61%)	22,797 (46%)	43,487 (59%)
Percent Increase/Decrease From Previous Year	--	*+8.1%*	*-3.1%*	*-33.8%*	*+90.8%*
Total	**52,543** (100%)	**54,758** (100%)	**58,495** (100%)	**49,870** (100%)	**74,139** (100%)
Percent Increase/Decrease From Previous Year	--	*+4.2%*	*+6.8%*	*-14.7%*	*+48.7%*

FIGURE 3-3: SUMMARY OF HISTORIC AVIATION FUEL DELIVERIES (MADRAS MUNICIPAL AIRPORT)



The airport currently has one turbine based aircraft (aerial applicator), but has accommodated locally-based business turboprop aircraft in the past. According to the FBO, the airport is attracting a growing amount of itinerant business aircraft, including turboprop and business jets. It is believed that competitive fuel prices and the availability of quality of aviation services have contributed to increased itinerant air traffic levels. This measure of activity helps to quantify recent and current demand, and provides a strong indication of the airport's future activity potential.

Updated Forecasts

Two new forecasts of based aircraft and aircraft operations were developed for Madras Municipal Airport to supplement the existing forecasts described earlier in the chapter. The first projection is based on the historic relationship between airport activity and local area population. The second projection is based on the regional characteristics of the four central Oregon NPIAS airports (Bend, Redmond, Prineville, and Madras). Composite growth rates were developed based on recent historic activity and the most recent master plan projections for these airports. This projection reflects the region's strength in general aviation activity that can reasonably be applied to Madras.

The updated forecasts are described below, summarized in **Table 3-11,** and depicted in **Figures 3-4 and 3-5** presented later in the chapter.

Projection #1 - Population-Airport Activity Ratio

This projection assumes that the long-term historic relationship established between local area population and activity at Madras Municipal Airport will continue largely unchanged during the current planning period. Recently updated long term population forecasts for the City of Madras and Jefferson County reflect moderate-to-strong growth over the next 40 to 50 years. This growth is expected to contribute in increased airport activity through the current 20-year planning period and beyond.

<u>Based Aircraft</u>

The based aircraft fleet at Madras Municipal Airport has generally grown at a slightly slower rate than local population over the last 30 to 40 years, although the airport has experienced occasional periods of faster growth. The service area for Madras Municipal Airport extends beyond the local community to include the outlying county. For forecasting purposes, an evaluation of airport activity based on future county population appears to be appropriate. The ratio of based aircraft to population within the county has remained relatively steady, with a slight decline from approximately 2.8 based aircraft per 1,000 residents in 1970, to about 2.7 in 2009.

The recently-updated Jefferson County comprehensive plan population forecasts were used to develop a projection of based aircraft that extends a similar trend through 2029. This projection assumes that airport activity will increase over the long term at a rate slightly slower than overall population growth. This assumption is reflected in a slight downward shift in the population to based aircraft ratios. However, as noted earlier, the annual rate of growth reflected in the comprehensive plan forecasts is significantly higher than State of Oregon OEA long-term population forecasts (2.6% annual growth compared to 1.6%). By using the more aggressive comprehensive plan forecast as a basis for projecting airport activity, the resulting aviation forecast is slightly more optimistic than the two existing forecasts (FAA and ODA). In this projection, based aircraft increase from 62 to 91 between 2009 and 2029, which equates to an average annual growth rate of **1.94 percent.**

Aircraft Operations

This projection assumes that aircraft operations during the 20-year planning period will increase at a rate slightly higher than based aircraft. The ratio of aircraft operations per based aircraft is projected to increase from 210 to 230 during the twenty-year planning period. This assumption reflects an expectation that future airport activity will be similar to current activity, although increased transient aircraft use of the airport is expected to coincide with local economic growth and the ability of the airport to provide facilities and services to serve this segment of activity. As noted earlier, the airport's historic activity ratios have fluctuated widely (194 to 358) based on the periodic RENS activity counts. The range of the gradual increase in activity ratios used in this forecast is also consistent with FAA guidance for estimating activity at non-towered general aviation airports. In this projection, annual operations increase from 13,020 to 20,865 between 2009 and 2029, which equates to an average annual growth rate of **2.39 percent.**

Projection #2 –Regional Market Trend

This projection reflects the historic growth and long-term expectations for general aviation activity at Central Oregon's primary public airports located in Redmond, Bend, Prineville and Madras. A summary of historic and forecast activity for the airports is presented in **Table 3-10**. The composite data illustrates a strong upward trend for general aviation activity that coincided with the area's dramatic population and economic growth over the last twenty years.

TABLE 3-10: CENTRAL OREGON GENERAL AVIATION ACTIVITY SUMMARY

Airport Master Plan Forecasts (1997-2002)	**Based Aircraft [1] (1994)**	**Based Aircraft [1] (2002)**	**Long-Term Forecast (Master Plans)**	
Bend Municipal	112	154	250[2]	
Redmond – Roberts Field	61	110	170[3]	
Madras Municipal	45	46	55[4]	
Prineville	37	74	124[5]	
Totals	**255**	**384**	**599**	
Overall Change		*+ 51%*	*+56%*	
Average Annual Growth Rate (%)		***5.25%***	***2.5% (+/-)***	
2007 Oregon Aviation Plan Forecasts	**Based Aircraft (2005)**	**Based Aircraft (2025)**	**GA Operations (2005)**	**GA Operations (2025)**
Bend Municipal	183	295	37,620	60,580
Redmond – Roberts Field	117	197	45,813	71,490
Madras Municipal	40	52	10,066	12,961
Prineville	94	121	10,239	15,481
Totals	**434**	**665**	**103,738**	**160,512**
Overall Change		*+ 53%*		*+55%*
Average Annual Growth Rate (%) (20 year forecast)		***2.2%***		***2.2%***

1. FAA 5010 record forms, local airport master plans or airport records.
2. Airport Plan Update (2020 Forecast), Century West Engineering (2001)
3. Airport Master Plan (2017 Forecast), Coffman Associates (1997)
4. Airport Layout Plan Report (2017 Forecast), Aron Faegre & Assoc./Century West Engineering (1997)
5. Airport Layout Plan Report (2024 Forecast), Century West Engineering (2002)

The long-term forecasts of activity contained in individual airport master plans and statewide aviation system planning maintains strong growth expectations for the region's airports. The average annual growth rates reflected in recent forecasts for the group of airports ranges from approximately 2.2 to 2.5 percent. When viewed as regional group, the activity at these airports clearly demonstrates the region's economic strength and the depth of the local general aviation user base.

Based Aircraft

A based aircraft forecast was prepared for Madras Municipal Airport utilizing an annual average growth rate of approximately 2.4 percent. This rate is comparable to the historic and forecast composite growth rates for the region's four primary general aviation airports and reflects the potential of Madras to compete effectively for market share. In this projection, based aircraft increase from 62 to 100 between 2009 and 2029, which equates to an average annual growth rate of **2.42 percent.**

Aircraft Operations

This projection also assumes that the ratio of aircraft operations to based aircraft will increase during the current planning period. For this projection, the activity ratio increases from 210 operations per based aircraft to 250 during the twenty-year planning period. This increase is consistent with slightly stronger growth in market share for both locally-based and itinerant activity, than assumed in Projection #1. In this projection, annual operations increase from 13,020 to 25,000 between 2009 and 2029, which equates to an average annual growth rate of **3.32 percent.**

Forecast Summary

The two updated projections and the two existing forecasts (TAF and Oregon Aviation Plan) provide a reasonable range of annual growth that creates a forecast envelope. The forecast envelop reflects the potential for variations in activity that can be caused by a wide variety of factors that are difficult to precisely quantify.

The recommended preferred master plan forecast for Madras Municipal Airport is **Projection #1 – Population-Airport Activity Ratio.** This forecast builds on an established activity trend that extends back over the last two decades. Based aircraft are projected to increase from 62 to 91 over the twenty year period (average annual growth rate of **1.94 percent)**. Annual operations are projected to increase from 13,020 to 20,865 during the same period (average annual growth rate of **2.39 percent**). The more aggressive **Projection #2 – Regional Market Trend** is recommended for use in defining near-term development reserves for activity-based facility requirements, such as hangar and aircraft parking capacity. The preferred forecasts are summarized in additional detail in **Table 3-12** and **Table 3-13.**

As with any long term facility demand forecast, it is recommended that adequate long term development reserves be protected to accommodate demand that may exceed current projections. For planning purposes, a reserve capable of accommodating a doubling of the 20-year preferred forecast demand should be adequate to accommodate unforeseen facility needs during the current planning period. However, should demand significantly deviate from the airport's recent historical trend, updated forecasts should be prepared to ensure that adequate facility planning is maintained.

Design Aircraft

The existing and future design aircraft for Runway 16/34 listed in the 1997 Airport Layout was an Aero Commander 1000, a twin-engine turboprop included in Airport Reference Code: C-II. However, it was determined that the business aviation activity represented by the Aero Commander was more consistent with ARC B-II. It was noted that the airport also accommodated nearly 300 itinerant operations with other B-II or larger aircraft, with total ADG II operations estimated at 700 in 1997.

The Aero Commander is no longer at the airport and all locally based fixed-wing aircraft are single-engine or multi-engine aircraft included in Airplane Design Group I (ADG I). However, the airport regularly accommodates a wide variety of itinerant ADG II business aircraft, primarily turboprops and small/medium business jets, and limited amount of larger business jets. This activity is currently estimated at approximately 650 annual operations (approximately 5 percent of total airport operations).

The majority of ADG II activity consists of Approach Category B aircraft, although many larger business jets are included in Approach Category C or D. In addition, with the planned relocation of the Butler Aviation aircraft maintenance facility to the airport in 2010, Runway 16/34 will accommodate a limited amount of ADG III and ADG IV aircraft (B-III, C-IV).

The current capabilities of the airport's primary runway-taxiway system are generally consistent with the requirements of Airplane Design Group II. Based on these considerations and FAA criteria for defining the "design aircraft," current and forecast traffic levels support maintaining the existing B-II design aircraft and Airport Reference Code (ARC) for Runway 16/34. Specific facility upgrades are anticipated to accommodate the larger ADG III/IV aircraft, although the projected activity levels are not expected justify a change in ARC.

For planning purposes, the existing design aircraft is defined as a medium business turboprop such as Beechcraft King Air 300 (Airport Reference Code (ARC) B-II). The future design aircraft is also included in Airport Reference Code (ARC) B-II, but is expected to be a medium size business jet, such as a Cessna Citation Bravo. This expectation is consistent with turbine aircraft manufacturing trends and Madras Municipal Airport's ability to serve a broad range of business aviation users.

The existing and future design aircraft for Runway 3/21 (now 4/22) noted on the 1997 ALP was an unspecified "light twin" (Airport Reference Code: A-I (small). Based on current and forecast activity, the previous design aircraft and corresponding ARC identified for the crosswind runway should be maintained for planning purposes.

A detailed discussion of design aircraft considerations is contained in the Facility Requirements chapter.

Fleet Mix & Peak Activity

The preferred forecast assumes that the level of business aviation activity (ADG II) will increase in the future, as the airport's share of business traffic grows. During the planning period, ADG I aircraft are expected to continue to account for greater than 90 percent of total operations, with ADG II aircraft increasing from about 5 percent to approximately 7 percent of total airport operations. The projected ADG III/IV activity, military fixed-wing activity and helicopter activity are each expected to account for less than 1 percent of annual airport operations during the planning period. The forecast fleet mix and distribution of operations by airport reference code (ARC) is included in **Table 3-12** and **Table 3-13**, at the end of the chapter.

Based on a review of fuel delivery data, it appears that the peak month activity occurs during the summer months and accounts for approximately 15 to 18 percent of annual activity. For forecasting purposes, the peak month will be estimated to be 18 percent.

Instrument Approaches

Historic data on instrument approaches at Madras Municipal Airport in the FAA Terminal Area Forecasts (TAF) is very limited and does not provide an indication of any established trend or sustained activity levels. Acquiring historic instrument related data from flightaware.com was investigated, but the site indicated that data was not available.

It has been noted that the approach minimums for the existing RNAV approach are high, which reduces the effectiveness of the approach during poor weather conditions. Options for reducing the approach minimums are being examined, which could increase instrument approach activity in the future. For planning purposes, it is assumed that instrument approaches typically account for approximately 1 to 2 percent of total aircraft landings at Madras Municipal Airport, which would be in the range of 100 to 200 per year.

TABLE 3-11: EXISTING & UPDATED GENERAL AVIATION FORECASTS

Source	2005	2009	2014	2019	2024	2029
Based Aircraft 7/2009 Count: 62						
FAA TAF (0.90% AAR: 2005-2025)	57	58	62	64	67	--
2007 ODA Forecast (1.27% AAR 2005-2025)	40	44*	48*	50**	52*	--
Master Plan Projection #! (Population/Activity Ratio) (1.94% AAR 2009-2029) ***Preferred Forecast***	--	**62**	**70**	**76**	**84**	**91**
Master Plan Projection #2 (Increased Market Share) (2.42% AAR 2009-2029)	--	62	70	79	88	100
Aircraft Operations 2008 Estimate: 13,020						
TAF (1.24% AAR: 2005-2025)	10,066	10,573	11,243	11,956	12,714	--
2007 ODA Forecast (1.27% AAR 2005-2025)	10,066*	10,978*	11,639*	12,282**	12,961*	--
Master Plan Projection #1 (Population/Activity Ratio) (2.39% AAR 2009-2029) ***Preferred Forecast***	--	**13,020**	**14,981**	**16,676**	**18,911**	**20,865**
Master Plan Projection #2 (Regional Trend Composite) (3.32% AAR 2009-2029)	--	13,020	15,357	18,077	21,237	25,000

* Data from adjacent (following) forecast year (2010, 2015, 2025)
** Interpolated between 2015 and 2025 projections

FIGURE 3-4: GENERAL AVIATION BASED AIRCRAFT FORECASTS

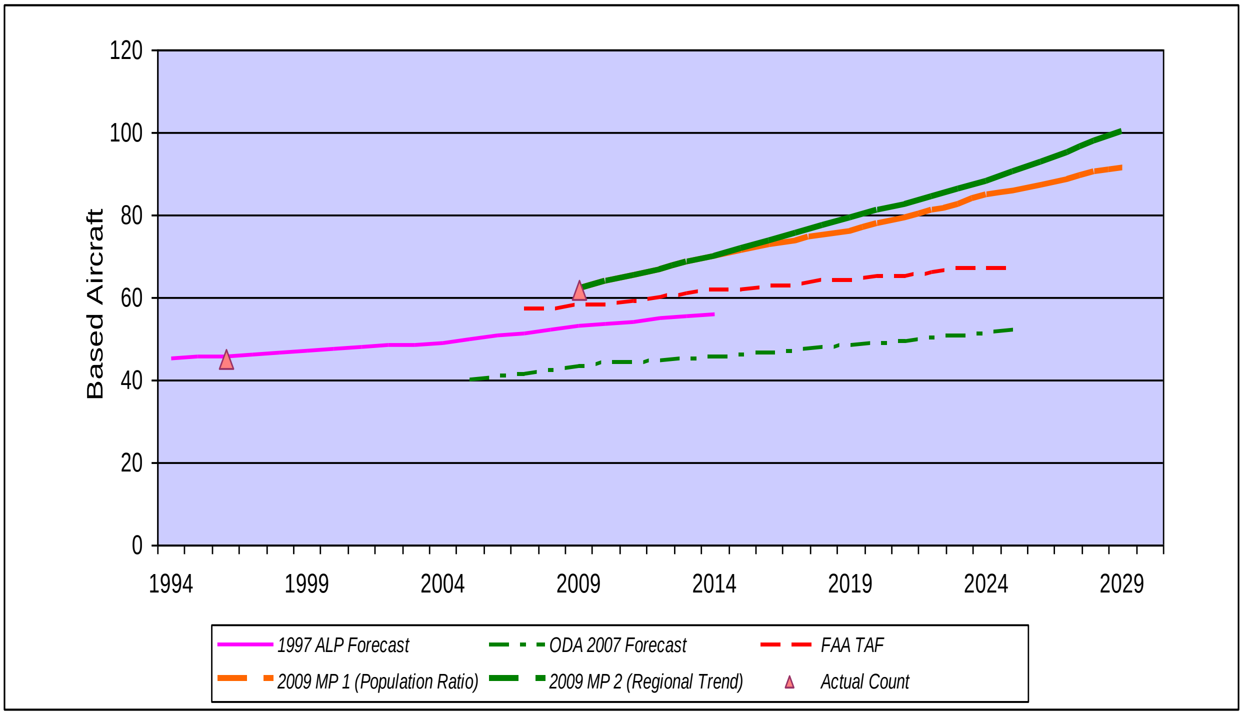


FIGURE 3-5: GENERAL AVIATION OPERATIONS FORECASTS

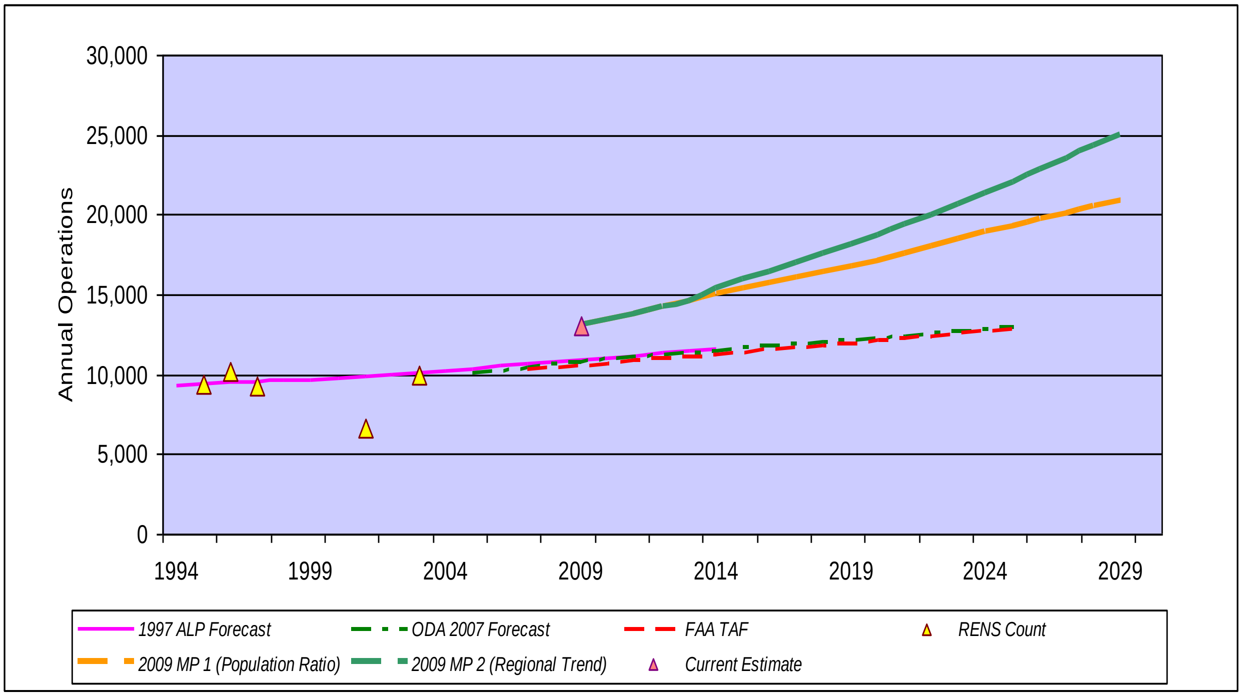


TABLE 3-12: SUMMARY OF PREFERRED AVIATION FORECAST

Activity	2009	2014	2019	2024	2029
Based Aircraft					
Single Engine Piston	57	60	62	64	66
Multi-Engine Piston	2	2	3	3	3
Turboprop	1	1	2	2	3
Business Jet/VLJ	0	0	0	1	2
Light Sport (LSA)	0	3	5	10	13
Other (Ultralight)	1	2	2	2	2
Helicopter	1	2	2	2	2
Total	**62**	**70**	**76**	**84**	**91**
Aircraft Operations					
Itinerant Operations (40%)					
General Aviation	5,058	5,792	6,340	7,214	7,896
Air Taxi	100	100	200	200	300
Fire Aircraft (Large)	0	50	80	100	100
Military	50	50	50	50	50
Total Itinerant Operations	5,208	5,992	6,670	7,564	8,346
Local Operations (60%)					
Total Local Operations (all GA)	7,812	8,989	10,006	11,347	12,519
Total Local & Itinerant Operations	**13,020**	**14,981**	**16,676**	**18,911**	**20,865**

TABLE 3-13: SUMMARY OF FORECAST ACTIVITY

Activity	2009	2014	2019	2024	2029
Total Local & Itinerant Operations	**13,020**	**14,981**	**16,676**	**18,911**	**20,865**
Peak Month Operations (18%)	2,435	2,697	3,002	3,404	3,756
Design Day (average day in peak month)	81	90	100	114	125
Peak Day Operations	110	122	136	154	170
Peak Hour Operations (assumed 15% of peak day)	17	18	20	23	26
A-I/B-I (small) Operations	12,270	14,081	15,526	17,556	19,155
A-II/B-II Operations	650	750	1,000	1,135	1,460
B-III Operations	0	30	30	40	50
C-IV Operations	0	20	20	30	50
Helicopter Operations	100	100	100	150	150
Airport Reference Code (ARC) Runway 16/34	**B-II**	**B-II**	**B-II**	**B-II**	**B-II**
Airport Reference Code (ARC) Runway 4/22	**A-I (small)**	**A-I (small)**	**A-I (small)**	**A-I (small)**	**A-I (small)**

Chapter Four
Airport Facility Requirements

CHAPTER FOUR
AIRPORT FACILITY REQUIREMENTS

Introduction

This evaluation uses the results of the inventory and forecasts contained in Chapters Two and Three, as well as established planning criteria, to determine the airside and landside facility requirements for Madras Municipal Airport through the current twenty year planning period. Airside facilities include runways, taxiways, navigational aids and lighting systems. Landside facilities include hangars, fixed base operator (FBO) facilities, aircraft parking apron, aircraft fueling, surface access and automobile parking, utilities, and other related items. All airfield items are evaluated based on established standards from the Federal Aviation Administration (FAA).

The facility requirements evaluation is used to identify the adequacy or inadequacy of existing airport facilities and identify what new facilities may be needed during the planning period based on forecast demand. Potential options and preliminary costs for providing these facilities will be evaluated in Chapter Five (Alternatives) to determine the most cost effective and efficient means for meeting projected facility needs.

Background

As noted in Chapter Three, the current and forecast design aircraft for Runway 16/34 is a business class aircraft (turboprop/business jet) included in Airplane Design Group II and Aircraft Approach Category B (Airport Reference Code B-II). The current and future design aircraft for Runway 4/22 is small single engine or light twin-engine aircraft included in Airplane Design Group I and Aircraft Approach Category A (Airport Reference Code A-I Small). Please see the "Airport Design Standards" section of this chapter (beginning on Page 4-11) for a detailed description of the criteria and characteristics used to categorize design standards.

Based on FAA criteria, the facility requirements associated with the design aircraft provide the basis for planning future airport improvements that are generally eligible for FAA funding. The primary requirement is a minimum of 500 annual itinerant operations by the design aircraft.

It is noted that Madras Municipal Airport will begin accommodating a limited amount of large aircraft (transport category) activity associated with new aircraft maintenance facility operated by

Butler Aircraft Company. According to company officials, maintenance on Butler's fleet of DC-6 and C130 aircraft will be relocated to Madras from Roberts Field in Redmond in 2010. The activity generated by these aircraft is expected to initially total less than 100 operations (takeoffs and landings) per year. Since the anticipated level of transport category aircraft activity is well below the 500 operations threshold required by FAA for use as a design aircraft, the primary master facility requirements assessment will be based on the needs of the design aircraft for each runway and specific landside facilities.

The facility requirements associated with the larger aircraft activity have been evaluated separately and are provided in **Appendix A – Large Aircraft Facility Requirements**. It is noted that many of the facility needs associated with the design aircraft will also benefit larger aircraft. It is expected that many of the large aircraft facility needs will be addressed as the overall facility requirements are addressed through the long-term planning period. Evaluations of potential FAA funding eligibility will be performed on each individual project as they are implemented.

Madras Municipal Airport Facility Requirements - Executive Summary

An executive summary of the major facility needs identified in the updated evaluation is provided in **Table 4-1**. Short term needs are anticipated within the first ten years of the planning period; long term needs are anticipated beyond ten years. Detailed information about each of these items can be found in the chapter.

Note: The technical evaluation related to Runway 4/22 assumes that the existing runway is maintained. However, options for re-development or replacement of the runway are also considered in chapter five (Development Alternatives).

TABLE 4-1: EXECUTIVE SUMMARY OF 2009 AIRPORT MASTER PLAN FACILITY REQUIREMENTS

RUNWAY 16/34

Current/Short Term:

- *Pavement Maintenance*
- *Increase Pavement Strength for Design Aircraft (overlay/reconstruction)*
- *Evaluate RSA and OFZ at Runway 16 end (in-line taxiway)*
- *Runway Extension (5,290 feet) based on design aircraft family of aircraft (75% of large aircraft less than 60,000 pounds with 60% useful load)*

Long Term:

- *Pavement Maintenance*
- *Reserve Area for Runway Extension (beyond 20 year planning period)*

RUNWAY 4/22 *(Need identified for existing runway; subject to change based on preferred alternative)*

Current/Short Term:

- *Pavement Maintenance*
- *Evaluate RSA and OFZ at Runway 22 end (in-line taxiway & AC hold area)*

Long Term:

- *Pavement Maintenance*
- *Runway Extension (3,300 feet) based on 75% of small airplane fleet*
- *Widen Runway to 60 feet (ADG I standard)*
- *Pavement Overlay/Reconstruction*

TAXIWAYS

Current/Short Term:

- *Pavement Maintenance*
- *Increase Pavement Strength for design aircraft (typical medium business jet)*
- *Evaluate North Access Taxiway Reconfiguration Options to address FAA standards and maintain required access to Runway 4/22*
- *Widen South Access Taxiway to Main Apron to 35 feet (ADG II standard)*
- *Add Second "mid-runway" Exit Taxiway north of the main apron to improve aircraft movement*
- *Reconfigure Aircraft Holding Areas (parallel taxiway) to meet ADG II taxiway OFA clearance*

Long Term:

- *Pavement Maintenance*
- *Pavement Overlays/Reconstruction*
- *Extend Taxiways/Taxilanes to new landside facilities*

TABLE 4-1: (CONTINUED) EXECUTIVE SUMMARY OF 2009 AIRPORT MASTER PLAN FACILITY REQUIREMENTS

AIRCRAFT APRON

Current/Short Term:

- *Reconfigure/Expand Apron:*
  - *Reconfigure/Increase Light Aircraft Tiedowns*
  - *Increase itinerant Business Aircraft Parking*
  - *Designated Helicopter Parking*
  - *Passenger Loading/Unloading Area*
  - *Aircraft Fueling Area*
  - *Increase Pavement Strength for Large Aircraft Parking and Access Taxilanes*
  - *Drainage/Stormwater Improvements*
  - *New Aircraft Wash Pad*
- *Large Aircraft Parking (DC6, C130)*

Long Term:

- *Aircraft Parking Reserves*

AIRCRAFT HANGARS

Current: Existing hangar lease area available for aircraft storage hangars and commercial hangars

Short Term:

- *0-10-Year Forecast Demand: +14 Aircraft (assume 90% to be hangared)*

Long Term:

- *11-20-Year Forecast Demand: +15 Aircraft (assume 90% to be hangared)*
- *Establish hangar development reserves (equal to 100 percent of 20-year forecast demand)*

AIRFIELD LIGHTING AND INSTRUMENTATION

Short Term:

- *Automated Weather Observation System (AWOS)*
- *Evaluate Options for Reducing Existing IAP Minimums*
- *Medium Intensity Taxiway Lighting (MITL)*
- *Lighted Airfield Signage (mandatory instruction, location, destination, etc.)*
- *Runway 16: PAPI, REIL*
- *Runway 34: REIL*

Long Term:

- *Rwy 34: PAPI (VASI replacement)*
- *Rwy 4/22: MIRL, PAPI*

TABLE 4-1: (CONTINUED) EXECUTIVE SUMMARY OF 2009 AIRPORT MASTER PLAN FACILITY REQUIREMENTS

MISCELLANEOUS (FENCING, ACCESS, UTILITIES)
Current: • *New Aircraft Wash Pad* • *Overhead Lighting (apron & fueling areas)* *Short Term:* • *Replace AVGAS & Jet Fuel Tanks* • *Extend Fencing & Controlled Access to New Landside Development Areas* • *Stormwater/Drainage Improvements (terminal area)* *Long Term:* • *Airport Perimeter Fencing (airfield operations area)* • *Access road improvements to new landside areas.*

Facility Requirements Assessment - Organization

This chapter divides the facility requirements assessment into two primary groups:

- Conformance with Federal Aviation Administration (FAA) airport design and airspace planning standards;
- Demand-based facility needs that reflect the updated aviation activity forecasts presented in Chapter Three.

The first group addresses Madras Municipal Airport's current and future conformance with FAA airport design standards and airspace planning criteria that will be reflected on the updated Airport Layout Plan. The second group will reflect in gross numbers, new facility needs such as runway length requirements, hangar spaces and aircraft parking positions based on forecast demand and the needs of the design aircraft. Items such as lighting and navigational aids are evaluated based on the type of airport activity, airport classification and current capabilities.

Figures 4-1, 4-2 and 4-3 illustrate the general location of the non conforming items identified on the airfield. In general, these items are relatively minor and can be corrected through specific facility upgrades or reconfigurations. The noted items are described in detail in the applicable sections of the chapter.

LEGEND

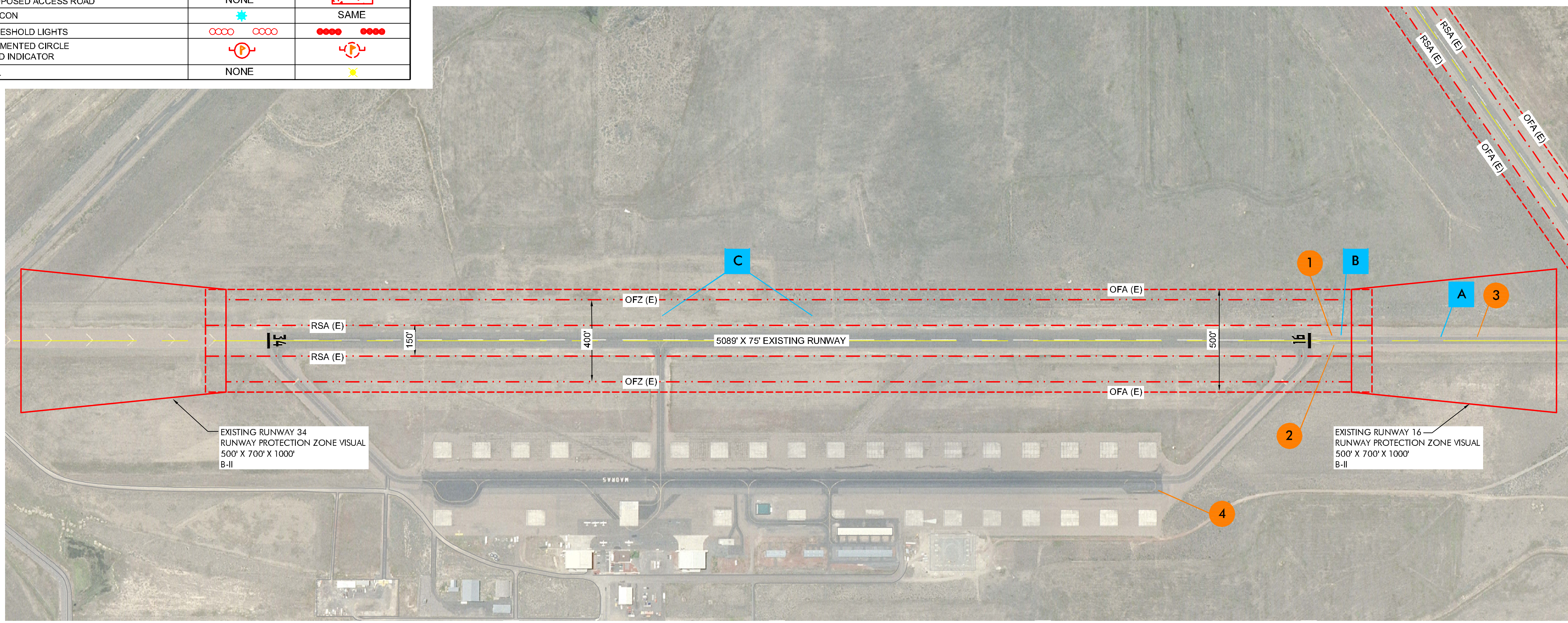
	EXISTING	FUTURE
FACILITIES		
BUILDINGS		
RUNWAY		
BUILDING RESTRICTION LINE (BRL)	BRL (E)	BRL (F)
AIRCRAFT PARKING LINE (APL)	APL (E)	APL (F)
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
TAXIWAY OBJECT FREE AREA (TOFA)		
OBSTACLE FREE ZONE (OFZ)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS		SAME
AIRPORT REFERENCE POINT (ARP)		
PROPOSED AIRFIELD PAVEMENT	N/A	
VISUAL GUIDANCE INDICATORS	NONE	PAPI
WIND INDICATOR		
AVIGATION EASEMENT		SAME
FENCE		
PROPOSED ACCESS ROAD	NONE	
BEACON		SAME
THRESHOLD LIGHTS		
SEGMENTED CIRCLE WIND INDICATOR		
REIL	NONE	

FAA AIRPORT DESIGN STANDARDS

1. RSA: IN LINE TAXIWAY
2. OFZ: IN LINE TAXIWAY
3. RPZ: IN LINE TAXIWAY
4. TAXIWAY OFA: AC HOLD AREA

FAR PART 77 SURFACE PENETRATIONS/CONFLICTS

A. APPROACH SURFACE (RWY 16): AIRCRAFT ON IN LINE TAXIWAY
B. PRIMARY SURFACE (RWY 16): AIRCRAFT ON IN LINE TAXIWAY
C. PRIMARY SURFACE: TREES/BUSHES



N

0 250 500
SCALE OF FEET
SCALE: 1"=250'

CENTURY WEST
ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT
NONSTANDARD ITEMS
RUNWAY 16-34

FIGURE NO.
4-1

LEGEND

	EXISTING	FUTURE
FACILITIES		
BUILDINGS		
RUNWAY		
BUILDING RESTRICTION LINE (BRL)	BRL (E)	BRL (F)
AIRCRAFT PARKING LINE (APL)	APL (E)	APL (F)
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
TAXIWAY OBJECT FREE AREA (TOFA)		
OBSTACLE FREE ZONE (OFZ)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS		SAME
AIRPORT REFERENCE POINT (ARP)		
PROPOSED AIRFIELD PAVEMENT	N/A	
VISUAL GUIDANCE INDICATORS	NONE	PAPI
WIND INDICATOR		
AVIGATION EASEMENT		SAME
FENCE		
PROPOSED ACCESS ROAD	NONE	
BEACON		SAME
THRESHOLD LIGHTS		
SEGMENTED CIRCLE WIND INDICATOR		
REIL	NONE	

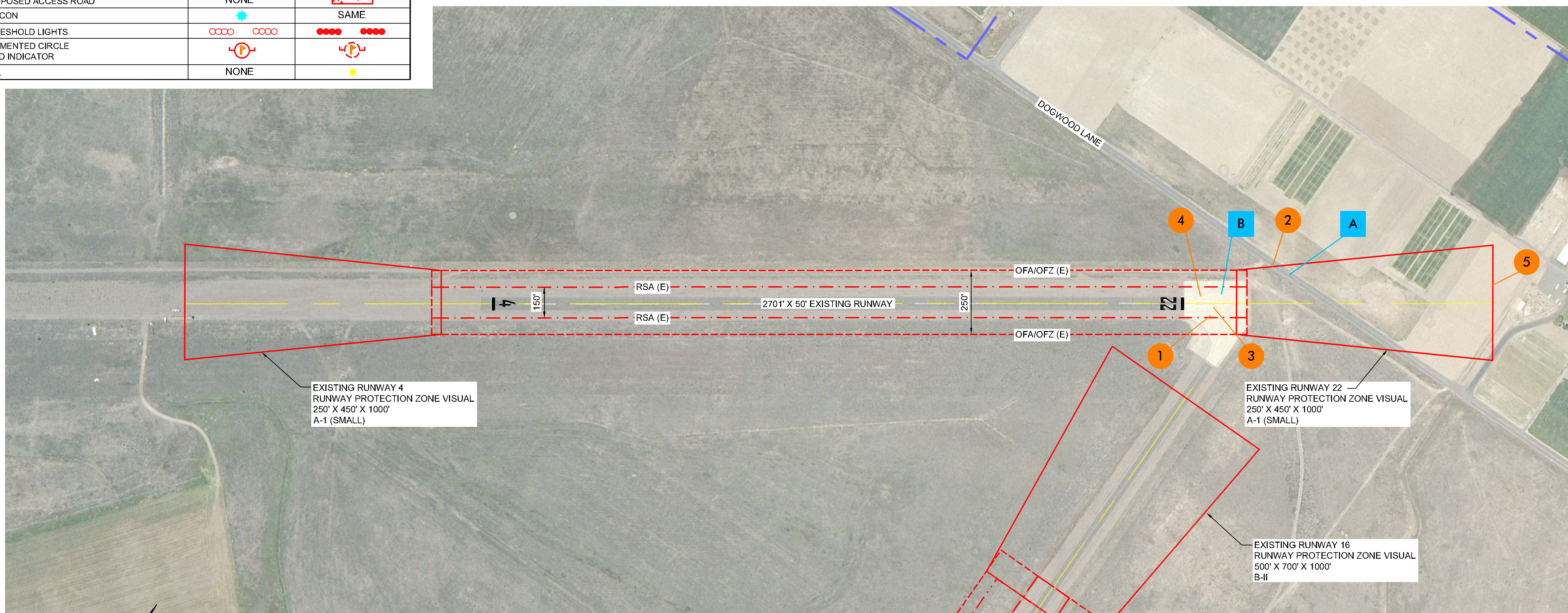
FAA AIRPORT DESIGN STANDARDS

1. OFZ/RSA: AC HOLD LINE
2. RPZ: VEHICLES ON PUBLIC ROAD
3. TAXIWAY MARKINGS : WHITE CENTERLINE STRIPE & ARROWHEADS
4. OFZ/RSA: IN LINE TAXILANE
5. RPZ: OWNERSHIP OF PROPERTY IN RPZ

FAR PART 77 SURFACE PENETRATIONS/CONFLICTS

A. APPROACH SURFACE (RWY 22): VEHICLES ON ROADWAY

B. PRIMARY SURFACE (RWY 22): AIRCRAFT IN LINE TAXILANE



N

0 250 500

SCALE OF FEET
SCALE: 1"=250'

CENTURY WEST
ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT
NONSTANDARD ITEMS
RUNWAY 4-22

FIGURE NO.

4-2

LEGEND

	EXISTING	FUTURE
FACILITIES		
BUILDINGS		
RUNWAY		
BUILDING RESTRICTION LINE (BRL)	BRL (E)	BRL (F)
AIRCRAFT PARKING LINE (APL)	APL (E)	APL (F)
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
TAXIWAY OBJECT FREE AREA (TOFA)		
OBSTACLE FREE ZONE (OFZ)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS		SAME
AIRPORT REFERENCE POINT (ARP)		
PROPOSED AIRFIELD PAVEMENT	N/A	
VISUAL GUIDANCE INDICATORS	NONE	PAPI
WIND INDICATOR		
AVIGATION EASEMENT		SAME
FENCE		
PROPOSED ACCESS ROAD	NONE	
BEACON		SAME
THRESHOLD LIGHTS		
SEGMENTED CIRCLE WIND INDICATOR		
REIL	NONE	

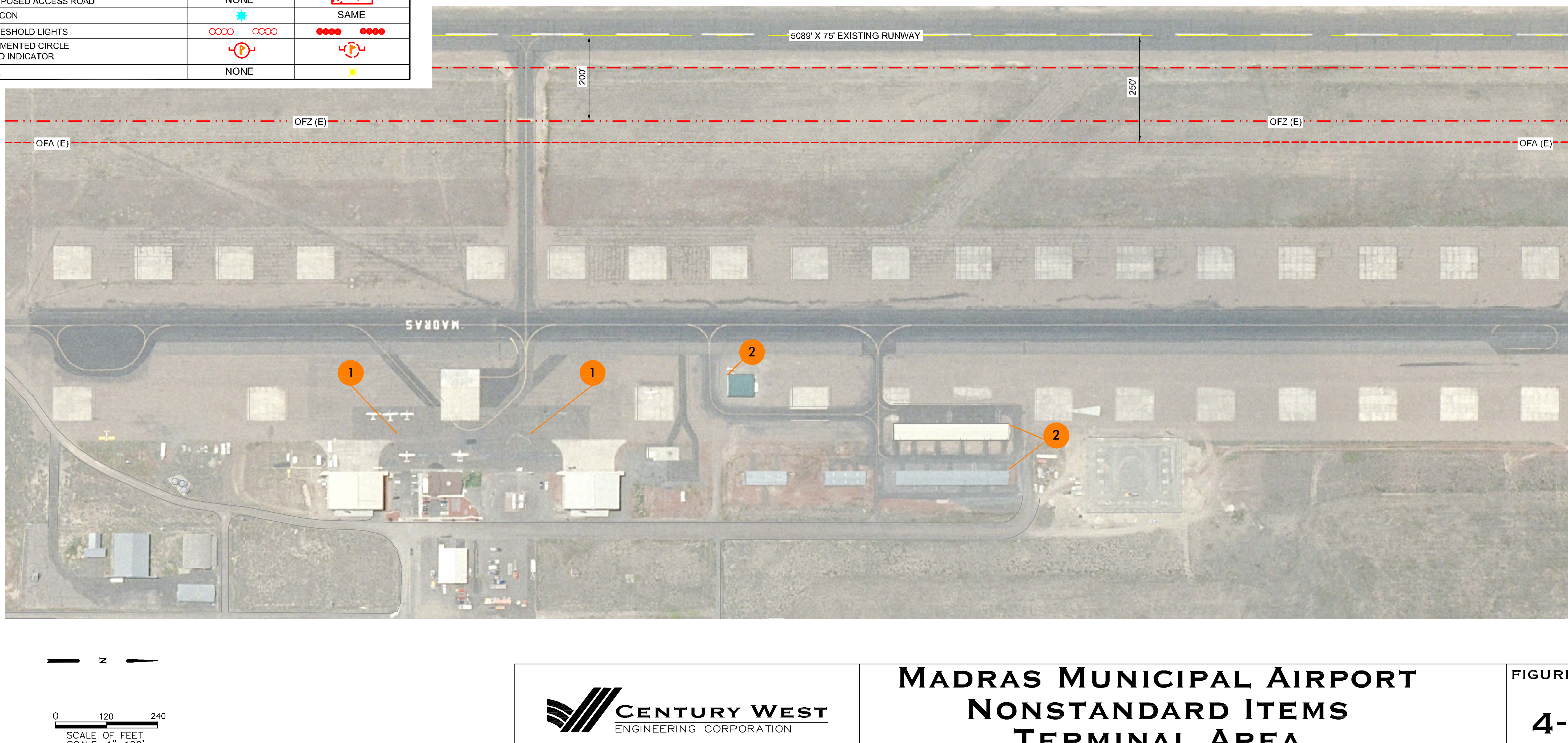
FAA AIRPORT DESIGN STANDARDS

1 TAXILANE OFA: PARKED AIRCRAFT; AIRCRAFT FUELING

2 TAXILANE OFA: HANGARS

FAR PART 77 SURFACE PENETRATIONS/CONFLICTS

A NONE



CENTURY WEST ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT NONSTANDARD ITEMS TERMINAL AREA

FIGURE NO. 4-3

1997 AIRPORT LAYOUT PLAN OVERVIEW

The 1997 Airport Layout Plan Report (Faegre/Century West) recommended a variety of facility improvements for the twenty year planning period that extended from 1997 to 2016. The projects summarized in **Table 4-2** were included in the plan's twenty year capital improvement program (CIP). The projects were reviewed to identify those that have been completed (noted in the table). Projects that have not been implemented will be revalidated, modified or eliminated based on the updated assessment of facility needs and current FAA guidelines. As noted earlier, the previous plan recommendations, including the configuration of the preferred alternative, will be reviewed in this master plan update.

Recommended projects from the 1997 ALP Report that have been completed include:

- The Madras Aviation Building, which houses the local fixed base operator (FBO), public space, amenities and public vehicle parking. The general aviation terminal building represents a significant upgrade of facilities and services available for general aviation users.
- A new hangar taxilane was constructed in 2002 to connect to existing T-hangar taxilanes north of the main apron.
- Weatherization and other limited maintenance have been performed on the large Quonset hangars.
- Most airfield pavement sections have been fog sealed and crack sealed since 2000.

Other significant projects include:

- Expansion of Portland cement concrete (PCC) pavement for business aircraft parking on the main apron.
- Construction of a new 40,000 square foot aircraft hangar (currently underway) to house Butler Aircraft Company large aircraft maintenance operations. Other taxiway and aircraft parking improvements and a new aircraft wash pad are planned in the vicinity of the new hangar.

TABLE 4-2: SUMMARY OF 1997 AIRPORT LAYOUT PLAN RECOMMENDED PROJECTS AND CURRENT STATUS

Completed? Yes/No	Projects
Short Term Projects	
Yes	Runway 16/34 Sealcoat (2000)
Partial*	Parallel Taxiway & Connecting Taxiway Sealcoat (*north & south angled sections – in 2000)
Yes	Parallel Taxiway Reflectors
Yes	Runway 3/21 Sealcoat (2000)
No*	Main Apron Reconfiguration/Expansion (Phase I – 15,600 sy) *(*Expanded business AC parking area completed in 2005)*
No	Hangar/Apron Flood Lighting
Yes	GA Terminal Building (2006)
Yes	Terminal Area Vehicle Parking
Long Term Projects	
Yes	Large Hangar Maintenance *(ongoing)*
Yes*	T-Hangar Taxiway *(*new section of North T-hangar taxilane constructed in 1998)*
No	9-Unit T-Hangar
No	Connecting Taxiway Overlay (north access taxiway)
No	PAPI – Rwy. 16 & 34
No	Main Apron Expansion (Phase II – 9,600 sy)
No	East/South Security Fencing
No	Airport Roadway Extension (4,200 LF)
No	Automated Weather Station
No	Lighted Wind Cones (3)
No	REILS – Rwy. 16 & 34
No	Parallel Taxiway Overlay
No	Runway Sealcoat
No	Parallel Taxiway & Connecting Taxiway Sealcoat
No	Apron Sealcoat
No	North Hangar Taxilanes Sealcoat
No	West/North Animal Fencing
No	MITL – Parallel Taxiway
No	Runway 3/21 Edge Lighting (MIRL)

Sources: 1997 Airport Layout Plan Update; 2006 Pavement Maintenance Plan

AIRPORT DESIGN STANDARDS

As noted earlier, the selection of design standards for airfield facilities is based upon the characteristics of the aircraft that are expected to use the airport. The **design aircraft** is defined as the most demanding aircraft type operating at the airport with a minimum of 500 annual itinerant operations, as described by the Federal Aviation Administration (FAA):

***"Substantial Use Threshold.** Federally funded projects require that critical design airplanes have at least 500 or more annual itinerant operations at the airport (landings and takeoffs are considered as separate operations) for an individual airplane or a family grouping of airplanes. Under unusual circumstances, adjustments may be made to the 500 total annual itinerant operations threshold after considering the circumstances of a particular airport. Two examples are airports with demonstrated seasonal traffic variations, or airports situated in isolated or remote areas that have special needs."*

Federal Aviation Administration (FAA) **Advisory Circular (AC) 150/5300-13, Airport Design**, serves as the primary reference in planning airfield facilities. **Federal Air Regulation (FAR) Part 77.25, Objects Affecting Navigable Airspace**, defines airport imaginary surfaces which are established to protect the airspace immediately surrounding a runway. The airspace and ground areas surrounding a runway should be free of obstructions (i.e., structures, parked aircraft, trees, etc.) to the greatest extent possible to provide a safe operating environment for aircraft.

The FAA groups aircraft into five categories (A-E) based upon their approach speeds. Aircraft Approach Categories A and B include small propeller aircraft, many small or medium business jet aircraft, and some larger aircraft with approach speeds of less than 121 knots (nautical miles per hour). Categories C, D, and E consist of the remaining business jets as well as larger jet and propeller aircraft generally associated with commercial and military use with approach speeds of 121 knots or more. The FAA also establishes six airplane design groups (I-VI), based on the wingspan and tail height of the aircraft. The categories range from Airplane Design Group (ADG) I, for aircraft with wingspans of less than 49 feet, to ADG VI for the largest commercial and military aircraft.

The combination of airplane design group and aircraft approach speed creates the Airport Reference Code (ARC), which is used to define applicable airfield design standards. Aircraft with a maximum gross takeoff weight greater than 12,500 pounds are classified as "large aircraft" by the FAA; aircraft 12,500 pounds and less are classified as "small aircraft." For purposes of airspace planning, runways designed to accommodate small aircraft exclusively are designated "utility" and runways that accommodate large aircraft are designated "other than utility." For Madras Municipal Airport, the planning for Runway 16/34 has been historically based on the needs of large aircraft. Runway 4/22 has been planned based on the needs of small aircraft.

A list of typical general aviation and business aviation aircraft and their respective design categories is presented in **Table 4-3.** For illustration purposes, the two large aircraft (C130 and DC6) operating at Madras Municipal Airport on a limited basis are also listed in the table. **Figure 4-4** illustrates representative aircraft in various design groups.

TABLE 4-3: TYPICAL AIRCRAFT & DESIGN CATEGORIES

Aircraft	Aircraft Approach Category	Airplane Design Group	Maximum Gross Takeoff Weight (lbs)
Grumman American Tiger	A	I	2,400
Cessna 182	A	I	3,110
Cirrus Design SR22	A	I	3,400
Cessna 206	A	I	3,600
Beechcraft Bonanza A36	A	I	3,650
Socata/Aerospatiale TBM 700	A	I	6,579
Beechcraft Baron 58	B	I	5,500
Cessna 340	B	I	5,990
Cessna Citation CJ1	B	I	10,600
Beech King Air B100	B	I	11,800
Beechcraft 400A/Mitsubishi Diamond II	B	I	16,100
Piper Malibu (PA-46)	A	II	4,340
Cessna Caravan 1	A	II	8,000
Pilatus PC-12	A	II	9,920
Cessna Citation CJ2	B	II	12,300
Cessna Citation II	B	II	13,300
Beech King Air 350	B	II	15,000
Cessna Citation Bravo	B	II	15,000
Dassault Falcon 20	B	II	28,660
Bombardier Learjet 55	C	I	21,500
Hawker (HS125-700A)	C	I	25,000
Beechcraft Hawker 800XP	C	II	28,000
Cessna Citation Sovereign	C	II	30,250
Gulfstream 200	C	II	34,450
Cessna Citation X	C	II	36,100
Bombardier Challenger 300	C	II	37,500
Gulfstream III	C	II	69,700
Learjet 35A/36A	D	I	18,300
Douglas DC6	B	III	104,000
Lockheed 100-30	C	IV	155,000

Source: AC 150/5300-13, as amended; aircraft manufacturer data.

A-I less than 12,500 lbs. or less (small)	B-I less than 12,500 lbs. or less (small)	A-II, B-II less than 12,500 lbs. or less (small)	B-II greater than 12,500 lbs.	A-III, B-III greater than 12,500 lbs.
Beech Baron 55 Beech Bonanza Cessna 150 Piper Archer Piper Seneca	Beech Baron 58 Beech King Air 100 Cessna 402 Cessna 421 Piper Navajo Piper Cheyenne Cessna Citation I	Super King Air 200 Cessna 441 DHC Twin Otter Cessna Caravan King Air C90	Super King Air 300, 350 Beech 1900 Jetstream 31 Falcon 20, 50 Falcon 200, 900 Citation II, Bravo, XLS+ Citation CJ3	DHC Dash 7 DHC Dash 8 Q-300, Q-400 DC-3 Convair 580 Fairchild F-27 ATR 72 ATP





C-I, D-I	C-II, D-II	C-III, D-III	C-IV, D-IV	D-V
Lear 25, 35, 55, 60 Israeli Westwind HS 125 - 700	Gulfstream II, III, IV Canadair 600 Canadair Regional Jet Lockheed JetStar Citation X Citataton Sovereign Hawker 800 XP	Boeing Business Jet B 727-200 B 737-300 Series MD-80, DC- 9 Fokher 70, 100 A319, A320 Gulfstream V Global Express	B- 757 B- 767 DC- 8-70 DC- 10 MD- 11 L 1011	B- 747 Series B- 777





Century West Engineering Corporation

Aircraft Airport Reference Codes (ARC)

Figure 4-4

Design Aircraft

The recommended airspace planning and airport design standards for Madras Municipal Airport, consistent with the updated master plan forecasts are summarized below:

<u>Airport Planning & Design Standards Note:</u>

The following FAA standards are recommended for Madras Municipal Airport based on current and forecast aviation activity and planned runway approach capabilities:

Runway 16/34 (Existing & Future) – *Airport Reference Code (ARC) B-II. Runway design standards for aircraft approach category A & B runways with not lower than ¾-statute mile approach visibility minimums. Runway Protection Zones based on the approach visibility standard "not lower than 1-mile" for Aircraft Approach Categories A and B. FAR Part 77 airspace planning criteria based on "other than utility runways" with non-precision instrument approaches; visibility minimums greater than ¾ statute mile.*

Runway 4/22 (Existing & Future) – *Airport Reference Code (ARC) A-I (small aircraft exclusively). Runway design standards for aircraft approach category A & B visual runways. Runway Protection Zones based on the approach visibility standard "not lower than 1-mile" for Aircraft Approach Categories A and B. FAR Part 77 airspace planning criteria based on "utility runways" with visual approaches; visibility minimums greater than ¾ statute mile.*

All references to the "standards" are based on these assumptions, unless otherwise noted. (Per FAA Advisory Circular 150/5300-13, as amended; FAR Part 77.25)

The current (B-II) design aircraft for Runway 16/34 is a business class turboprop, which is represented by a Beechcraft Super King Air 300. The future design aircraft is a small/medium business jet, which is represented by a Cessna Citation Bravo. Both design aircraft are classified as "large" general aviation airplanes based on the maximum takeoff weights above 12,500 pounds. These aircraft typically carry 5 to 8 passengers and are used extensively for short and medium flights of 1 to 3 hours or less.

According to the local FBO, Madras Municipal Airport also accommodates occasional transient activity from Approach Category C or D aircraft (typically Airplane Design Group I or II). Current activity is estimated to be less 30 annual operations (typically 1 to 2 aircraft per month). Aircraft included this category are higher performance or larger aircraft such as Learjet, Falcon, Hawker, Challenger, and Gulfstream business jets. As noted earlier, the airport also expects to accommodate limited large aircraft operations beginning in 2010. These aircraft are included Approach Category B and C and Airplane Design Group III and IV. As with the larger business jet traffic, this activity is not expected to reach the FAA design aircraft activity threshold of 500 annual itinerant operations during the current twenty-year planning period. The facility needs of this specific activity will be evaluated on individual basis.

The existing conditions for Runway 16/34, the applicable design standards, and the current conformance to the standards are summarized in **Table 4-4.** For comparison, the standards associated with reduced approach visibility minimums (typically consistent with a precision instrument approach with approach lights) for B-II runways are also summarized in the table. A summary of existing conditions, ADG I (small) design standards, and current conformance to the standards for Runway 4/22 is presented in **Table 4-5**.

TABLE 4-4: AIRPORT DESIGN STANDARDS SUMMARY (DIMENSIONS IN FEET)

FAA Standard	**Runway 16/34** ***Existing Conditions***[1] *Shaded Items Meet or Exceed Recommended FAA Standard*	**Airplane Design Group II** *A&B Aircraft* *Approach Visibility* *≥ 3/4 mile*	**Airplane Design Group II** *A&B Aircraft* *Approach Visibility* *< ¾ mile*
Runway Length	5,089	5,290/7,250 [7]	5,290/7,250 [7]
Runway Width	75	75	100
Runway Shoulder Width	10	10	10
Runway Safety Area Width	150	150	300
Runway Safety Area Length (Beyond Runway End/Prior to Landing Threshold)	300 [2]	300	600
Obstacle Free Zone Width	400	400	400
Obstacle Free Zone Length (Beyond Runway End)	200 [2]	200	200
Object Free Area Width	500	500	800
Object Free Area Length (Beyond Runway End)	300	300	600
Primary Surface Width	500	500	1,000
Primary Surface Length (Beyond Rwy End)	200 [2]	200	200
Runway Protection Zone Length	1,000	1,000/1,700[9]	1,000/1,700[9]
Runway Protection Zone Inner Width	500	500	1,510
Runway Protection Zone Outer Width	700	700/1,010[9]	700/1,010[9]
Runway Centerline to: Parallel Taxiway/Taxilane Centerline Aircraft Parking Line (East) Building Restriction Line (East/West)	 680 773 [3] 773/850 [4]	 240 745.5 [8] 745.5 [8]	 300 745.5 [8] 745.5 [8]
Taxiway Width	35	35	35
Taxiway Shoulder Width	10	10	10
Taxiway Safety Area Width	115 [4]	115	115
Taxiway Object Free Area Width	131 [4]	131	131
Taxiway Centerline to Fixed/Movable Object	>65.5 [5]	65.5	65.5
Taxilane Object Free Area Width ADG II/ADG I (for light aircraft tiedowns)	<115 [6]	115/79	115/79
Taxilane CL to Fixed/Movable Object ADG II/ADG I (for light aircraft tiedowns)	<57.5/<39.5 [6]	57.5/39.5	57.5/39.5

1. "Existing" dimensions as depicted on 1997 Airport Layout Plan based on B-II Airport Reference Code. Current clearances vary, but generally exceed Airplane Design Group II standards for Category A and B aircraft. Part 77 surface dimensions listed reflect the "ultimate" airspace configuration depicted on the 1997 Airspace Plan, consistent with FAA airspace protection standards.
2. RSA, OFZ and Primary Surface area is contained within airport property and appears level and graded. The north access taxiway that extends from the end of Runway 16 is located within the defined areas extending beyond the north end of the runway.
3. The nearest existing aircraft parking area (outer portion of the main apron) is located approximately 800 feet east of runway centerline.

4. The nearest structure (hangar) on the east side of the runway is located approximately 800 feet from runway centerline.
5. The nearest structure (hangar) to the east parallel taxiway is located approximately 120 feet from taxiway centerline.
6. The taxilanes within main apron have variable OFA clearances, but are typically less than ADG II standard. OFA clearance for some sections of apron used by small aircraft (tiedowns) less than ADG I standard.
7. Per FAA Runway Length Model: Runway lengths required to accommodate 75 percent of large airplanes (60,000 pounds or less) at 60 and 90 percent useful load at Madras Municipal Airport. 86.7 degrees F, 7-foot change in runway centerline elevation.
8. Distance required to remain clear of the ADG II Object Free Area established for existing parallel taxiway. The taxiway OFA setback also accommodates common aircraft types and hangars (70+ feet of vertical clearance) without penetrating the 7:1 Transitional Surface for non-precision instrument runway.
9. RPZ dimensions for approach visibility minimums not lower than 1-mile/not lower than ¾-mile

TABLE 4-5: AIRPORT DESIGN STANDARDS SUMMARY (DIMENSIONS IN FEET)

FAA Standard	**Runway 4/22** ***Existing Conditions*** [1] *Shaded Items Meet or Exceed Recommended FAA Standard*	**Airplane Design Group I (small)** ***A&B Aircraft Approach Visibility ≥ 1- mile***
Runway Length	2,701	3,310/4,050 [3]
Runway Width	50	60
Runway Shoulder Width	10	10
Runway Safety Area Width	120	120
Runway Safety Area Length (Beyond Runway End/Prior to Landing Threshold)	240 [2]	240
Obstacle Free Zone Width	250	250
Obstacle Free Zone Length (Beyond Runway End)	200 [2]	200
Object Free Area Width	250	250
Object Free Area Length (Beyond Rwy End)	200	200
Primary Surface Width	250	250
Primary Surface Length (Beyond Rwy End)	200 [2]	200
Runway Protection Zone Length	1,000	1,000
Runway Protection Zone Inner Width	250	250
Runway Protection Zone Outer Width	450	450
Runway Centerline to: Parallel Taxiway/Taxilane Centerline Aircraft Parking Line Building Restriction Line	 N/A N/A 475	 150 195 [4] 251 [5]
Taxiway Width (access taxiway)	35	25
Taxiway Shoulder Width	10	10
Taxiway Safety Area Width	49	49
Taxiway Object Free Area Width	89	89
Taxiway Centerline to Fixed/Movable Object	44.5	44.5
Taxilane Object Free Area Width	79	79
Taxilane CL to Fixed/Movable Object	39.5	39.5

1. “Existing” dimensions as depicted on 1997 Airport Layout Plan based on A-I (small) Airport Reference Code. Part 77 surface dimensions listed reflect the “ultimate” airspace configuration depicted on the 1997 Airspace Plan, consistent with FAA airspace protection standards.
2. RSA, OFZ and Primary Surface areas are contained within airport property and appear level and graded. The north access taxiway that extends from the end of Runway 22 is located within the defined areas extending beyond the east end of the runway.
3. Per FAA Runway Length Model: Runway lengths required to accommodate 75 and 95 percent of small airplane fleet at Madras Municipal Airport. 86.7 degrees F, 7-foot change in runway centerline elevation.

4. Distance required to clear 10-foot tail height without penetrating the 7:1 Transitional Surface for visual runway, compatible with ADG I (small) parallel taxiway OFA.
5. Distance required to clear 18-foot structure without penetrating the 7:1 Transitional Surface for visual runway, compatible with ADG I (small) parallel taxiway OFA.

Runway Safety Area

The FAA defines runway safety area (RSA) as *"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."* Runway safety areas are most commonly used by aircraft that inadvertently leave (or miss) the runway environment during landing or takeoff.

By FAA design standard, the runway safety area *"shall be:*

1) *cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;*
2) *drained by grading or storm sewers to prevent water accumulation;*
3) *capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and*
4) *free of objects, except for objects that need to be located in the runway safety area because of their function. Objects higher than 3 inches above grade should be constructed on low impact resistant supports (frangible mounted structures) of the lowest practical height with the frangible point no higher than 3 inches. Other objects such as manholes should be constructed at grade. In no case should their height exceed 3 inches."*

The recommended transverse grade for the lateral RSA ranges between 1½ and 5 percent from runway shoulder edges. The recommended longitudinal grade for the first 200 feet of extended RSA beyond the runway end is 0 to 3 percent. The remainder of the RSA area must remain below the runway approach surface slope. The maximum negative grade is 5 percent. Limits on longitudinal grade changes are plus or minus 2 percent per 100 feet within the RSA. The City should regularly clear the RSA area of brush or other debris and periodically grade and/or compact the surface to maintain FAA standards, as needed.

Runway 16/34

The RSA for Runway 16/34 appears to be level and free of significant terrain variations, although some periodic grading and/or compaction may be required per FAA design standards. Minor vegetation growth observed along the west side of the runway located within the RSA should be regularly cleared. Drainage features located within the RSA along the sides of the runway should be maintained to meet the FAA standard.

Runway pavement edges should be periodically inspected to ensure that grass, dirt or gravel build ups aren't allowed to exceed 3 inches. Runway edge lights, signs and the Visual Approach Slope Indicator (VASI) for Runway 34 appear to meet the FAA frangibility (break away) standard. Any future lighting (such as new precision approach path indicators) to be located within the runway safety area will also need to meet the FAA frangibility standard.

The access taxiway that extends from the north end of the runway has the potential of placing taxiing and/or holding aircraft within the RSA while the runway is in use. Options to reconfigure the taxiway access to eliminate the RSA conflict should be evaluated in the alternatives analysis.

Runway 4/22

The RSA for Runway 4/22 appears to be level and free of significant terrain variations. Vegetation along the sides of the runway located within the RSA should be regularly cleared and the other recommendations noted above to maintain RSA standards also apply to this runway.

The north access taxiway is also located within the RSA for Runway 4/22 and the recommendation to reconfigure the taxiway to eliminate RSA conflicts should also address the clearance issues beyond the end of Runway 22.

Runway Object Free Area

Runway object free areas (OFA) are two dimensional surfaces intended to be clear of ground objects that protrude above the runway safety area edge elevation. Obstructions within the object free area may interfere with aircraft flight in the immediate vicinity of the runway. The FAA defines the object free area clearing standard:

"The object free area clearing standard requires clearing the object free area of above ground objects protruding above the runway safety area edge elevation. Except where precluded by other clearing standards, it is acceptable to place objects that need to be located in the object free area for air navigation or aircraft ground maneuvering purposes and to taxi and hold aircraft in the object free area. Objects non-essential for air navigation or aircraft ground maneuvering purposes are not to be placed in the object free area. This includes parked airplanes and agricultural operations."

The City should periodically inspect the object free area and remove any protruding objects.

Runway 16/34

The OFA for Runway 16/34 appears to be free of significant obstructions. Minor vegetation growth (small trees/bushes) observed along the west side of the runway within the OFA should be cleared.

Runway 4/22

The OFA for Runway 4/22 appears to be level and free of significant obstructions. Minor vegetation growth within the OFA should be cleared.

Obstacle Free Zone

The obstacle free zone (OFZ) is a plane of clear airspace extending upward above runway elevation that is intended to protect close-in obstructions that may create hazards for aircraft.

The FAA defines the Runway OFZ as:

"The runway OFZ is a defined volume of airspace centered above the runway centerline. The runway OFZ is the airspace above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The runway OFZ extends 200 feet beyond each end of the runway."

The FAA defines the following clearing standard for the obstacle free zone:

"The obstacle free zone clearing standard precludes taxiing and parked airplanes and object penetrations, except for frangible visual NAVAIDs that need to located in the obstacle free zone because of their function."

Runway 16/34

The FAA recommended runway OFZ width for Runway 16/34 is 400 feet, based on its ability to serve large airplanes. The OFZ appears to be free of significant obstructions, with the exception of taxiing or holding aircraft on the north access taxiway and permitted airfield items (runway lights, VASI, and airfield signage, etc.) which have locations fixed by function. All items located within the OFZ must meet the FAA frangibility (break away) standard. The measures previously noted to address RSA clearing standards also apply to the OFZ. Aircraft hold lines on the runway's three exit taxiways that connect to the parallel taxiway are located approximately 200 feet from runway centerline, which coincides with the outer edge of the OFZ. An aircraft hold line was not observed on the north taxiway near the Runway 16 end.

Runway 4/22

The FAA recommended runway OFZ width for Runway 4/22 is 250 feet, based on its ability to serve small airplanes. The OFZ appears to be free of significant obstructions, with the exception of taxiing or holding aircraft on the north access taxiway. An aircraft hold line was not observed on the north taxiway near the Runway 22 end.

Taxiway Safety Area

Taxiway safety areas serve a similar function as runway safety areas and follow precisely the same design standards (see description of runway safety area provided earlier in this chapter), with varying dimensions based on airplane design group. It is noted that safety area standards do not apply to *taxilanes* typically located within hangar developments or aircraft parking aprons. Taxilanes provide aircraft access within a parking or hangar area; taxiways provide aircraft access between points on the airfield and serve runways (e.g. parallel taxiways and exit taxiways). The main taxiways on the airfield (parallel taxiway, exit taxiways, main access taxiways) should be capable of accommodating the same design aircraft used for runway planning purposes (Airplane Design Group II).

The Airplane Design Group II standard taxiway safety area dimension is 79 feet, centered on the taxiway, extending 39.5 feet each side of centerline. Most major taxiways at Madras Municipal Airport are 35 feet wide, which meet the Airplane Design Group II taxiway width standard. Applying the Airplane Design Group II taxiway safety area standard to a 35-foot wide taxiway requires 22 feet of prepared area beyond the edges of pavement. Items within this area that have locations fixed by function (taxiway reflectors, edge lights, signs, etc.) must be mounted on frangible (breakable) mounts.

It appears that all of the major access taxiways on Madras Municipal Airport meet the Airplane Design Group II surface condition standard for taxiway safety areas (level and graded).

As with runway safety areas, the ground surface located immediately adjacent to the taxiways may require some periodic maintenance or improvement to adequately support the weight of an aircraft or an airport vehicle. Grading and/or soil compaction within taxiway safety areas should be completed as needed, and grass, brush or other debris should be regularly cleared to maintain FAA standards. Taxiway pavement edges should be periodically inspected to ensure that grass, dirt or gravel build ups aren’t allowed to exceed 3 inches.

Taxiway/Taxilane Object Free Area

Runway 16/34

The 1997 ALP drawing identifies a 93-foot setback on the parallel taxiway and the mid-runway exit taxiway, which coincides with an ADG III taxiway OFA (186 feet wide). The rationale behind the use of ADG III setbacks appears to be related to the 1,000-foot runway extension development reserve identified at the south end of the runway.

The standard Airplane Design Group II (ADG II) taxiway object free area width dimension is 131 feet. All built items, facilities and parked aircraft located along the taxiways used by ADG II aircraft should have a minimum setback of 65.5 feet, which corresponds to the outer edge of the taxiway OFA. As with the taxiway safety area, any items within the taxiway OFA that have locations fixed by function must be frangible (breakable mount) to meet the FAA clearing standard.

Some taxilanes on the main apron or in the north hangar area are designed for use by Airplane Design Group I (ADG I) aircraft. The ADG I taxiway OFA standard dimension is 79 feet wide, extending 39.5 feet from centerline. The north-south taxilane that runs through the main apron does not appear have standard taxilane OFA clearance from adjacent aircraft tiedowns, aircraft parking positions or the aircraft fueling area. Portions of the apron used by both ADG I and II aircraft should be designed to meet the ADG II taxilane OFA standard. Areas used exclusively by small airplanes can be designed based on ADG I standards. Options for improving the taxilane and aircraft parking configuration of the main apron should be addressed in the alternatives analysis.

Building Restriction Line

A building restriction line (BRL) identifies the minimum setback required to accommodate a typical building height, such as a T-hangar or large conventional hangar, based on the ability to remain clear of all runway and taxiway clearances on the ground, and the protected airspace surrounding a runway. Taller buildings are located progressively farther from a runway in order to remain beneath the 7:1 Transitional Surface slopes that extend laterally from both sides of a runway.

Runway 16/34

The 1997 ALP includes a note indicating *"BRL setbacks based on 50 foot high structure clearing 7:1 transitional surface, except east side of RW 16-34 based on TOFA [taxiway object free area] for ADG III."* As noted earlier, the ALP drawing identifies a 93-foot clearance on the parallel taxiway and the mid-runway exit taxiway, which coincides with an ADG III taxiway OFA. The noted 50-foot structure clearance corresponds to the airspace surfaces associated with a precision instrument approach.

The 1997 Airport Layout Plan depicts a 773-foot BRL on the east side of Runway 16/34 and an 850-foot BRL on the west side of the runway. There are no buildings currently located within the defined BRLs for Runway 16/34. The nearest building (small conventional hangar) on the east side of the runway is located approximately 800 feet from centerline, with a roof peak height of approximately 18 feet. The new large maintenance hangar currently under construction on the airport has a roof elevation approximately 56 feet above grade and the front of the building is located approximately 900 feet east of runway centerline.

The 773-foot east BRL that extends along the airport's landside development area can accommodate structures with roof heights approximately 75 feet above runway elevation (at the BRL) without penetrating the runway's non-precision instrument transitional surface. The west BRL, located in the undeveloped infield area of the airport, can accommodate structures up to 85 feet above runway elevation without penetrating the non-precision transitional surface. The existing BRLs adequately protect the runway and parallel taxiway, and the airspace associated with the runway's non-precision instrument approach.

<u>Runway 4/22</u>

The 1997 Airport Layout Plan depicts 475-foot BRLs on both sides of Runway 4/22. There are no buildings currently located in the vicinity of Runway 4/22. The 475-foot BRLs can accommodate structures up to approximately 50 feet above runway elevation without penetrating the utility runway's visual transitional surface. The setback would also accommodate a standard A-I (small) parallel taxiway on either side of the runway.

Runway Protection Zones

The FAA provides the following definition for runway protection zones:
"The RPZ's function is to enhance the protection of people and property on the ground. This is achieved through airport owner control over RPZ's. Such control includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. Control is preferably exercised through the acquisition of property interest in the RPZ. The RPZ is trapezoidal in shape and centered about the extended runway centerline. The RPZ's begins 200 feet beyond the end of the area useable for takeoff or landing."

Runway protection zones (RPZ) with buildings, roadways, or other items do not fully comply with FAA standards. It is recognized that realigning major surface roads located within the runway protection zone may not always be feasible. It is recommended that airport sponsors control the runway protection zones through ownership whenever possible. Alternatively, avigation easements[15] should be acquired where the airport purchases an easement that limits the height of any constructed items and may limit types of uses or activities that are allowed in the area.

Runway 16/34

The existing and future RPZs for Runways 16 and 34 are based on the design aircraft and approach capabilities (B-II with approach visibility minimums "visual and not lower than 1-mile"). This standard is consistent with existing non-precision instrument approaches. Both RPZs for Runway 16/34 are located entirely within airport property. The RPZs are free of obstructions, with the exception of taxiing aircraft on the north access taxiway, which extends through the full length of the Runway 16 RPZ.

Runway 4/22

The existing and future runway protection zones (RPZ) for Runways 4 and 22 (previously designated 3 & 21) are based on the design aircraft and approach capabilities (A-I (small) with visual approaches) of the runway. The majority of the Runway 22 RPZ extends beyond Dogwood Lane and airport property. The RPZ for Runway 4 is located entirely within airport property. A portion of the aircraft hold apron/access taxiway located near the end of Runway 22 is located in the RPZ.

Aircraft Parking Line

The 1997 Airport Layout Plan depicts an aircraft parking line (APL) on the east side of Runway 16/34 that coincides with an ADG III taxiway object free area. The APL is co-located with the east BRL, 93 feet from the parallel taxiway centerline and 773 feet from runway centerline. The nearest existing aircraft parking area is located approximately 780 feet east of runway centerline (west edge of the main apron). For planning purposes, a maintaining the current APL is recommended based on the anticipated ADG III and IV aircraft use of the parallel taxiway. The location of new aircraft parking areas, if required, will be reviewed in the alternatives evaluation. All proposed areas will be compatible with all FAR Part 77 surfaces and other applicable design standards.

Runway - Parallel Taxiway Separation

Runway 16/34 has a full length east parallel taxiway with a 680-foot runway-to-taxiway centerline separation, which exceeds the Airplane Design Group II standard (240 feet) for runways with approach visibility minimums greater than ¾-statute mile. For comparison, it is noted that the

[15] An avigation easement (*avigation = aviation + navigation*) involves the purchase of airspace rights over a particular defined ground area. The easement normally limits the maximum height of any natural or built items and may include provisions restricting the type of activities permitted. Compensation is negotiated between the airport owner and property owner.

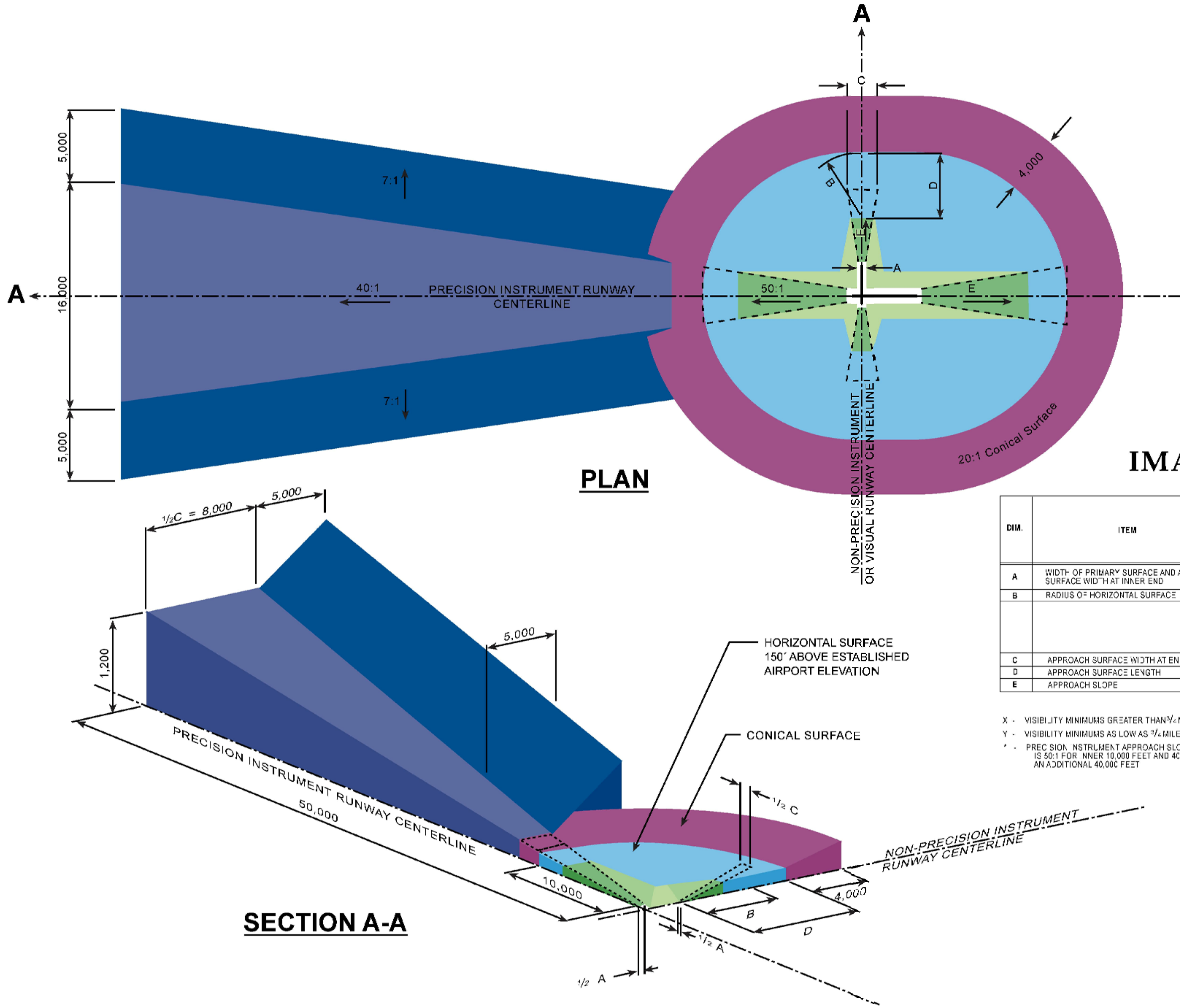
standard runway-parallel separation for ADG III and IV is 300 or 400 feet, depending on the aircraft approach category. While options for relocating the parallel taxiway nearer the runway could be considered in the future, it appears that maintaining the existing taxiway location provides operational flexibility for the airport's diverse traffic mix.

FAR PART 77 SURFACES

Airspace planning for U.S. airports is defined by Federal Air Regulations (FAR) Part 77 – Objects Affecting Navigable Airspace. FAR Part 77 defines imaginary surfaces (airspace) to be protected surrounding airports. **Table 4-6** summarizes the airspace surface dimensions recommended for Madras Municipal Airport based on existing and planned approach capabilities. **Figures 4-5 and 4-6** on the following pages illustrate plan and isometric views of generic Part 77 surfaces.

TABLE 4-6: FAR PART 77 AIRSPACE SURFACES

Item	**Runway 16/34** *Other than Utility (Visual)* *Depicted on 1997 Airspace Plan*	**Runway 16/34** *Other than Utility (Non Precision)*	**Runway 4/22** *Utility (Visual)*
Width of Primary Surface	500 feet	500 feet	250 feet
Approach Surface Width at End	1,500 feet	3,500 feet	1,250 feet
Approach Surface Length	5,000 feet	10,000 feet	5,000 feet
Approach Surface Slope	20:1	34:1	20:1
Horizontal Surface Elevation/Radius	150 feet above airport elevation/5,000 feet	150 feet above airport elevation/10,000 feet	150 feet above airport elevation/5,000 feet
Conical Surface	20:1 for 4,000 feet	20:1 for 4,000 feet	20:1 for 4,000 feet



SURFACE SLOPE KEY

- HORIZONTAL SURFACE
- 20:1
- 7:1
- 7:1
- VARIES (SEE "E" VALUE IN TABLE BELOW)
- 40:1 (PRECISION INSTRUMENT RUNWAY ONLY)

CIVIL AIRPORT IMAGINARY SURFACES

DIM.	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		UTILITY	LARGER THAN UTILITY	UTILITY	LARGER THAN UTILITY X	LARGER THAN UTILITY Y	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		UTILITY	LARGER THAN UTILITY	UTILITY	LARGER THAN UTILITY X	LARGER THAN UTILITY Y	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

X - VISIBILITY MINIMUMS GREATER THAN 3/4 MILE

Y - VISIBILITY MINIMUMS AS LOW AS 3/4 MILE

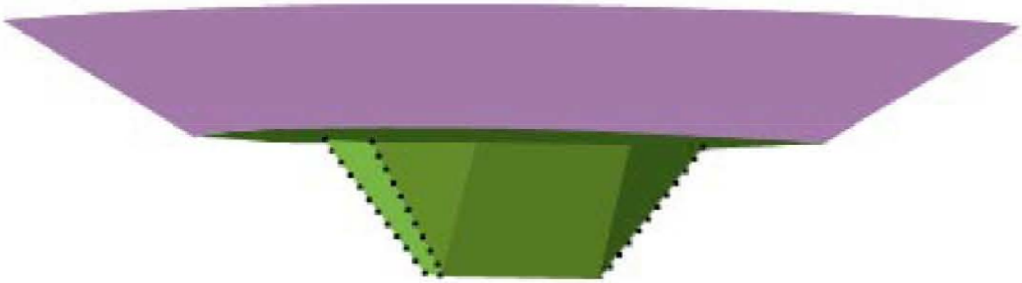
* - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET

IMAGE SOURCE: WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (AVIATION DIVISION).

CENTURY WEST ENGINEERING CORPORATION

FAR PART 77 DIAGRAM

FIGURE 4-5



PROTECTED AIRSPACE

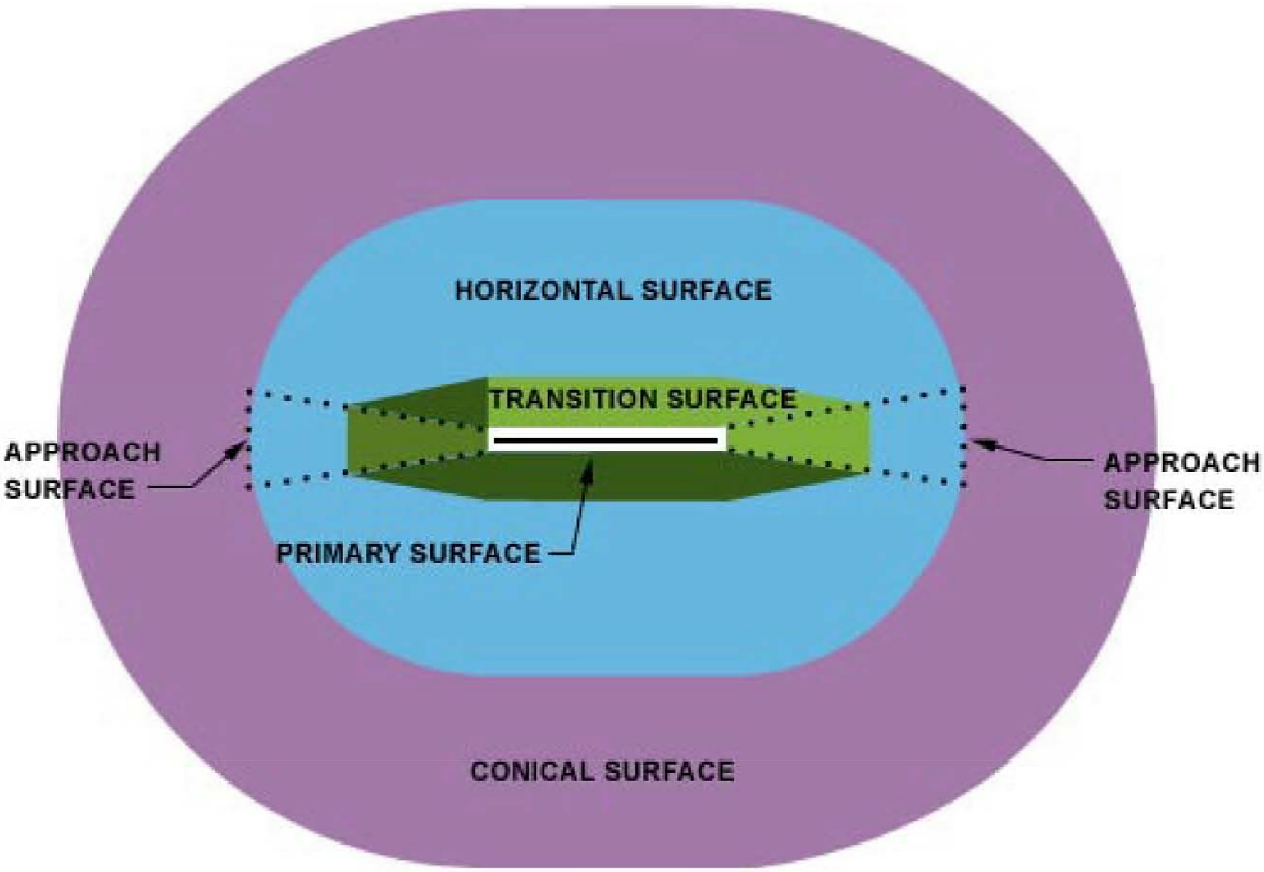


IMAGE SOURCE: WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (AVIATION DIVISION).

CENTURY WEST ENGINEERING CORPORATION

PLAN & PROFILE VIEWS (FAR PART 77 SURFACES)

FIGURE 4-6

The 1997 Airspace Plan depicts "other than utility" surfaces based on visual approach capabilities for Runway 16/34 and "utility" visual surfaces for Runway 4/22. The existing non-precision instrument approach at Madras Municipal Airport is classified as a "circling" procedure, which requires aircraft to establish visual contact with the airport environment prior to reaching the designated missed approach point. The pilot must then proceed visually for landing, and may land on any runway.

Although the airspace surfaces currently defined for Madras Municipal Airport are technically consistent with the current instrument approach procedure, it appears that Runway 16/34 has the potential to accommodate straight-in non-precision procedures, which would require non-precision instrument airspace surfaces. The airport is surrounded by flat terrain in all directions, suggesting an ability to accommodate more demanding airspace associated with non-precision approaches. In addition, based on the ongoing technological improvements in instrument approach development, it seems appropriate for long-term planning to protect airspace that is consistent with a level of approach capability above visual.

For these reasons, it is suggested that the airspace planning for Runway 16/34 be based on non-precision instrument approach standards for "other-than-utility" runways. The current "utility" visual airspace planning for Runway 4/22 should be maintained. If FAA supports long-term airspace planning for Runway 16/34 based on non-precision instrument approach capabilities, an evaluation of terrain and built items (roads, structures, power lines, etc.) will be conducted.

No areas of terrain penetration are identified within the Part 77 surfaces on the 1997 airspace plan.

Approach Surfaces

Runway approach surfaces extend outward and upward from each end of the primary surface, along the extended runway centerline. As noted earlier, the dimensions and slope of approach surfaces are determined by the type of aircraft intended to use the runway and most demanding approach planned for the runway.

Runway 16/34

No obstructions are identified to the 20:1 approach surfaces for Runway 16 or 34 on the 1997 Airspace Plan. However, the taxiway that extends beyond the north end of the runway is located within the inner portion of the Runway 16 approach surface. An aircraft located on the taxiway may create an approach surface obstruction. The recommendation to evaluate options for taxiway reconfiguration noted earlier in the chapter also applies to the approach surface.

It is noted that Dogwood Lane is located approximately 1,800 feet north of the Runway 16 threshold. At this distance, Runway 16 could accommodate both a 34:1 non-precision and a 50:1 precision approach surface with adequate clearance over the roadway, assuming that the north access taxiway obstruction is eliminated.

Runway 4/22

The 1997 Airspace Plan identifies one item in the obstruction data table (Dogwood Lane - vehicles traveling on the road create a 9.1 foot penetration to the Runway 22 approach surface). The drawing depicts an obstacle clearance surface to mitigate the approach surface obstruction. The 20:1 OCS begins at the runway threshold, rather than 200 feet beyond the runway end.

Primary Surface

The primary surface is a rectangular plane of airspace, which rests on the runway (at centerline elevation) and extends 200 feet beyond the runway end. The primary surface should be free of any penetrations, except items with locations fixed by function (i.e., VASI, runway or taxiway edge lights, etc.). The primary surface end connects to the inner portion of the runway approach surface.

Runway 16/34

The 1997 Airspace Plan depicts no obstructions within the primary surface for Runway 16/34. However, the southern 200 feet of taxiway that extends beyond the north end of the runway is located within the primary surface. An aircraft holding short of Runway 16 on the taxiway or taxiing on the southern section of the taxiway would create an obstruction within the primary surface. The recommendation to evaluate options for taxiway reconfiguration also applies to the primary surface for Runway 16/34.

Runway 4/22

The 1997 Airspace Plan depicts no obstructions within the primary surface for Runway 4/22. However, the western 200 feet of taxiway/aircraft holding area located beyond the east end of runway is located within the primary surface. An aircraft holding short of Runway 22 or taxiing on this section of taxiway would create an obstruction within the primary surface. The recommendation to evaluate options for taxiway reconfiguration also applies to the primary surface for Runway 4/22.

Transitional Surface

The transitional surface is located at the outer edge of the primary surface, represented by a plane of airspace that rises perpendicularly at a slope of 7 to 1, until reaching an elevation 150 feet above runway elevation. This surface should be free of obstructions (i.e., parked aircraft, structures, trees, etc.).

No penetrations are identified in the transitional surfaces for Runway 16/34 or Runway 4//22 on the 1997 Airspace Plan. However, it does appear that an aircraft located on the taxiway or holding area near the end of Runway 22 would penetrate the transitional surface, beginning approximately 250 feet from runway centerline.

Horizontal Surface

The horizontal surface is a flat plane of airspace located 150 feet above runway elevation with its boundaries defined by 5,000-foot or 10,000-foot radii (based on approach type and runway category) that extend from each runway end. The outer points of the radii for each runway are connected to form an oval, which is defined as the horizontal surface.

The 1997 Airspace Plan depicts the horizontal surface elevation at 2,583.4 feet above mean sea level (MSL), based on an airport elevation (2,433.4 feet). No areas of terrain penetration are identified in the horizontal surface. Current published airport elevation is 2,437 feet MSL, which would result in a horizontal surface elevation of 2,587 feet MSL.

Conical Surface

The conical surface is an outer band of airspace, which abuts the horizontal surface. The conical surface begins at the elevation of the horizontal surface and extends outward 4,000 feet at a slope of 20:1. The 1997 Airspace Plan depicts the top elevation of the conical surface at 2,783.4 feet above mean sea level (MSL), 200 feet above the horizontal surface and 350 feet above airport elevation (2,433.4 feet). No areas of terrain penetrations are identified within the conical surface on the 1997 Airspace Plan. Based on the current published airport elevation, the top elevation of the conical surface is 2,787 feet MSL.

AIRSIDE REQUIREMENTS

Airside facilities are those directly related to the arrival and departure and movement of aircraft:

- Runways
- Taxiways
- Airfield Instrumentation and Lighting

Runways

The adequacy of the existing runway system at Madras Municipal Airport was analyzed from a number of perspectives including runway orientation, airfield capacity, runway length, and pavement strength.

Runway Orientation & Wind Coverage

The orientation of runways for takeoff and landing operations is primarily a function of wind velocity and direction, combined with the ability of aircraft to operate under adverse wind conditions. A runway's wind coverage is measured by an aircraft's ability to operate with a "direct" crosswind, which is defined as 90 degrees to the direction of travel. For runway planning purposes, the maximum direct crosswind for small aircraft is 12 miles per hour; for larger general aviation aircraft, a maximum 15-mile per hour direct crosswind is used. Aircraft are able to operate safely in progressively higher wind speeds as the crosswind angle decreases and the wind direction turns more closely to the direction of flight. In addition, some aircraft are designed to safely operate with higher crosswind components. Ideally, an aircraft will take off and land directly into the wind or with light crosswind.

The FAA recommends that primary runways accommodate at least 95 percent of local wind conditions; when this level of coverage is not provided, the FAA recommends development of a secondary (crosswind) runway. According to the wind rose depicted on the 1997 Airport Layout Plan (data from 1943-1944), Runway 16/34 accommodates small aircraft operations in approximately 93.5 percent of local wind conditions based on the 12 mile per hour crosswind component. The coverage listed at 24 miles per hour is listed at 99.6 percent. The 12 mile per hour coverage for Runway 3/21 (now designated 4/22) is 89.9 percent.

Runway Length

Runway length requirements are based primarily upon airport elevation, mean maximum daily temperature of the hottest month, runway gradient, and the critical aircraft type expected to use the runway. For general aviation airport runways used by large aircraft (typically aircraft with maximum takeoff weights between 12,500 pounds and 60,000 pounds), the FAA recommends an evaluation based on the "family of aircraft" approach which captures the most common aircraft within a particular category. For Madras Municipal Airport, the future design aircraft identified in the updated forecasts is a medium size business jet (above 12,500 pounds), such as a Cessna Citation Bravo. FAA Advisory Circular (AC) 150-5325-4B, Runway Length Requirements for Airport Design identifies a group of "airplanes that make up 75 percent of the fleet." **Table 4-7** summarizes representative aircraft within this "family of aircraft," which includes the design aircraft recommended for Madras Municipal Airport.

TABLE 4-7: AIRPLANES THAT MAKE UP 75% OF THE FLEET (LARGE AIRPLANES LESS THAN 60,000 POUNDS)

- British Aerospace – Bae 125-700
- Beechcraft/Mitsubishi - Beechjet – 400A, Premier I
- Bombardier – Challenger 300
- Cessna – Citation I/II/III/V/VII, CJ-1, 2,3,4, Bravo, Excel, Encore, Sovereign
- Dassault – Falcon 10, 20, 50
- Israel Aircraft Industries – Jet Commander 1121, 1123, 1124
- Learjet - 20 series, 30 series, 40, 45
- Raytheon Hawker – Hawker 400, 600
- Rockwell - Saberliner 75

Based on the FAA recommended methodology, the future length of Runway 16/34 should be planned based on the requirements of this segment of activity. The runway length requirements for Runway 4/22 are based on typical use by small aircraft. A secondary runway used primarily by small aircraft should be capable of accommodating 75 percent of the small airplane fleet, unless the primary runway's wind coverage is severely limited.

A summary of FAA recommended runway lengths for large and small aircraft and a variety of load configurations is presented in **Table 4-8**. The runway length requirements for a variety of business aircraft are summarized in **Table 4-9** for comparison to the output from the FAA model.

TABLE 4-8: FAA RECOMMENDED RUNWAY LENGTHS (FROM FAA COMPUTER MODEL)

Runway Length Parameters for Madras Municipal Airport

- *Airport Elevation: 2,437 feet MSL*
- *Mean Max Temperature in Hottest Month: 86.7 F*
- *Maximum Difference in Runway Centerline Elevation: 7 Feet*
- *Existing Runway Length: 5,089'*

Small Airplanes with less than 10 seats	
75 percent of these airplanes	***3,310 feet***
95 percent of these airplanes	*4,050 feet*
100 percent of these airplanes	*4,580 feet*
Small airplanes with 10 or more seats	*4,720 feet*
Large Airplanes of 60,000 pounds or less	
75 percent of these airplanes at 60 percent useful load	***5,290 feet***
75 percent of these airplanes at 90 percent useful load	*7,250 feet*
100 percent of these airplanes at 60 percent useful load	*6,390 feet*
100 percent of these airplanes at 90 percent useful load	*8,980 feet*
Airplanes of more than 60,000 pounds	***5,870 feet***

Based on local conditions and the methodology outlined in **AC 150/5325-4A,** a length of **5,290 feet** is required for Runway 16/34 to accommodate 75 percent of large airplanes (60,000 pounds or less maximum gross takeoff weight) at 60 percent useful load.[16]

A length of **5,870 feet** is needed to accommodate large airplanes (60,000 pounds or more gross takeoff weight) on Runway 16/34 for the conditions outlined above. The large aircraft group includes large firefighting aircraft that are expected to operate on a limited basis at Madras Municipal Airport beginning in 2010. However, based on information provided by the aircraft owner, the aircraft are not expected to regularly operate at or near maximum gross weight at Madras Municipal Airport. In addition, based on current plans, these aircraft are expected to account for less than 100 annual operations, which is well below the activity level required by FAA for use as a design aircraft.

At 5,089 feet, Runway 16/34 is 201 feet shorter than the length identified to accommodate the 60 percent useful load profile and 2,161 feet shorter than the length for the 90 percent useful load profile. The FAA indicates that the selection of the 60- or 90-percent of useful load curves is based on the haul lengths and service needs of critical design aircraft. Assuming a typical haul length of 500 miles or less, it appears that 60 percent of useful load profile for the 75 percent of the fleet is

[16] Useful load is generally defined as passengers, cargo, and usable fuel.

most consistent with anticipated activity. Runway 16/34 is 781 feet shorter than the length identified for large aircraft above 60,000 pounds.

Reasonable justification would be required to demonstrate to FAA that the typical operational requirements of the design aircraft family are consistent with the higher useful load or other large aircraft assumptions. As noted earlier, the FAA establishes a "substantial use threshold" of 500 annual itinerant takeoffs and landings for the design aircraft or family of design aircraft. To pursue a runway extension based on the higher demand profile, the City would need to document sufficient activity (either aircraft currently using the airport that are regularly constrained by current or extended runway length or new aircraft unable to operate at the airport due to runway length) to meet the FAA substantial use threshold.

The 1997 ALP listed the future length of Runway 16/34 at 5,100 feet. However, a note on the ALP identified a development reserve at the south end of the runway to accommodate a future 1,000-foot runway extension. The future runway length and reserve (6,100 feet) identified on the 1997 Airport Layout Plan is similar to the runway length identified to accommodate large aircraft weighing more than 60,000 pounds (5,870 feet). Maintaining the 1,000-foot runway extension reserve and protecting the associated runway clear areas is recommended to allow the City to preserve its runway extension options beyond currently forecast need.

The 1997 ALP listed Runway 3/21 (now designated 4/22) with a 2,700-foot existing and future runway length. Although the existing length is generally considered to be adequate for current use, the ability to accommodate 75 percent of the small airplane fleet provides a reasonable long-term planning standard.

TABLE 4-9: TYPICAL BUSINESS AIRCRAFT RUNWAY REQUIREMENTS

Aircraft	Passengers (typical configuration)	Maximum Takeoff Weight	Runway Length Required for Takeoff[1]	Runway Length Required for Landing[2]
Beechcraft King Air 200	6-8	12,500	5,300	4,450
Cessna Citation Mustang	5	8,645	4,700	2,860
Cessna Citation CJ1+	6-7	10,700	5,080	2,950
Cessna Citation CJ2+	8-9	12,500	4,530	3,310
Cessna Citation CJ3	6-8	13,870	4,130	3,100
Cessna Citation CJ4	8-9	16,950	4,720	3,000
Cessna Citation S/II	6-9	15,100	5,560	3,600
Cessna Citation Encore+	8-11	16,830	4,950	3,140
Cessna Citation XLS	7-8	20,200	4,750	3,540
Cessna Citation VII	7-8	22,450	6,000	3,280
Citation Sovereign	9-12	30,300	4,370	2,920
Cessna Citation X	8-12	36,100	6,560	3,950
Learjet 45	7-9	20,500	4,350(a)	2,660(a)
Challenger 300	8-15	37,500	4,950(a)	2,600(a)
Gulfstream 100 (Astra)	6-8	24,650	5,395(a)	2,920(a)
Gulfstream 200 (G-II)	8-10	35,450	6,080(a)	3,280(a)
Gulfstream 300 (G-III)	11-14	72,000	5,100(a)	3,190(a)

1. FAR Part 25 or 23 Balanced Field Length (Distance to 35 Feet Above the Runway) based on Madras conditions; 2,437 feet MSL, 86 degrees F; Zero Wind, Dry Level Runway, 15 Degrees Flaps, except otherwise noted.
2. Distance from 50 Feet Above the Runway; Flaps Land, Zero Wind; MGLW; same elevation and temperature as note 1.
   a. For general comparison only. **Distances based on sea level and standard day temperature** (59 degrees F) at maximum takeoff/landing weight; higher airfield temperatures will require additional runway length and/or reduction in operating weights.

Source: Aircraft manufacturers operating data, flight planning guides.

The runway length requirements summarized in **Table 4-8** suggest that the majority of small and medium size business jets are currently able to operate on Runway 16/34 under typical load and weather conditions. Although passenger and/or fuel load limitations may occur during warmer summer days, it appears that the majority of these aircraft can be accommodated on a regular basis with moderate loads.

Runway Width

Runway 16/34 is 75 feet wide, which meets the ADG II standard for Category A&B aircraft. Runway 4/22 is 50 feet wide, which is less than the ADG I standard (60 feet) for Category A&B aircraft.

Airfield Pavement

In 2006, the airfield pavements at Madras Municipal Airport were inspected and assigned Pavement Condition Index (PCI) ratings[17], through a study administered by the Oregon Department of Aviation (ODA). Most of the airfield pavements were rated “very good” or “excellent” in the 2006 inspection, although the original Portland Cement Concrete sections of the main apron and the apron located adjacent to the end of Runway 22 were rated “failed.” The southern connecting taxiway between the main apron and parallel taxiway was rated “fair” and some of the north hangar taxilanes were rated “fair or poor.”

The predicted condition of these pavements in 2016, assuming that no major maintenance is performed, is consistent with normal wear and age. Both runways are projected to be rated “good” and most taxiways and aircraft apron areas are rated “fair” or better. The PCC pavements that were rated “failed” in 2006 will continue to deteriorate, eventually becoming unusable.

The pavement maintenance report recommends a regular program of maintenance and rehabilitation to effectively manage airfield pavements. Virtually all of the airfield pavements at Madras Municipal Airport have maintenance recommended for 2007, with two additional projects recommended for 2011. Pavements recommended for reconstruction include a concrete section of the main apron, the concrete apron located near the end of Runway 22, and two taxilanes in the north hangar area. Pavements recommended for 2” asphalt overlays include the north holding area on the parallel taxiway, the south taxiway connection between the main apron and parallel taxiway, and several north hangar taxilanes.

Table 4-10 summarizes the six year unlimited budget major rehabilitation plan for Madras Municipal Airport and additional pavement maintenance items anticipated during the current twenty year planning period.[18] The dates listed in the table are estimates intended to illustrate the general timeframes involved. Actual project scheduling may be adjusted based on funding availability and overall project prioritization, which are included in the capital improvement program that will reflect specific projects identified within the preferred alternative. It is noted that some pavements with relatively high PCIs may require more extensive rehabilitation than suggested by the pavement rating. For example, the severity of cracking on Runway 4/22 indicates a need for areas of repair/reconstruction in conjunction with resurfacing.

[17] PCI Rating Scale 0 to 100 (failed to excellent).
[18] Applied Pavement Technology, Inc. (February, 2006)

TABLE 4-10: SUMMARY OF RECOMMENDED AIRFIELD PAVEMENT MAINTENANCE

Pavement	2007-2011 Recommended Maintenance	Other Recommended Maintenance During twenty year Planning Period (2012-2029)
Runway 16/34	Fog Seal	Fog/Slurry Seal (5-6 yr cycles) Asphalt Overlay (2015+)
Parallel Taxiway (center section)	Fog Seal	Fog/Slurry Seal (5-6 yr cycles) Asphalt Overlay (2015+)
Parallel Taxiway (north & south connectors)	Fog Seal	Fog/Slurry Seal (5-6 yr cycles) Asphalt Overlay (2010+)
Runway 16/34 – Midfield Exit Taxiway	Fog Seal	Fog/Slurry Seal (5-6 yr cycles) Asphalt Overlay (2015+)
South A/C Holding Area on Parallel Taxiway	Fog Seal	Fog/Slurry Seal (5-6 yr cycles) Asphalt Overlay (2010+)
North A/C Holding Area on Parallel Taxiway	2” AC Overlay	Fog/Slurry Seal (5-6 yr cycles)
Runway 4/22	Fog Seal	Fog/Slurry Seal (5-6 yr cycles) Asphalt Overlay (2015+)
Connecting Taxiway (Rwy 16 end to Rwy 22 end)	Fog Seal	Fog/Slurry Seal (5-6 yr cycles) Asphalt Overlay (2025+)
AC Hold Area (@ Rwy 22 end)	Fog Seal	Fog/Slurry Seal (5-6 yr cycles) Asphalt Overlay (2012+)
Main Apron (main area)	Reconstruct w/ 4” AC	Fog/Slurry Seal (5-6 yr cycles)
Main Apron (north & south original PCC sections)	Reconstruct w/ 4” AC	If reconstructed: in AC: Fog/Slurry Seal (5-6 yr cycles); If reconstructed in PCC: Replace joints as needed; repair spalling
Main Apron (original PCC center section)	Fog Seal	Reconstruct w/ 4” AC or PCC (2009) Fog/Slurry Seal (5-6 yr cycles) for AC
Main Apron (new PCC section)	None	Maintain, replace joints, repair spalling
Main Apron (new asphalt section)	Fog Seal	Fog/Slurry Seal (5-6 yr cycles)
Main Apron Taxiway Connector (south)	2” AC Overlay	Fog/Slurry Seal (5-6 yr cycles)
Main Apron Taxiway Connector (north)	Fog Seal	Asphalt Overlay (2015+) Fog/Slurry Seal (5-6 yr cycles)
North Hangar Taxilanes	Areas of Reconstruction or Overlay; Fog Seal	Fog/Slurry Seal (5-6 yr cycles)

The rate of deterioration of airfield pavements increases significantly as they age. A regular maintenance program of vegetation control, crackfilling, and sealcoating is recommended to extend the useful life of all airfield pavements. It should also be noted that some of the pavement plan’s recommended 6 year projects might not be required or appropriate if superseded by other projects such as runway strengthening (which would probably involve an overlay or reconstruction).

Pavement Strength

As noted in the Inventory Chapter, based on a preliminary evaluation of section data, the pavement strength for both runways and taxiway connectors should be rated at approximately 12,500 pounds for single wheel (SW) aircraft. The parallel taxiway should be rated approximately 20,000 pounds SW.

From a planning perspective, all airfield pavements designed for use by the B-II design aircraft should have a SW rating of approximately 30,000 pounds, with dual wheel (DW) ratings in the 50,000 to 75,000 pound range. Pavements used exclusively by small aircraft should have a minimum weight bearing capacity of 12,500 pounds SW.

Airfield Capacity

The capacity of a single runway with a full length parallel taxiway at an uncontrolled airport typically ranges between 50 and 60 operations per hour during visual flight rules (VFR) conditions. Most airports without terminal area radar, an ILS and a control tower cannot accommodate more than 10 to 20 operations per hour in IFR conditions. Current and forecast operations at Madras Municipal Airport are projected to remain well below estimated hourly and annual capacity through the current planning period and well beyond.

The 1997 ALP Report estimated theoretical hourly capacity for Runway 16/34 to be 95 to 106 operations during VFR conditions. The theoretical annual capacity (annual service volume) for the airfield was estimated at 65,700 operations.

Taxiways

Taxiways are constructed primarily to facilitate aircraft movements to and from the runway system. Some taxiways are necessary simply to provide access between apron and runways, while other taxiways become necessary as activity increases and safer and more efficient use of the airfield is needed.

Runway 16/34

Runway 16/34 has a full length parallel taxiway with three connecting exit taxiways. The parallel taxiway has two taxiway connections to the main apron and other taxiway connections providing access to adjacent hangar areas. The main taxiways serving Runway 16/34 are 35 feet wide, which meets the ADG II standard. The south access taxiway connecting the main apron and parallel taxiway is 30 feet wide and does not meet the ADG II dimensional standard.

The addition of a second mid-runway exit could be considered to improve runway efficiency for larger aircraft landing on Runway 34. The existing mid-runway exit is located approximately 1,900 feet from the Runway 34 threshold. Aircraft unable to stop at the mid-runway exit taxiway are required to roll out to the runway end (approximately 3,200 feet) or turnaround on the runway and back-taxi to the exit taxiway.

North Access Taxiway

The north access taxiway connects the airport's primary and crosswind runways. The taxiway is 35 feet wide, which meets the ADG II taxiway width standard. However, as noted earlier, the taxiway extends beyond the ends of both runways (in line taxiway). FAA generally discourages in-line or similar end-around taxiways based on operational concerns and the need to maintain a clear runway safety area and other areas associated with runway ends. Options for addressing the existing access taxiway between Runway 16/34 and 4/22 will be evaluated in the alternatives analysis.

Hangar & Apron Taxilanes

Improvements to existing hangar taxiways/taxilanes will be required during the planning period, in addition to adding new taxiways to access new hangar or apron developments. The access taxiways and taxilanes serving most hangar development areas range from 10 to 25 feet wide.

The taxilanes located within the main aircraft apron should be configured to provide the standard object free area clearances for the specific aircraft types. Light airplane tiedown rows and adjacent taxilanes are typically designed to accommodate airplane design group (ADG) I aircraft. Parking positions for larger business class aircraft should be designed based on ADG II taxilane clearing standards. The taxilane centerline to the nearest fixed/moveable object (parked aircraft) of 39.5 and 57.5 feet, correspond to the object free area dimensions for ADG I and II.

Instrument Approach Capabilities & Airspace Planning

Madras Municipal Airport currently accommodates day and night operations in visual flight rules (VFR) and instrument flight rules (IFR) conditions. The airport currently has one non-precision "circling" approach. The current approach has relatively high descent minimums (1,080 to 1,163 feet above airport elevation) with a missed approach point located at the end of Runway 34. The FAA has been asked to determine if the current approach minimums may be improved by the addition of on-site weather observation, upgrading runway markings, or development of another procedure, such as an approach to Runway 16. As noted earlier, the relatively flat terrain surrounding the airport suggests that airspace compatible with straight-in non-precision instrument approaches should be protected, unless FAA identifies a critical site limitation that would limit the airport to visual airspace surfaces.

Note: FAA has indicated that design of a straight-in RNAV (GPS) approach to Runway 16 has been initiated. The questions regarding existing approach minimums are under review.

Airfield Instrumentation, Lighting and Marking

Navigational Aids

The existing instrument approach at Madras Municipal Airport utilizes global positioning system (GPS) satellites and requires no ground based navigational aids.

Runway Lighting

Runway 16/34 has medium intensity runway edge lighting (MIRL), which is the standard for general aviation runways. Runway 34 is equipped with a visual approach slope indicator (VASI) that provides visual glide path guidance to pilots for landing. The Runway 16/34 MIRL system and VASI appear to be in good operational condition. However, replacement of all lighting systems that are more than twenty years old should be included in long term capital programming.

The 1997 ALP Report recommended replacement of the existing VASI with the newer precision approach path indicator (PAPI). A PAPI was also recommended for Runway 16.

Runway End Identifier Lights (REIL) are recommended for Runway 16 and 34. Edge lighting (MIRL) for Runway 4/22 was identified as a long-term improvement in the 1997 ALP Report.

Runway and Taxiway Markings

Runway 16/34 has visual markings, which are consistent with the current “visual” approach element of the circling non-precision instrument approach. However, FAA indicates that straight-in instrument approaches cannot be commissioned for runways with visual markings, which may explain why the current approach to Runway 34 is a circling procedure. Upgrading the runway markings for both ends of Runway 16/34 to non-precision instrument is recommended to support straight-in instrument approaches.

Runway 4/22 has visual markings which are consistent with current and planned approach capabilities.

The markings on the taxiway/aircraft hold area at the end of Runway 22 are white, which is not consistent with FAA standards for taxiway markings (yellow).

Approach Lighting

Runway 16/34 is not currently equipped with an approach lighting system. Based on the current and planned approach capabilities for the runway, an approach lighting system would not typically be required. However, the addition of runway end identifier lights (REIL) noted above, would improve runway recognition during both visual and instrument conditions.

Taxiway Lighting

The taxiways on Madras Municipal Airport do not have edge lighting, although major taxiways are equipped with reflective edge markers. Local airport users have identified taxiway edge lighting for major taxiways as a significant current facility need. Adding medium intensity taxiway lighting (MITL) on the parallel taxiway and the exit taxiways would be highest priorities. The 1997 ALP Report recommended MITL for the parallel taxiway.

Airfield Signage

Replacement of the existing reflective airfield signage with internally-illuminated signage is recommended to improve pilot recognition and improve safety. Location, mandatory instruction, direction, destination, and runway distance remaining signs are recommended.

Airfield Lighting

The existing airport beacon appears to be in good operational condition, although replacement should be anticipated during the current planning period. The internally lighted wind cone is in good condition. Providing additional lighted wind cones near the ends of Runway 16, 34, adjacent to Runway 4/22 may be helpful to pilots in recognizing surface wind conditions.

On Field Weather Data

Madras Municipal Airport does not currently have on-site weather observation capabilities. The instrument approach procedure to Madras is authorized only when the Redmond altimeter setting is available. The reliance on distant weather data is believed to be a factor in the relatively high minimums for the current approach procedure at Madras. The 1997 ALP Report recommended the addition of an automated weather observation system (AWOS), or a similar ASOS (owned by FAA).

The addition of an AWOS or ASOS will significantly improve flight safety and the operational capabilities of the airport in both visual and instrument operations.

LANDSIDE FACILITIES

For general aviation airports, landside facilities are generally defined as those that serve aircraft, passenger needs and their related functions. At Madras Municipal Airport, landside facilities include aircraft parking aprons, hangars, fueling and FBO facilities.

The airport currently has one FBO (Berg Air) that operates the new general aviation terminal and performs aircraft maintenance in the south Quonset hangar. The ability to economically maintain the existing large hangars is an ongoing challenge for the City. Additional development space is available within the terminal area to accommodate new commercial hangar requirements that exceed the capabilities of the large hangars.

Although recent improvements have been made to provide a drive-through parking position for one itinerant business aircraft, the overall configuration of the main apron does not provide adequate space for the variety of activities that current exist. Current requirements include space for business aircraft parking, light airplane tiedowns, helicopter parking, aircraft fueling, and passenger loading/unloading in front of the terminal building.

Although the acreage comprising Madras Municipal Airport is expansive, large portions of the airport have been designated for non-aviation land uses. The developable areas available for aviation use include the east side of Runway 16/34, the infield area and areas adjacent to Runway 4/22. When combined, these areas appear to have adequate capacity to accommodate current forecasts of facility demand and development reserves. However, because the overall acreage is relatively scarce it should continue to be preserved to accommodate aviation related land uses well beyond the current twenty year planning period.

Aircraft Parking and Tiedown Apron

At most general aviation airports, aircraft aprons provide parking for locally based aircraft that are not stored in hangars and for transient aircraft visiting the airport. The main apron currently has 12 light airplane tiedowns (with anchors) and 1 drive-through parking position for a business aircraft. Some older sections of apron not in regular use have tiedown anchors and or cables that have not been removed. These positions are not included in the current count of tiedowns.

Future parking requirements are summarized at the end of this chapter in **Table 4-11**. It is noted that the 1997 ALP recommended expansion and reconfiguration of the main apron to provide for parking and aircraft servicing needs noted earlier.

Light Aircraft Parking (Local and Itinerant)

Approximately 6 to 8 locally based aircraft are currently parked in reserved tiedowns at Madras Municipal Airport. For planning purposes, it is assumed that 10 percent of locally based aircraft will utilize apron parking, with 90 percent stored in hangars. Based on this assumption, 9 light aircraft tiedowns will be required for locally based aircraft by 2029. These estimates may prove to be slightly optimistic in gauging apron parking demand for based aircraft. However, this approach will better ensure that adequate apron is preserved for long term use. The use of development reserves for both hangars and aircraft will also provide for potential demand that exceeds current projections.

FAA **Advisory Circular 150/5300-13** suggests a methodology by which itinerant parking requirements can be determined from knowledge of busy day operations. At Madras Municipal Airport, the demand for itinerant parking spaces was estimated based on 25 percent of busy day itinerant operations (25% of busy day itinerant operations divided by two, to identify peak parking demand). The FAA planning criterion of 360 square yards per itinerant aircraft was applied to the number itinerant spaces to determine future itinerant ramp requirements. By the end of the twenty year planning period, itinerant aircraft parking requirements are estimated to be 10 small aircraft positions. This level of projected demand is relatively low due to the high percentage of local operations reflected in the forecasts. The use of apron development reserves will ensure that adequate transient tiedown capacity is maintained at the airport.

Corporate Aircraft Parking

The airport accommodates regular itinerant business aircraft activity including turboprops and business jets. Initially, two or three parking positions (drive through) for transient corporate aircraft should be adequate to accommodate current demand adjacent. For planning purposes, it is assumed that 25 percent of forecast peak parking demand will consist of corporate aircraft. Based on the formula described above, three parking positions for corporate aircraft would be required by the end of the twenty year planning period. Overflow parking areas for corporate aircraft should be reserved on the main apron in addition to development reserves for accommodating potential unanticipated demand.

Commercial/Air Taxi Parking

It is anticipated that Madras Municipal Airport will continue to accommodate regular air taxi and charter flight activity. It appears that this demand can be accommodated within the recommended corporate aircraft parking positions described above. The area located directly in front of the general aviation terminal should be reserved for this activity.

Air Cargo Aircraft Parking

Madras Municipal Airport does not currently accommodate regular air cargo aircraft activity. However, the potential exists for the airport to accommodate daily package express flights or occasional air taxi cargo flights during the current planning period. It appears that adequate space exists within the terminal area to accommodate air cargo aircraft parking if demand occurs in the future. The area should be capable of accommodating larger aircraft such as the Cessna Caravan or other single engine and multi engine aircraft commonly used by small cargo carriers.

Helicopter Parking

Madras Municipal Airport accommodates one locally based helicopter and occasional itinerant activity. The locally based helicopter is stored in a hangar when at the airport. Options for providing one transient helicopter parking position should be considered in the alternatives analysis. Ideally, helicopter parking areas should be physically separated from light aircraft tiedowns to reduce the effect of rotor wash of light aircraft.

Aircraft Fueling Area

The existing aircraft fueling area does not appear to have adequate clearance from the existing north-south apron taxilane OFA to accommodate multiple aircraft. The planned replacement of the existing fuel storage tanks provides an opportunity to improve the configuration or location of the fueling area in conjunction with overall apron reconfiguration/expansion.

Development Reserve

In order to address a variety of potential events and the uncertainty associated with long term demand, aircraft apron reserve areas should be identified to preserve the airport's ability to accommodate user needs. A development reserve area equal to 100 percent of the twenty year parking demand will provide a conservative planning guideline to accommodate unanticipated demand, changes in existing apron configurations, and demand beyond the current planning period.

Aircraft Hangars

In Fall 2009 Madras Municipal Airport had two large Quonset hangars, four multiple unit hangars (24 spaces), and one small/medium conventional hangar that were used for aircraft storage. It appears that approximately 25 to 30 of the airport's current 62 based aircraft are stored in the large hangars, with approximately 20 to 25 aircraft stored in the smaller hangars. For planning purposes, it is assumed that existing hangar space is committed and all additional (forecast) demand will need to be met through new construction.

A planning standard of 1,500 square feet per based aircraft stored in hangars is used to project gross space requirements. As indicated in the aviation activity forecasts, the number of based aircraft at Madras Municipal Airport is projected to increase by 29 aircraft during the twenty year planning period. Based on a projected 90 percent hangar utilization level, additional long term demand for new hangar space is estimated to be 26 spaces (approximately 39,000 square feet). The projected hangar requirements for aircraft storage at Madras Municipal Airport are presented in **Table 4-11.**

In addition to aircraft storage, additional demand for business related and commercial hangar needs should also be expected. The relocation of Butler Aircraft Company's maintenance operations to Madras Municipal Airport in 2010 also has the potential of attracting other aviation service businesses. While there is no specific formula to predict demand for general aviation service businesses at a particular airport, reserving space for several commercial hangars is recommended.

Individual aircraft owners needs vary and demand can be influenced by a wide range of factors beyond the control of an airport. In addition, the forecasts of based aircraft reflect moderate growth rates that could be easily exceeded if economic conditions are favorable. For this reason, it is recommended that additional hangar development reserves be identified to accommodate unanticipated demand. The address the uncertainty of hangar market conditions and demand factors, conservative development reserves should be established to accommodate a combination of conventional hangars and T-hangars, roughly equal to 100 percent of the twenty year forecast demand.

TABLE 4-11: APRON AND HANGAR FACILITY REQUIREMENTS SUMMARY

Item	Base Year (2009)	2014	2019	2024	2029
Based Aircraft Forecast	**62**	**70**	**76**	**84**	**91**
Aircraft Parking Apron					
Single Engine Aircraft Tiedowns	12				
Twin Engine Aircraft Tiedowns	0*				
Corporate Aircraft Parking Spaces	1				
Helicopter Parking Spaces	0*				
Air Cargo Aircraft Parking Spaces	0*				
Total Designated Parking Spaces Available	13				
Total Useable Apron Area	**9,500 sy (estimated)**				
Projected Needs *(Demand)* [1]					
Itinerant Aircraft Parking (@ 360 SY each)		7 spaces / 2,520 sy	8 spaces / 2,880 sy	9 spaces / 3,240 sy	10 spaces / 3,600 sy
Locally Based Tiedowns (@ 300 SY each)		6 spaces / 1,800 sy	7 spaces / 2,100 sy	8 spaces / 2,400 sy	9 spaces / 2,700 sy
Business Aircraft Parking Demand (@ 625 SY each)		2 spaces / 1,250 sy	2 spaces / 1,250 sy	3 spaces / 1,875 sy	3 spaces / 1,875 sy
Helicopter Parking Positions (@ 625 SY each)		1 space / 625 sy	1 space / 625 sy	1 space / 625 sy	2 spaces / 1,250 sy
Air Cargo Aircraft Parking Demand (@ 625 SY each)		0 spaces / 0 sy	0 spaces / 0 sy	1 space / 625 sy	1 space / 625 sy
Total Apron Needs		**16 spaces 6,195 SY**	**18 spaces 6,855 SY**	**22 spaces 8,765 SY**	**25 spaces 10,050 SY**
Aircraft Hangars *(Existing Facilities)*					
Existing Hangar Spaces	(55) 56,000 sf *(estimated)*				
Projected Needs *(Demand)* [2]					
(New) Hangar Space Demand (@ 1,500 SF per space) *(Cumulative twenty year projected demand: 26 spaces / 39,000 SF)*		**+7 spaces / 10,500 sf**	**+6 spaces / 9,000 sf**	**+7 spaces / 10,500 sf**	**+6 spaces / 9,000 sf**

* Light airplane tiedowns are current used for multi-engine aircraft parking
1. Aircraft parking demand levels identified for each forecast year represent forecast gross demand.
2. Hangar demand levels identified for each forecast year represent the net increase above current hangar capacity.

Aircraft Wash Down Facilities

The City has noted that existing aircraft wash down facilities at the airport require upgrades with a catch basin and hard piping to divert wash residue into the sanitary sewer system. Wash facilities are typically sized to accommodate one aircraft on a pad approximately 50 feet by 50 feet. The wash pad may be located adjacent to existing parking apron or hangars; close access to utility systems is a key siting factor.

Surface Access Requirements

The primary surface access to the east landside area of the airport is provided by Cherry Lane and NW Airport Way, which connect to U.S. Highway 26. Improvements to NW Airport Way (paving, curbs, gutters, sidewalks, etc.) are anticipated as part of the new maintenance development project. It appears that surface access to all landside facilities east of Runway 16/34 can be provided by extending NW Airport Way.

The east landside area has several areas used for vehicle parking located adjacent to the road system and within individual lease areas. Some of the vehicle parking is paved, other areas are gravel surfaced. A paved public vehicle parking area is located adjacent to the terminal building.

Future aviation related developments will require adequate vehicle parking. The requirements for providing designated vehicle parking areas adjacent to hangars vary greatly at small airports. A planning standard of 0.5 to 1.0 vehicle parking spaces per based aircraft will accommodate the most common parking demand levels. For larger hangars, a formula based on the square footage of the building is often used to determine parking requirements. This is a common approach for establishing off street parking in most communities.

Agricultural Aircraft Facilities

The airport's locally-based aerial applicator operates from facilities located south of the terminal area. The area appears to have adequate space and airfield access to accommodate current and future facility expansion needs.

SUPPORT FACILITIES

Aviation Fuel Storage

The City has indicted that the two single-wall aboveground tanks aviation fuel storage tanks will require replacement in the near future due their age and ongoing maintenance and monitoring costs. The existing capacity (10,000 gallons AVGAS and 20,000 gallons jet fuel) appears to be adequate for current and near-term projected demand. A review of airport fuel delivery records over the last several years indicates regular deliveries are common, particularly during peak demand periods. For both fuel grades, it appears that larger deliveries (30 to 50 percent of tank capacity) are common during the summer months, with smaller deliveries occurring on monthly basis. The location of the fuel storage tanks and the fuel pumps (currently north of the terminal building) should be included in the evaluation of terminal apron options in the alternatives analysis.

The development of a secondary containment area for mobile fuel truck parking should also be considered. Most mobile fuel trucks in use today have single wall tank construction and do not provide the secondary containment of double wall aboveground bulk storage tanks. It is expected that new federal or state regulations will eventually require secondary containment for single wall tank mobile fuel trucks when unattended, such as for overnight parking when the trucks are not in service or otherwise monitored. It is anticipated that the secondary containment area for airport fuel trucks would be best located in close proximity to the bulk fuel storage area.

Airport Utilities

The existing utilities on the airport appear to be adequate both in capacity and service within the developed areas of the airport. Extensions of water, sanitary sewer, electrical, and telephone service to serve future landside developments may be required. All power lines located in the vicinity of the airfield should be buried. The potential installation of an automated weather observation station on the west side of Runway 16/34 will require electrical and communication extensions from existing service.

Improvements to the terminal area's existing stormwater drainage system are anticipated as the areas of impervious surface increase. The soil composition on the airport creates significant design challenges for containment and treatment of stormwater runway from runways, taxiways, aprons and structures.

Security

The airport has limited chain link fencing located along the rear of the main apron and wire fencing around the outlying areas of the airport. There are no major security concerns at the airport, although providing chain link fencing and electronic vehicle gates to control public access to aviation use areas is recommended.

Shielded flood lighting should be provided in aircraft parking and hangar areas and any other new development areas on the airport to maintain adequate security. All lighting installed on the airport should be compatible with aircraft operations and produce limited glare from above and at ground level.

FACILITY REQUIREMENTS SUMMARY

The projected twenty year facility needs for Madras Municipal Airport are summarized in **Table 4-12**. As noted in the table, maintaining existing pavements represents a significant, ongoing facility need. The updated forecasts of aviation activity anticipate moderate growth in activity that will result in similarly moderate airside and landside facility demands beyond existing capabilities. The existing airfield facilities have the ability to accommodate a significant increase in activity, with targeted facility improvements. For the most part, the need for new or expanded facilities, such as aircraft hangars, will be market driven, although there will be significant front end investments required in preparation, utility extensions, road extensions, and taxiway construction. The nonconforming items noted in Part 1 of this chapter are generally minor and can be addressed systematically during the current planning period to improve overall safety for all users.

TABLE 4-12: FACILITY REQUIREMENTS SUMMARY

Item	Short Term (0-10 Years)	Long Term (10-20 Years)
Runway 16/34	Pavement Maintenance[1] Increase Pavement Strength Runway Extension (approximately 201 feet) Address North RSA, OFZ etc. (north access taxiway connection to runway end)	Pavement Maintenance[1] Runway Extension (approximately 580 feet)
Runway 4/22[2]	Pavement Maintenance[1]	Pavement Maintenance[1] Widen Runway to 60 feet Overlay Runway Runway Extension (to 3,300 feet)
Taxiways	Pavement Maintenance[1] Increase Pavement Strength on Parallel Taxiway Add Second Mid-Runway Exit Taxiway Reconfigure North Access Taxiway Widen Apron South Access Taxiway to 35 feet Rehabilitation of Hangar Taxilanes Taxiways/Taxilanes to New Hangar Areas	Pavement Maintenance[1] Reconfigure/Expand Aircraft Holding Bays at north and south ends of Parallel Taxiway Rehabilitation of Hangar & Access Taxilanes
Aircraft Aprons	Reconfigure/Expand Main Apron to meet FAA design standards and accommodate aircraft parking, fueling and other projected demand Pavement Maintenance[1]	Pavement Maintenance[1] Apron Development Reserves
Hangars	New T-hangar and conventional hangar development areas (market demand)	New T-hangar and conventional hangar development areas (market demand) Hangar development reserves
Navigational Aids and Lighting	MITL Taxiway Edge Lighting – Parallel Taxiway PAPI (Rwy 16) REIL (Rwy 16 & 34)	PAPI (Rwy 34 – VASI replacement) PAPI (crosswind runway)
Fuel Storage	Replace Fuel Storage Tanks Develop Secondary Containment Area for Fuel Truck Parking	Expansion reserves adjacent to bulk storage areas
FBO	Accommodate within defined landside development areas (vacant lease areas)	Same
Utilities	Extend Service to New Development Areas	Same
Roadways	Extend/Improve Roads to New Development Areas	Extend Roads to New Development Areas
Security	Configure Perimeter Fencing and Automated Gates for new landside areas Flood Lighting	Same

1. Vegetation control, crackfill, fog/slurry seal, localized patching, joint rehabilitation, etc., as required
2. Facility Requirements for maintain/improving existing runway. Some items may not be required depending on preferred development alternative selected for the airport.

Chapter Five
Airport Development Alternatives

CENTURY WEST
ENGINEERING CORPORATION

Madras Municipal Airport

CHAPTER FIVE
AIRPORT DEVELOPMENT ALTERNATIVES

The evaluation of future development options represents a critical step in the airport master planning process. The primary goal is to define a path for future development that provides an efficient use of resources and is capable of accommodating the forecast demand and facility needs defined in the master plan. As noted in the facility requirements evaluation, current and long term planning for Madras Municipal Airport is based on maintaining and improving the airport's ability to serve a wide range of general aviation and business aviation aircraft.

All proposed facilities are designed for consistency with applicable FAA airport design standards and FAR Part 77 airspace planning standards. Airplane Design Group II (ADG II) standards are recommended for all facilities used regularly by the design aircraft (business class turboprop or medium business jet). Facilities used small aircraft exclusively are based on ADG I design standards (small single engine or multi-engine aircraft).

In addition, development setbacks consistent with large fire bomber aircraft have been used to improve overall operational safety. These include protecting wingtip clearances (to adjacent hangars and parked aircraft) for large aircraft traveling on the parallel taxiway. The geometry of the existing runway-taxiway system at Madras Municipal Airport exceeds many of the minimum setback dimensions associated with ADG II aircraft. Maintaining existing separations where possible provides flexibility to accommodate occasional use by large aircraft without requiring extensive airfield reconfiguration.

Creating preliminary alternatives represents the first step in a multi-step process that leads to the selection of a preferred alternative. The elements of the preferred alternative will guide future design and construction on the airfield. The preliminary alternatives will be evaluated to identify general preferences for both individual items and the overall concepts being presented. The process will allow the widest range of ideas to be considered and the most effective facility development concept to be defined. From this evaluation process, elements of a preferred alternative will emerge that can best accommodate all required facility improvements. The Consultant will integrate these items into a draft preferred alternative that will be reviewed and refined as the City proceeds through the process of selecting a final preferred development alternative for Madras Municipal Airport. Throughout this process, public input and coordination with the FAA will also help to shape the preferred alternative.

Once the preferred alternative is defined, a detailed capital improvement program will be created that identifies and prioritizes specific projects that can be implemented. The elements of the preferred alternative will be integrated into the updated airport layout plan (ALP) drawings that will be used to guide future improvements at the airport.

No-Action Alternative

In addition to proactive options that are designed to respond to future facility needs, a "no-action" option also exists, in which the City would choose to maintain existing facilities and capabilities without investing in facility upgrades or expansion to address future demand. The existing airfield configuration would remain unchanged from its present configuration and the airport would essentially be operated in a "maintenance-only" mode.

The primary result of this alternative would be the inability of the airport to accommodate forecast aviation demand beyond current facility capabilities. Future aviation activity would eventually be constrained by the capacity, safety and operational limits of the existing airport facilities.

The no-action alternative concept establishes a baseline from which the action alternatives can be developed and compared. The purpose and need for the action alternatives is defined by the findings of the forecasts and facilities requirements analyses. Forecast aviation activity and the factors associated with increased activity (potential for congestion, safety, etc.) are the underlying rationale for making facility improvements. Market factors (demand) effectively determine the level and pace of private investment (hangar construction, business relocation to the airport, etc.) at an airport. Public investment in facilities is driven by safety, capacity and the need to operate the airport on a financially self-sufficient basis.

Based on the factors noted above, the no-action alternative is inconsistent with the management and development policies of the City of Madras and its long-established commitment to provide a safe and efficient public air transportation facility that is socially, environmentally, and economically sustainable.

PRELIMINARY DEVELOPMENT ALTERNATIVES

The primary facility needs identified in the facility requirements analysis include runway length, aircraft parking and aircraft hangars. The preliminary alternatives have been organized into two groups to address these broad needs and other related needs:

- Runway/Taxiway Development Options
- Terminal Area Improvement Options

The preliminary development alternatives are described below with graphic depictions (**Figures 5-1 through 5-4**) provided at the end of the chapter to illustrate the key elements of each alternative. The preliminary alternatives are intended to facilitate a discussion and evaluation about the best path to meet the facility needs of the airport.

RUNWAY/TAXIWAY OPTIONS

Runway/Taxiway Option A

The primary elements of Runway/Taxiway Option A include:

- South Extension Runway 16/34
- Other Taxiway Improvements
- Reconfigured North Access Taxiway
- Runway 4/22 Extension and Widening

Runway 16/34 Extension. The proposed runway extensions at the south end of Runway 16/34 depicted in Option A are based on the lengths needed to accommodate the design aircraft family (business aircraft weighing more than 12,500 pounds, but less than 60,000 pounds) and larger aircraft (typical large fire fighting aircraft and large business jets weighing more than 60,000 pounds). The existing 75-foot width of Runway 16/34 is maintained.

The proposed runway extensions are located at the south end of the runway, which is consistent with prior master planning. While the option of extending the runway at its north end also exists, the proximity to NW Dogwood Lane (public road) and the need to protect for a non-precision instrument 34:1 approach surface for Runway 16 suggest that the south end of the runway is better suited for extension.

The first 201-foot runway extension corresponds to the length of 5,290 feet needed to accommodate 75 percent of the large airplane fleet at a 60 percent useful load on Runway 16/34. Based on FAA aircraft classification, 75 percent of large airplane fleet includes a variety of business jets including Bombardier Challenger 300; Citation Bravo, Excel, Encore, Sovereign; Falcon 10, 20, 50; IAI/Jet Commander 1123, 1124; Learjet 20, 30 series, 45; and Hawker 400, 600. Based on FAA criteria, the 60 percent useful load calculation appears to be most consistent with the type of activity anticipated in the updated aviation forecasts for Madras Municipal Airport.

The second 580-foot extension corresponds to the length of 5,870 feet needed to accommodate large airplanes (> 60,000 pounds) on Runway 16/34. This facility need is associated with larger business jet activity and larger fire bomber aircraft operated under a variety of load conditions. The two extensions total 781 feet, which represents a 15 percent increase in the current length of Runway 16/34.

As noted in the facility requirements chapter, the FAA requires justification for all FAA-funded runway extensions. Typically, documentation of a minimum 500 annual itinerant operations by aircraft that are constrained by the existing runway length is required to meet the FAA's "substantial use" threshold for funding.

Reconfigured North Access Taxiway. As noted in the facility requirements, the existing access taxiway that extends from the north end of Runway 16/34 to the east end of Runway 4/22 is inconsistent with several FAA airport design standards (including runway safety area) and FAR Part 77 airspace clearing standards. Option A replaces the existing north access taxiway by extending taxiway access from the north end of the east parallel taxiway for Runway 16/34. The new taxiway section is located 400 feet east for the extended centerline of Runway 16/34. At its north end, the taxiway angles toward a taxiway connector at the end of Runway 22. The 400-foot runway separation for the taxiway exceeds the ADG II standard of 240 feet, and is intended to provide an additional margin of safety when the runway accommodates ADG III and IV aircraft. The proposed configuration reduces the length of new taxiway that would be required if the taxiway was extended from the north end of the parallel section of the parallel taxiway (680 feet from runway centerline).

A future parallel taxiway is located on the south side of Runway 4/22 is designed to connect to the north end of the new access taxiway. The parallel taxiway is depicted with an ADG II separation of 240 feet (based on wind coverage provided by Runway 16/34 for large airplanes), although it is anticipated that taxiway pavement would initially constructed based on ADG I (small aircraft) standards.

Other Taxiway Improvements. Option A includes a southern extension of the Runway 16/34 parallel taxiway that corresponds to the runway extensions noted above. A second mid-field 90-degree exit taxiway located north of the terminal area is designed to reduce runway back-taxiing and extended roll-out for aircraft landing on Runway 34, unable to slow in time to use the existing single 90-degree mid-runway exit. The second midfield taxiway will also improve overall aircraft ground movement between the terminal area and the runway-taxiway system. A new aircraft hold area is located near the north end of the Runway 16/34 parallel taxiway, clear of the required protected areas for the runway. The holding area is located on the south side (inside) of the angled section of parallel taxiway due to the location of the new north access taxiway. The existing holding area located on the north section of parallel taxiway does not meet the ADG II taxiway object free area (OFA) standard (wingtip clearance between holding aircraft and taxiing aircraft).

Runway 4/22 Extension and Widening. In Option A, Runway 4/22 is widened to 60 feet to meet the ADG I standard. The runway is extended to 3,000 feet at the west end to improve its utilization as a crosswind runway. At 3,000 feet, the runway will be approximately 310 feet shorter than the length required to accommodate 75 percent of the small airplane fleet. However, based on the type of aircraft typically using the runway and the severity of crosswinds that dictate use of the runway, it appears that 3,000 feet provides an effective compromise between the current runway capabilities and a higher planning standard.

Runway/Taxiway Option B

The primary elements of Runway/Taxiway Option B include:

- South Extension Runway 16/34
- Relocated Crosswind Runway
- Other Taxiway Improvements

Runway 16/34 Extension. The proposed extensions for Runway 16/34 contained in Option A are maintained in Option B.

Relocated Crosswind Runway. Option B addresses the non-standard north access taxiway in a significantly different way than Option A. Option B eliminates the need for the north access taxiway entirely by relocating the crosswind runway near the north end of Runway 16/34. A comparison of common cost elements of Option A and B is presented in **Table 5-1**.

Option B replaces Runway 4/22 with a new crosswind runway (aligned at 5/23). Based on available wind data, the proposed alignment slightly improves runway wind coverage compared that currently provided by Runway 16/34 & 4/22 combined. An updated wind study would be needed to verify the optimal runway alignment. However, a similar crosswind runway relocation/realignment was recommended in the 1974 Airport Master Plan and depicted on the approved airport layout plan.

The basic rationale for this option is the cost of constructing a new runway adjacent to Runway 16/34 compares relatively favorably with the costs associated with replacing the north access taxiway, upgrading Runway 4/22 to meet ADG I standards, and rehabilitating the existing pavement for Runway 4/22.

The new crosswind runway would be located on the west side of Runway 16/34, near its north end in an "Open-V" configuration. As currently proposed, the runways do not intersect or connect directly. The proposed runway is 3,000 by 60 feet with a full length south side parallel taxiway. Access to Runway 5/23 would be provided by a taxiway extending from the Runway 16 threshold. A future parallel taxiway is located on the south side of Runway 5/23. The parallel taxiway is depicted with an ADG II separation of 240 feet (ADG II standard) although it is anticipated that taxiway pavement would initially constructed based on ADG I (small aircraft) standards.

The existing north access taxiway and Runway 4/22 pavement would be removed.

Other Taxiway Improvements. The other proposed taxiway improvements depicted in Option A are maintained in Option B, although the proposed aircraft holding area at the north end of the Runway 16/34 parallel taxiway is located on the north side (outside) of the angled section of parallel taxiway.

TABLE 5-1: COMPARISON OF PLANNING LEVEL COST ELEMENTS (RUNWAY/TAXIWAY OPTIONS)

Item A Eliminate In-Line Taxiway Connector (in Rwy 16 RSA, etc.)

Option 1 - Replace Taxiway *Replaces existing in-line taxiway with a parallel taxiway extension that connects to the end of Runway 22*

		Width	Length	SF	SY	Unit $ (SY)	Subtotal	35% Eng, Environ, Contingency	Total
A.	Extend East Parallel Taxiway for Rwy 16/34 with 240' CL separation	25	2,188	60,170	6,686	$75	$501,417	$175,496	$676,913
B.	Widen Runway 4/22 10' to meet ADG I width standard	10	2,701	29,711	3,301	$65	$214,579	$75,103	$289,682
C.	Extend Runway 4/22 to 3,000 feet	60	299	19,734	2,193	$75	$164,450	$57,558	$222,008
D.	2" AC Overlay Runway 4/22	60	2,701	178,266	19,807	$35	$693,257	$242,640	$935,897
							$1,573,703	$550,796	$2,124,499

Option 2 - Relocate/Replace Rui *Relocates Runway 4/22 to connect with Runway 16/34 in an "open-V" configuration*

		Width	Length	SF	SY	Unit $ (SY)	Subtotal	35% Eng, Environ, Contingency	Total
A.	Construct New Runway (3,000 x 60')	60	3,000	198,000	22,000	$75	$1,650,000	$577,500	$2,227,500
B.	Taxiway Connection to Rwy 23 End	25	410	11,275	1,253	$75	$93,958	$32,885	$126,844
C.	Demo Existing Runway & North Access Taxiway	-	-	181,725	20,192	$2	$40,383	$14,134	$54,518
							$1,784,342	$624,520	$2,408,861

Unit Cost Assumptions	
2" asphalt overlay	$35
Minor New Construction (12,500# s	$65
Major New Construction (12,500# s	$75

** Major new construction assumes drainage, safety area grading and other items associated with new runway/taxiway construction*

TERMINAL AREA OPTIONS

As noted in the facility requirements analysis, several needs were identified related to the existing terminal area to be addressed in the evaluation of alternatives:

- Apron Taxilane Clearances (non-standard clearances to parked aircraft, fueling, etc.)
- Small Aircraft Parking (configuration and capacity)
- Business Aircraft Parking (configuration and capacity)
- Helicopter Parking (dedicated parking for helicopter)
- Aircraft Fueling Area (clearance from apron taxilanes, apron congestion)
- New Hangar Space

Airplane Design Group II standards were used for the main apron; ADG I standards were used for light aircraft tiedowns and small aircraft hangar taxilanes. An additional development setback has been incorporated into both options based on the anticipated large aircraft use of the Runway 16/34 parallel taxiway. The ADG III taxiway object free area clearance of 93 feet from the parallel taxiway centerline has been used to define the limits of aircraft parking and hangars.

Terminal Area Option A

Terminal Area Option A (see **Figure 5-3**) reconfigures and expands the existing apron to address the facility needs identified above.

Taxilanes/Taxiways. In this option, a north-south taxilane (ADG II) is established through the entire apron that provides access to all terminal area facilities. An unobstructed 115-foot ADG II taxilane object free area is provided through the apron. The existing angled taxiway connections between the apron and the parallel taxiway are eliminated and replaced with 90-degree taxilane connections. The northern main apron taxilane connection consolidates the existing access taxiways that currently serve the small aircraft wash pad and adjacent hangars. Additional access taxilanes for small aircraft are identified for aircraft tiedown and hangar areas.

Several existing taxilanes associated with the north T-hangar area do not meet FAA ADG I design standards for width of object free area clearance. Modifications are depicted where feasible.

Aircraft Parking. Three business aircraft drive-through parking positions are located on the west side of the main taxilane, directly in front of the fixed base operator (FBO)/terminal building. The business aircraft parking positions are accessible directly from the parallel taxiway or from the apron taxilane. A small aircraft loading and unloading area is located immediately adjacent to the building provides a convenient short term parking location for itinerant aircraft that is clear of the main taxilane through the apron.

Two areas of light aircraft tiedowns are identified in Option A. A single (east-facing) row of tiedowns is located at the north end of the main apron. These tiedowns are intended to serve itinerant aircraft. The configuration of the north tiedown row (single-sided) is limited based on parallel taxiway and main apron taxilane clearances. A double-sided row of tiedowns is located at the south end of the main apron. These tiedowns are intended to serve locally based and itinerant aircraft. As currently depicted, the south tiedown apron has two taxilane connections to the parallel taxiway to improve aircraft movement and flow.

An itinerant helicopter parking pad is located near the middle of the expanded apron, adjacent to the business aircraft parking positions. Additional separation is provided between the helicopter parking pad and nearby light aircraft tiedowns.

Hangars. Option A includes space to accommodate new T-hangars and small/medium conventional hangars. The majority of new hangars are located north of the main apron, with additional hangars located near the south end of the expanded main apron. One T-hangar (typical 8-unit) can be accommodated in the area immediately north of the small airplane wash pad. However, to accommodate the T-hangar and its east-side taxilane, two older hangars located along the back (east) row would first need to be removed. The older hangars are identified as “to be removed” assuming that they will reach the end of their useful life within the next twenty years or shortly thereafter.

Several additional small/medium conventional hangar sites are identified within existing hangar rows in the north hangar area. In most cases, building configurations will be limited to one-side taxiway access due to separation requirements for the parallel taxiway or interior hangar taxilanes.

A small T-hangar (typical 6-unit) and several small/medium conventional hangars are located adjacent to the proposed south tiedown apron. This development area is currently limited by the existing access road configuration and several aboveground storage tanks.

Terminal Area Option B

Terminal Area Option B (see **Figure 5-4**) reconfigures and expands the existing apron to address the facility needs identified above.

Taxilanes/Taxiways. In this option, a north-south taxilane (ADG II) is also established through the entire apron that provides access to all terminal area facilities. The existing angled taxiway connections between the apron and the parallel taxiway are eliminated and replaced with 90-

degree taxilane connections. The northern main apron taxilane connection consolidates the existing access taxiways that currently serve the small aircraft wash pad and adjacent hangars and upgrades the taxiway to meet ADG II standards. Additional access taxilanes for small aircraft are identified for aircraft tiedown and hangar areas. One significant element in Option B is the development of a commercial hangar area north of the main apron with ADG II taxilane access provided. The north hangar taxilanes modifications noted in Option A are also applied in this option.

Aircraft Parking. Four business aircraft drive-through parking positions are located on the west side of the main taxilane directly in front of the fixed base operator (FBO)/terminal building. The business aircraft parking positions are accessible directly from the parallel taxiway or from the apron taxilane. The small aircraft loading and unloading area noted in Option A is maintained in this option.

Option B includes a new light aircraft tiedown apron at the south end of the main apron. A double sided row of tiedowns (approximately 16 spaces) is located at the south end of the main apron. These tiedowns are intended to serve locally based and itinerant aircraft.

Two itinerant helicopter parking pad are located near the middle of the expanded apron, north of the business aircraft parking positions.

Aircraft Fueling Apron. The existing aircraft fuel pumps are relocated approximately 50 feet east in conjunction with the anticipated replacement of the existing fuel storage tanks. An expanded aircraft fueling apron is provided to improve aircraft flow within the fueling area and on the adjacent main apron.

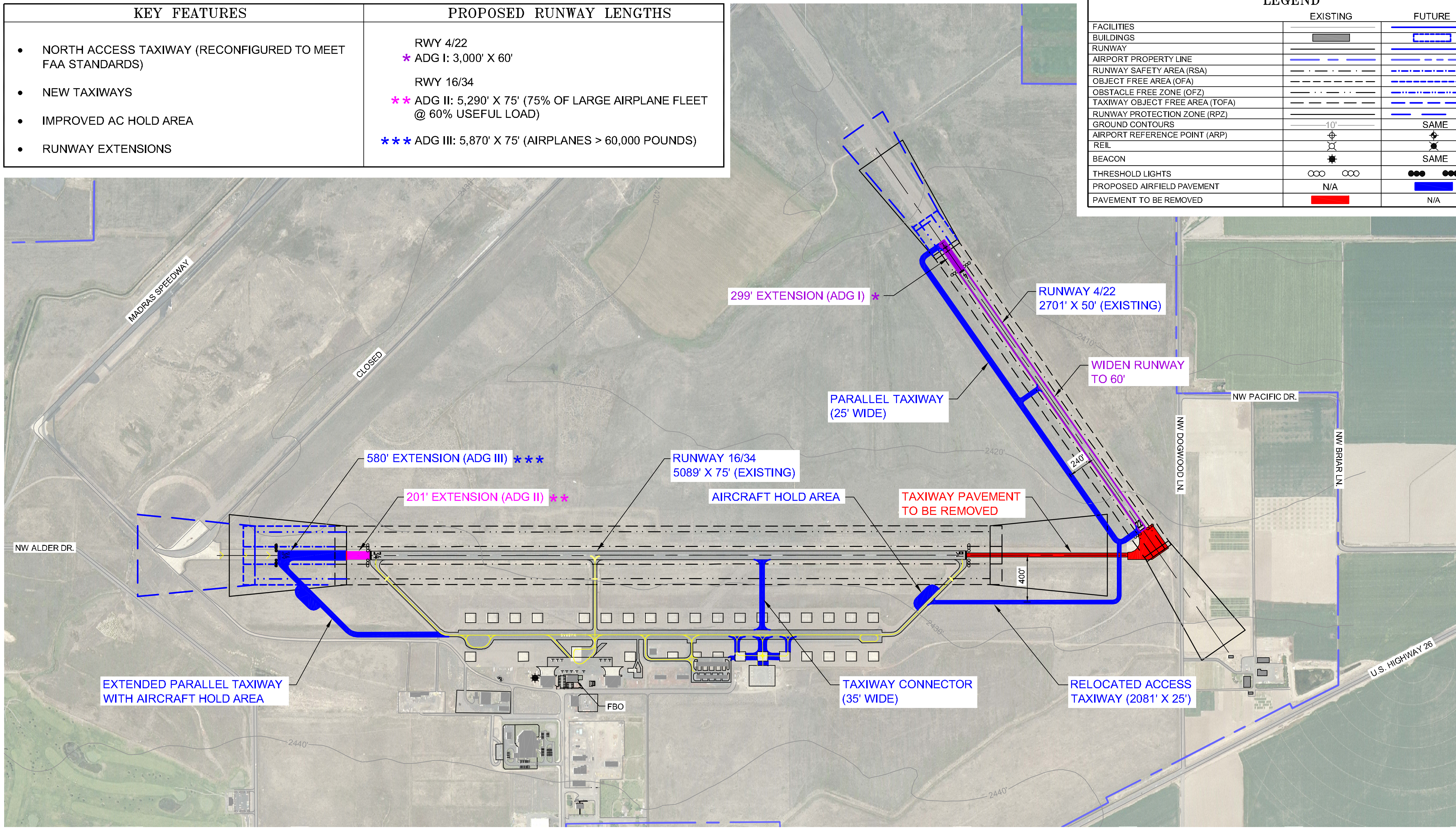
Hangars. Option B includes space to accommodate new small/medium conventional hangars, executive hangars and large commercial hangars. As with Option A, the majority of new hangars are located north of the main apron, with additional hangars located near the south end of the expanded main apron. The large commercial hangar area is located immediately north of the small airplane wash pad, which also requires removal of two older hangars. Vehicle parking areas are identified adjacent to the commercial hangars to accommodate employee parking needs typical of commercial aviation businesses.

Several additional small/medium conventional hangar sites are identified within existing hangar rows in the north hangar area. In most cases, building configurations will be limited to one-side taxiway access due to separation requirements for the parallel taxiway or interior hangar taxilanes. Several small/medium conventional hangars are located adjacent to the proposed south tiedown apron.

KEY FEATURES	PROPOSED RUNWAY LENGTHS
• NORTH ACCESS TAXIWAY (RECONFIGURED TO MEET FAA STANDARDS) • NEW TAXIWAYS • IMPROVED AC HOLD AREA • RUNWAY EXTENSIONS	RWY 4/22 * ADG I: 3,000' X 60' RWY 16/34 ** ADG II: 5,290' X 75' (75% OF LARGE AIRPLANE FLEET @ 60% USEFUL LOAD) *** ADG III: 5,870' X 75' (AIRPLANES > 60,000 POUNDS)

LEGEND

	EXISTING	FUTURE
FACILITIES		
BUILDINGS		
RUNWAY		
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
OBSTACLE FREE ZONE (OFZ)		
TAXIWAY OBJECT FREE AREA (TOFA)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS	10'	SAME
AIRPORT REFERENCE POINT (ARP)		
REIL		
BEACON		SAME
THRESHOLD LIGHTS		
PROPOSED AIRFIELD PAVEMENT	N/A	
PAVEMENT TO BE REMOVED		N/A



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SCALE OF FEET
SCALE: 1"=400'

CENTURY WEST ENGINEERING CORPORATION

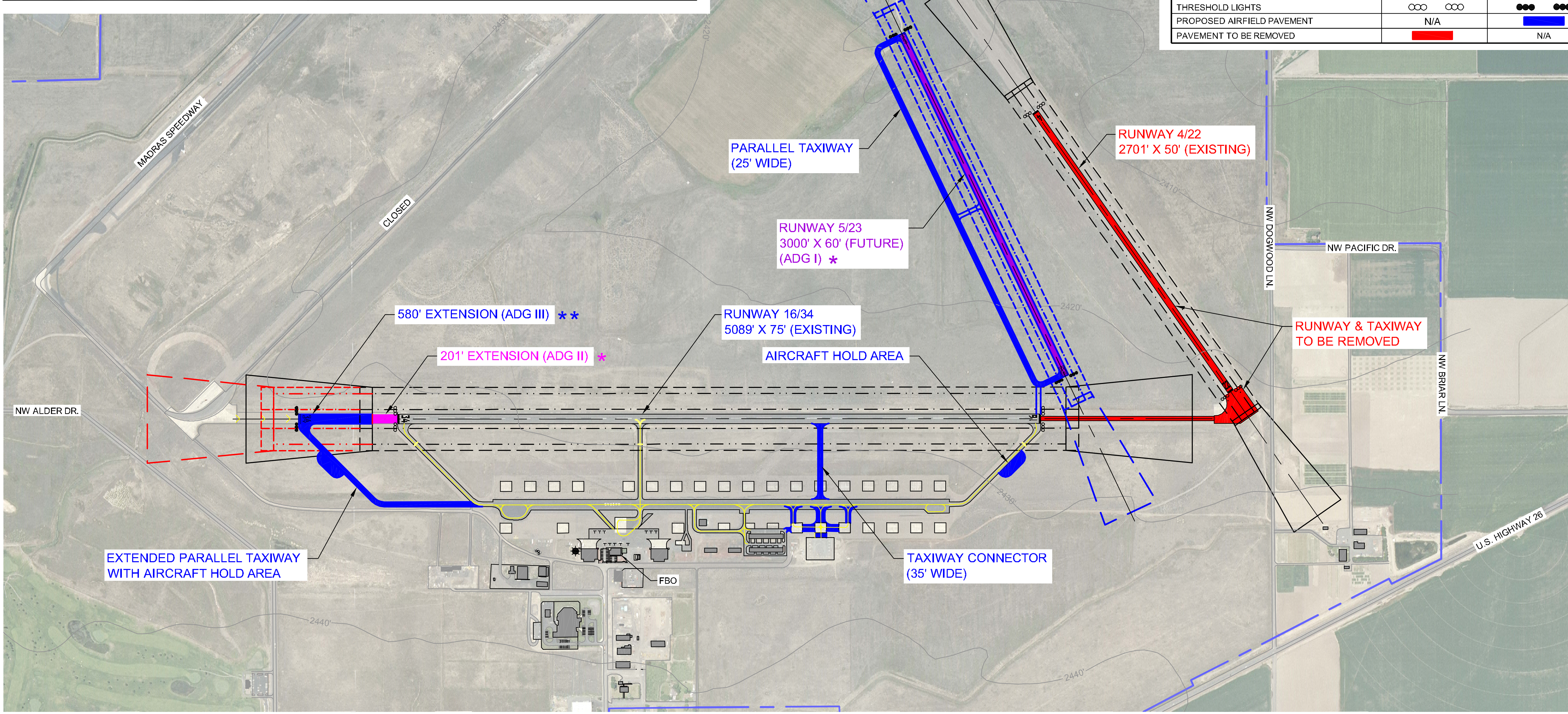
MADRAS MUNICIPAL AIRPORT RUNWAY/TAXIWAY OPTION A

FIGURE NO. 5-1

KEY FEATURES	PROPOSED RUNWAY LENGTHS
• NEW CROSSWIND RUNWAY	RWY 5/23 * ADG I: 3,000' X 60'
• IMPROVED WIND COVERAGE	RWY 16/34
• REDUCERS TAXI DISTANCES	** ADG II: 5,290' X 75' (75% OF LARGE AIRPLANE FLEET @ 60% USEFUL LOAD)
• RUNWAY EXTENSIONS	*** ADG III: 5,870' X 75' (AIRPLANES > 60,000 POUNDS)
• IMPROVED AC HOLD AREAS	

LEGEND

	EXISTING	FUTURE
FACILITIES		
BUILDINGS		
RUNWAY		
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
OBSTACLE FREE ZONE (OFZ)		
TAXIWAY OBJECT FREE AREA (TOFA)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS	10'	SAME
AIRPORT REFERENCE POINT (ARP)		
REIL		
BEACON		SAME
THRESHOLD LIGHTS		
PROPOSED AIRFIELD PAVEMENT	N/A	
PAVEMENT TO BE REMOVED		N/A



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SCALE: 1"=400'

CENTURY WEST
ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT
RUNWAY/TAXIWAY OPTION B

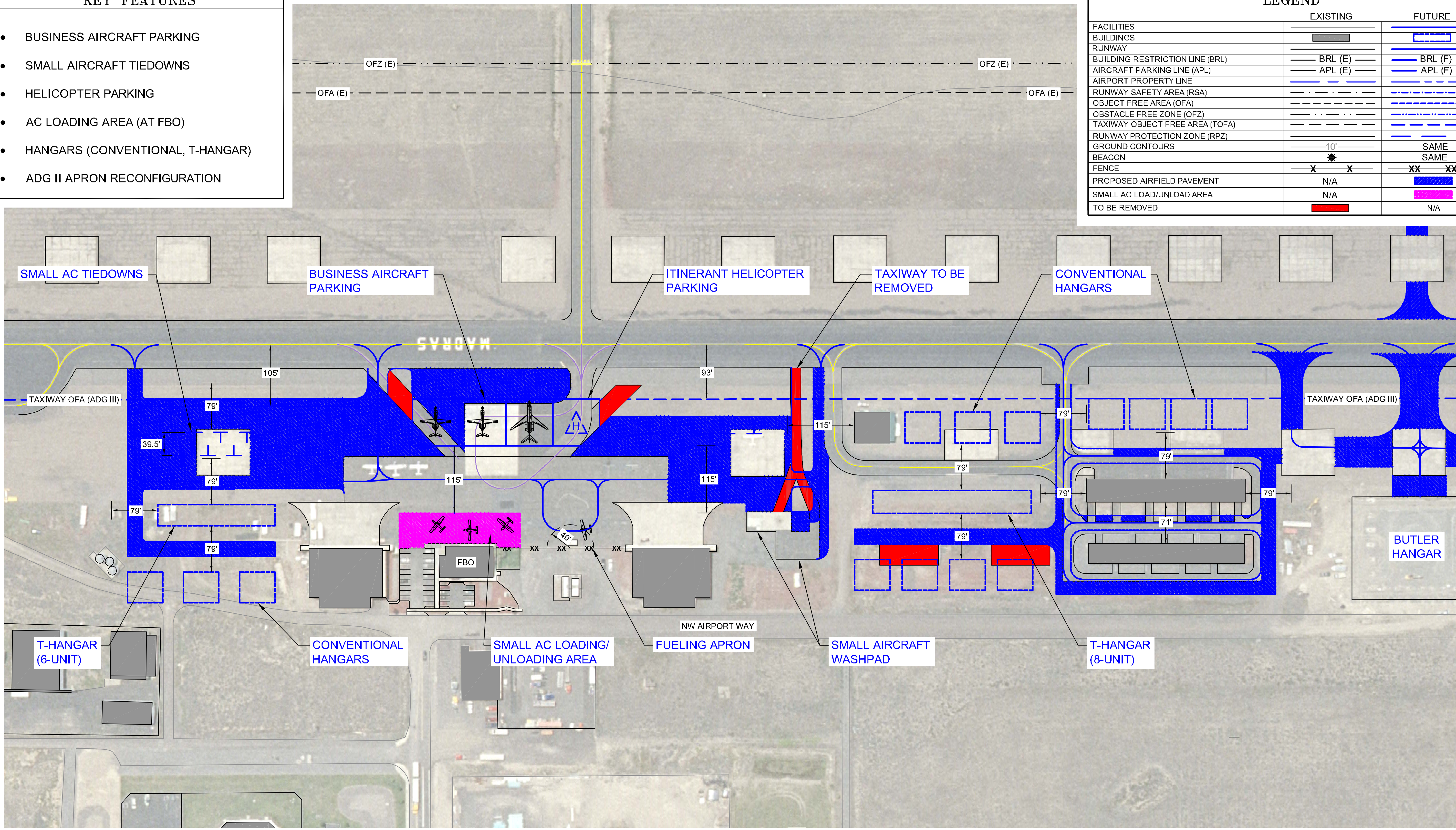
FIGURE NO.
5-2

KEY FEATURES

- BUSINESS AIRCRAFT PARKING
- SMALL AIRCRAFT TIEDOWNS
- HELICOPTER PARKING
- AC LOADING AREA (AT FBO)
- HANGARS (CONVENTIONAL, T-HANGAR)
- ADG II APRON RECONFIGURATION

LEGEND

	EXISTING	FUTURE
FACILITIES		
BUILDINGS		
RUNWAY		
BUILDING RESTRICTION LINE (BRL)	BRL (E)	BRL (F)
AIRCRAFT PARKING LINE (APL)	APL (E)	APL (F)
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
OBSTACLE FREE ZONE (OFZ)		
TAXIWAY OBJECT FREE AREA (TOFA)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS	10'	SAME
BEACON		SAME
FENCE	X X	XX XX
PROPOSED AIRFIELD PAVEMENT	N/A	
SMALL AC LOAD/UNLOAD AREA	N/A	
TO BE REMOVED		N/A



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SCALE OF FEET
SCALE: 1"=80'

CENTURY WEST ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT TERMINAL AREA OPTION A

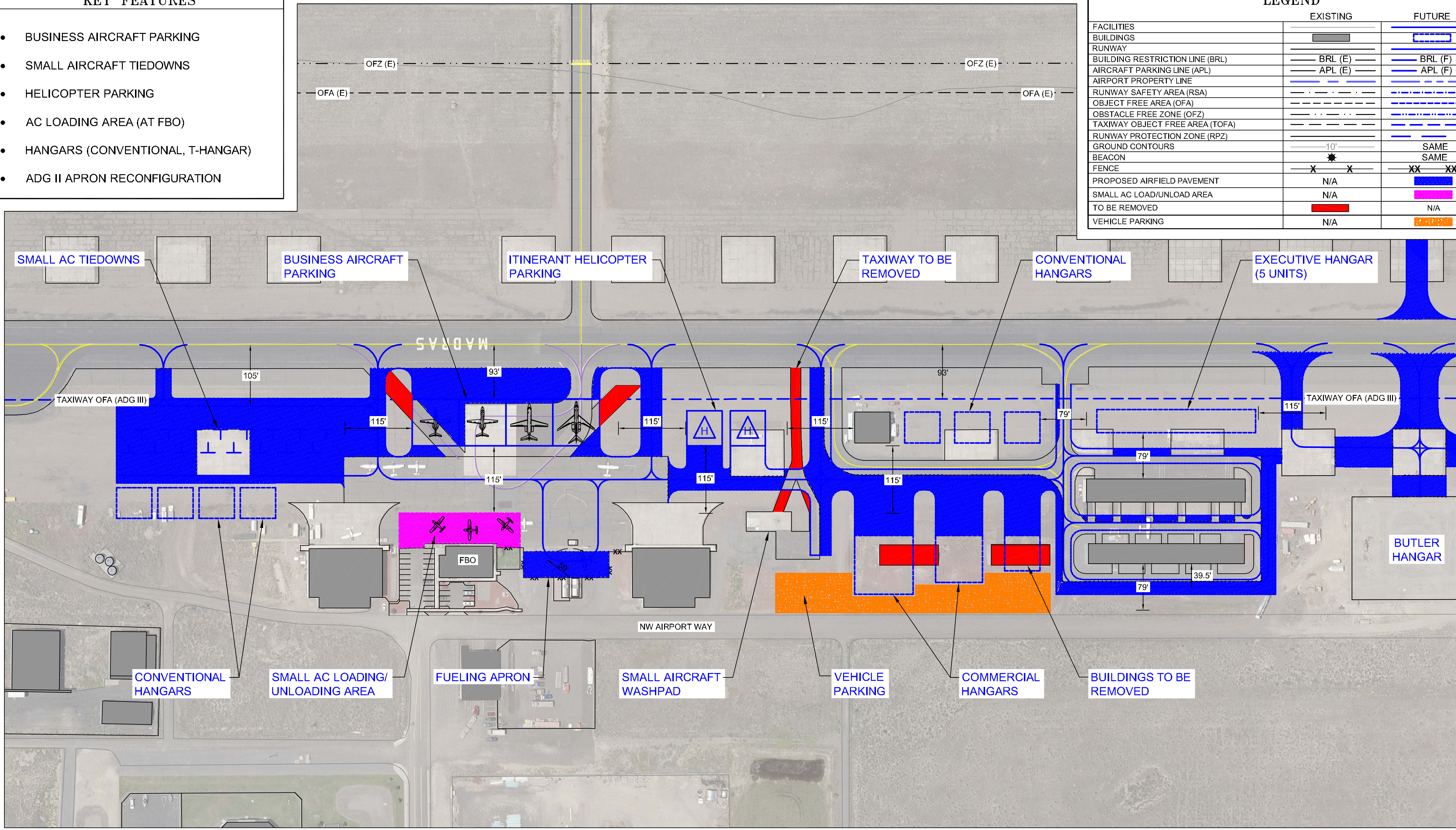
FIGURE NO. 5-3

KEY FEATURES

- BUSINESS AIRCRAFT PARKING
- SMALL AIRCRAFT TIEDOWNS
- HELICOPTER PARKING
- AC LOADING AREA (AT FBO)
- HANGARS (CONVENTIONAL, T-HANGAR)
- ADG II APRON RECONFIGURATION

LEGEND

	EXISTING	FUTURE
FACILITIES		
BUILDINGS		
RUNWAY		
BUILDING RESTRICTION LINE (BRL)	BRL (E)	BRL (F)
AIRCRAFT PARKING LINE (APL)	APL (E)	APL (F)
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
OBSTACLE FREE ZONE (OFZ)		
TAXIWAY OBJECT FREE AREA (TOFA)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS	10'	SAME
BEACON		SAME
FENCE	X X	XX XX
PROPOSED AIRFIELD PAVEMENT	N/A	
SMALL AC LOAD/UNLOAD AREA	N/A	
TO BE REMOVED		N/A
VEHICLE PARKING	N/A	



CENTURY WEST ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT TERMINAL AREA OPTION B

FIGURE NO. 5-4

Summary of Preferred Alternative

Following a thorough review of the preliminary alternative concepts and subsequent refinements, the City of Madras selected a preferred alternative concept that includes proposed improvements to Runway 16/34 and its parallel taxiway, and the construction of a new crosswind runway to replace the existing crosswind runway. The long access taxiway that connects the two runways will be eliminated, providing a more efficient and compact runway/taxiway system. The preferred alternative also includes several terminal area and other landside facility improvements. **Figures 5-5 and 5-6** illustrate the preferred alternative elements described below.

No property acquisition is required to accommodate the proposed improvements in the preferred alternative. The preferred alternative addresses a variety of facility improvements within the standards defined for Airport Reference Code (ARC) B-II for Runway 16/34 and B-I (small) for Runway 5/23 (new crosswind runway). Key elements include:

Runway & Taxiway Improvements. The preferred runway option is based on **Preliminary Runway Option B**, which includes two phased extensions (201 feet and 580 feet) at the south end of Runway 16/34 and the construction of a new crosswind runway (5/23).

<u>Runway 16/34 & Taxiways</u>

- A 201-foot extension at the south end of Runway 16/34 is recommended to accommodate the FAA-defined standard of 75 percent of the large airplane fleet with a 60 percent useful load described in the preliminary alternatives. This minor extension would increase the length of Runway 16/34 from 5,089 feet to 5,290 feet and allow the airport to accommodate the current mix of business jets under a broader range of weather conditions. A small turnaround area is proposed on the east side of the runway extension to allow aircraft to use the entire runway length for takeoff on Runway 34 and landing on Runway 16.
- The second 580-foot extension corresponds to the length required to accommodate large aircraft weighing more than 60,000 pounds. The Douglas DC6 or Lockheed C-130 fire bomber aircraft are representative of this category of large aircraft expected to operate at Madras during the current twenty year planning period. It is recognized that because the forecast level of large aircraft activity at the airport is below the threshold required by FAA for use as a design aircraft, FAA funding for the second runway extension may not be available. However, in the interest of long-term planning, the second runway extension will be reflected in the ultimate airfield layout so that the associated airspace surfaces and compatible land uses can be protected. Because of potential funding limitations, future runway extensions may be configured differently within the range defined between existing

and ultimate runway length. A scenario exists where a longer initial runway extension (i.e., increase to 5,500 feet, etc.) may be feasible through use of different funding sources.

- Increasing the weight bearing capacity for Runway 16/34 and the parallel taxiway is recommended based on the needs of large aircraft. A single wheel rating of 30,000 pounds will typically provide a corresponding dual wheel rating in the range of 50,000 to 75,000 pounds. Occasional operations by heavier aircraft (above 100,000 pounds) should be considered in the pavement design to avoid premature deterioration.
- The east parallel taxiway will be extended in conjunction with the second runway extension, or potentially an intermediate extension. A new aircraft hold area is recommended near the south end of the Runway 16/34 parallel taxiway.
- A new aircraft hold area is recommended near the north end of the Runway 16/34 parallel taxiway (locate on angled taxiway section near runway end) to replace the current hold area.
- Airspace planning for Runway 16/34 is based on accommodating straight-in nonprecision instrument approaches by large aircraft.
- The markings for Runway 16/34 will be upgraded from visual to nonprecision instrument, consistent with current/future instrument approach capabilities.
- A second 90-degree mid-runway exit taxiway is recommended approximately 1,400 feet north of the existing mid-runway exit taxiway. The new exit taxiway will improve runway operational efficiency and safety by reducing runway occupancy times, particularly for landing aircraft unable use the existing exit.

Crosswind Runway

Developing a new crosswind runway near the north end of Runway 16/34 was selected as the preferred option for addressing several issues related to the existing crosswind runway and the north access taxiway that extends beyond the north end of Runway 16/34.

Several financial factors supported the preferred option (over upgrading the existing crosswind runway and access taxiways) including the alternative cost of replacing the north access taxiway to eliminate existing Runway 16 conflicts, resurfacing Runway 4/22 (requiring some reconstruction), and bringing Runway 4/22 up to FAA standards for width and length. When evaluated, these costs were nearly comparable to the cost of constructing a new runway, in part by eliminating lengthy access taxiway construction. Both in terms of initial construction and life cycle pavement maintenance costs, constructing a new, more compact runway-taxiway system provided a cost effective option. In addition, local pilots indicate that use of the current crosswind runway is reduced by the lengthy taxiing distances required. Reducing aircraft taxiing distances also provides energy consumption and environmental (air quality) benefits. In addition, by relocating the crosswind runway, significant aviation land use development potential is created for the northern section of the airport.

Key features include:

- A 3,000 by 60-foot runway to be constructed in an "Open-V" configuration. Based on available wind data, it appears that a 050-230 degree alignment (Runway 5/23) will provide slightly improved wind coverage than the existing 040-220 degree alignment. Prior to final design and construction, a wind study is recommended to update and verify local wind patterns and to refine the proposed runway alignment, if needed.
- Runway 5/23 will be accessed by a short connecting taxiway extending from the Runway 16 threshold and the north end of the east parallel taxiway. The access taxiway will be compatible with a future south side parallel taxiway for Runway 5/23.
- Airspace planning for Runway 5/23 is based on accommodating visual approaches by small airplanes.
- The existing Runway 4/22 will be closed and the area will be available for redevelopment.

Note: the specific timeline for replacing Runway 4/22 is dependent on several factors including the availability of funding. Due to the seriously deteriorated condition of the concrete pavement located at the end of Runway 22, an interim solution will be needed if the runway cannot be replaced within the next few years. As such, a short bypass taxiway is planned that will connect the north access taxiway to the Runway 22 threshold, bypassing the concrete pavement.

Terminal Apron Reconfiguration & Expansion. The main apron will be reconfigured and expanded to increase current aircraft parking capacity and improve aircraft circulation within the apron. All aircraft parking is configured to meet FAA design standards for taxilane object free area clearance, for both the main taxilane and taxilanes serving parking rows. A main north-south access taxilane will provide access throughout the apron, with adequate clearance (ADG II) provided between taxiing aircraft and parked aircraft, aircraft fueling, etc.

The improvements will increase the number of light aircraft tiedowns, business aircraft and helicopter parking positions, and improve the efficiency of aircraft fueling operations. The expanded apron capacity appears to be adequate to accommodate projected demand until late in the 20-year planning period. The primary improvements include:

- Improved taxilane access within the apron to serve aircraft parking, hangars, and fueling areas. The two existing angled taxiways that connect the main apron and parallel taxiway will be replaced with 90-degree taxiways, which increases aircraft parking space available for business aircraft and facilitates aircraft movement throughout the expanded apron. Addition taxiway connections to the parallel taxiway are provided north and south of the center section of the apron.

- An aircraft loading/unloading area is located directly in front of the general aviation terminal. This area will accommodate short term parking for small single-engine or multi-engine aircraft associated with passenger loading and unloading.
- Four drive-through parking positions for business class aircraft are located near the general aviation terminal. The parking positions are sized to accommodate a variety of aircraft types, including large business jets that are not designed to use light aircraft tiedowns.
- The existing aircraft fueling area will be reconfigured in conjunction with replacement of the two old single wall fuel tanks. The existing fence that extends along the rear edge of the apron, from FBO building to the north Quonset hangar, will be relocated eastward with the fuel tanks and pumps. The fueling apron will be expanded within the area. It is anticipated that the fuel tanks will be replaced with above ground double wall tanks; the tank capacities will be determined by airport management based on delivery factors, seasonal demand, other market considerations and price. Individual tank capacities used at general aviation airports typically range from 10,000 to 20,000 gallons; individual tanks can also be partitioned to accommodate different fuel types (e.g., AVGAS and Jet Fuel). 12,000 gallon tanks are popular because they enable airports to accept a full delivery of fuel (around 9,000 gallons) without running too low between deliveries. Aviation fuel distributors will typically charge a flat fee for each delivery regardless of the volume. The ability to regularly accept full deliveries is factor in pricing fuel.
- Space is provided for three helicopter parking pads to the north of the business aircraft parking. The parking pads will be constructed of Portland Cement Concrete (PCC) and will be used by medevac helicopters and other itinerant rotorcraft. The helicopter parking may be constructed in phases based on parking demand.
- 12 light airplane tiedowns will be provided at the south end of the main apron. The tiedown area can be expanded further to the south in conjunction with the relocation of the south aircraft hold area on the parallel taxiway.

Landside Development. The north hangar will accommodate additional T-hangar and small conventional hangar development. The taxilanes serving the hangar area will be upgraded/reconfigured to meet FAA taxilane object free area clearances. As configured, the north hangar area will accommodate one 6-unit T-hangar and eight to nine conventional hangars. The hangar sites that are located immediately adjacent to the parallel taxiway are limited by taxiway/taxilane clearances and will be accessed from the east sides of the buildings. These sites are also compatible with multi-unit executive hangars that share a common roof, with interior walls separating rectangular units. The taxilanes surrounding the existing T-hangars will be resurfaced and designed to meet FAA standards. Sites for a second new 6-unit T-hangar and several small conventional hangars are identified adjacent to the south tiedown apron expansion.

The preferred alternative provides new storage capacity to accommodate 25 to 30 additional aircraft in T-hangars and Conventional Hangars, which is in line with long-term based aircraft forecasts. Ample reserve areas exist on the airport to expand beyond current planned development or if any existing hangars required replacement.

Existing airport fencing and gates will be modified along NW Airport Way, with controlled access provided via pedestrian and automated vehicle gates located adjacent to the apron. Public vehicle parking and a passenger pick-up/drop off area will be provided adjacent to landside areas (outside the fence). An automated access vehicle gate is recommended to provide tenant access to the north and south hangar areas.

The northern section of the Runway 16/34 flight line is reserved for commercial aviation use, including several large hangar sites, fixed wing, and helicopter parking. The recent City development of a large commercial hangar and the planned apron and taxiway improvements provides a template for future development.

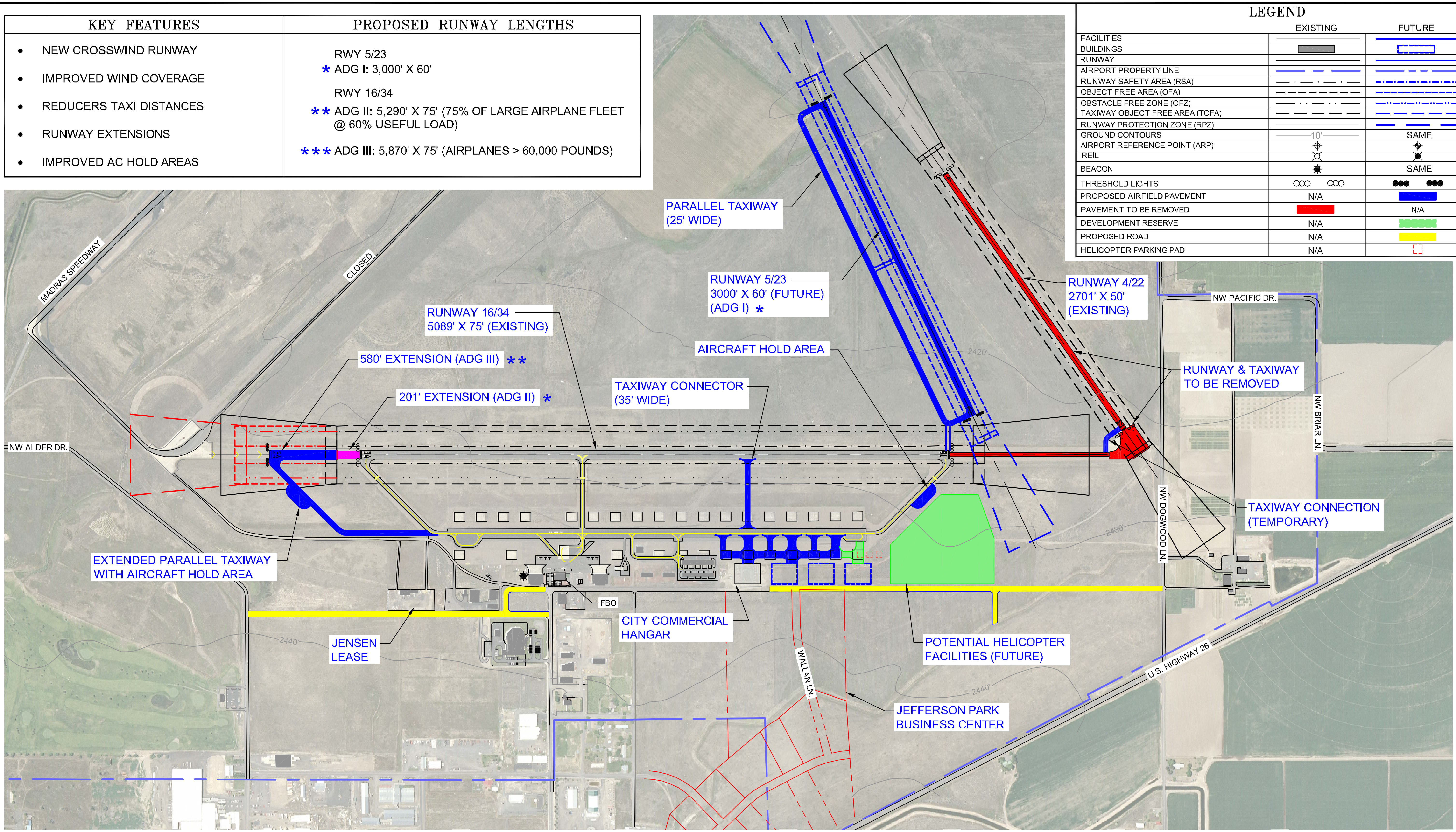
Parallel Taxiway Lighting. The parallel taxiway will be equipped with medium intensity taxiway edge lighting (MITL).

Airfield Signage. Airfield signage will be updated and upgraded to internally-illuminated units (mandatory instructional signs, location signs, direction signs, destination signs, runway distance remaining signs).

Automated Weather Observation System (AWOS). An AWOS will be located near mid-runway, on the west side of Runway 16/34. The AWOS will be protected by a 500-foot radius clear area, which must be kept free of structures or other items that could adversely affect operation.

Airport Fencing. Airport security fencing will be installed around a defined airport operations area that is defined by the runway-taxiway system and adjacent aviation use facilities. Controlled access points (gates) will be located based on specific operational requirements.

KEY FEATURES	PROPOSED RUNWAY LENGTHS
• NEW CROSSWIND RUNWAY • IMPROVED WIND COVERAGE • REDUCERS TAXI DISTANCES • RUNWAY EXTENSIONS • IMPROVED AC HOLD AREAS	RWY 5/23 * ADG I: 3,000' X 60' RWY 16/34 ** ADG II: 5,290' X 75' (75% OF LARGE AIRPLANE FLEET @ 60% USEFUL LOAD) *** ADG III: 5,870' X 75' (AIRPLANES > 60,000 POUNDS)



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SCALE OF FEET
SCALE: 1"=400'

CENTURY WEST ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT
PREFERRED RUNWAY/TAXIWAY

FIGURE NO. 5-5

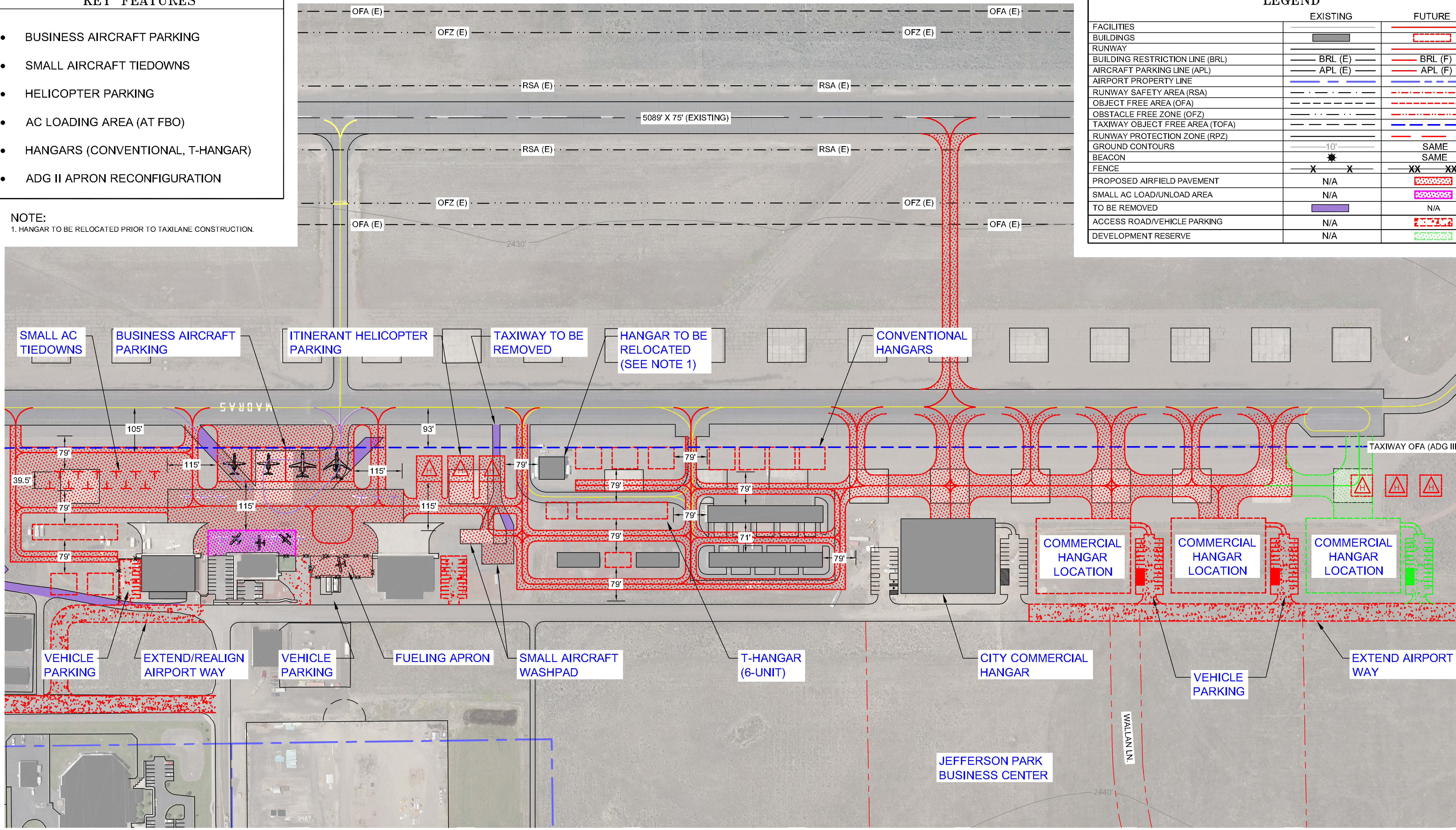
KEY FEATURES

- BUSINESS AIRCRAFT PARKING
- SMALL AIRCRAFT TIEDOWNS
- HELICOPTER PARKING
- AC LOADING AREA (AT FBO)
- HANGARS (CONVENTIONAL, T-HANGAR)
- ADG II APRON RECONFIGURATION

NOTE:
1. HANGAR TO BE RELOCATED PRIOR TO TAXILANE CONSTRUCTION.

LEGEND

	EXISTING	FUTURE
FACILITIES		
BUILDINGS		
RUNWAY		
BUILDING RESTRICTION LINE (BRL)	BRL (E)	BRL (F)
AIRCRAFT PARKING LINE (APL)	APL (E)	APL (F)
AIRPORT PROPERTY LINE		
RUNWAY SAFETY AREA (RSA)		
OBJECT FREE AREA (OFA)		
OBSTACLE FREE ZONE (OFZ)		
TAXIWAY OBJECT FREE AREA (TOFA)		
RUNWAY PROTECTION ZONE (RPZ)		
GROUND CONTOURS	10'	SAME
BEACON		SAME
FENCE	X X	XX XX
PROPOSED AIRFIELD PAVEMENT	N/A	
SMALL AC LOAD/UNLOAD AREA	N/A	
TO BE REMOVED		N/A
ACCESS ROAD/VEHICLE PARKING	N/A	
DEVELOPMENT RESERVE	N/A	



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0 110 220
SCALE OF FEET
SCALE: 1"=110'

CENTURY WEST ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT
PREFERRED TERMINAL AREA

FIGURE NO.
5-6

Chapter Six
Financial and Development Program

CENTURY WEST
ENGINEERING CORPORATION

Madras Municipal Airport

CHAPTER SIX
FINANCIAL AND DEVELOPMENT PROGRAM

Introduction

The purpose of this chapter is to present the projects identified in the Airport Capital Improvement Program (ACIP) that have been developed and assembled based on the analyses conducted in the Facility Requirements and Development Alternatives chapters (Chapters Four and Five). The ACIP projects are summarized in **Table 6-1**.

The master plan preferred alternative includes airside elements (runway and parallel taxiway extensions, new taxiway access, lighting upgrades, etc.) and landside elements (main apron reconfiguration, helicopter parking, hangars, FBO related facility development areas). In addition to specific construction related activities, some projects will require environmental study. Minor pavement maintenance items such as vegetation removal and crack filling are not included in the capital improvement program, but will need to be undertaken by the City on an annual or semi-annual basis.

The ACIP lists all major projects included in the twenty year planning period addressed in the Master Plan. Individual projects for the first six years of the planning period are listed in order of priority by year. Projects for the intermediate and long-term phases of the planning period (years 7-20) are listed in order of priority but have not been assigned a year. Each project's eligibility for FAA funding is noted, based on current federal legislation and funding formulas. Specific project details are depicted on the updated airport layout plan and terminal area plan drawings contained in Chapter Seven.

A primary source of potential funding identified in this plan is the FAA's Airport Improvement Program (AIP). As proposed, approximately 95 percent of the airport's 20 year ACIP will be eligible for federal funding. Funds from this program are derived from the Aviation Trust Fund, which is the depository for all federal aviation taxes collected on such items as airline tickets, aviation fuel, lubricants, tires, aircraft registrations, and other aviation related fees. These funds are distributed by FAA under appropriations set by Congress to all airports in the United States that have certified eligibility.

However, as noted in **Table 6-1**, the projected twenty year total for FAA eligible projects in the ACIP significantly exceeds current FAA funding levels through the non-primary entitlement program. While other types of FAA funding may be available for some projects, it is reasonable to assume that despite establishing eligibility for FAA funding, not all eligible projects are likely to be funded by FAA. As the City manages its ACIP, maximizing the use of available FAA and other outside sources of funding is assumed. However, in some cases, the limited availability of outside funds may require projects to be deferred, or funded with increased levels of City, State or private funding.

AIRPORT DEVELOPMENT SCHEDULE AND COST ESTIMATES

Cost estimates for each individual project were developed in 2010 dollars based on typical construction costs associated for the specific type of project. The project costs listed in the ACIP represent order-of-magnitude estimates that approximate design engineering, environmental, other related costs, and contingencies. The estimates are intended only for preliminary planning and programming purposes. Specific project analysis and detailed engineering design will be required at the time of project implementation to provide more refined and detailed estimates of the development costs.

In future years, as the plan is carried out, these cost estimates can continue to assist management by adjusting the 2010-based figures for subsequent inflation. This may be accomplished by converting the interim change in the United States Consumer Price Index (USCPI) into a multiplier ratio through the following formula:

$$\frac{X}{I} = Y$$

Where:
X = USCPI in any given future year
Y = Change Ratio
I = Current Index (USCPI)[19]

USCPI
218.178 **(1982-1984 = 100)** **May 2010**

[19] U.S. Consumer Price Index for All Urban Consumers (USCPI-U)

Multiplying the change ratio (Y) times any 2010-based cost figures presented in this study will yield the adjusted dollar amounts appropriate in any future year evaluation. Several different CPI-based indices are available for use and any applicable index may be substituted by the City in its financial management program.

The following sections outline the recommended development program and funding assumptions. The scheduling has been prepared according to the facility requirements determined through the master plan evaluation. The projected staging of development projects is based upon anticipated needs and investment priorities. Actual activity levels may vary from projected levels; therefore, the staging of development in this section should be viewed as a general guide. When activity does vary from projected levels, implementation of development projects should occur when demand warrants, rather than according to the estimated staging presented in this chapter. In addition to major projects, the airport will continue to require regular facility maintenance such as pavement maintenance, vegetation control, sweeping, lighting repair and fuel system maintenance.

The first phase of the capital improvement program includes the highest priority projects recommended during the first six years. Intermediate and long term projects are anticipated to occur in the 7 to 20 year period, although changes in demand or other conditions could accelerate or slow demand for some improvements.

Short Term Projects

The short term program contains work items of the highest priority. Priority items include improvements related to safety. Because of their priority, these items will need to be incorporated into Airport District Office and FAA capital improvement programming. To assist with this process, the short term projects are scheduled in specific calendar years for the first six years of the planning period (2010/11-2016).

<u>Short Term Projects:</u>

- Aircraft parking and taxiway improvements and large aircraft wash pad adjacent to City commercial hangar.
- Install medium intensity taxiway edge lighting (MITL) on Runway 16/34 parallel taxiway.
- Install REIL on Runway 16.
- Upgrade Runway 16/34 markings to nonprecision instrument.
- Automated weather observation system (AWOS).
- Pavement maintenance (crack filling and slurry seals) on runway, major taxiways, hangar taxilanes) and repaint markings.

- Second mid-runway exit taxiway for Runway 16/34.
- Bypass taxiway for Runway 4/22 (to bypass failed concrete at Runway 22 end)

Intermediate & Long Term Projects

Several intermediate or long term projects are considered to be current needs. However, based on the limited funding resources available, it was necessary to shift some projects to the longer term timeline. Projects may be completed sooner in the event that additional funding can be generated.

Intermediate Term Projects (7-11 years)

- Conduct environmental evaluation for runway and parallel taxiway extension(s).
- 201-foot runway south extension (Runway 16/34); relocate VASI or replace with new PAPI
- Reconfigure north aircraft hold area (on Runway 16/34 parallel taxiway) to meet taxiway OFA clearance
- Overlay/reconstruct Runway 16/34; increase pavement strength.
- Install PAPI (Rwy 16 & 34); REIL (Rwy 34)
- Reconfigure and Expand main apron (configuration depicted on the ALP and Terminal Area Plan – sheets three and four in chapter seven) to meet FAA standards and improve efficiency:
  - Expand aircraft fueling area
  - Reconfigure & upgrade taxilanes; improved access to parallel taxiway
  - Aircraft loading/unloading area in front of FBO
  - 12 aircraft tiedowns
  - 4 business aircraft parking positions (PCC)
  - 1 Itinerant helicopter parking position (PCC)
- Reconfigure/upgrade north hangar taxilanes to meet FAA standards
- Replace Aircraft Fuel Storage Tanks
- Extend airport security fencing in terminal area and east flightline
- Install automated vehicle and pedestrian access gates (north and south ends of the terminal area)
- Extend Demers Road to Alder

- Extend NW Airport Way to north end of flightline

Long Term Projects (12-20 years)

- Complete pavement maintenance projects: Regular crack filling, slurry seal all airfield (asphalt) pavements on 6 to 8 year intervals; repaint airfield markings.
- Auto parking adjacent to hangars and aircraft parking apron.
- Extend airport fencing around defined airport operations area.
- Overlay Parallel Taxiway and midfield exit taxiway; increase pavement strength.
- Conduct environmental evaluation for new Runway 5/23.
- Construct T-hangar or multi-unit executive hangars.
- Construct new Runway 5/23 and access taxiway; install MIRL and PAPI.
- Remove north access taxiway pavement (within Runway 16/34 RSA); grade and compact RSA.
- Replace Runway 16/34 MIRL (at end of useful life).
- 580-foot runway south extension (Runway 16/34); relocate PAPI and extend MIRL; extend parallel taxiway and construct new aircraft hold area.
- Construct parallel taxiway for Runway 5/23.
- Replace airport beacon (at end of useful life).
- Construct second itinerant helicopter parking pad (PCC).
- Construct south hangar taxilane (demand based).

City of Madras
Madras Municipal Airport
2010-2030

20-YEAR CAPITAL IMPROVEMENT PROGRAM

Prepared by Century West Engineering (6/10)

Short Term	Yr	Project	Project Category	Unit	Quantity	Unit Cost	Subtotal Cost	45% Engineering/ Contingency/ Environmental / ODOT Fee	Total Cost	FAA GA Entitlement	FAA Other Funding **	Local Costs*
2010-2011	**1**	Heavy Aircraft Hangar Taxiway, Apron and Washpac	Pavement Construction	LS	1	$515,400	$515,400	$108,749	$624,149	$426,156	$0	$197,993
		Install REIL - Runway 16	Lighting	ea	1	$94,060	$94,060	$19,847	$113,907	$0	$0	$113,907
		Install AWOS	Other	LS	1	$192,000	$192,000	$40,512	$232,512	$0	$0	$232,512
		Install Medium Intensity Taxiway Edge Lighting (MITL) - Rwy 16/34 Parallel Taxiway & Exits	Lighting	LF	1	$205,000	$205,000	$43,255	$248,255	$0	$0	$248,255
		Terminal Area Flood Lighting	Security	LS	1	$85,000	$85,000	$17,935	$102,935	$0	$0	$102,935
		Terminal Area Apron Expansion (120' x 150')	Pavement Construction	LS	1	$360,115	$360,115	$75,984	$436,099	$0	$0	$436,099
		Install NPI Markings (Rwy 16 & 34 ends)	Other	LS	1	$122,000	$122,000	$25,742	$147,742	$0	$0	$147,742
Subtotal - Year 1							$1,573,575	$332,024	$1,905,599	$426,156	$0	$1,479,443
2012	**2**	No Projects										
Subtotal - Year 2							$0	$0	$0	$0	$0	$0
2013	**3**	No Projects										
Subtotal - Year 3							$0	$0	$0	$0	$0	$0
2014	**4**	Mid-Runway Exit Taxiway (Rwy 16/34)	Pavement Construction	SY	5,192	$75	$389,400	$175,230	$564,630	$536,399	$0	$28,232
		Runway 4/22 Bypass Taxiway (@ Rwy 22 end)	Pavement Construction	SY	1,050	$75	$78,750	$35,438	$114,188	$74,446	$34,033	$5,709
Subtotal - Year 4							$468,150	$210,668	$678,818	$610,844	$34,033	$33,941
2015	**5**	No Projects										
Subtotal - Year 5							$0	$0	$0	$0	$0	$0
2016	**6**	Main Apron Sealcoat	Pavement Maintenance	SY	10,500	$5	$55,500	$24,975	$80,475	$76,451	$0	$4,024
		Hangar Taxilanes Sealcoat	Pavement Maintenance	SY	5,100	$5	$28,500	$12,825	$41,325	$39,259	$0	$2,066
		Parallel Taxiway Sealcoat	Pavement Maintenance	SY	24,526	$5	$125,630	$56,534	$182,164	$173,055	$0	$9,108
Subtotal - Year 6							$209,630	$94,334	$303,964	$288,765	$0	$15,198
						Yr 0-6 Total	*$2,251,355*	*$637,025*	*$2,888,380*	*$1,325,765*	*$34,033*	*$1,528,582*

* Local share of ACIP includes City funds, Connect Oregon grants, other grants or private funds.

** Other FAA Funding Total listed for reference only based on general project eligibility; FAA funding levels are expected to be below projected needs.

GA Year	Non-Primary Entitlements (NPE)	
2010	(Accumulated NPE)	$437,000
2011		$150,000
	Total	$587,000
	Used	$426,156
	Balance	$160,844
	(Accumulated NPE)	$160,844
2012		$150,000
	Total	$310,844
	Used	$0
	Balance	$310,844
	(Accumulated NPE)	$310,844
2013		$150,000
	Total	$460,844
	Used	$0
	Balance	$460,844
	(Accumulated NPE)	$460,844
2014		$150,000
	Total	$610,844
	Used	$610,844
	Balance	$0
	(Accumulated NPE)	$0
2015		$150,000
	Total	$150,000
	Used	$0
	Balance	$150,000
	(Accumulated NPE)	$150,000
2016		$150,000
	Total	$300,000
	Used	$288,765
	Balance	$11,235

Intermediate Term (2017-2021)	Yr	Project	Project Category	Unit	Quantity	Unit Cost	Subtotal Cost	45% Engineering/ Contingency/ Environmental / ODOT Fee	Total Cost	FAA GA Entitlement	FAA Other Funding **	Local Costs*
		Reconfigured AC Hold Area (north end of Rwy 16/34 parallel taxiway)	Pavement Construction	SY	2,112	$75	$158,400	$71,280	$229,680	$0	$218,196	$11,484
		Environmental - Runway 16/34 Extension, Strengthening	Other	LS	1	$100,000	$100,000	$45,000	$145,000	$0	$137,750	$7,250
		Runway 16/34 Overlay/Reconstruct; NPI Markings	Pavement Maintenance	SY	42,410	$65	$2,781,650	$1,251,743	$4,033,393	$761,235	$3,070,488	$201,670
		Phase 1 Runway 16/34 Extension (201' x 75')	Pavement Construction	SY	1,675	$75	$220,625	$99,281	$319,906	$0	$303,911	$15,995
		PAPI - Rwy 16 & 34	Lighting	ea	2	$60,000	$120,000	$54,000	$174,000	$0	$165,300	$8,700
		Install REIL - Runway 34	Lighting	ea	2	$94,060	$188,120	$84,654	$272,774	$0	$259,135	$13,639
		Reconfigure Main Apron (reconfigure/restripe taxilanes; install and stripe 12 Light AC tiedowns; four business aircraft parking positions; taxiway connections to parallel taxiway)	Other	SY	12,000	$75	$900,000	$405,000	$1,305,000	$0	$1,239,750	$65,250
		Construct Itinerant Helicopter Parking Apron (1 - 60'x60' PCC Pad and asphalt taxiway connection)	Pavement Construction	SY	670	$85	$71,950	$32,378	$104,328	$0	$99,111	$5,216
		Main Apron Aircraft Fueling Area Expansion	Pavement Construction	SY	500	$75	$37,500	$16,875	$54,375	$0	$51,656	$2,719
		Aircraft Fuel Tanks (2 - 12,000 gallon above ground tanks; pumps, cardlock)	Other	LS	1	$175,000	$175,000	$78,750	$253,750	$0	$241,063	$12,688
		North Hangar Area Taxilane Reconstruction/Replacement	Pavement Construction	SY	3,000	$75	$225,000	$101,250	$326,250	$0	$309,938	$16,313
		Airport Fencing (east flightline)	Security	LF	2,200	$18	$39,600	$17,820	$57,420	$0	$54,549	$2,871
		Install Automated Vehicle Access Gate (North Hangar Area)	Security	LS	1	$15,000	$15,000	$6,750	$21,750	$0	$20,663	$1,088
		Install Automated Vehicle Access Gate (South end of Main Apron)	Security	LS	1	$15,000	$15,000	$6,750	$21,750	$0	$20,663	$1,088
		Extend Demers Road (to Alder)	Other	LF	3,100	$60	$186,000	$83,700	$269,700	$0	$256,215	$13,485
		Extend NW Airport Way (to serve north end of flightline)	Other	LF	800	$60	$48,000	$21,600	$69,600	$0	$66,120	$3,480
Subtotal - Year 6-10							$5,281,845	$2,376,830	$7,658,675	$761,235	$6,514,507	$382,934

* Local share of ACIP includes City funds, Connect Oregon grants, other grants or private funds.

** Other FAA Funding Total listed for reference only based on general project eligibility; FAA funding levels are expected to be below projected needs.

	(Accumulated NPE)	$11,235
FAA NPE $	(2017-2021)	$750,000
	Total NPE Available	**$761,235**

Long Term (2022 2030)	Yr	Project	Project Category	Unit	Quantity	Unit Cost	Subtotal Cost	45% Engineering/ Contingency/ Environmental / ODOT Fee	Total Cost	FAA GA Entitlement	FAA Other Funding **	Local Costs*
		Auto Parking (adjacent to hangars)	Other	SY	700	$25	$17,500	$7,875	$25,375	$24,106	$0	$1,269
		Airport Fencing (northeast section of airport operations area)	Security	LF	2,700	$18	$48,600	$21,870	$70,470	$66,947	$0	$3,524
		Airport Fencing (southeast section of airport operations area)	Security	LF	4,500	$18	$81,000	$36,450	$117,450	$111,578	$0	$5,873
		Main Apron PCC Maintenance (joint replacements, crack repairs)	Pavement Maintenance	SY	2,800	$12	$36,600	$16,470	$53,070	$50,417	$0	$2,654
		Construct Itinerant Helicopter Parking Apron (1 - 60'x60' PCC Pad and asphalt taxiway connection)	Pavement Construction	SY	670	$85	$71,950	$32,378	$104,328	$99,111	$0	$5,216
		Runway 16/34 Sealcoat & NPI Markings	Pavement Maintenance	SY	44,083	$5	$245,415	$110,437	$355,852	$338,059	$0	$17,793
		Environmental - Runway 5/23 Construction	Other	LS	1	$125,000	$125,000	$56,250	$181,250	$172,188	$0	$9,063
		Parallel Taxiway & Midfield Exit Overlay/Reconstruc	Pavement Maintenance	SY	24,526	$65	$1,604,190	$721,886	$2,326,076	$0	$2,209,772	$116,304
		Multi-Unit Executive or T-Hangar (6)	Other	LS	5,400	$40	$216,000	$97,200	$313,200	$0	$297,540	$15,660
		New Runway (5/23) - 3,000 x 60' with connecting access taxiway	Pavement Construction	SY	22,000	$75	$1,650,000	$742,500	$2,392,500	$0	$2,272,875	$119,625
		MIRL Runway 5/23	Lighting	LF	3,000	$45	$135,000	$60,750	$195,750	$0	$185,963	$9,788
		PAPI - Rwy 5 & 23	Lighting	ea	2	$60,000	$120,000	$54,000	$174,000	$0	$165,300	$8,700
		Demo North Access Taxiway (within RSA @ north end of Runway 16)	Safety	SY	1,167	$5	$5,835	$2,626	$8,461	$0	$8,038	$423
		South Hangar Taxilane	Pavement Construction	SY	700	$75	$52,500	$23,625	$76,125	$0	$72,319	$3,806
		Airport Fencing (northern section airport operations area)	Security	LF	6,800	$18	$122,400	$55,080	$177,480	$0	$168,606	$8,874
		Airport Beacon Replacement	Lighting	LS	1	$25,000	$25,000	$11,250	$36,250	$0	$34,438	$1,813
		Multi-Unit Executive or T-Hangar (6)	Other	LS	5,400	$40	$216,000	$97,200	$313,200	$0	$297,540	$15,660
		MIRL (Replacement) Runway 16/34	Lighting	LF	5,300	$45	$238,500	$107,325	$345,825	$0	$328,534	$17,291
		Airport Fencing (western section of airport operations area)	Security	LF	9,300	$18	$167,400	$75,330	$242,730	$0	$230,594	$12,137
		Runway 5/23 Sealcoat & Repaint Visual Markings	Pavement Maintenance	SY	22,000	$5	$113,000	$50,850	$163,850	$0	$155,658	$8,193
		Main Apron Sealcoat	Pavement Maintenance	SY	10,500	$5	$55,500	$24,975	$80,475	$0	$76,451	$4,024
		Phase 2 Runway 16/34 Extension (580' x 75')	Pavement Construction	SY	4,833	$75	$457,475	$205,864	$663,339	$0	$630,172	$33,167
		Phase 2 Runway 16/34 Parallel Taxiway Extension & AC Hold Area	Pavement Construction	SY	8,900	$75	$762,500	$343,125	$1,105,625	$0	$1,050,344	$55,281
		Hangar Taxilanes Sealcoat	Pavement Maintenance	SY	5,100	$5	$28,500	$12,825	$41,325	$0	$39,259	$2,066
		Parallel Taxiway Sealcoat (Rwy 16/34)	Pavement Maintenance	SY	24,526	$5	$125,630	$56,534	$182,164	$0	$173,055	$9,108
		Runway 5/23 Parallel Taxiway	Pavement Construction	SY	10,400	$75	$780,000	$351,000	$1,131,000	$0	$1,074,450	$56,550
		Runway 16/34 Sealcoat & NPI Markings	Pavement Maintenance	SY	48,916	$5	$269,580	$121,311	$390,891	$0	$371,346	$19,545
Subtotal - Year 11-20							$7,771,075	$3,496,984	$11,268,059	$862,405	$9,842,251	$563,403
						20 Yr Total	$15,304,275	$6,510,839	$21,815,114	$2,949,405	$16,390,791	$2,474,919

* Local share of ACIP includes City funds, Connect Oregon grants, other grants or private funds.

** Other FAA Funding Total listed for reference only based on general project eligibility; FAA funding levels are expected to be well below projected needs

	(Accumulated NPE)	$0
FAA NPE $	(2022-2030)	$1,200,000
	Total NPE Available	**$1,200,000**

Estimate of
Available FAA NPE Grants
2010-2030 = $3,287,000
(includes accumulation prior to FY10)

CAPITAL FUNDING SOURCES

Federal Grants

Federal funding is provided through the Federal Airport Improvement Program (AIP). This reauthorization is the latest evolution of a funding program originally authorized by Congress in 1946 as the Federal Aid to Airports Program (FAAP). The program provides grant funding for airports listed in the National Plan of Integrated Airport Systems (NPIAS). Under current legislation, eligible general aviation airports can receive up to $150,000 per year in general aviation "non-primary entitlement" grants. If a project is anticipated to cost in excess of $150,000, the participating airport can roll over the funding allocations for up to four years, at which time the accumulated total of funds can be used for larger projects. Any unused funds that remain beyond the maximum allowable roll over period revert to the FAA for use at other airports. These funds may only be used for eligible capital improvement projects and may not support airport operation and maintenance costs.

FAA funding is limited to projects that have clearly defined need that has been identified through preparation of an FAA approved airport layout plan (ALP). Periodic updates of the ALP are required when new or unanticipated project needs or opportunities exist that require use of FAA funds. The FAA will not generally participate in vehicle parking, utilities, building renovations or projects associated with non-aviation developments.

Some changes in funding levels and project eligibility were included in the current Airport Improvement Program (AIP) legislation (extending through FY 2009). Projects such as hangar construction or fuel systems, which have not traditionally been eligible for funding, are currently eligible, although the FAA indicates that this category of project would be considered to be a lower priority than other airfield needs. In addition, FAA funding levels have been increased from 90 percent to 95 percent.

The FAA also provides discretionary grants to airports. The dollar amounts of individual grants vary and can be significantly larger than the primary entitlements. Discretionary grants are awarded at the FAA's sole discretion. Discretionary funds are distributed after all entitlement funds have been allocated. For larger projects requiring substantially larger amounts of funding, non-primary entitlement and discretionary grants are often combined. Other types of FAA funding include facilities & equipment (F&E) projects and Congressionally-appropriated dollars for specific projects.

State Funding

No specific level of Oregon Department of Aviation (ODA) funding has been assumed in the CIP presented in **Table 6-1**. It is recommended that the City maximize use of any ODA funds that are available in the planning period.

Pavement Maintenance Program

The Pavement Management Program (PMP) programs airfield pavement maintenance funds on established multi-year cycles. This program is intended to preserve and maintain existing airfield pavements in order to maximize their useful lives and the economic value of the pavement. As noted earlier, several short-term pavement maintenance projects are identified for Madras Municipal State Airport in the most recent PMP. The program funds pavement maintenance and associated improvements (crack filling, repair, sealcoats, etc.), including some items which have not traditionally been eligible for FAA funding.

Funding for the PMP is generated through collection of aviation fuel taxes. ODA manages the PMP through an annual consultant services contract and work is programmed on a 3-year regional rotation. The program includes a regular schedule of inspection and subsequent field work. Benefits from the PMP include:

- Economy of scale in bidding contracts
- Federal/State/Local partnerships that maximize airport improvement funds
- PMP is not a grant program and local match is on a sliding scale (50% - 5% required).

The PMP includes the following features:

- Review prior year's Pavement Condition Index (PCI) reports
- Only consider PCIs above 70
- Apply budget
- Limit work to patching, crack sealing, fog sealing, slurry sealing
- Add allowance for striping
- Program to include approximately 20 airports per year, depending on funding levels.

Financial Aid to Municipalities (FAM) Grants

ODA's FAM grant program has been suspended in recent years due to a lack of funding. Efforts to resume the program are currently being considered by ODA. Previously, FAM grants up to $25,000 were available to Oregon airports for eligible airport related projects.

Local Funding

As currently defined, the locally funded portion for twenty year planning period is estimated to be just under $2.5 million (approximately 11 percent of the total project development costs). A large Connect Oregon grant awarded in 2010 is included in the local share.

Hangar construction costs have been included in the ACIP. It has been assumed that FAA funds may be used for hangar construction. However, since the other proposed capital improvements exceed the projected level of AIP funding over the twenty year planning period, the use of FAA funding for hangars projects is a relatively low priority.

The majority of local matching funds are generated through airport revenues, including fuel flowage fees, land leases and sale proceeds from non-aviation parcels in the airport industrial park. The City reviews Madras Municipal Airport's rates and fees schedule and land lease terms annually to ensure that the airport is generating fair and reasonable revenue for its facilities. Property appraisals are also recommended to periodically gauge local market valuation.

Chapter Seven
Airport Layout Plan Drawings

CENTURY WEST ENGINEERING CORPORATION

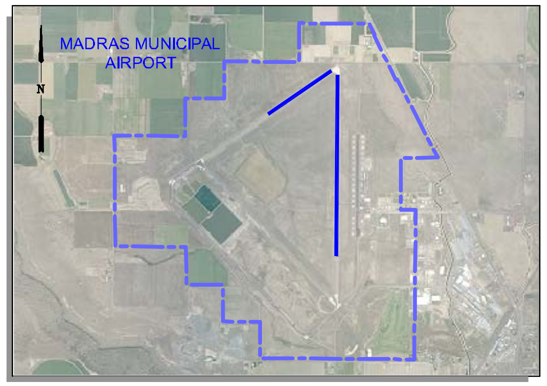
Madras Municipal Airport

CHAPTER SEVEN
AIRPORT LAYOUT PLAN DRAWINGS

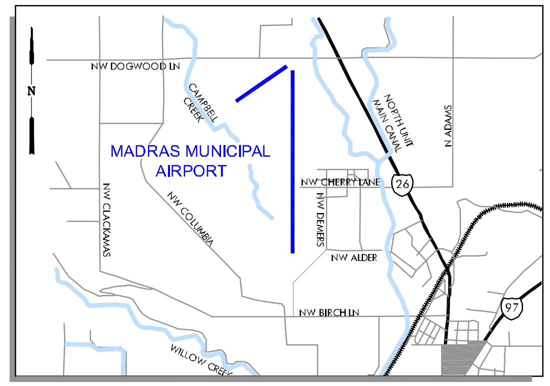
Introduction

The options that were considered for the long-term development of Florence Municipal Airport resulted in the selection of a preferred alternative. The preferred alternative has been incorporated into the airport layout plan drawings, which are depicted in this chapter. The set of airport plans, which is referred to in aggregate as the "Airport Layout Plan" (ALP) has been prepared in accordance with FAA guidelines. The drawings illustrate existing conditions, recommended changes in airfield facilities, existing and recommended property ownership, land use, and obstruction removal. The ALP set is presented at the end of this chapter:

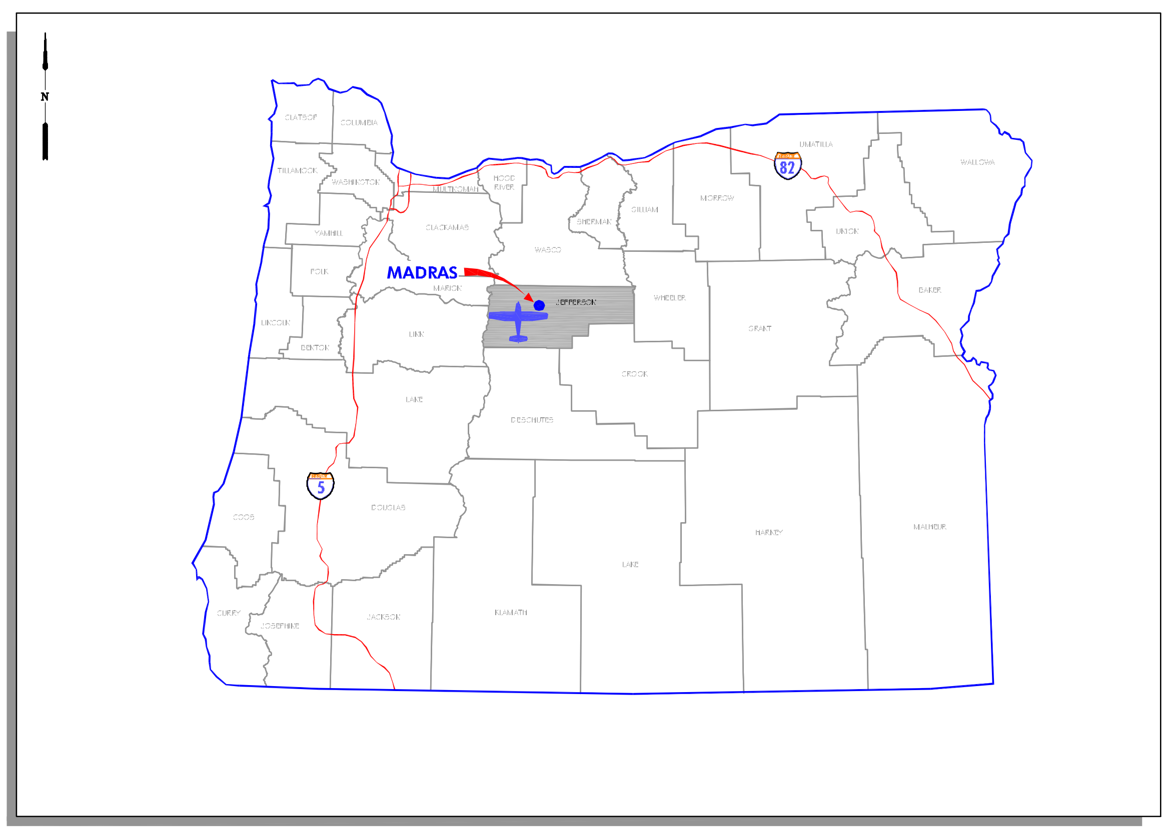
- *Sheet 1 – Cover Sheet*
- *Sheet 2 – Airport Data Sheet*
- *Sheet 3 – Airport Layout Plan*
- *Sheet 4 – Terminal Area Plan*
- *Sheet 5 - FAR Part 77 Airspace Plan*
- *Sheet 6 – Runway 16/34 Approach Plan & Profile*
- *Sheet 7 – Runway 4/22 & New Runway 5/23 Approach Plan & Profile*
- *Sheet 8 – Runway 16/34 RPZ and Inner Approach Plan & Profile*
- *Sheet 9 – Runway 4/22 RPZ and Inner Approach Plan & Profile*
- *Sheet 10 – New Runway 5/23 RPZ and Inner Approach Plan & Profile*
- *Sheet 11 – Airport Land Use Plan*
- *Sheet 12 – Airport Property Plan (Exhibit A)*



AERIAL PHOTO



VICINITY MAP



LOCATION MAP

MADRAS MUNICIPAL AIRPORT

MADRAS, OREGON
CWEC PROJECT NO. 10149018.01
AIP NO. 3-41-0035-005
DECEMBER 2010

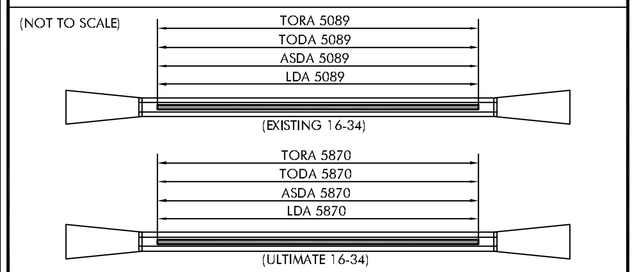
SHEET INDEX

CENTURY WEST
ENGINEERING CORPORATION
6650 S.W. Redwood Lane, Suite 350
Portland, Oregon 97224
503-419-2130 phone ♦ 503-639-2710 fax
www.centurywest.com

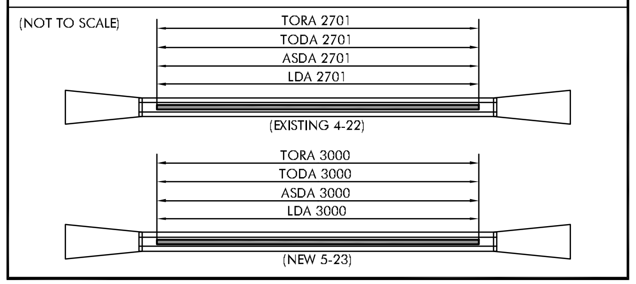
AIRPORT DATA TABLE

DESCRIPTION	EXISTING	* FUTURE	* ULTIMATE
AIRPORT ELEVATION	2437.0'	SAME	2434.0' (EST.)
AIRPORT ACREAGE	2098	SAME	SAME
ARP COORDINATES	LAT. N 44° 40' 12.60" LONG. W 121° 09' 18.50"	LAT. N 44° 40' 11.65" LONG. W 121° 09' 18.38"	LAT. N 44° 40' 5.81" LONG. W 121° 09' 20.11" **
MAGNETIC DECLINATION	15° 50'E (2010 NGDC)	SAME	SAME
MEAN MAX. DAILY TEMPERATURE	86.7°	SAME	SAME
FAA IDENTIFIER	S33	SAME	SAME
DATUM	NAD83/NGVD29	NAD83/NGVD29	NAD83/NGVD29

RUNWAY 16-34 DECLARED DISTANCES



RUNWAY 4-22 & 5-23 DECLARED DISTANCES



MODIFICATION TO STANDARDS

NO.	ITEM	DESCRIPTION	DISPOSITION
1	RSA, OFA, OFZ (IN-LINE TAXIWAY RWY 16 END)	IN-LINE TAXIWAY LOCATED WITHIN PROTECTED AREAS; NO AC HOLD LINES & RWY 16 APPROACH OBSTRUCTION	RECONFIGURE; ADD AC HOLD LINES
2	TAXIWAY OFA (AC HOLD AREA)	AC HOLD AREA LOCATED WITHIN TAXIWAY OFA	RECONFIGURE / RELOCATE AC HOLD LINES
3	TAXILANE OFA (HANGARS)	HANGARS LOCATED WITHIN TAXILANE OFA	USE FAA ALTERNATIVE OFA CLEARING STANDARD BASED ON AC WINGSPAN. RECONFIGURE TAXILANES
4	TAXILANE OFA (APRON)	AIRCRAFT TIEDOWNS WITHIN TAXILANE OFA	RECONFIGURE APRON

NOTES:

1. AIRCRAFT HOLDING ON THE EXISTING IN-LINE TAXIWAY CAN CONFLICT WITH CLEARING STANDARDS AND REDUCE SOME DECLARED DISTANCES FOR RUNWAY 16/34. HOWEVER LOCATING AC HOLD LINES BEYOND RSA WILL ALLOW STANDARD RUNWAY CLEARING.
2. FUTURE AND ULTIMATE RUNWAY END COORDINATES AND ELEVATIONS ESTIMATED.

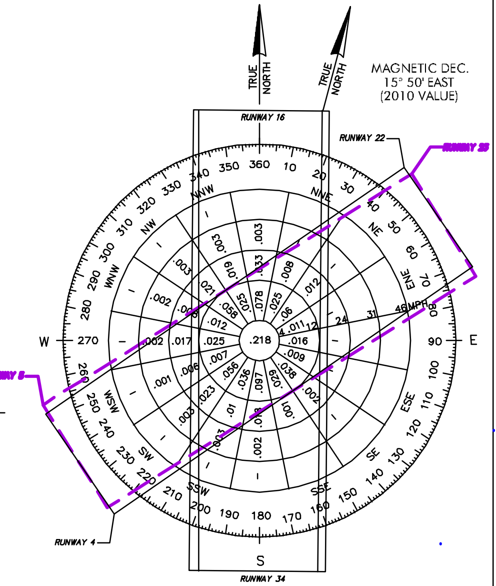
* FUTURE CONDITIONS CORRESPONDS TO PHASE I, ULTIMATE CONDITIONS CORRESPONDS TO PHASE II.

** ULTIMATE ARP IS BASED ON PHASE II RUNWAY EXTENSION AND NEW 5-23 RUNWAY.

ALL WEATHER WIND ROSE

RUNWAYS	CROSSWIND COVERAGE (12 MPH)
RUNWAY 16-34	98.1%
RUNWAY 16-34 AND RUNWAY 5-23 COMBINED	98.5%

MAY 1943 TO MAY 1944 (967 OBSERVATIONS)
SOURCE: U.S. ARMY AIR FORCE, WEATHER DIVISION



	RUNWAY 16-34			EXISTING RUNWAY 04-22		NEW RUNWAY 05-23	
	EXISTING CONDITIONS RUNWAY 16 - 34	* FUTURE CONDITIONS RUNWAY 16 - 34	* ULTIMATE CONDITIONS RUNWAY 16 - 34	EXISTING CONDITIONS RUNWAY 04 - 22	FUTURE CONDITIONS RUNWAY 04 - 22	EXISTING CONDITIONS NEW RUNWAY 05 - 23	FUTURE CONDITIONS NEW RUNWAY 05 - 23
AIRPORT REFERENCE CODE (ARC)	B-II	B-II	B-II	A-I (SMALL)	TO BE CLOSED	TO BE CONSTRUCTED	A-I (SMALL)
FAR PART 77 DESIGNATION	LARGER THAN UTILITY NON PRECISION INSTRUMENT	LARGER THAN UTILITY NON PRECISION INSTRUMENT	LARGER THAN UTILITY NON PRECISION INSTRUMENT	UTILITY-VISUAL	TO BE CLOSED	TO BE CONSTRUCTED	UTILITY-VISUAL
NPIAS ROLE / SERVICE LEVEL	GENERAL AVIATION	GENERAL AVIATION	GENERAL AVIATION	GENERAL AVIATION	TO BE CLOSED	TO BE CONSTRUCTED	GENERAL AVIATION
RUNWAY LENGTH AND WIDTH	5089' X 75'	5290' X 75'	5870' X 75'	2701' X 50'	TO BE CLOSED	TO BE CONSTRUCTED	3000' X 60'
RUNWAY PAVEMENT STRENGTH (IN 1000 LBS)	12.5 (SW)	30 (SW) - 75 (DW)	30 (SW) - 75 (DW)	12.5 (SW)	TO BE CLOSED	TO BE CONSTRUCTED	12.5 (SW)
RUNWAY PAVEMENT TYPE	ASPHALT	ASPHALT	ASPHALT	ASPHALT	TO BE CLOSED	TO BE CONSTRUCTED	ASPHALT
RUNWAY PERCENT WIND COVERAGE (@ 12/24 MPH)	93.5% / 99.6%	93.5% / 99.6%	93.5% / 99.6%	89.5% / -	TO BE CLOSED	TO BE CONSTRUCTED	89.9%
RUNWAY PERCENT GRADIENT / MAXIMUM GRADE	0.13%	0.13%	0.70%	0.26%	TO BE CLOSED	TO BE CONSTRUCTED	0.50%

	RUNWAY 16-34				EXISTING RUNWAY 04-22			NEW RUNWAY 05-23		
	EXISTING CONDITIONS	EXISTING/FUTURE STANDARD	* FUTURE CONDITIONS	* ULTIMATE CONDITIONS	EXISTING CONDITIONS	EXISTING/FUTURE STANDARD	FUTURE CONDITIONS	EXISTING CONDITIONS	FUTURE CONDITIONS	FUTURE STANDARD
RUNWAY SAFETY AREA LENGTH AND WIDTH / LENGTH BEYOND RUNWAY ROLL-OUT END	5689' X 150' 300'	5689' X 150' 300'	5890' X 150' 300'	6470' X 150' 300'	3181' X 120' 240'	3181' X 120' 240'	TO BE CLOSED	TO BE CONSTRUCTED	3480' X 120' 240'	3480' X 120' 240'
OBJECT FREE AREA LENGTH AND WIDTH / LENGTH BEYOND RUNWAY ROLL-OUT END	5689' X 500' 300'	5689' X 500' 300'	5890' X 150' 300'	6470' X 500' 300'	3181' X 250' 240'	3181' X 250' 240'	TO BE CLOSED	TO BE CONSTRUCTED	3480' X 250' 240'	3480' X 250' 240'
OBSTACLE FREE ZONE LENGTH AND WIDTH / LENGTH BEYOND RUNWAY ROLL-OUT END	5489' X 400' 200'	5489' X 400' 200'	5690' X 400' 200'	6270' X 400' 200'	3101' X 250' 200'	2671' X 250' 200'	TO BE CLOSED	TO BE CONSTRUCTED	3400' X 250' 200'	3400' X 250' 200'

	RUNWAY 16-34						EXISTING RUNWAY 04-22				NEW RUNWAY 05-23			
	EXISTING CONDITIONS		* FUTURE CONDITIONS		* ULTIMATE CONDITIONS		EXISTING CONDITIONS		FUTURE CONDITIONS		EXISTING CONDITIONS		FUTURE CONDITIONS	
RUNWAY LIGHTING	MIRL		SAME		SAME		REFLECTORS				TO BE CONSTRUCTED		MIRL	
RUNWAY END	16	34	16	34	16	34	04	22	04	22	TO BE CONSTRUCTED	TO BE CONSTRUCTED	05	23
RUNWAY APPROACH CATEGORY	VISUAL	VISUAL	NPI	NPI	NPI	NPI	VISUAL	VISUAL	TO BE CLOSED	TO BE CLOSED	TO BE CONSTRUCTED	TO BE CONSTRUCTED	VISUAL	VISUAL
RUNWAY APPROACH SLOPE PART 77 REQUIRED	20:1	20:1	34:1	34:1	34:1	34:1	20:1	20:1	TO BE CLOSED	TO BE CLOSED	TO BE CONSTRUCTED	TO BE CONSTRUCTED	20:1	20:1
ACTUAL	>20:1	>20:1	34:1	34:1	34:1	34:1	20:1	20:1	TO BE CLOSED	TO BE CLOSED	TO BE CONSTRUCTED	TO BE CONSTRUCTED	20:1	20:1
APPROACH VISIBILITY MINIMUMS	≧ 1 MILE	VISUAL ≧ 1 MILE	≧ 1 MILE	≧ 1 MILE	≧ 1 MILE	≧ 1 MILE	VISUAL ≧ 1 MILE	VISUAL ≧ 1 MILE	TO BE CLOSED	TO BE CLOSED	TO BE CONSTRUCTED	TO BE CONSTRUCTED	VISUAL ≧ 1 MILE	VISUAL ≧ 1 MILE
RUNWAY MARKINGS	VISUAL	VISUAL	NPI	NPI	NPI	NPI	VISUAL	VISUAL	TO BE CLOSED	TO BE CLOSED	TO BE CONSTRUCTED	TO BE CONSTRUCTED	VISUAL	VISUAL
RUNWAY END COORDINATES LAT. LONG.	N 44°40'26.5063" W 121°09'12.1857"	N 44°39'36.2592" W 121°09'12.2002"	N 44°40'26.5063" W 121°09'12.1857"	N 44°39'34.2673" W 121°09'12.2007"	N 44°40'26.5063" W 121°09'12.1857"	N 44°39'28.5398" W 121°09'12.2024"	N 44°40'26.0652" W 121°09'45.7992"	N 44°40'41.3532" W 121°09'15.1814"	TO BE CLOSED	TO BE CLOSED	TO BE CONSTRUCTED	TO BE CONSTRUCTED	N 44°40'15.66" W 121°09'54.33"	N 44°40'28.44" W 121°09'16.88"
INSTRUMENTATION AND APPROACH AIDS	GPS	GPS	SAME	SAME	SAME	SAME	NONE	NONE	TO BE CLOSED	TO BE CLOSED	TO BE CONSTRUCTED	TO BE CONSTRUCTED	NONE	NONE
VISUAL AIDS	NONE	VASI			PAPI; REIL	PAPI; REIL	NONE	NONE	TO BE CLOSED	TO BE CLOSED	TO BE CONSTRUCTED	TO BE CONSTRUCTED	PAPI	PAPI
CRITICAL AIRCRAFT / (ARC)	BE 300 (KING AIR)	B-II	CE 550 CITATION (BRAVO)	B-II	CE 550 CITATION (BRAVO)	B-II	BE 58	A-I (SMALL)	TO BE CLOSED		TO BE CONSTRUCTED		BE 58	A-I (SMALL)
WINGSPAN	49' TO LESS THAN 79'		49' TO LESS THAN 79'		49' TO LESS THAN 79'		LESS THAN 49'		TO BE CLOSED		TO BE CONSTRUCTED		LESS THAN 49'	
WEIGHT	MORE THAN 12,500 LBS		MORE THAN 12,500 LBS		MORE THAN 12,500 LBS		12,500 LBS OR LESS		TO BE CLOSED		TO BE CONSTRUCTED		12,500 LBS OR LESS	
APPROACH SPEED	91 TO LESS THAN 121 KNOTS		91 TO LESS THAN 121 KNOTS		91 TO LESS THAN 121 KNOTS		LESS THAN 91 KNOTS		TO BE CLOSED		TO BE CONSTRUCTED		LESS THAN 91 KNOTS	
LENGTH OF HAUL	≦ 500 MILES		≦ 500 MILES		≦ 500 MILES		≦ 500 MILES		TO BE CLOSED		TO BE CONSTRUCTED		≦ 500 MILES	
OFZ PENETRATION	YES (SEE 1)		NONE		NONE		YES (SEE 1)		TO BE CLOSED		TO BE CONSTRUCTED		NONE	
TERMINAL NAVAIDS	BEACON		BEACON		BEACON		NONE		TO BE CLOSED		TO BE CONSTRUCTED		NONE	
TAXIWAY LIGHTING	NONE (REFLECTORS)		MEDIUM INTENSITY		MEDIUM INTENSITY		NONE		TO BE CLOSED		TO BE CONSTRUCTED		NONE	
TAXIWAY MARKING	BASIC		BASIC		BASIC		BASIC		TO BE CLOSED		TO BE CONSTRUCTED		REFLECTORS	

DECLARED DISTANCES

RWY 16-34 (EXISTING)	RW 16	RW 34
LDA	5089 (SEE NOTE 2)	5089
ASDA	5089	5089 (SEE NOTE 2)
TORA	5089	5089 (SEE NOTE 2)
TODA	5089	5089 (SEE NOTE 2)

RWY 16-34 * (FUTURE/ULTIMATE)	RW 16	RW 34
LDA	5290/5870	5290/5870
ASDA	5290/5870	5290/5870
TORA	5290/5870	5290/5870
TODA	5290/5870	5290/5870

RWY 04-22 (EXISTING)	RW 04	RW 22
LDA	5089	5089
ASDA	5089	5089
TORA	5089	5089
TODA	5089	5089

RWY 04-22 (FUTURE)	RW 04	RW 22
LDA	TO BE CLOSED	TO BE CLOSED
ASDA	TO BE CLOSED	TO BE CLOSED
TORA	TO BE CLOSED	TO BE CLOSED
TODA	TO BE CLOSED	TO BE CLOSED

RWY 05-23 (FUTURE (NEW))	RW 05	RW 23
LDA	TO BE CONSTRUCTED	TO BE CONSTRUCTED
ASDA	TO BE CONSTRUCTED	TO BE CONSTRUCTED
TORA	TO BE CONSTRUCTED	TO BE CONSTRUCTED
TODA	TO BE CONSTRUCTED	TO BE CONSTRUCTED

RWY 05-23 (FUTURE (NEW))	RW 05	RW 23
LDA	3000	3000
ASDA	3000	3000
TORA	3000	3000
TODA	3000	3000

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NO.	DATE	BY	APPR	REVISIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING.
0" 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

FEDERAL AVIATION ADMINISTRATION APPROVAL
APPROVAL DATE: ______
SIGNATURE

CITY OF MADRAS APPROVAL
APPROVAL DATE: ______
SIGNATURE

CENTURY WEST ENGINEERING CORPORATION
6650 S.W. Redwood Lane, Suite 350
Portland, Oregon 97224
503-419-2130 phone • 503-639-2710 fax
www.centurywest.com

DESIGNED BY: DM	DRAWN BY: JLS	CHECKED BY: SLK	SCALE: AS SHOWN
DATE: DECEMBER 2010		PROJECT NO: 10149018.01	

MADRAS MUNICIPAL AIRPORT

AIRPORT DATA SHEET

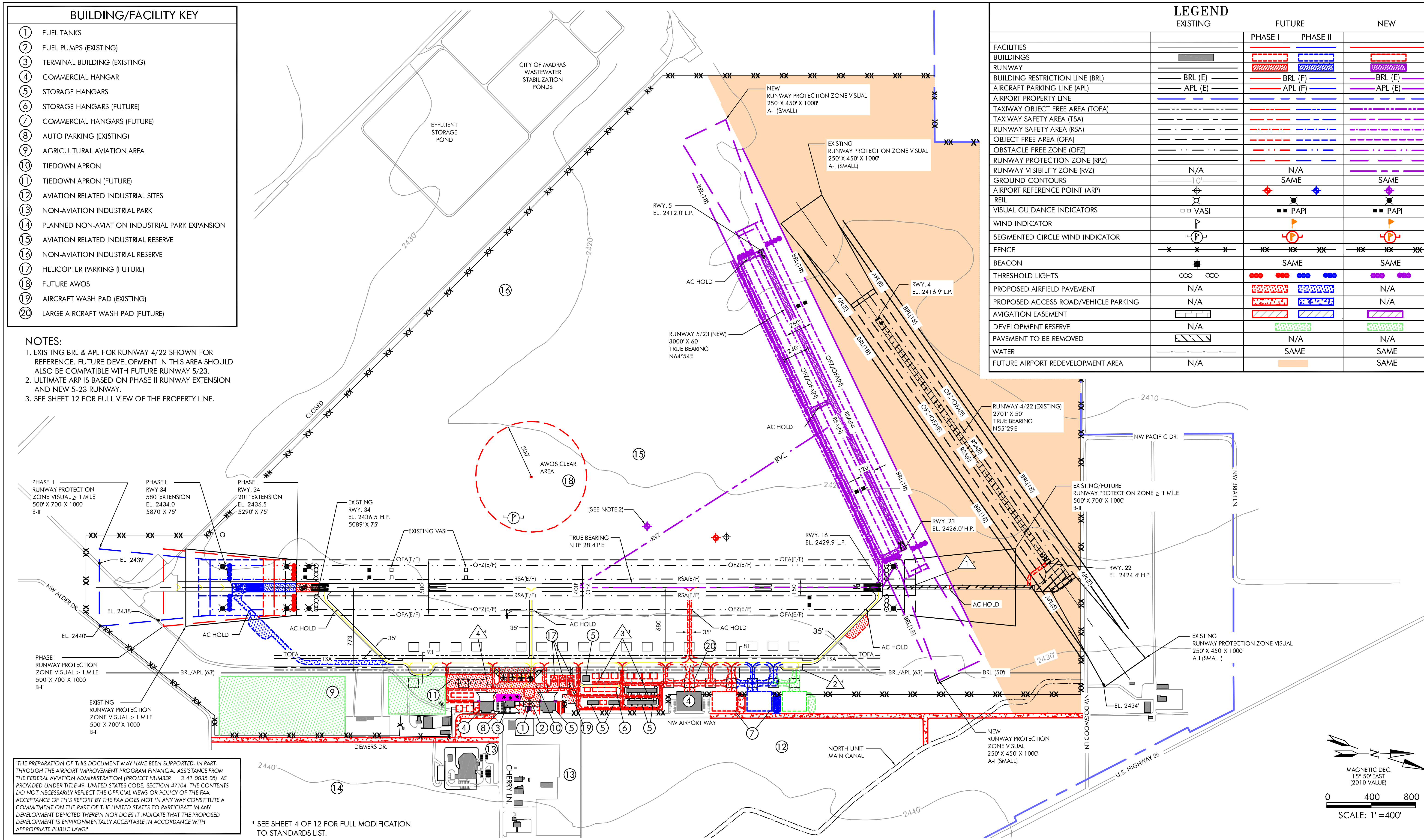
FIGURE NO. .

BUILDING/FACILITY KEY

1. FUEL TANKS
2. FUEL PUMPS (EXISTING)
3. TERMINAL BUILDING (EXISTING)
4. COMMERCIAL HANGAR
5. STORAGE HANGARS
6. STORAGE HANGARS (FUTURE)
7. COMMERCIAL HANGARS (FUTURE)
8. AUTO PARKING (EXISTING)
9. AGRICULTURAL AVIATION AREA
10. TIEDOWN APRON
11. TIEDOWN APRON (FUTURE)
12. AVIATION RELATED INDUSTRIAL SITES
13. NON-AVIATION INDUSTRIAL PARK
14. PLANNED NON-AVIATION INDUSTRIAL PARK EXPANSION
15. AVIATION RELATED INDUSTRIAL RESERVE
16. NON-AVIATION INDUSTRIAL RESERVE
17. HELICOPTER PARKING (FUTURE)
18. FUTURE AWOS
19. AIRCRAFT WASH PAD (EXISTING)
20. LARGE AIRCRAFT WASH PAD (FUTURE)

NOTES:

1. EXISTING BRL & APL FOR RUNWAY 4/22 SHOWN FOR REFERENCE. FUTURE DEVELOPMENT IN THIS AREA SHOULD ALSO BE COMPATIBLE WITH FUTURE RUNWAY 5/23.
2. ULTIMATE ARP IS BASED ON PHASE II RUNWAY EXTENSION AND NEW 5-23 RUNWAY.
3. SEE SHEET 12 FOR FULL VIEW OF THE PROPERTY LINE.



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* SEE SHEET 4 OF 12 FOR FULL MODIFICATION TO STANDARDS LIST.

LEGEND

	EXISTING	FUTURE PHASE I	FUTURE PHASE II	NEW
FACILITIES				
BUILDINGS				
RUNWAY				
BUILDING RESTRICTION LINE (BRL)	BRL (E)	BRL (F)	BRL (F)	BRL (E)
AIRCRAFT PARKING LINE (APL)	APL (E)	APL (F)	APL (F)	APL (E)
AIRPORT PROPERTY LINE				
TAXIWAY OBJECT FREE AREA (TOFA)				
TAXIWAY SAFETY AREA (TSA)				
RUNWAY SAFETY AREA (RSA)				
OBJECT FREE AREA (OFA)				
OBSTACLE FREE ZONE (OFZ)				
RUNWAY PROTECTION ZONE (RPZ)				
RUNWAY VISIBILITY ZONE (RVZ)	N/A	N/A		
GROUND CONTOURS	10'	SAME		SAME
AIRPORT REFERENCE POINT (ARP)				
REIL				
VISUAL GUIDANCE INDICATORS	VASI	PAPI		PAPI
WIND INDICATOR				
SEGMENTED CIRCLE WIND INDICATOR				
FENCE				
BEACON		SAME		SAME
THRESHOLD LIGHTS				
PROPOSED AIRFIELD PAVEMENT	N/A			N/A
PROPOSED ACCESS ROAD/VEHICLE PARKING	N/A			N/A
AVIGATION EASEMENT				
DEVELOPMENT RESERVE	N/A			
PAVEMENT TO BE REMOVED		N/A		N/A
WATER		SAME		SAME
FUTURE AIRPORT REDEVELOPMENT AREA	N/A			SAME

NO.	DATE	BY	APPR	REVISIONS

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING. 0" 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

FEDERAL AVIATION ADMINISTRATION APPROVAL

APPROVAL DATE: ____________

MANAGER, SEATTLE ADO

CITY OF MADRAS APPROVAL

APPROVAL DATE: ____________

SIGNATURE

CENTURY WEST ENGINEERING CORPORATION
6650 S.W. Redwood Lane, Suite 350
Portland, Oregon 97224
503-419-2130 phone • 503-639-2710 fax
www.centurywest.com

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SCALE:
DM	JLS	SLK	AS SHOWN
DATE: DECEMBER 2010		PROJECT NO: 10149018	

MADRAS MUNICIPAL AIRPORT

AIRPORT LAYOUT PLAN

FIGURE NO. .

BUILDING/FACILITY KEY

1. FUEL TANKS
2. FUEL PUMPS (EXISTING)
3. TERMINAL BUILDING (EXISTING)
4. COMMERCIAL HANGAR
5. STORAGE HANGARS
6. STORAGE HANGARS (FUTURE)
7. COMMERCIAL HANGARS (FUTURE)
8. AUTO PARKING (EXISTING)
9. AGRICULTURAL AVIATION AREA
10. TIEDOWN APRON
11. TIEDOWN APRON (FUTURE)
12. AVIATION RELATED INDUSTRIAL SITES
13. NON-AVIATION INDUSTRIAL PARK
14. PLANNED NON-AVIATION INDUSTRIAL PARK EXPANSION
15. AVIATION RELATED INDUSTRIAL RESERVE
16. NON-AVIATION INDUSTRIAL RESERVE
17. HELICOPTER PARKING (FUTURE)
18. FUTURE AWOS
19. AIRCRAFT WASH PAD (EXISTING)
20. LARGE AIRCRAFT WASH PAD (FUTURE)

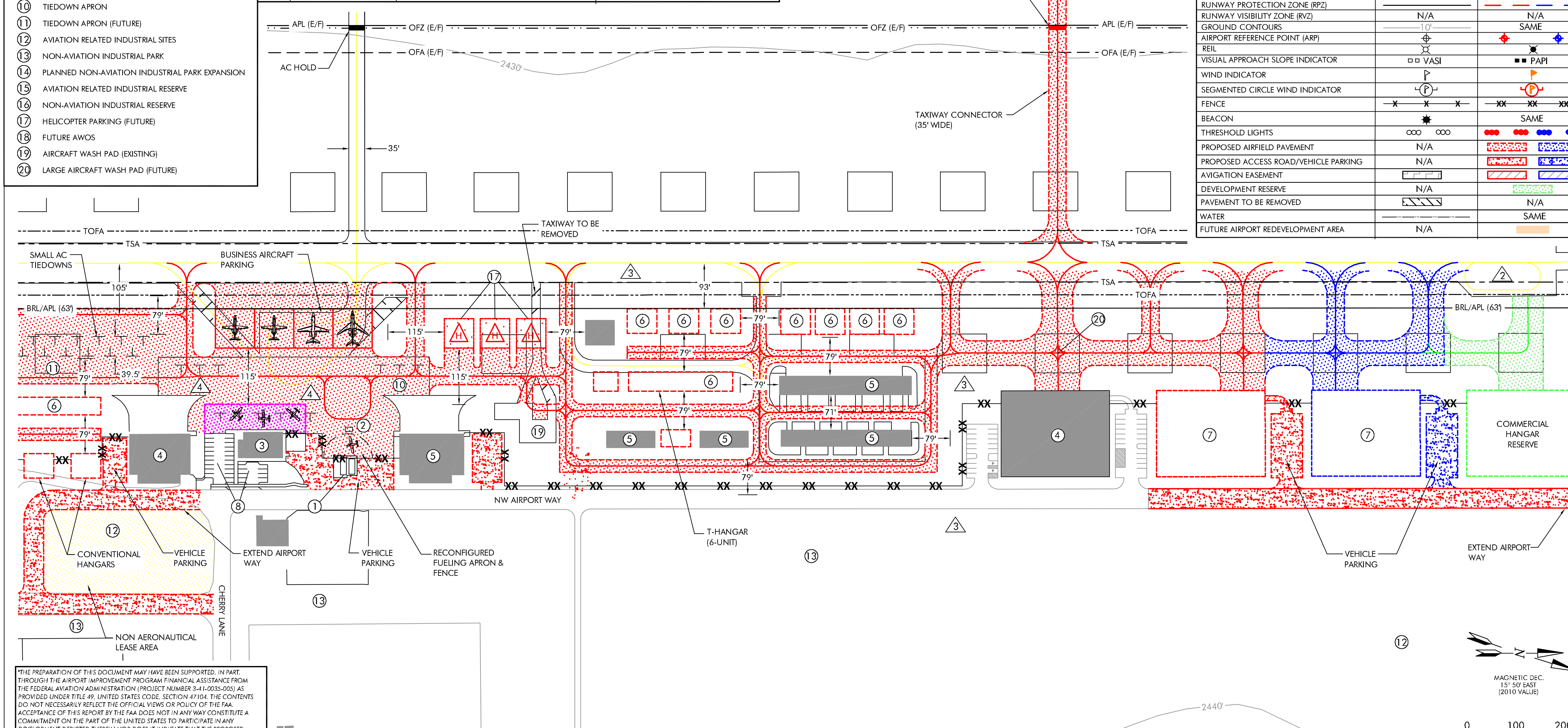
MODIFICATION TO STANDARDS

NO.	ITEM	DESCRIPTION	DISPOSITION
1	RSA, OFA, OFZ (IN-LINE TAXIWAY RWY 16 END)	IN-LINE TAXIWAY LOCATED WITHIN PROTECTED AREAS; NO AC HOLD LINES & RWY 16 APPROACH OBSTRUCTION	RECONFIGURE; ADD AC HOLD LINES
2	TAXIWAY OFA (AC HOLD AREA)	AC HOLD AREA LOCATED WITHIN TAXIWAY OFA	RECONFIGURE / RELOCATE AC HOLD LINES
3	TAXILANE OFA (HANGARS)	HANGARS LOCATED WITHIN TAXILANE OFA	USE FAA ALTERNATIVE OFA CLEARING STANDARD BASED ON AC WINGSPAN. RECONFIGURE TAXILANES
4	TAXILANE OFA (APRON)	AIRCRAFT TIEDOWNS WITHIN TAXILANE OFA	RECONFIGURE APRON

NOTE:
1. NOT ALL ITEMS IN THE BUILDING/FACILITY KEY ARE SHOWN IN THIS VIEW. SEE SHEET 3 OF 12 FOR FULL VIEW.

LEGEND

	EXISTING	FUTURE PHASE I	FUTURE PHASE II
FACILITIES			
BUILDINGS			
RUNWAY			
BUILDING RESTRICTION LINE (BRL)	BRL (E)	BRL (F)	
AIRCRAFT PARKING LINE (APL)	APL (E)	APL (F)	
AIRPORT PROPERTY LINE			
TAXIWAY OBJECT FREE AREA (TOFA)			
TAXIWAY SAFETY AREA (TSA)			
RUNWAY SAFETY AREA (RSA)			
OBJECT FREE AREA (OFA)			
OBSTACLE FREE ZONE (OFZ)			
RUNWAY PROTECTION ZONE (RPZ)			
RUNWAY VISIBILITY ZONE (RVZ)	N/A	N/A	
GROUND CONTOURS	10'	SAME	
AIRPORT REFERENCE POINT (ARP)			
REIL			
VISUAL APPROACH SLOPE INDICATOR	VASI	PAPI	
WIND INDICATOR			
SEGMENTED CIRCLE WIND INDICATOR			
FENCE			
BEACON		SAME	
THRESHOLD LIGHTS			
PROPOSED AIRFIELD PAVEMENT	N/A		
PROPOSED ACCESS ROAD/VEHICLE PARKING	N/A		
AVIGATION EASEMENT			
DEVELOPMENT RESERVE	N/A		
PAVEMENT TO BE REMOVED		N/A	
WATER		SAME	
FUTURE AIRPORT REDEVELOPMENT AREA	N/A		



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TERMINAL AREA

NO.	DATE	BY	APPR	REVISIONS

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MANAGER, SEATTLE ADO

CITY OF MADRAS APPROVAL
APPROVAL DATE: ______
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DM	JLS	SLK	AS SHOWN
DATE: DECEMBER 2010		PROJECT NO: 10149018	

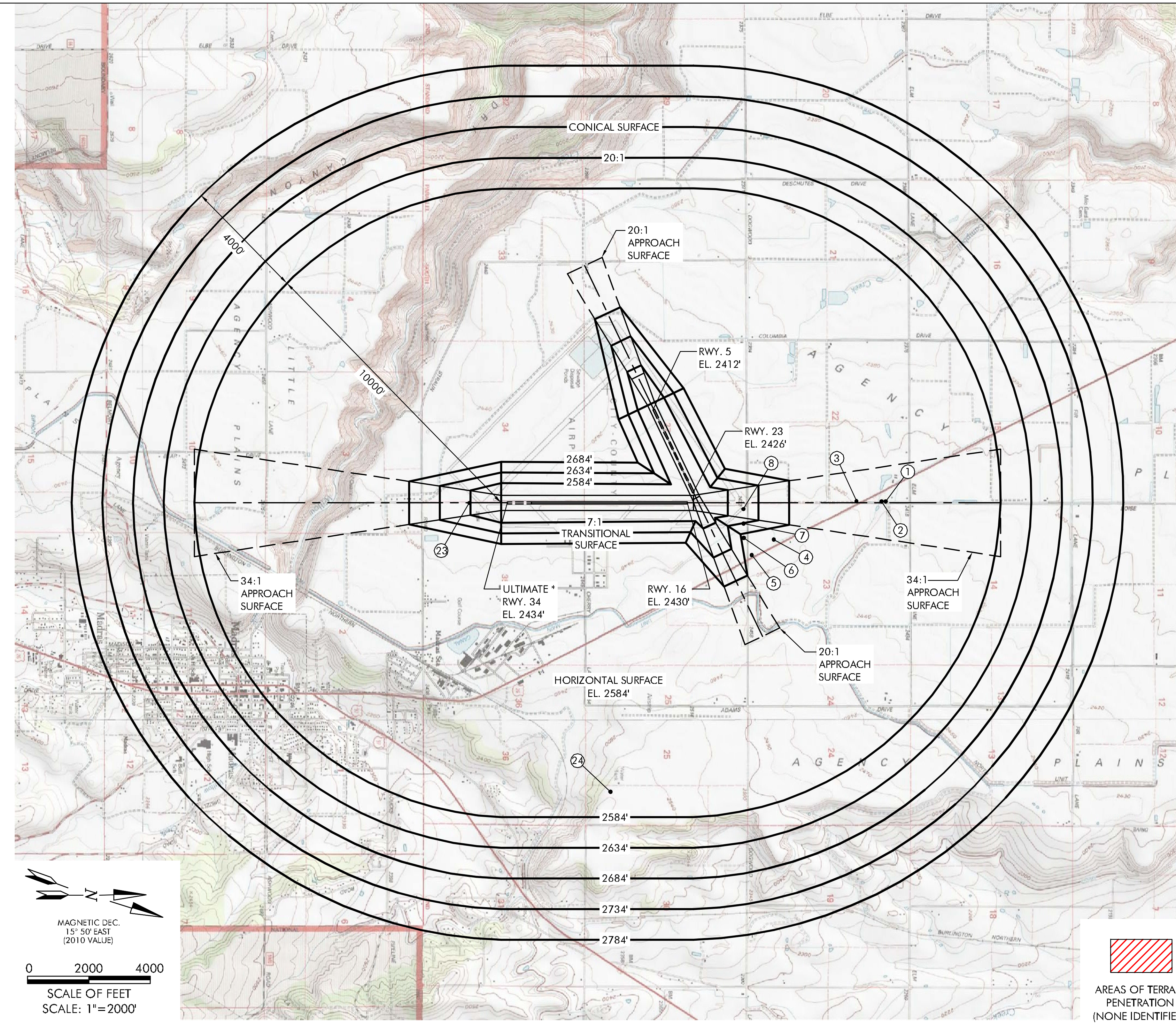
MADRAS MUNICIPAL AIRPORT

TERMINAL AREA PLAN

FIGURE NO. .

SHEET NO. 4 OF 12

OBSTRUCTION CHART								
NO.	ITEM	PART 77 SURFACE	MSL ELEV (EST.)	DISTANCE FROM RWY CL	DISTANCE FROM RWY END	AMOUNT OF PENETRATION (ESTIMATED)	AIRPORT PROPERTY	DISPOSITION
1	BOISE DRIVE	APPROACH (RWY 16)	2438.0'	40' R	6468'	-176'	NO	NO OBSTRUCTION, REFERENCE ONLY
2	BOISE DRIVE	APPROACH (RWY 16)	2436.0'	40' R	6337'	-174'	NO	NO OBSTRUCTION, REFERENCE ONLY
3	HIGHWAY 26	APPROACH (RWY 16)	2435.0'	46' R	5517'	-151'	NO	NO OBSTRUCTION, REFERENCE ONLY
4	POWER POLE	APPROACH (RWY 22)	2473.0'	273' R	1922'	-37'	YES	NO OBSTRUCTION, REFERENCE ONLY
5	HIGHWAY 26	HORIZONTAL (RWY 22)	2454.0'	607' L	1928'	-101'	NO	NO OBSTRUCTION, REFERENCE ONLY
6	DOGWOOD LANE	HORIZONTAL (RWY 22)	2454.0'	503' L	1818'	-64'	YES	NO OBSTRUCTION, REFERENCE ONLY
7	DOGWOOD LANE	TRANSITIONAL (RWY 22)	2450.0'	238' L	934'	-17'	YES	NO OBSTRUCTION, REFERENCE ONLY
8	DOGWOOD LANE	APPROACH (RWY 22)	2443.0'	140' R	360'	14'	YES	OCS; RUNWAY TO BE CLOSED
9	RWY SPOT ELEV.	PRIMARY (RWY 22)	2424.4'	0'	0'	N/A	YES	NO OBSTRUCTION, REFERENCE ONLY
10	RWY SPOT ELEV.	PRIMARY (RWY 4)	2416.9'	0'	0'	N/A	YES	NO OBSTRUCTION, REFERENCE ONLY
11	RWY SPOT ELEV.	PRIMARY (RWY 16)	2429.9'	0'	0'	N/A	YES	NO OBSTRUCTION, REFERENCE ONLY
12	VAULT	TRANSITIONAL (RWY 16)	2433.0'	269' L	-2132'	-3'	YES	NO OBSTRUCTION, REFERENCE ONLY
13	BEACON	TRANSITIONAL (RWY 16)	2481.0'	856' L	-2612'	-37'	YES	NO OBSTRUCTION, REFERENCE ONLY
14	VAULT	PRIMARY (RWY 16)	2438.0'	255' L	-2863'	-4'	YES	NO OBSTRUCTION, REFERENCE ONLY
15	WINDSOCK	TRANSITIONAL (RWY 34)	2458.0'	275' R	-2479'	20'	YES	LIGHT
16	WINDSOCK	TRANSITIONAL (RWY 34)	2446.0'	614' L	-2534'	-41'	YES	NO OBSTRUCTION, REFERENCE ONLY
17	VASI	PRIMARY (RWY 34)	N/A	100' L	-2102'	N/A	YES	NO OBSTRUCTION, REFERENCE ONLY
18	3X3X3 CONC. BLK.	PRIMARY (RWY 34)	2436.0'	193' L	-1920'	1'	YES	REMOVE
19	VASI	PRIMARY (RWY 34)	N/A	99' L	-1384'	N/A	YES	NO OBSTRUCTION, REFERENCE ONLY
20	3X3X3 CONC. BLK.	PRIMARY (RWY 34)	2437.0'	193' L	-1270'	1'	YES	REMOVE
21	3X3X3 CONC. BLK.	PRIMARY (RWY 34)	2438.0'	185' L	-846'	2'	YES	REMOVE
22	RWY SPOT ELEV.	PRIMARY (RWY 34)	2436.5'	0'	-781'	N/A	YES	NO OBSTRUCTION, REFERENCE ONLY
23	BUSH	APPROACH (RWY 34)	2456.0'	9' R	1231'	-6.9'	YES	NO OBSTRUCTION, REFERENCE ONLY
24	WATER TOWER	HORIZONTAL	2701.0'	9429' L	-2506'	117'	NO	LIGHT



FAR PART 77 PLAN VIEW

NOTES:

1. DISTANCES FOR NOTED OBSTRUCTIONS ARE BASED ON THE ULTIMATE RUNWAY CONFIGURATION. DIMENSIONS INCLUDE 200' DISTANCE FROM RUNWAY END TO BEGINNING OF APPROACH.
2. THE AIRSPACE SURFACES DEPICTED ON THIS DRAWING ARE BASED ON THE ULTIMATE RUNWAY CONFIGURATION ON THE ALP (SHEET 3 OF 12), INCLUDING THE NEW RUNWAY 5/23. THE EXISTING RUNWAY 4/22 WILL BE CLOSED AND IS NOT DEPICTED ON THIS DRAWING (SEE SHEET 9 OF 12 FOR RUNWAY 4/22 DETAIL).

* FUTURE CONDITIONS CORRESPONDS TO PHASE I, ULTIMATE CONDITIONS CORRESPONDS TO PHASE II.

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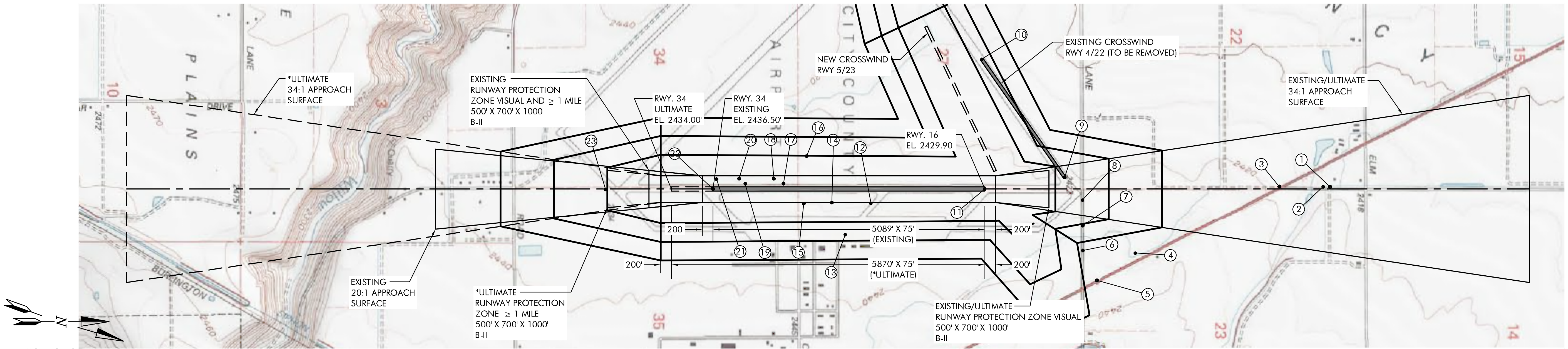
DM	JLS	SLK	AS SHOWN
DATE: DECEMBER 2010		PROJECT NO: 10149018	

MADRAS MUNICIPAL AIRPORT

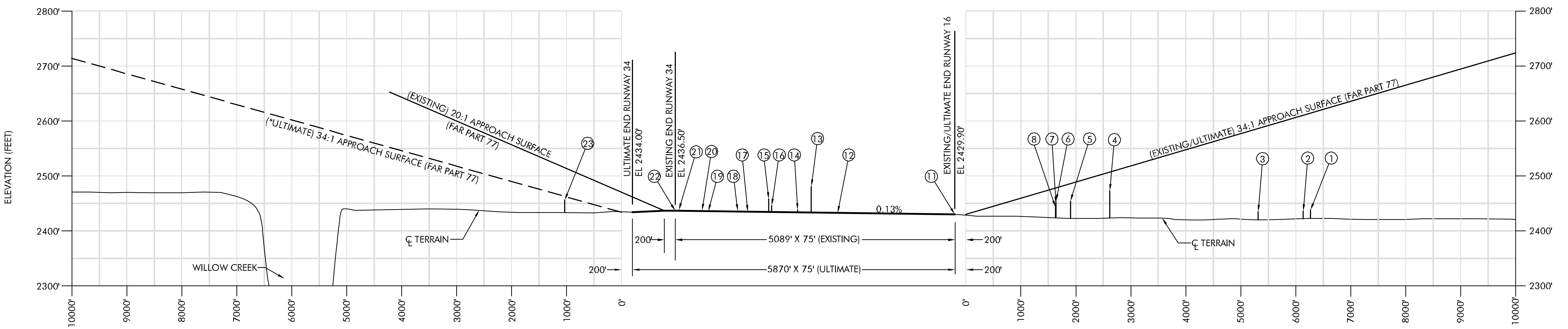
FAR PART 77 AIRSPACE PLAN

FIGURE NO.
.

SHEET NO.



RUNWAY 16-34 PLAN VIEW



0 100 200
SCALE OF FEET
VERTICAL SCALE 1"=100'

RUNWAY 16-34 PROFILE VIEW

0 1000 2000
SCALE OF FEET
HORIZONTAL SCALE 1"=1000'

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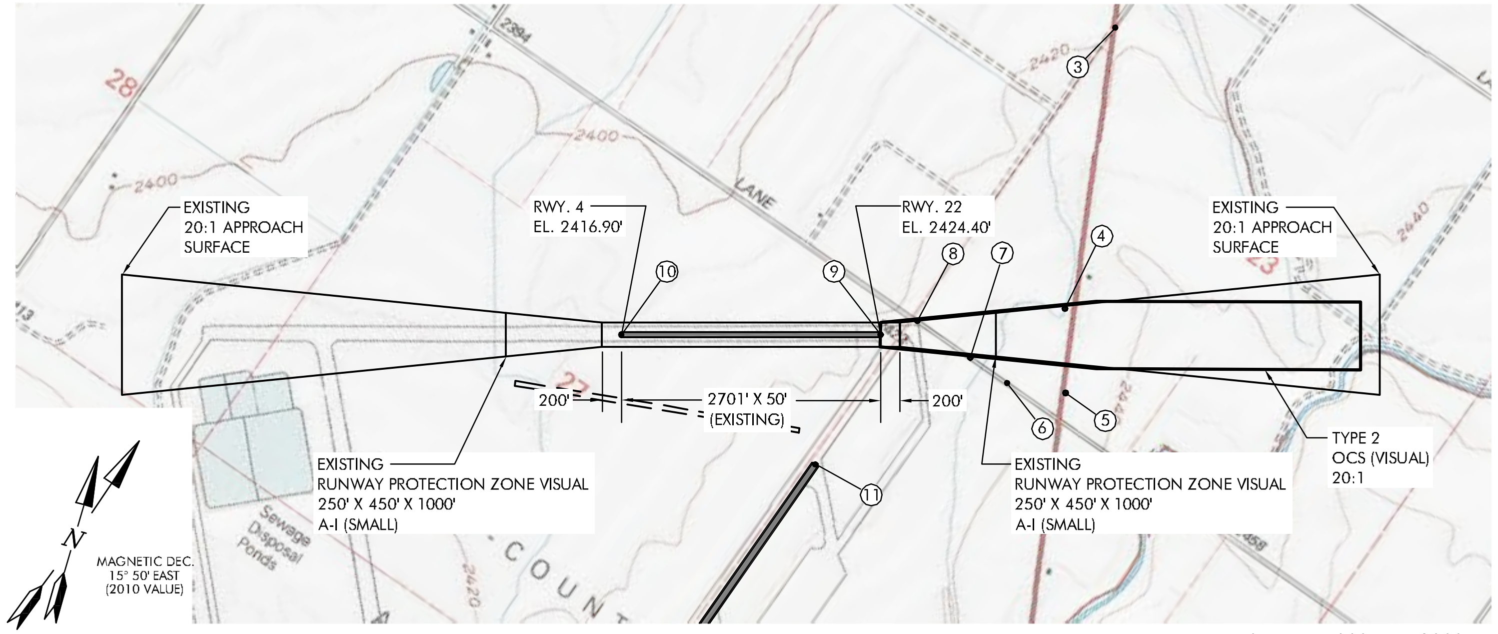
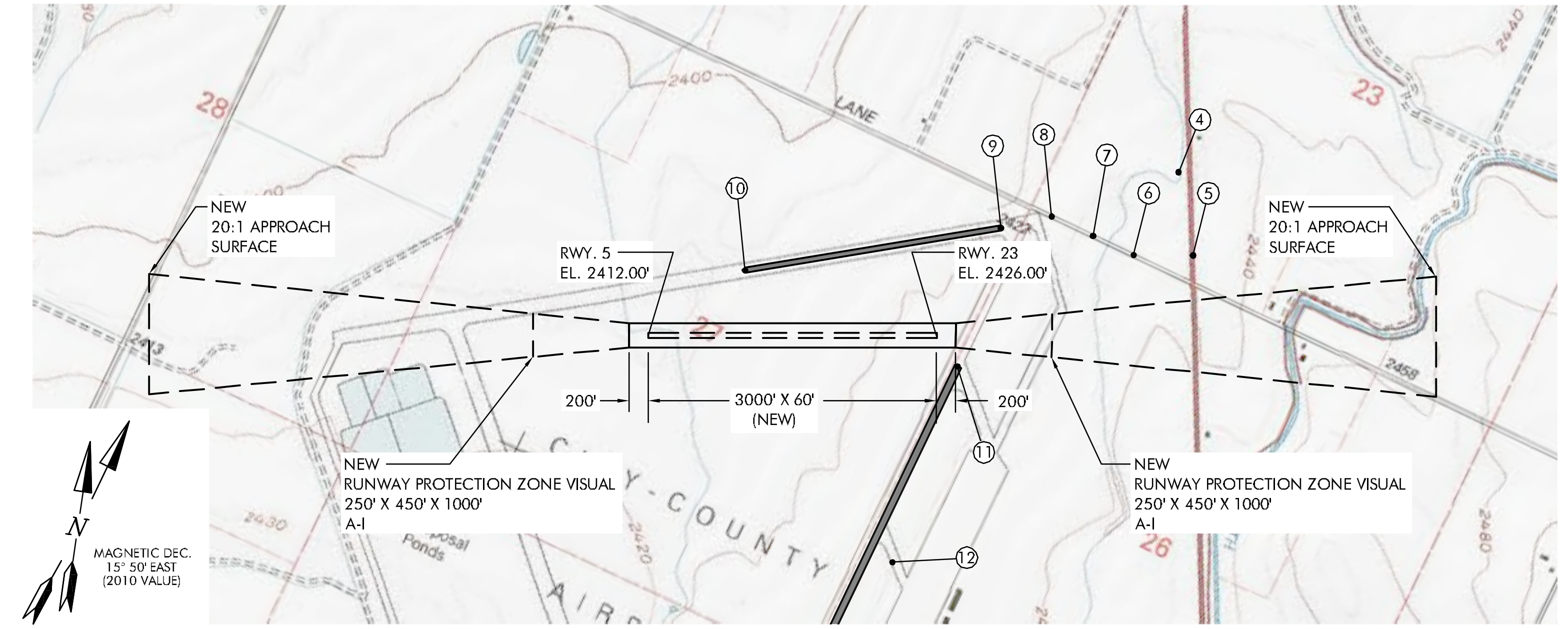
MADRAS MUNICIPAL AIRPORT
RUNWAY 16-34 APPROACH PLAN & PROFILE

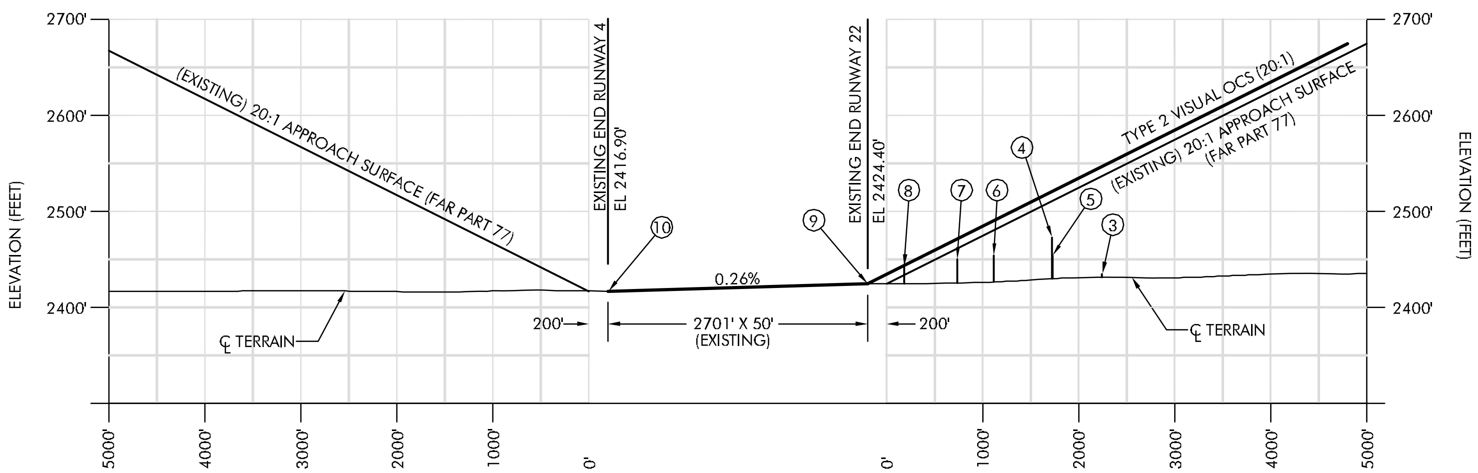
FIGURE NO. .
SHEET NO. 6 OF 12



RUNWAY 4-22 PLAN VIEW
(RUNWAY TO BE CLOSED)



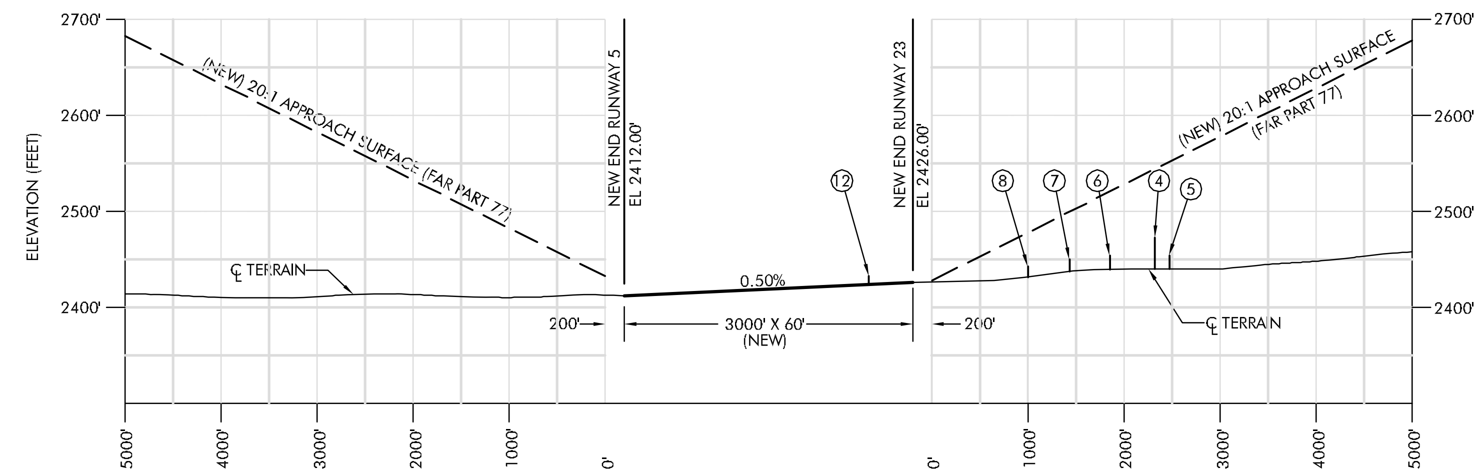
NEW RUNWAY 5-23 PLAN VIEW



0 100 200
SCALE OF FEET
VERTICAL SCALE 1"=100'

RUNWAY 4-22 PROFILE VIEW
(RUNWAY TO BE CLOSED)

0 1000 2000
SCALE OF FEET
HORIZONTAL SCALE 1"=1000'



0 100 200
SCALE OF FEET
VERTICAL SCALE 1"=100'

NEW RUNWAY 5-23 PROFILE VIEW

0 1000 2000
SCALE OF FEET
HORIZONTAL SCALE 1"=1000'

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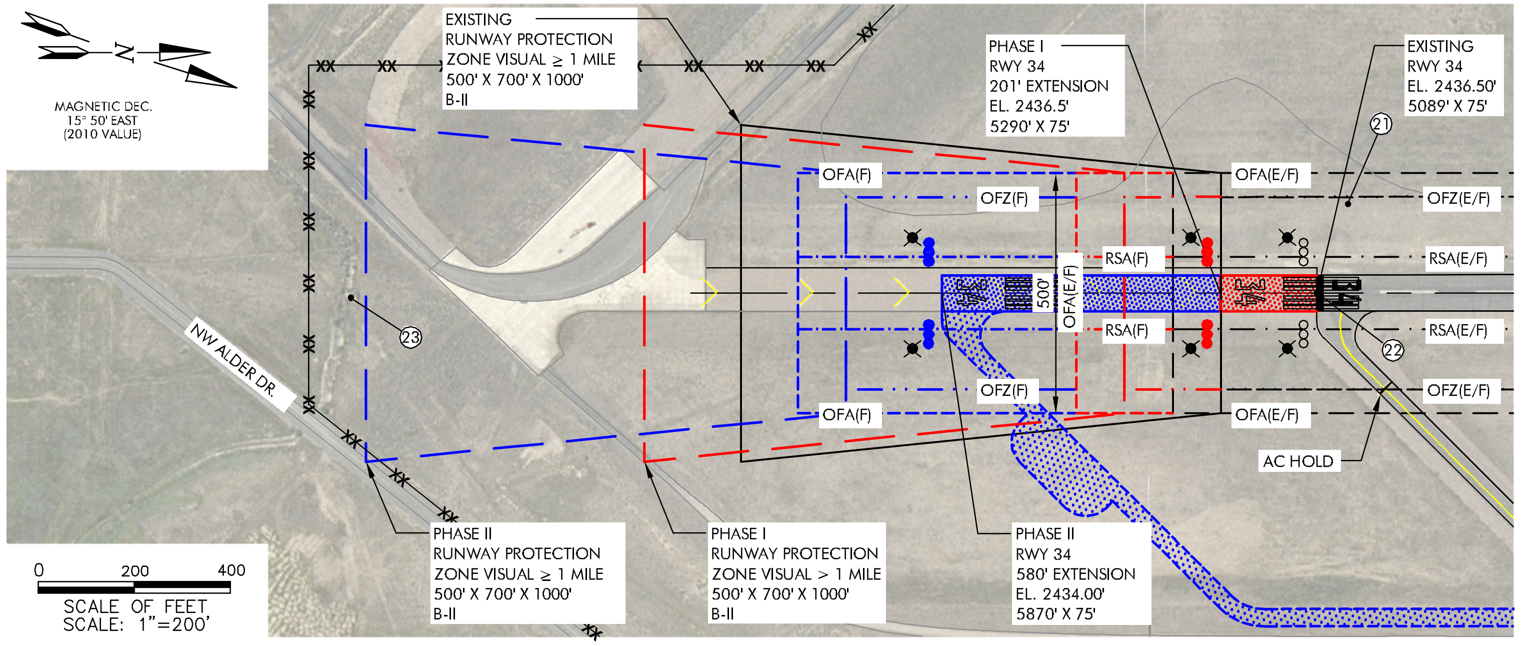
MADRAS MUNICIPAL AIRPORT

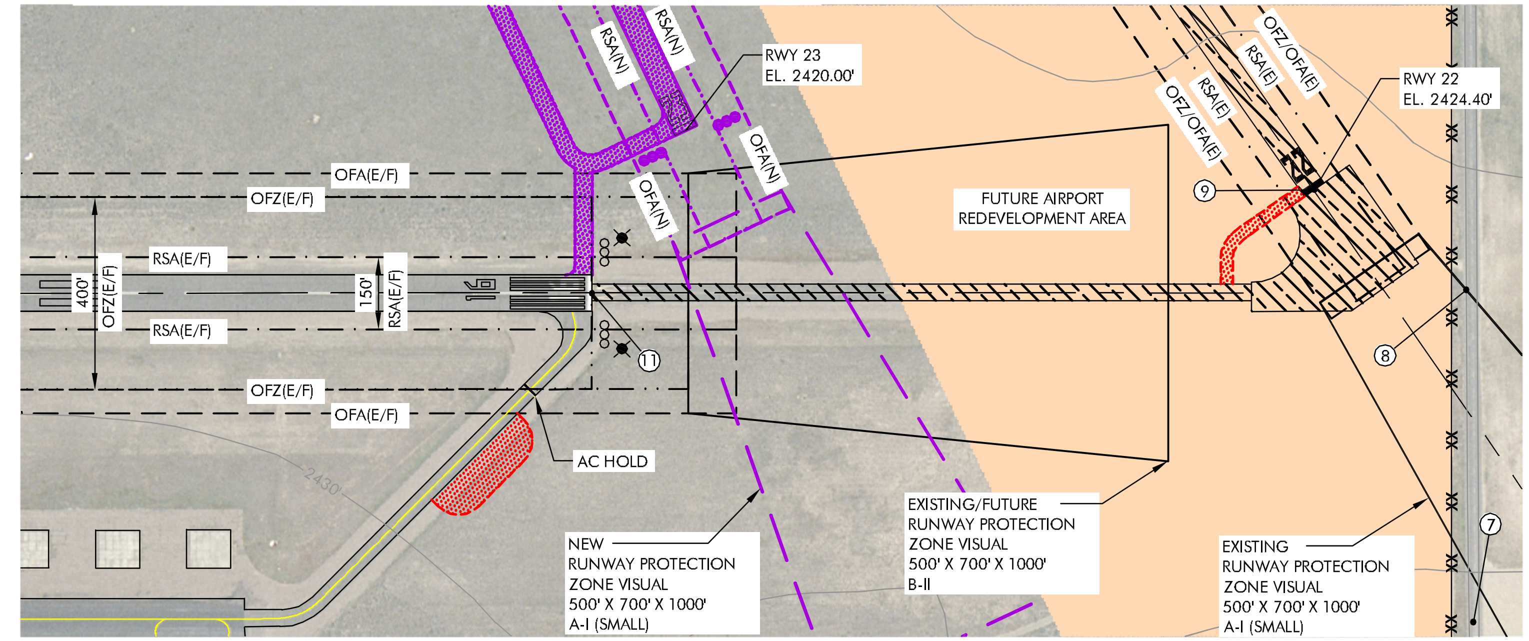
RUNWAY 4-22 & NEW RUNWAY 5-23 APPROACH PLAN & PROFILE

FIGURE NO. .

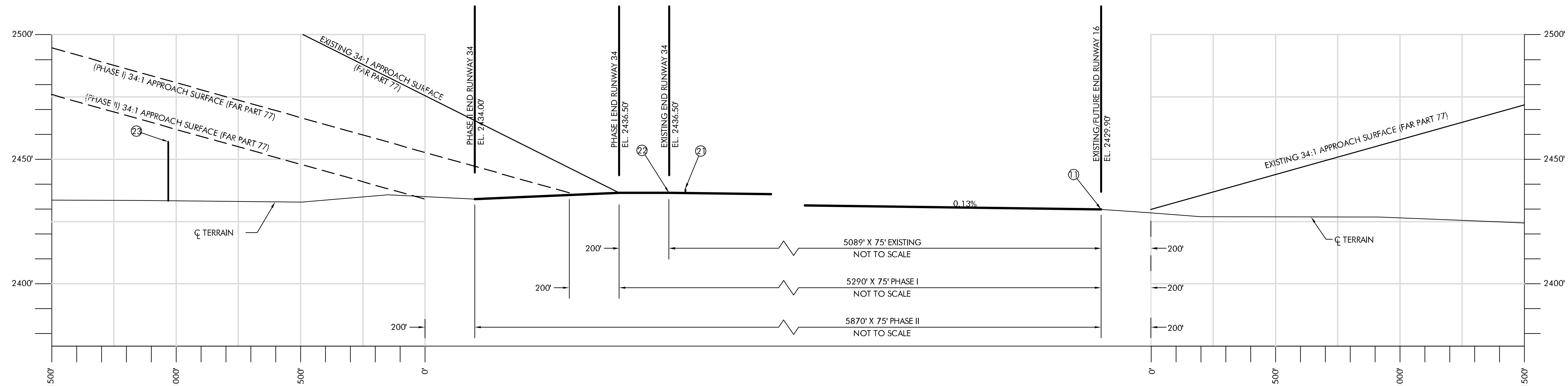
SHEET NO. 7 OF 12



RUNWAY 34 PLAN VIEW



RUNWAY 16 PLAN VIEW



RUNWAY 34 PROFILE VIEW

RUNWAY 16 PROFILE VIEW

SCALE OF FEET
HORIZONTAL SCALE: 1"=200'

SCALE OF FEET
VERTICAL SCALE: 1"=20'

NOTES:

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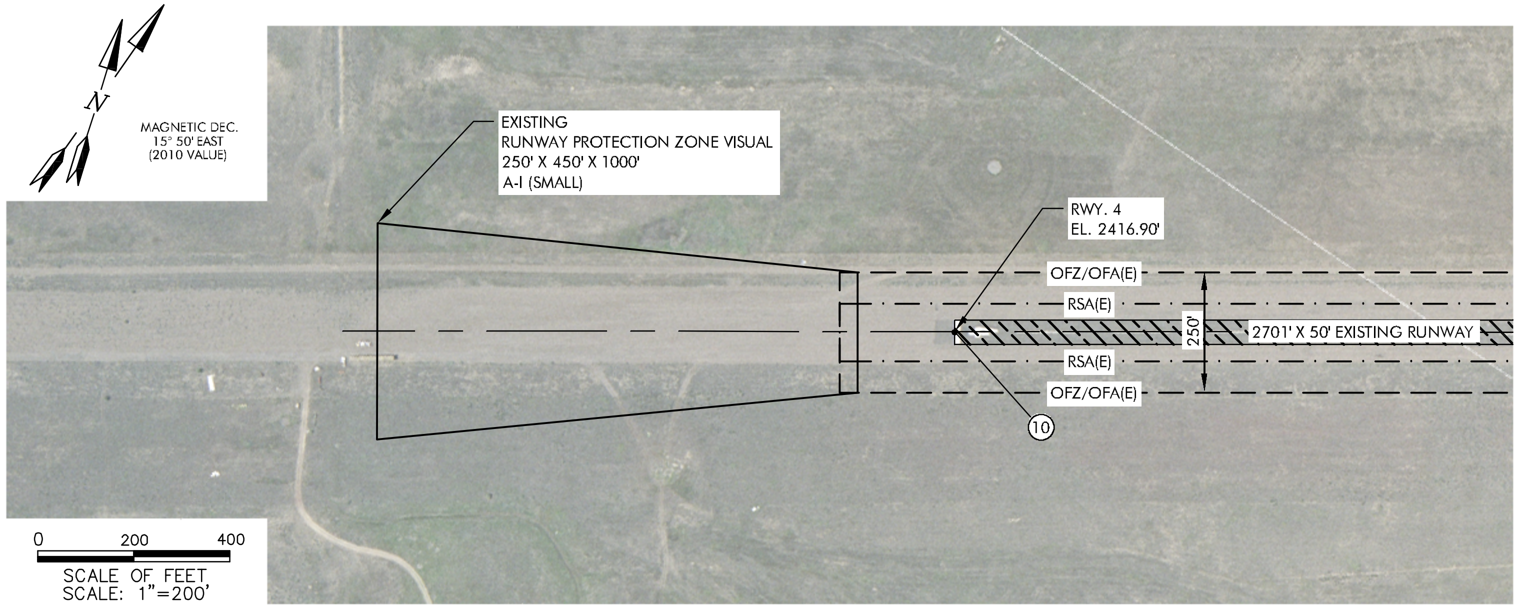
MADRAS MUNICIPAL AIRPORT

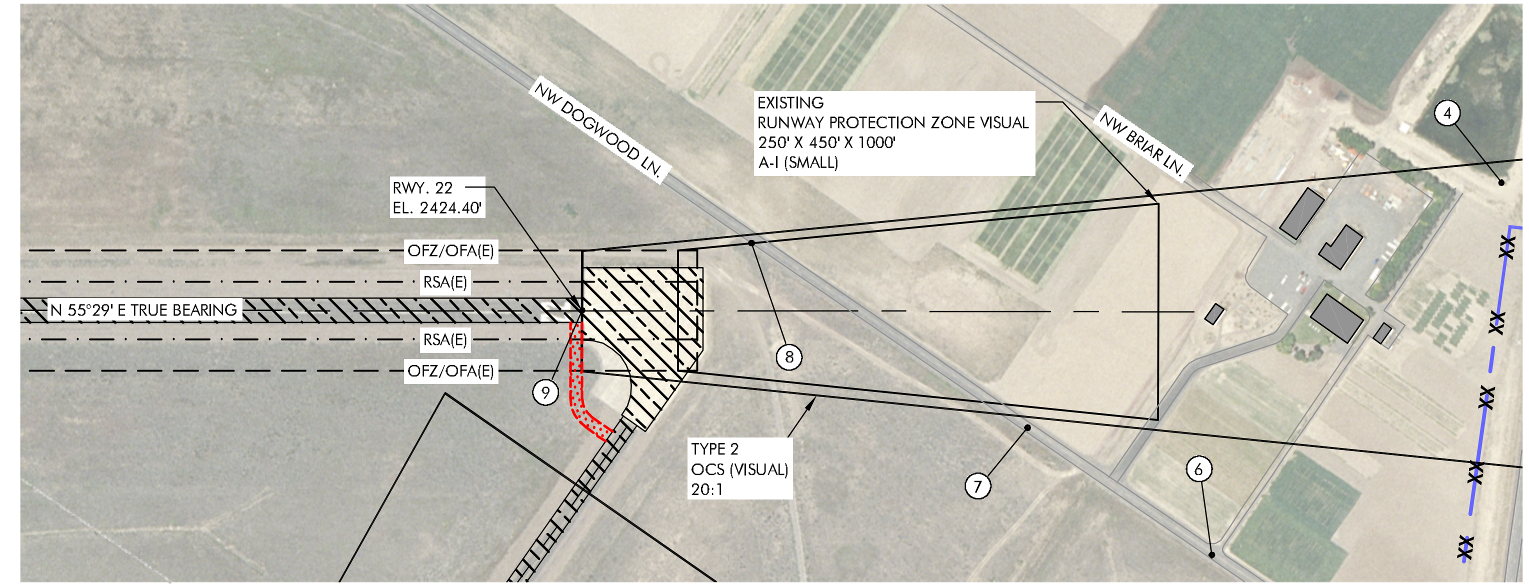
RUNWAY 16-34 RPZ & INNER APPROACH PLAN & PROFILE

FIGURE NO. .

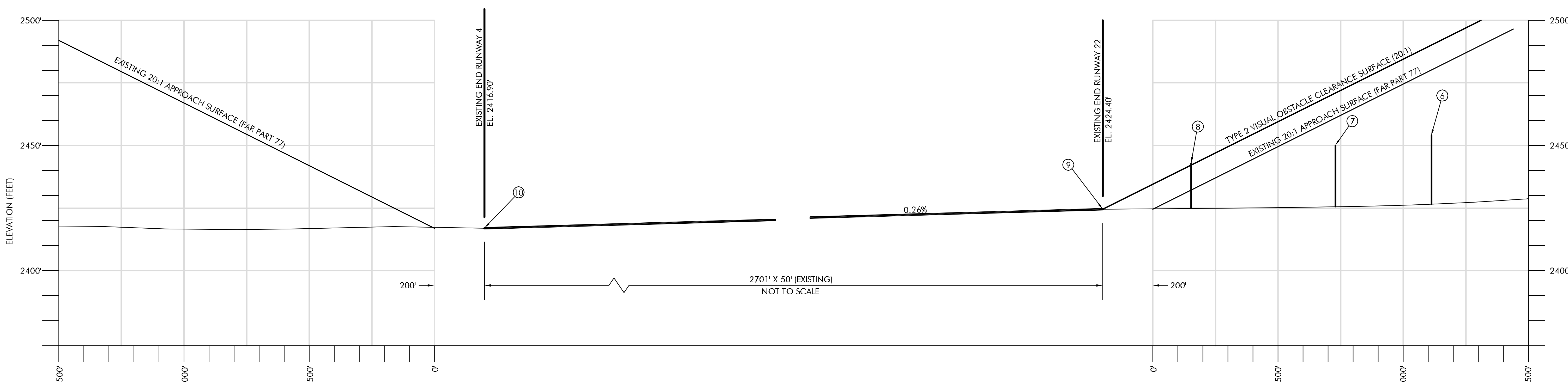
SHEET NO. 8 OF 12



RUNWAY 4 PLAN VIEW
(RUNWAY TO BE CLOSED)



RUNWAY 22 PLAN VIEW
(RUNWAY TO BE CLOSED)



RUNWAY 4 PROFILE VIEW
(RUNWAY TO BE CLOSED)

0 200 400
SCALE OF FEET
HORIZONTAL SCALE: 1"=200'

0 20 40
SCALE OF FEET
VERTICAL SCALE: 1"=20'

RUNWAY 22 PROFILE VIEW
(RUNWAY TO BE CLOSED)

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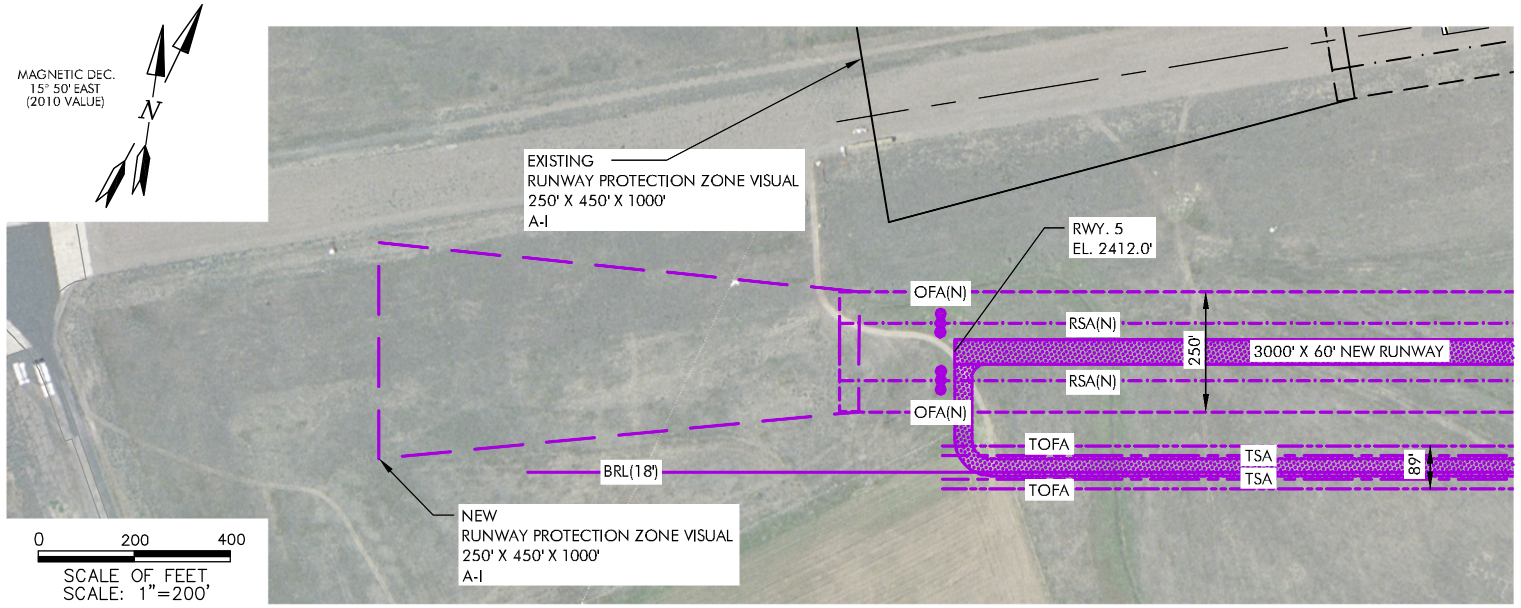
DATE: DECEMBER 2010		PROJECT NO: 10149018.01	

MADRAS MUNICIPAL AIRPORT

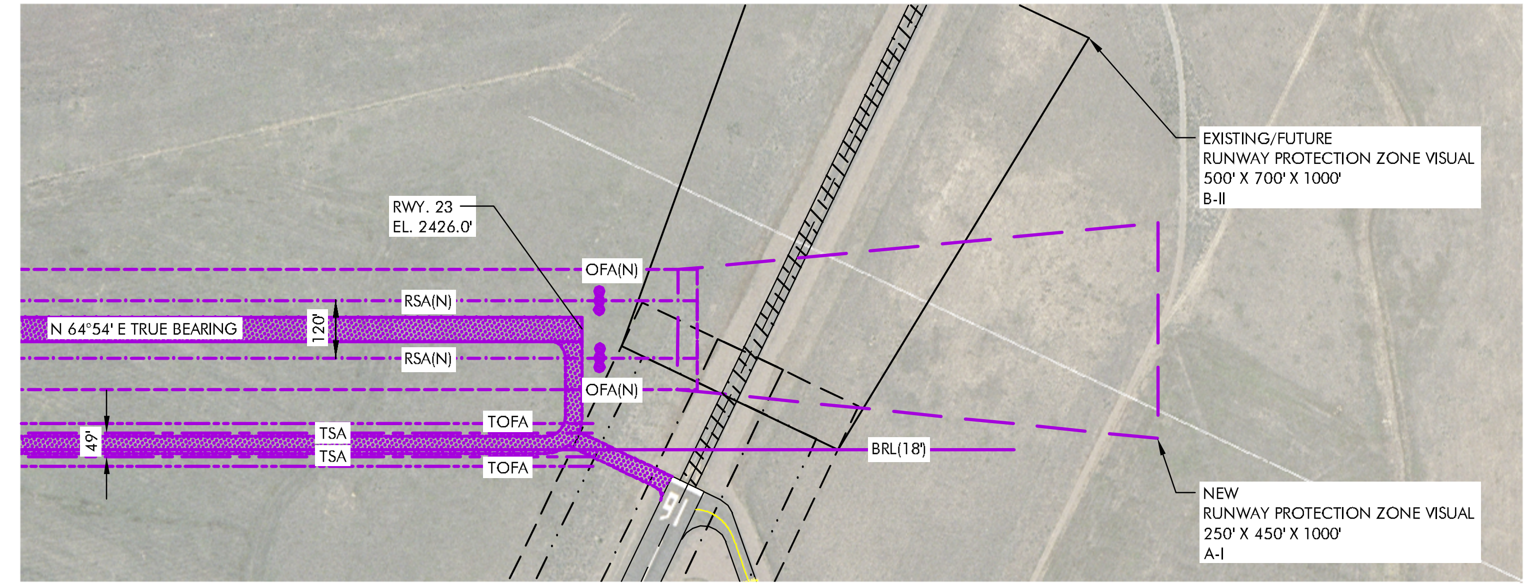
RUNWAY 4-22 RPZ & INNER APPROACH PLAN & PROFILE

FIGURE NO. .

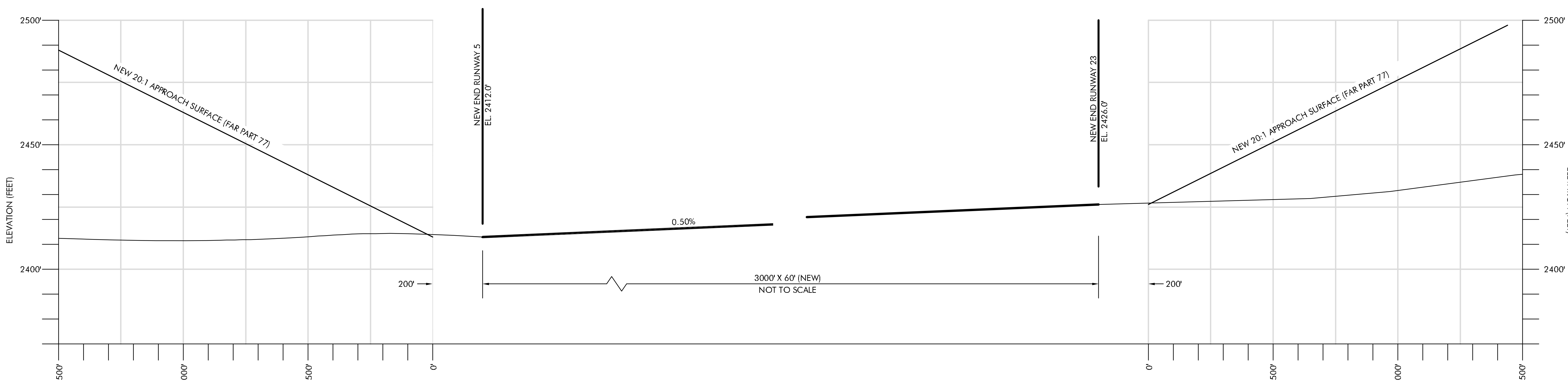
SHEET NO. 9 OF 12



NEW RUNWAY 5 PLAN VIEW



NEW RUNWAY 23 PLAN VIEW



NEW RUNWAY 5 PROFILE VIEW

NEW RUNWAY 23 PROFILE VIEW

0 200 400
SCALE OF FEET
HORIZONTAL SCALE: 1"=200'

0 20 40
SCALE OF FEET
VERTICAL SCALE: 1"=20'

NOTES:

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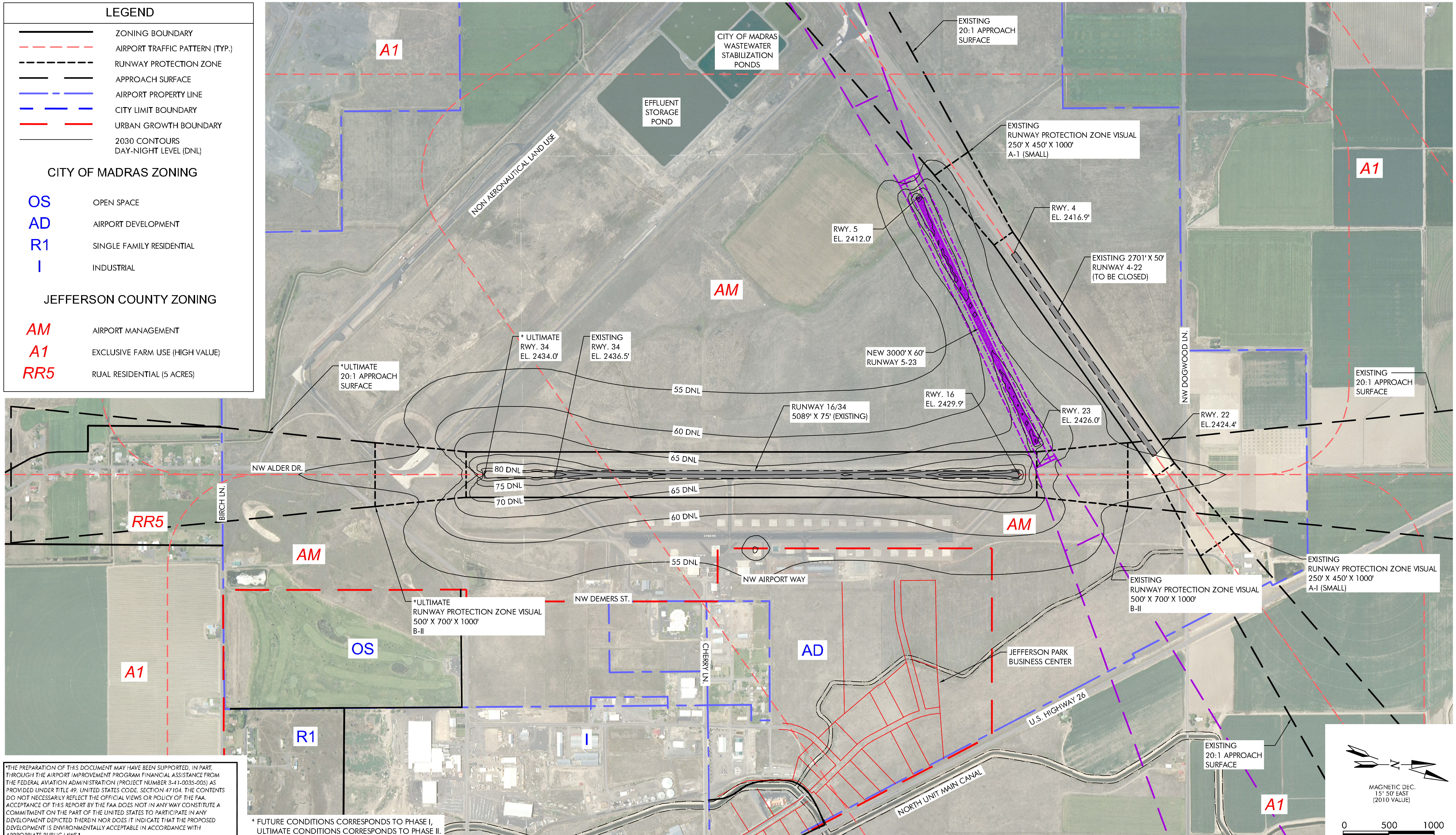
MADRAS MUNICIPAL AIRPORT

NEW RUNWAY 5-23 RPZ & INNER APPROACH PLAN & PROFILE

FIGURE NO. .

SHEET NO. 10 OF 12



THE PREPARATION OF THIS DOCUMENT MAY HAVE BEEN SUPPORTED, IN PART, THROUGH THE AIRPORT IMPROVEMENT PROGRAM FINANCIAL ASSISTANCE FROM THE FEDERAL AVIATION ADMINISTRATION (PROJECT NUMBER 3-41-0035-005) AS PROVIDED UNDER TITLE 49, UNITED STATES CODE, SECTION 47104. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THIS REPORT BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED THEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS.

* FUTURE CONDITIONS CORRESPONDS TO PHASE I, ULTIMATE CONDITIONS CORRESPONDS TO PHASE II.

NO.	DATE	BY	APPR	REVISIONS

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING.
0" 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

FEDERAL AVIATION ADMINISTRATION APPROVAL

APPROVAL DATE: ____________

MANAGER, SEATTLE ADO

CITY OF MADRAS APPROVAL

APPROVAL DATE: ____________

SIGNATURE

CENTURY WEST ENGINEERING CORPORATION
6650 S.W. Redwood Lane, Suite 350
Portland, Oregon 97224
503-419-2130 phone • 503-639-2710 fax
www.centurywest.com

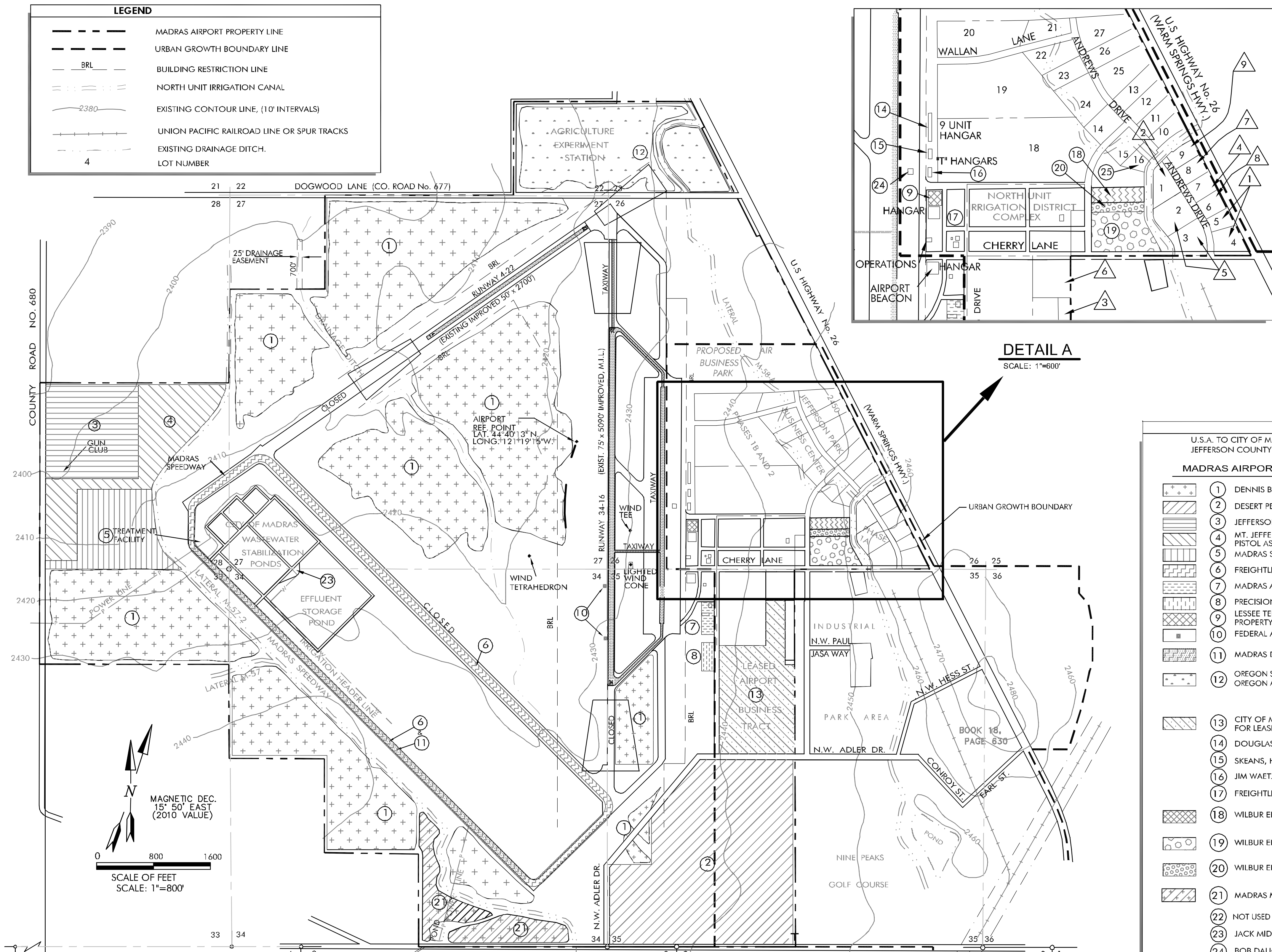
DESIGNED BY: DM	DRAWN BY: JLS	CHECKED BY: SLK	SCALE: AS SHOWN
DATE: DECEMBER 2010		PROJECT NO: 10149018	

MADRAS MUNICIPAL AIRPORT

AIRPORT LAND USE PLAN WITH 2030 NOISE CONTOURS

FIGURE NO.
.

SHEET NO.
11 OF 12



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PROPERTY SOLD

PARCEL	OWNER	ACRES	RECORDED	DEED RECORD	INTEREST	PREVIOUS OWNER
1	TAYLOR NORTHWEST, LLC	1.4 (LOT 4) 0.96 (LOT 5)	SEPT 28, 2004	#2004-004472	FEE	CITY OF MADRAS
2	SHIELDING INDUSTRIAL PROPERTIES, LLC	2.24	FEB 25, 2005	#2005-00920	FEE	CITY OF MADRAS
3	OLIVER & JANELLE ORCUTT d.b.a. MADRAS SANITARY SERVICE	2.52	TBA	TBA	TBA	CITY OF MADRAS
4	TRIO DEVELOPMENT LLC	1.31	MAR 16, 2006	#2006-001522	FEE	CITY OF MADRAS
5	STEVEN C. SEGAL	2.87 (LOT 2) 1.88 (LOT 3)	JUNE 9, 2006	#2006-003546	FEE	CITY OF MADRAS
6	DOUBLE PRESS MANUFACTURING	3.67	OCT. 6, 2006	#2006-006088	FEE	CITY OF MADRAS
7	JERRY AND CAROLYN BAGGETT AND LEE AND TERESA BAGGETT	1.31 (LOT 8)	OCT. 6, 2006	#2006-006080	FEE	CITY OF MADRAS
8	STEVE CHARRON SEPARATE PROPERTY TRUST	1.20 (LOT 6)	NOV. 13, 2006	#2006-006796	FEE	CITY OF MADRAS
9	JAMES AND DEBRA MARSHALL REVOCABLE LIVING TRUST DATED AUG 4, 2005	1.46 (LOT 9)	OCT. 10, 2006	#2006-006120	FEE	CITY OF MADRAS

PROPERTY ACQUSITION

U.S.A. TO CITY OF MADRAS, OR. AND JEFFERSON COUNTY, OREGON. 2,112.03 AC. - BK. 23, PG. 91 - 7/16/48

TOTAL AIRPORT PROPERTY = 2,112.03 AC. (ASSESSOR'S)

MADRAS AIRPORT LEASE AREAS:	ACRES	RECORDED	M.F.#	ORIGINATED	EXPIRES	PROJECT#
1 DENNIS BLANN	526.9	UNRECORDED	N/A	7/5/79	DEC. 1, 2009	NONE
2 DESERT PEAKS GOLF CLUB	128.72	UNRECORDED	N/A	N/A	N/A	NONE
3 JEFFERSON COUNTY ROD AND GUN CLUB.	39.2	UNRECORDED	N/A	11/15/63	DEC. 31, 2026	NONE
4 MT. JEFFERSON RIFLE, ARCHERY AND PISTOL ASSOCIATION.	40.0	UNRECORDED	N/A	9/1/58	SEPT. 1, 2018	NONE
5 MADRAS SPEEDWAY	32.0	32.0 UNREC	N/A	3/12/85	APR. 1, 2010	NONE
6 FREIGHTLINER CORPORATION.	RUNWAYS	UNRECORDED	N/A	2/15/73	AUG. 31, 2009	NONE
7 MADRAS AIR SERVICE	2.0	UNRECORDED	N/A	1/1/76	JULY 31, 2007	NONE
8 PRECISION APPLICATIONS.	1.64	UNRECORDED	N/A	11/6/78	NOV. 5, 2013	NONE
9 LESSEE TERMINATED THE LEASE PROPERTY IS AVAILABLE FOR LEASE	0.5	-	-	-	-	-
10 FEDERAL AVIATION ADMINISTRATION. (VASI)	0.11	UNRECORDED	N/A	8/1/85	CONTINUOUS	NONE
11 MADRAS DRAGSTRIP	RUNWAY	UNRECORDED	N/A	4/10/89	MAR. 31, 2013	NONE
12 OREGON STATE UNIVERSITY - CENTRAL OREGON AGRICULTURAL RESEARCH CENTER	66.71 FRMLND 15.29 BLDGS 82.0 TOTAL	UNRECORDED	N/A	9/27/91	SEPT. 26, 2011 (FRMLND) DEC. 31, 2040 (BLDGS)	NONE
13 CITY OF MADRAS PROPERTY AVAILABLE FOR LEASE.	58.05	UNRECORDED	N/A	N/A	N/A	NONE
14 DOUGLAS SHEPARD, (ET.AL)	T-HANGAR,#3	UNRECORDED	N/A	1/2/76	DEC. 31, 2010	NONE
15 SKEANS, HORNING, LEHR	T-HANGAR,#2	UNRECORDED	N/A	10/1/71	OCT. 1, 2011	NONE
16 JIM WAETJEN	T-HANGAR,#1	UNRECORDED	N/A	4/1/86	MAY 31, 2011	NONE
17 FREIGHTLINER CORPORATION	T-121 BLDG. & 1.5 AC	UNRECORDED	N/A	2/16/76	AUG. 31, 2007	NONE
18 WILBUR ELLIS FIRST RIGHT OF REFUSAL	160' x 570'	UNRECORDED	N/A	4/9/2002	N/A	NONE
19 WILBUR ELLIS LEASED PREMISIS	5.227	UNRECORDED	N/A	1/1/1995	JAN. 1, 2025	NONE
20 WILBUR ELLIS ADDITION TO LEASE	100' x 570'	UNRECORDED	N/A	4/9/2002	CONTINUOUS	NONE
21 MADRAS MX, LLC	35.7	UNRECORDED	N/A	2/27/2007	FEB. 28, 2012	NONE
22 NOT USED	-	-	-	-	-	-
23 JACK MIDDLETON	0.4	UNRECORDED	N/A	8/13/1996	AUG. 31, 2009	NONE
24 BOB DAUGHS	0.25	UNRECORDED	N/A	4/9/2002	MAY 1, 2012	NONE
25 MID COLUMBIA LUMBER PRODUCTS	1.29	UNRECORDED	N/A	10/1/2003	OCT. 1, 2008	NONE

NO.	DATE	BY	APPR	REVISIONS

VERIFY SCALES

BAR IS ONE INCH ON ORIGINAL DRAWING.
0" 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

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APPROVAL DATE: ______

MANAGER, SEATTLE ADO

CITY OF MADRAS APPROVAL

APPROVAL DATE: ______

SIGNATURE

CENTURY WEST ENGINEERING CORPORATION
6650 S.W. Redwood Lane, Suite 350
Portland, Oregon 97224
503-419-2130 phone • 503-639-2710 fax
www.centurywest.com

DESIGNED BY: JNR	DRAWN BY: JJB	CHECKED BY: WMR	SCALE: AS SHOWN
DATE: DECEMBER 2010		PROJECT NO: 1014901801	

MADRAS MUNICIPAL AIRPORT

EXHIBIT "A" AIRPORT PROPERTY PLAN

FIGURE NO. -

SHEET NO. 12 OF 12

Chapter Eight
Environmental Review

Century West Engineering Corporation

Madras Municipal Airport

CHAPTER EIGHT
ENVIRONMENTAL REVIEW

Introduction

The purpose of this Environmental Review is to identify physical or environmental conditions of record which may affect improvement options for Madras Municipal Airport. With the exception of the airport noise evaluation, the scope of work for this element is limited to compiling, reviewing and briefly summarizing information of record from applicable local, federal and state source for the airport site and its environs.

The airport noise evaluation was conducted based on prescribed Federal Aviation Administration (FAA) guidelines, using the FAA's Integrated Noise Model (INM) computer software with several airport-specific inputs including FAA-approved air traffic forecasts, fleet mix, common aircraft flight tracks, and existing/future runway configurations.

Included below are brief summaries of the categories in which potentially significant issues were identified or appear to be possible, and where notable ecological or social conditions appear to be pertinent to the future development of the airport.

AIRPORT NOISE ANALYSIS

Airport Noise and Noise Modeling

It is often noted that noise is the most common negative impact associated with airports. A simple definition of noise is "unwanted sound." However, sound is measurable, whereas noise is subjective. The relationship between measurable sound and human irritation is the key to understanding aircraft noise impact. A rating scale has been devised to relate sound to the sensitivity of the human ear. The A-weighted decibel scale (dBA) is measured on a "log" scale, by which is meant that for each increase in sound energy level by a factor of 10, there is a designated increase of 1 dBA. This system of measurement is used because the human ear functions over such an enormous range of sound energy impacts. At a psychological level, there is a rule of thumb that the human ear often "hears" an increase of 10 decibels as equivalent to a "doubling" of sound.

The challenge to evaluating noise impact lies in determining what amount and what kind of sound constitutes noise. The vast majority of people exposed to aircraft noise are not in danger of direct physical harm. However, much research on the effects of noise has led to several generally accepted conclusions:

- The effects of sound are cumulative; therefore, the duration of exposure must be included in any evaluation of noise.
- Noise can interfere with outdoor activities and other communication.
- Noise can disturb sleep, TV/radio listening, and relaxation.
- When community noise levels have reached sufficient intensity, community wide objection to the noise will likely occur.

Research has also found that individual responses to noise are difficult to predict.[20] Some people are annoyed by perceptible noise events, while others show little concern over the most disruptive events. However, it is possible to predict the responses of large groups of people – i.e. communities. Consequently, community response, not individual response, has emerged as the prime index of aircraft noise measurement.

On the basis of the findings described above, a methodology has been devised to relate measurable sound from a variety of sources to community response. For aviation noise analysis, the FAA has determined that the cumulative noise energy exposure of individuals to noise resulting from aviation activities must be established in terms of yearly day/night average sound level (DNL) as FAA's primary metric. The DNL methodology is used in conjunction with the standard A-weighted decibel scale (dBA) which is measured on a "log" scale, by which is meant that for each increase in sound energy level by a factor of 10, there is a designated increase of 1 dBA. DNL has been adopted by the U. S. Environmental Protection Agency (EPA), the Department of Housing and Urban Development (HUD), and the Federal Aviation Administration (FAA) for use in evaluating noise impacts. In a general sense, it is the yearly average of aircraft-created noise for a specific location (i.e., runway), but includes a calculation penalty for each night flight.

The FAA has determined that a significant noise impact would occur if analysis shows that the proposed action will cause noise sensitive areas to experience an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure when compared to the no action alternative for the same time frame. As an example, an increase from 63.5 dB to 65 dB is considered a significant impact. The DNL methodology also includes a significant calculation penalty for each night flight. DNL levels are

[20] Beranek, Leo, *Noise and Vibration Control*, McGraw-Hill, 1971, pages ix-x.

normally depicted as contours. These contours are generated from noise measurements processed by a FAA-approved computer noise model. They are superimposed on a map of the airport and its surrounding area. This map of noise contour levels is used to predict community response to the noise generated from aircraft using that airport.

The basic unit in the computation of DNL is the sound exposure level (SEL). An SEL is computed by mathematically summing the dBA level for each second during which a noise event occurs. For example, the noise level of an aircraft might be recorded as it approaches, passes overhead, and then departs. The recorded noise level of each second of the noise event is then added logarithmically to compute the SEL. To provide a penalty for nighttime flights (considered to be between 10 PM and 7 AM), 10 dBA is added to each nighttime dBA measurement, second by second. Due to the mathematics of logarithms, this calculation penalty is equivalent to 10-day flights for each night flight.[21]

A DNL level is approximately equal to the average dBA level during a 24-hour period with a weighing for nighttime noise events. The main advantage of DNL is that it provides a common measure for a variety of different noise environments. The same DNL level can describe an area with very few high noise events as well as an area with many low-level events.

Noise Modeling and Contour Criteria

DNL levels are typically depicted as contours. Contours are an interpolation of noise levels drawn to connect all points of a constant level, which are derived from information processed by the FAA-approved computer noise model. They appear similar to topographical contours and are superimposed on a map of the airport and its surrounding area. It is this map of noise levels drawn about an airport, which is used to predict community response to the noise from aircraft using that airport. DNL mapping is best used for comparative purposes, rather than for providing absolute values. That is, valid comparisons can be made between scenarios as long as consistent assumptions and basic data are used for all calculations. It should be noted that a line drawn on a map by a computer does not imply that a particular noise condition exists on one side of the line and not on the other. These calculations can only be used for comparing average noise impacts, not precisely defining them relative to a specific location at a specific time.

---

[21] Where Leq ("Equivalent Sound Level") is the same measure as DNL without the night penalty incorporated, this can be shown through the mathematical relationship of:

$$Leq_d = 10 \log \left(\frac{N_d \times 10^{(SEL/10)}}{86,400} \right)$$

If SEL equals the same measured sound exposure level for each computation, and if N_d = 10 daytime flights, and N_n = 1 night-time flight, then use of a calculator shows that for any SEL value inserted, $Leq_d = Leq_n$.

Noise and Land-Use Compatibility Criteria

Federal regulatory agencies of government have adopted standards and suggested guidelines relating DNL to compatible land uses. Most of the noise and land-use compatibility guidelines strongly support the concept that significant annoyance from aircraft noise levels does not occur outside a 65 DNL noise contour. Federal agencies supporting this concept include the Environmental Protection Agency, Department of Housing and Urban Development, and the Federal Aviation Administration.

Federal Aviation Regulations (FAR) Part 150, Airport Noise Compatibility Planning provides guidance for land-use compatibility around airports. **Table 8-1** summarizes the federal guidelines for compatibility or non-compatibility of various land uses and noise exposure levels. Under federal guidelines, all land uses, including residential, are considered compatible with noise exposure levels of 65DNL and lower. Generally, residential and some public uses are not compatible within the 65-70 DNL, and above. As noted in this table, some degree of noise level reduction (NLR) from outdoor to indoor environments may be required for specific land uses located within higher-level noise contours. Land uses such as commercial, manufacturing, some recreational uses, and agriculture are compatible within 65-70 DNL contours.

Residential development within the 65 DNL contour and above is not recommended and should be discouraged. Care should be taken by local land use authorities to avoid creating potential long-term land use incompatibilities in the vicinity of the airport by permitting new development of incompatible land uses such as residential subdivisions in areas of moderate or higher noise exposure. Oregon's airport noise and land use compatibility guidelines discourage residential development within the 55 DNL contour, although it is not prohibited.

Oregon Revised Statutes (ORS) Chapters 836.000 through 836.630 address the appropriate zoning and protection of Oregon's airports and their surroundings. Under the statute, height restrictive zoning and, to some extent, use-restrictive zoning are indicated as necessary components affecting land uses in the immediate vicinity of a public airport. As noted in the Inventory Chapter, the City of Madras and Jefferson County currently maintain airport overlay zoning that is consistent with state and federal airport protection guidelines.

Planning Period Noise Contours

A noise analysis of the effects of existing aircraft operations and proposed projects/activities linked to the updated airport master plan has been performed using the FAA's Integrated Noise Model (INM), version 7.0. A set of noise contours and associated information have been developed to assess current and future aircraft noise exposure and assist in the development of the airport land use compatibility plan. Data from the updated forecasts of activity levels were assigned to the common arrival, departure and airport traffic pattern flight tracks defined for the runways.

Air Traffic Distribution by Runway	2009	2030
Runway 34	57%	55%
Runway 16	38%	35%
Runway 4 (Rwy 5 in 2030)	2%	4%
Runway 22 (Rwy 23 in 2030)	2%	4%
Rotor (not runway specific)	1%	2%

The airport's standard traffic patterns were maintained for all future years and adjusted as necessary for the future runway configurations. The existing noise contours are based on the current runway configuration and 2009 activity. Five-year and twenty-year noise contours were developed for 2015 and 2030 with the future Runway 16/34 extensions and the new crosswind runway (5/23) from the preferred airport development alternative. The 2030 contours reflect the ultimate airfield configuration, which includes Runway 16/34 (5,870 feet) and the new Runway 5/23 that is planned to replace Runway 4/22.

The noise contours are depicted in **Figure 8-1** at the end of this section. The contours are plotted in 5 DNL increments from 55 DNL to 80 DNL, which is consistent with local noise and land use compatibility planning. As noted earlier in this section, under federal standards, all land uses are considered compatible with noise exposure below 65 DNL and the FAA does not formally recognize noise levels below 65DNL in its land use compatibility planning assessments.

Noise Contours

The large land area that comprises Madras Municipal Airport creates significant land use compatibility benefits for the surrounding community. Based on the forecast activity levels at the airport through 2030, all 55 DNL and higher noise contours (for 2009, 2015 and 2030) are contained entirely within the current airport property boundary.

However, the projected increase in air traffic and its associated noise exposure combined with residential development patterns in the vicinity of the airport suggest that an increase in noise related complaints should be expected during the planning period. Perceived noise impacts and resulting complaints are not typically confined to areas of 55 DNL or higher significant thresholds established by state or federal regulatory agencies. For this reason local land use officials should work closely with the community to avoid creating any potential long-term land use incompatibilities surrounding Madras Municipal Airport, particularly within the runway approaches. In addition, local officials should consider developing and maintaining an ongoing "fly friendly" program to educate pilots and neighbors about safe airport operating practices and nearby noise sensitive areas.

TABLE 8-1: LAND USE COMPATIBILITY WITH DNL

	Yearly Day-Night Average Sound Level (DNL) in Decibels					
Land Use	Below 65	65-70	70-75	75-80	80-85	Over85
Residential						
Residential, other than mobile homes & transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile Home Parks	Y	N	N	N	N	N
Transient Lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and Nursing Homes	Y	25	30	N	N	N
Churches, Auditoriums, and Concert Halls	Y	25	30	N	N	N
Government Services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, Business and Professional	Y	Y	25	30	N	N
Wholesale and Retail-Building Materials, Hardware and Farm Equipment and Farm Equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail Trade-General	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing General	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and Optical	Y	Y	25	30	N	N
Agriculture (except livestock) and Forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock Farming and Breeding	Y	Y(6)	Y(7)	N	N	N
Mining and Fishing, Resource Production and Extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor Sports Arenas, Spectator Sports	Y	Y(5)	Y(5)	N	N	N
Outdoor Music Shells, Amphitheaters	Y	N	N	N	N	N
Nature Exhibits and Zoos	Y	Y	N	N	N	N
Amusement Parks, Resorts and Camps	Y	Y	Y	N	N	N
Golf Courses, Riding Stables and Water Recreation	Y	Y	25	30	N	N

Y (Yes) Land-use and related structures compatible without restrictions.
N (No) Land-use and related structures are not compatible and should be prohibited.
NLR - Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into design and construction of the structure.
25, 30 or 35 - Land uses and structures generally compatible; measure to achieve NLR or 25, 30 or 35 dB must be incorporated into design and construction of the structure.

1. Where the community determines that residential uses must be allowed, measures to achieve outdoor to indoor Noise Levels Reduction (NLR) of at least 25dB and 30dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB; thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.
2. Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
3. Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
4. Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

5. Land-use compatible, provided special sound reinforcement systems are installed.
6. Residential buildings require an NLR of 25.
7. Residential buildings require an NLR of 30.
8. Residential buildings not permitted.

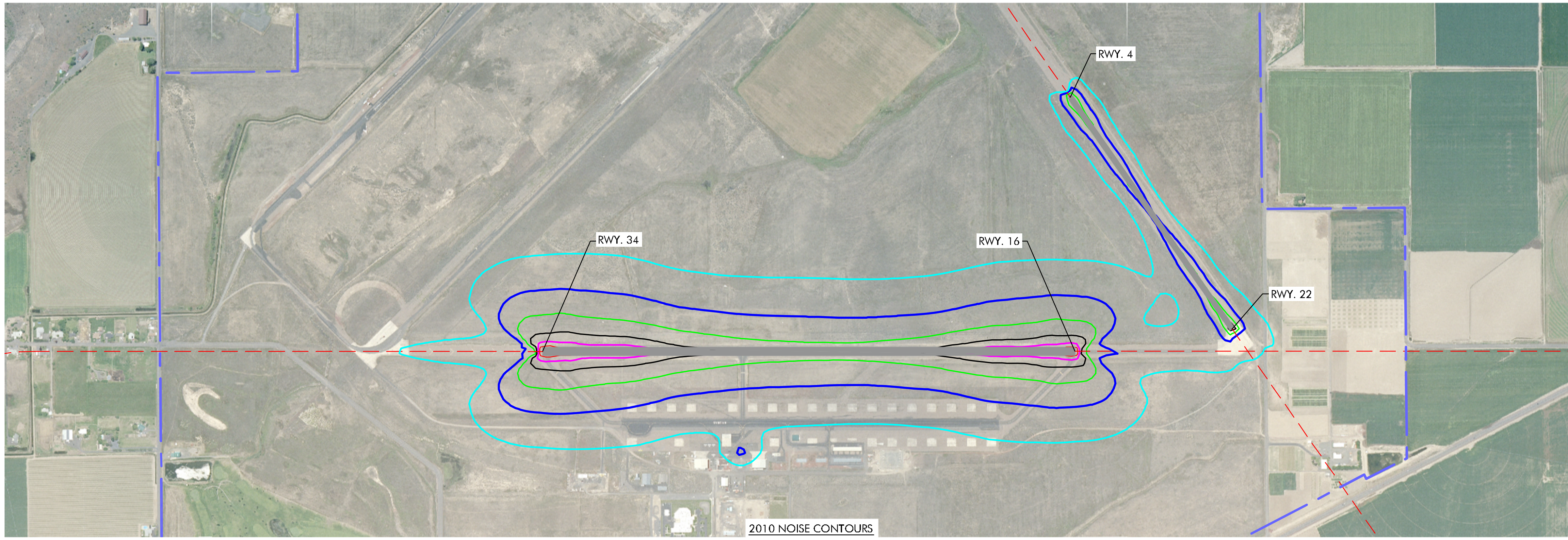
SOURCE: Federal Aviation Regulations, Part 150, Airport Noise Compatibility Guidelines

LEGEND

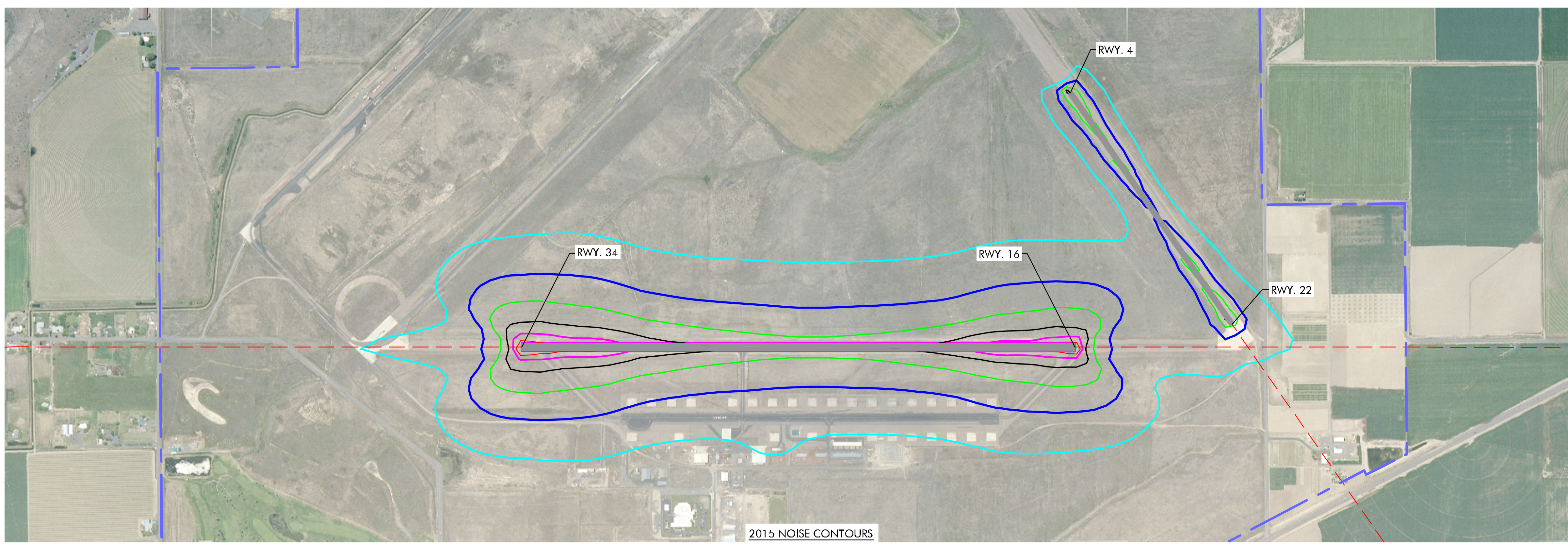
cyan line	55 DNL
blue line	60 DNL
green line	65 DNL
black line	70 DNL
magenta line	75 DNL
red line	80 DNL
red dashed line	FLIGHT TRACKS
blue dashed line	PROPERTY LINE

DAY-NIGHT LEVEL (DNL)

NOTES:
1.) FAA INM VERSION 7.0a USED TO DEVELOP NOISE CONTOURS. CONTOURS BASED ON MASTER PLAN FORECAST AIRCRAFT OPERATIONS FOR 2007, 2012, 2027.



2010 NOISE CONTOURS



2015 NOISE CONTOURS

N

MAGNETIC DEC.
15° 50' EAST
(2010 VALUE)

0 600 1200
SCALE: 1"=600'

CENTURY WEST
ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT
NOISE CONTOURS

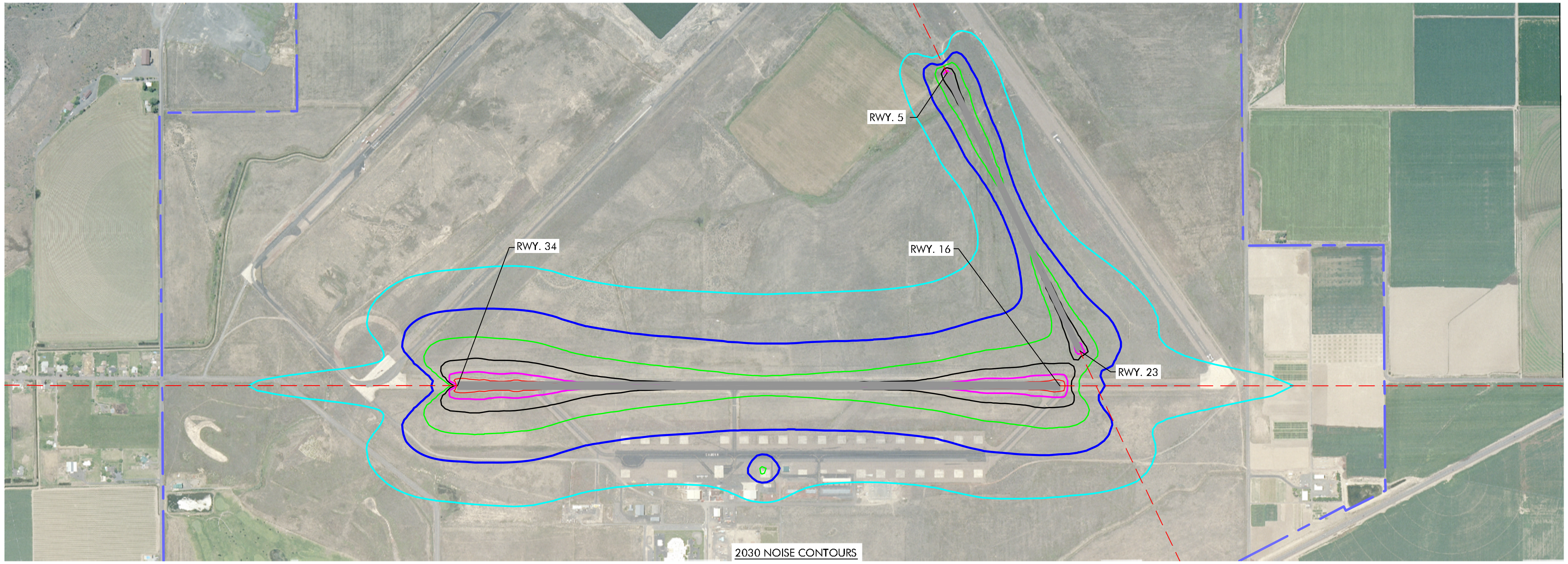
FIGURE NO.
8-1

LEGEND

55 DNL	
60 DNL	
65 DNL	
70 DNL	
75 DNL	
80 DNL	
FLIGHT TRACKS	
PROPERTY LINE	

DAY-NIGHT LEVEL (DNL)

NOTES:
1.) FAA INM VERSION 7.0a USED TO DEVELOP NOISE CONTOURS. CONTOURS BASED ON MASTER PLAN FORECAST AIRCRAFT OPERATIONS FOR 2007, 2012, 2027.



MAGNETIC DEC.
15° 50' EAST
(2010 VALUE)

0 600 1200
SCALE: 1"=600'

CENTURY WEST
ENGINEERING CORPORATION

MADRAS MUNICIPAL AIRPORT
NOISE CONTOURS

FIGURE NO.
8-2

Hazardous Materials

The airport has two single-walled above ground fuel storage tanks used for aviation gasoline and jet fuel. The fuel tanks are located north of the terminal building near the northeast corner of the apron. No mechanical problems have been identified with the fuel tanks. The airport's fixed base operator (FBO) also operates several small fuel trucks (Century West Engineering 2009).

DEQ's Environmental Cleanup Site Information (ECSI) Database includes several listings for the airport property. These include the following:

- Madras Airport (ECSI Site No. 299) – This ECSI listing relates to the discovery and cleanup of residual pesticide contamination of soils from historic disposal of pesticide rinse water by aerial applicators. The ECSI Site Summary Report for this site notes that Madras Air Service and Precision Applicators both routinely rinsed planes and pesticide containers on the site prior to 1985. Sampling and analysis of site soils was completed to characterize the nature and extent of contamination, and a coordinated cleanup effort was completed. DEQ and EPA accepted a "Clean Closure Report" submitted by the City of Madras for the cleanup in 1992, and a "no further action" determination was made by the agencies.
- Livingston Air Service (ECSI Site No. 4106) – This facility was added to the ECSI database for tracking purposes in 2004 based on a 1956 phone book advertisement, which noted the facility to offer agricultural services including aerial spraying of pesticides and fertilizers. The ECSI Site Summary Report for this site notes the status to be "Site Screening Recommended."
- North Unit Aviation (ECSI Site No. 4107) – This facility was added to the ECSI database in 2004 for tracking as a former aerial pesticide applicator, based on a 1959 phone book advertisement. The ECSI Site Summary Report for this site notes the status to be "Site Screening Recommended."
- Madras Air Service (ECSI Site No. 4108) – This facility was added to the ECSI database in 2004 for tracking as a former aerial pesticide applicator, based on phone book advertisements from the 1970s and 1980s. The ECSI Site Summary Report for this site notes the status to be "Site Screening Recommended."
- Precision Applicators (ECSI Site No. 4603) – This facility was added to the ECSI database in 2006 for tracking as former aerial pesticide applicator, based on previous investigations related to ECSI Site No. 299. The ECSI Site Summary Report for this site notes the status to be "Site Screening Recommended."
- Tidewater Oil Bulk Plant – Madras (ECSI Site No. 4059) – This site was added to the ECSI database in 2004 for tracking a former bulk plant, based on a DEQ conversation with a

former jobber. The site was reportedly located at the former airport fuel depot, and the operators reportedly used semi-buried tanks. The ECSI Site Summary Report for this site notes the status to be "Site Screening Recommended."

Threatened and Endangered Species

There are no known threatened or endangered species documented to occur on the Madras Municipal Airport (Tenneson Engineering 1990). According to the US Fish and Wildlife website, no critical habitat is designated to occur on the site. A site visit was conducted on June 11, 2010 by a wildlife biologist. No suitable habitat for listed fish, wildlife, or plant species was found to occur on site.

Land Use

Land use in the vicinity of the airport is administered by the City of Madras or Jefferson County. The eastern portion of the airport (landside development) and the Jefferson Park Business Center (JPBC) are located within the Madras city limits and urban growth boundary (UGB). Allowable development uses in the City of Madras is covered under Ordinance 723 Zoning. The runways and taxiways and surrounding areas are located outside of the city limits and UGB and are subject to Jefferson County zoning.

<u>Airport Development (AD) Zone (City of Madras)</u>

The terminal area and the proposed Air Business park that is bordered by Cherry Lane to the south, Highway 26 to the east, and the runway/taxiway system to the west is zoned Airport Development (AD). The purpose of this zone is to provide land adjacent to the airport facilities for future commercial and industrial uses, which may be dependent on air transportation. The following are allowed uses in the AD zone (a site plan review is required);

- Air cargo terminals.
- Aircraft sales, repair, service, storage and schools related to aircraft operations, and facilities essential for the operation of airports, such as fuel storage, hangar use, and F.B.O. offices.
- Terminals (passenger - air, taxi, and bus).
- Public and semi-public buildings, structures and uses essential to the welfare of an area, such as fire stations, pump stations, and water storage.
- Ancillary uses with a total floor area of no larger than 1,000 square feet.

- Uses where the ongoing operations must be directly, dependent upon and associated with the airport.
- Assembly and manufacture of goods.
- Assembly, repair, and storage of heavy vehicles and machinery.
- Storage and processing of agricultural products.
- Warehouse and freight terminal operations.
- Professional offices.
- Public utility facilities.
- Call Centers.

In an AD zone, the following conditions shall apply:

- Liquid and Solid Wastes - Storage of animal, vegetable, or other wastes, which attract insects, rodents, or birds or otherwise create a health hazard shall be prohibited.
- Discharge Standards - There shall be no emissions of smoke, fly ash, dust, vapor, gases, or other forms of air pollution that may cause nuisance or injury to human, plant or animal life, or to property, or that may conflict with any present or planned operations of the airport.
- Lighting - Sign lighting and exterior lighting shall not project directly into an abutting lot unless necessary for safe and convenient air travel, sign lighting and exterior lighting shall not project directly into the runway, taxi-way, or approach zone. Outdoor lighting for safety purposes shall be allowed, however, the outdoor lighting shall not project directly into the abutting lot. The source of the light shall not be able to be seen or light reflective or amplifying device from outside property line. No structure shall have blinking, strobe, or rotating light(s) unless required by FAA. Lighted poles shall not exceed twenty feet (20') in height.

Industrial (I) Zone (City of Madras)

The JPBC is zoned industrial (I). The I zoning district allows for a variety of industrial uses within a designated area. Development in the JPBC must meet the Covenants, Conditions and Restrictions (CC&Rs) of the JPBC. The CC&Rs set the design standards for development. After approval by the JPBC Design Review Committee (DRC), improvements are still subject to the filing and review conditions of the I zone. The following are allowed uses in the I zone and require a site plan application:

- Electronics firms with professional offices.

- Secondary wood products (e.g. furniture, toys).
- Manufacturing of recreation/sporting goods equipment.
- Precision machine shops.
- Manufacturing of medical, dental, and orthopedic equipment.
- Wholesale printing and publishing facilities and distribution centers.
- Corporation headquarters and business offices directly related to industry.
- Aircraft service, maintenance, and aviation related industry.
- Energy related manufacturing, research, and development.
- Manufacturing of photographic equipment.
- Mail order companies.
- Medical research facilities.
- General research and development facilities.
- Wholesale distribution and sales; wholesale bakeries and/or laundries.
- Fire, police or other governmental buildings.
- Retail sales incidental or subordinate to a Permitted Use.
- Public or semi-public use.
- Facilities necessary to the operation of an industrial enterprise, or for a night watchman dwelling.
- Planned Unit Development District including Industrial condominiums related business offices.
- Transportation terminals.
- Freighting or trucking yards and terminals.
- Manufacturing, fabricating, processing, packaging or storage, repairing and warehousing, which are conducted within an enclosed building.
- Petroleum and plastic products and shaping or distribution.
- Manufacturing of manufactured homes and recreational vehicles.
- Trucking and freighting yards, vehicle storage yards, or wrecking yards.
- Processing and packaging of agricultural products (excluding animals).
- Utility facilities (does not include Communication Tower requirements).

- Repair garages, body and fender works, paint, and upholstery shops.
- Lumber yards and building material yards.
- Brick and pottery factories.
- Recycling plants.
- Steel and boiler works, fabrication, assembly and storage of structural steel products, foundries, and machine shops.
- Ancillary uses (i.e., deli, tavern, mini-market) provided that they comprise of less than 30% of the total square footage of a building located in the Industrial zoning district; is secondary to the primary use of the building; and is primarily for the use and convenience of the employees who work in the industrial area.
- High-tech industry.
- Food processing.
- General manufacturing.
- Call Centers.
- Contractor’s Yards.
- Building roof and wall-mounted antennas for cellular, PCS, and similar radio services.

The following uses would require a Conditional Use Plan Review in the I zone:

- Incidental and necessary services such as child care facilities and recreational facilities for persons working in the Industrial zoning district, when conducted within an integral part of a main structure and having no exterior display or advertising.
- Asphalt, redi-mix operations, concrete or concrete products manufacturing including storage yards.
- Lumber manufacturing, wood processing or yard storage incidental to use.
- Stone cutting and shaping for construction, ornamental and/or monumental purposes.
- Communication Tower requirements.
- Chemical manufacturing or storage, including farm chemicals.
- Glue manufacturing.
- Reduction, refining, smelting or alloying of metals, petroleum products or ores.

The following are not allowed in the I zone:

- Explosives manufacture or storage.
- Garbage, offal or dead animal reduction or dumping.
- Any use, which has been declared a nuisance by statute or ordinance, by any court of competent jurisdiction, or which may be obnoxious or offensive by reason of emission of odor, dust, smoke, gas or noise, provided the City Council shall have the power, upon recommendation of the Planning Commission, to grant a conditional and revocable permit for any such use within the Industrial Zoning District. After the public hearing and examination of the location and upon due proof of the satisfaction of the City Council that the maintenance of such use would not be unduly detrimental to adjacent surrounding property.

Airport Management (AM) Zone (Jefferson County)

The portion of the airport under county jurisdiction is zoned Airport Management (AM). The purpose of the AM zone is to encourage and support continued operation and vitality of airports in the county by allowing uses that are compatible with aviation activities. The following uses and their accessory uses are permitted in the AM zone, subject to compliance with the airport protection procedures of the Zoning Code. Any use involving construction of a new structure is subject to the Site Plan Review.

- Customary and usual aviation-related activities, including but not limited to takeoffs and landings, aircraft hangars, tie-downs, construction and maintenance of airport facilities, fixed based operator facilities, a residence for an airport caretaker or security officer, and other activities incidental to the normal operation of an airport are permitted outright. Residential, commercial, industrial, manufacturing and other uses are not "customary and usual aviation-related activities" except as provided in section.
- Emergency medical flight services, including activities, aircraft, accessory structures, and other facilities necessary to support emergency transportation for medical purposes. Emergency medical flight services include search and rescue operations but do not include hospitals, medical offices, medical labs, medical equipment sales, and other similar uses.
- Law enforcement and firefighting activities, including aircraft and ground-based activities, facilities and accessory structures necessary to support federal, state or local law enforcement or land management agencies engaged in law enforcement or firefighting activities. Law enforcement and firefighting activities include transport of personnel, aerial observation, and transport of equipment, water, fire retardant and supplies.
- Flight instruction, including activities, facilities, and accessory structures located at airport sites that provide education and training directly related to aeronautical activities. Flight

instruction includes ground training and aeronautic skills training, but does not include schools for flight attendants, ticket agents or similar personnel.

- Aircraft service, maintenance and training, including activities, facilities and accessory structures provided to teach aircraft service and maintenance skills; to maintain service, refuel or repair aircraft or aircraft components; and to assemble aircraft and aircraft components. "Aircraft service, maintenance and training" includes the construction and assembly of aircraft and aircraft components for personal use, but does not include activities, structures or facilities for the manufacturing of aircraft or aircraft related products for sale to the public.
- Aircraft rental, including activities, facilities and accessory structures that support the provision of aircraft for rent or lease to the public.
- Aircraft sales and the sale of aeronautic equipment and supplies, including activities, facilities and accessory structures for the storage, display, demonstration and sales of aircraft and aeronautic equipment and supplies to the public.
- Aeronautic recreational and sporting activities, including activities, facilities and accessory structures at airports that support recreational usage of aircraft and sporting activities that require the use of aircraft or other devices used and intended for use in flight. Aeronautic recreation and sporting activities include, but are not limited to, fly-ins, glider flights, hot air ballooning, ultralight aircraft flights, displays of aircraft, aeronautic flight skills contests, gyrocopter flights, flights carrying parachutists, and parachute drops onto an airport. Evidence must be submitted that the airport owner, manager, or other person designated to represent the interests of the airport has authorized the use. As used herein, parachuting and parachute drops include all forms of skydiving. Parachuting businesses are permitted only where they have secured approval to use a drop zone that is at least ten contiguous acres roughly approximating a square or circle.
- Crop dusting activities, including activities, facilities and structures accessory to crop dusting operations. Crop dusting activities include, but are not limited to, aerial application of chemicals, seed, fertilizer, defoliant and other chemicals or products used in a commercial agricultural, forestry or rangeland management setting.
- Agricultural and forestry activities, including activities, facilities and accessory structures that qualify as a "farm use" as defined in Section 105 or "farming practice" as defined in ORS 30.390.
- Air passenger and air freight services and facilities at public use airports at levels consistent with the classification and needs identified in the state Airport System Plan.
- Golf course, excluding the designated clubhouse.

- Automobile parking facilities.
- Utility and communication facilities. Approval of a wireless communication tower is also subject to the requirements of Section 427.
- Expansion or alteration of the airport that does not permit service to a larger class of airplanes.
- Personal exempt wind energy facilities.
- Small Wind Energy Systems subject to compliance with section 431 of this Ordinance.

In addition, the Jefferson County Zoning Code provides the following uses to be allowed or expanded at the Madras Municipal Airport

- Executive Hanger for temporary overnight lodging of pilots only.
- Drag Strip
- Motor Cross Track
- Gun Club
- Round Track
- Vehicular Road Testing

The following uses and their accessory uses may be allowed in the AM zone if approved by the Planning Commission after a public hearing, in accordance with the Conditional Use procedures, the airport protection procedures, the site plan review standards, and findings that the use will not create a safety hazard or otherwise limit approved airport uses.

- Expansion or alteration of the airport that will allow service to a larger class of airplanes.
- Commercial, industrial, manufacturing or other uses deemed appropriate for the area, subject to compliance with the following:
- The use is consistent with applicable provisions of the Comprehensive plan, statewide planning goals and OARs;
- The use will not create a safety hazard or otherwise limit approved airport uses;
- Adequate types and levels of facilities and services and transportation systems are available to serve the use;
- The use will not seriously interfere with existing land uses in areas surrounding the airport; and

- The use will not force a significant change in or significantly increase the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest use.

Air and Water Quality

The air quality in the area around Madras is considered quite good. There are five industrial plants, which are known to discharge particulate matter into the atmosphere. These are not known to violate current state and federal regulations. The nearest DEQ monitoring station is located in Bend (Tenneson Engineering 1990).

Campbell Creek runs through the Madras Municipal Airport Field. No other creeks are in the vicinity. As a component of the Clean Water Act, Section 303(d) requires states to develop lists of impaired waters that do not meet water quality standards. Campbell creek is not on the 303(d) list.

Wastewater and Solid Waste Treatment or Disposal

The City of Madras has a Public Facilities Plan pursuant to Oregon Administrative Rule 660-011 (Tenneson Engineering 1990).

The City of Madras provides sewer service to the airport and surrounding industrial park. Major utility lines extend along Cherry Lane and NW Airport Way, which parallels the terminal apron and hangers. The City's Wastewater Stabilization Ponds and Effluent Storage Pond are located due east of the airport, along the Madras Speedway.

Treatment and disposal of wastewater is regulated by DEQ. Wastewater treatment plants must provide a minimum of secondary treatment in most cases, and higher levels of treatment where required by DEQ in order to protect the environment. Depending on whether the effluent from a wastewater treatment plant is discharged into a receiving water body or is disposed of by reuse, DEQ issues each wastewater treatment plant a National Pollutant Discharge Elimination System (NPDES) permit or a Water Pollution Control Facility (WPCF) permit which establishes the treatment parameters to which the system must be operated. The permits are periodically renewed about every five (5) years.

The existing Madras wastewater treatment system treats raw wastewater in facultative lagoons, stores it during the winter "non-irrigation" months, and then polishes stored wastewater together with the current lagoon effluent to DEQ Level IV quality standards for spray irrigation on a nearby golf course, Desert Peaks Golf Course. Madras currently has more wastewater effluent than the Desert Peaks Golf Course can accommodate (ACE Consultants, Inc. 1996). The City has secured additional publicly owned property for the land application of this treated effluent on the east side of Madras. This land is adjacent to both the enlarged treatment and storage ponds. The City has included this management practice in its effluent management plan filed with and approved by DEQ (ACE Consultants, Inc. 1997 and Ordinance No. 781, passed by Council on December 12, 2006.

Drainage Patterns (Stormwater Issues, Stormwater Detention Ponds)

The City of Madras has developed the "Storm Drainage Capital Improvement Plan." This plan is not a definitive document but is intended to provide a basic framework for planning and establishing guidelines for future development.

At the airport, there are two stormwater detention ponds. One located across Airport Way from the new hanger and the other is located south of the most southern hanger (south of the terminal).

Several dry ditches are located in the undeveloped area of the airfield. These ditches may collect stormwater runoff during large rain events. There is no developed stormwater collection system for the runways/taxiways or apron. Development or redevelopment of these areas would require them to met current stormwater standards.

Wetlands

A wetland reconnaissance was performed at the airport on June 11, 2010, by a qualified wetland scientist. The "triple parameter" method described in the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (December 2006) was used to determine wetland presence. Prior to beginning fieldwork reference information was reviewed to provide preliminary site information regarding wetland occurrence, presence of streams or creeks, vegetation, soils, and hydrology.

The following information was reviewed:

- National Wetlands Inventory quad sheets by the U.S. Fish and Wildlife Service – The NWI map indicates three potential wetland areas and one Water of the US:
    - The first is a series of ponds indicated as PUBKx (Palustrine, Unconsolidated Bottom, Artificially flooded, excavated) that are the City of Madras Wastewater Stabilization Ponds and Effluent Storage Pond.
    - There are two other potential wetlands located to the south the Effluent Storage Pond indicated on the maps as PEMc (Palustrine Emergent, seasonally flooded) and PSSc (Palustrine Scrub-shrub, seasonally flooded).
    - Campbell Creek is also indicated to run, generally, north-south through the airport.
- County Soil Survey by USDA Soil Conservation Service – The soil survey indicates that the predominate soil type for the Madras Airport is Madras loam, with slopes of 0 to 3 percent.

The soils are relatively shallow, having a depth to hardpan of 20 to 30 inches and a depth to bedrock of 25 to 40 inches. Both the hardpan and bedrock are "rippable". Drainage varies from rapid through the surface layers to very slow through the hardpan. The soil maps also indicate springs maybe present in the area south of the Effluent Storage Pond and in Campbell Creek.

- WETS table for National Weather Service – The Madras area lies in the weather shadow of the Cascade Range, causing a semi-arid climate. The area receives only about 10 inches of precipitation annually and experiences nearly 50 inches of evaporation. The area has an average annual snowfall of about 15 inches and a growing season of 100 days. Review of the year to date precipitation data indicates that rainfall falls within the “normal rainfall year.

Wetlands are required to have a prevalence of wetland hydrology, hydric soils, and hydrophytic vegetation. Jurisdictional wetlands are determined when positive indicators of all of these three criteria are present. The wetland reconnaissance was performed when saturated conditions would have occurred in the growing season. Based on review of existing information and the field reconnaissance, wetlands maybe present along Campbell Creek and in the area south of the effluent storage pond and west of Runway 16/34. If airport activities are planned in this area, a formal wetland delineation should be conducted.

Jurisdictional wetland boundaries are subject to review and acceptance by the U.S. Army Corps of Engineers Corps (Corps) and the Oregon Department of State Lands (DSL).

Other Critical Areas

There are no known mineral and aggregate resources, energy sources, or ecological and scientific natural areas within the airport planning area (Tenneson Engineering 1997). According to the comprehensive plans of Madras and Jefferson County, there are also no wilderness areas, cultural areas, or developed recreation trails within the airport planning area.

Parks and Recreation Areas

Cove Palisades, a major Oregon State Park, lies approximately nine miles southwest of Madras. The park offers fishing, waterskiing, and camping facilities, currently, over one-half million people visit the park each year. Madras serves as the commercial center for the area.

Madras has four developed City parks. The parks include the Bike and Skate Park on H Street, Sahalee Park, Bean Park, and Crescent Park. The County’s Juniper Hill Park is also located within city limits.

Another major recreational opportunity near the airport is the Desert Peaks Golf Course, a public nine-hole golf course located south of the airport.

Agricultural Areas

The Madras soil series generally have moderately severe to severe limitation for use for tilled crops. The land is used primarily as range land and dry farming with a low yield of grain crops being produced. Agricultural uses surround the airport on the north, west and south sides. There is still an area on the east end of the airport (adjacent to Cambell Creek) that is flood irrigated.

The principal crops in the Madras area have been wheat, mint, and potatoes.

Critical Aquifer Designation Areas

The City's source of domestic water is supplied by Deschutes Valley Water District (DVWD). The City of Madras has three wells. Two of the existing wells are located near the airport, approximately 175 to 200 feet apart (Tenneson Engineering 1997).

The groundwater table occurs at an altitude of about 1,900 feet in the Madras area and is approximately 300 feet below the ground surface. It appears to have a gradient to the northwest under Agency Plains to the Deschutes River. The first groundwater can be found in a gravel layer on top of impermeable sandstone in some areas of Madras. This water may be as shallow as 18 to 20 feet below the ground surface and appears to lie in old stream beds of Willow Creek.

There are no critical aquifer designated areas at the airport in either the Jefferson County Comprehensive Plan or the City of Madras Comprehensive Plan.

The Opal Springs aquifer is the sole source of supply of domestic water for DVWD (approximately 3600 services). The artesian spring and three artesian wells are located 5 miles southwest of Culver at the bottom of the 850 foot deep Crooked River canyon, less than 150 feet from the river.

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Appendix A

APPENDIX A
LARGE AIRCRAFT FACILITY REQUIREMENTS

Introduction

Madras Municipal Airport has historically accommodated a wide variety of general aviation aircraft ranging from small single-engine aircraft to large business jets. The airport also accommodates occasional large fixed-wing military activity. The existing runway-taxiway system includes a 5,089-foot primary runway with a full length parallel taxiway. The design aircraft used for the primary runway-taxiway system is a large (maximum takeoff weight above 12,500 pounds) turboprop or business jet that is include in Aircraft Approach Category B and Airplane Design Group II (ADG II). The resulting Airport Reference Code (ARC) for the airport is B-II. As noted in the facility requirements chapter, the FAA planning standard for selection of a design aircraft is a minimum of 500 annual itinerant operations by a particular aircraft or family of similar aircraft.

Butler Aircraft Company plans to relocate its large aircraft maintenance operations to a new hangar currently being constructed at Madras Municipal Airport. According to company officials, it is anticipated that two or three large fire bomber aircraft will initially be based at Madras Municipal Airport for routine and major maintenance that is performed between flight assignments during fire season and during the off season. The company operates a fleet of Douglas DC6 and Lockheed C130 Hercules aircraft in fire response operations.

Although the level of activity associated with these aircraft is expected to remain below the FAA's activity threshold for use as design aircraft for the foreseeable future, it is recognized that there are a variety facility requirements associated with these aircraft that need to be considered over the long-term.

Table A-1 at the end of this memo summarizes the current design standards for Runway 16/34 and the parallel taxiway and the design standards associated with two large aircraft. Two figures located at the end of the memo illustrate some of the physical facility requirements associated with the large aircraft.

This summary of large aircraft facility requirements provides a broad outline of facility needs that can be used to evaluate specific upgrades that may be undertaken in the future. It is recognized that the operational needs associated with these particular aircraft are not entirely consistent with other transport category aircraft include the same design category.

For example, both the DC-6 and C130 are capable of operating on relatively unimproved airfields. The C130 is also noted for its short-field performance capabilities. By contrast, many commercial airliners included in the same design categories require significantly more improved airfield facilities. Another unique factor is that at Madras, these aircraft are generally expected to be operated below maximum design weights, which affects both pavement strength and runway length considerations.

Runway Length & Width

As noted in the facility requirements analysis, based on local conditions, the runway length required for large aircraft weighing more than 60,000 pounds is 5,870 feet. According the Butler company officials, the current length of Runway 16/34 (5,089 feet) is generally adequate for most operations. However, the existing length would likely limit takeoff weights during warmer summer months. A 201-foot extension of Runway 16/34 recommended in the facility requirements chapter to accommodate the design aircraft would also provide a nominal safety benefit for larger aircraft.

Runway 16/34 is 75 feet wide. The standard runway widths for this type of ADG III or IV aircraft are 100 and 150 feet respectively. Similar fire-related large aircraft operations are accommodated on Runway 7-25 at Portland Troutdale Airport, which is 150 feet wide and on both runways at Roberts Field (100 and 150 feet wide). As with runway length, it is anticipated that the existing width of Runway 16/34 is adequate to accommodate the anticipated use by Butler Aircraft. However, widening the runway to 100 feet would provide additional safety benefits.

Taxiway Exits

Runway 16/34 has currently has three exit taxiways, including one at each end of the runway and one exit located near the middle of the runway. Based on a preliminary review, it appears that adding a second mid-runway exit would improve the efficiency of aircraft operations, particularly for aircraft landing on Runway 34. The existing mid-runway exit taxiway is located 1,900 feet from the Runway 34 threshold. In addition to the large aircraft, many turboprops and business jets are unable to slow to the speed needed to negotiate the 90-degree exit without excessive braking or use of reverse thrust/pitch. If the mid-runway exit is missed, aircraft are required to continue the landing roll-out to the north end of the runway (approximately 3,200 feet) or execute a 180-degree turn on the runway to return to the exit taxiway. It is anticipated that placing a second mid-runway exit in the vicinity of the Butler operations area would provide a useable stopping distance and the most direct taxiing route to the facility for aircraft landing on Runway 34. The addition of second mid-runway taxiway north of the current exit will also improve efficiency and safety for all aircraft operating at the airport.

For aircraft landing on Runway 16, the existing mid-runway exit appears to be useable by the large aircraft, if upgraded. The taxiway exit is located 3,200 feet from the Runway 16 threshold. For use by large aircraft, the existing taxiway would require widening and modification to the turn geometry and an increase in pavement strength. Alternatively, a new south exit taxiway could be located approximately 4,000 feet beyond the Runway 16 threshold, which would provide an effective location and improve overall air traffic movement on the airfield.

The location of the new taxiway(s) should reflect the specific capabilities of the large aircraft since additional pavement strength and geometry consistent for use by large aircraft would be required.

Taxiway Geometry

The FAA standard for taxiway turn radius is 75 feet for ADG II aircraft; 100 feet for ADG III aircraft; and 150 feet for ADG IV aircraft. It is anticipated that the existing exit taxiways would require modification if used by large aircraft. The exit taxiways located at each end of Runway 16/34 have reverse angles that require aircraft to turn approximately 130 degrees when exiting the runway. A preliminary analysis of the turn geometry for a C130 illustrated on **Figure 4-X** illustrates that the outer edge of the taxiway and fillet would need to widened to accommodate standard turn movement.

The parallel taxiway is 35 feet wide, which was narrowed from the original 50 foot width, which still exists in fair condition. The mid-runway exit taxiway is also 35 feet wide. The standard taxiway widths for ADG III or IV aircraft are 50 and 75 feet respectively.

Pavement Strength

The large aircraft operated by Butler include the DC6 and C130, which have operating weights ranging from 55,000 (empty weights) to 155,000 pounds (maximum gross takeoff weights). These aircraft are equipped with dual wheel main landing gear configurations.

As noted in the Inventory Chapter, based on a preliminary evaluation of section data, the pavement strength for both runways and taxiway connectors have design characteristics consistent with a rating approximately 12,500 pounds for single wheel (SW) aircraft; the parallel taxiway would be rated approximately 20,000 pounds SW based on its design characteristics. The preliminary analysis suggests a need currently exists to strengthen Runway 16/34 and several taxiways based on the current design aircraft. The addition of heavier aircraft activity is expected to accelerate the need for pavement strengthening.

The facility requirements analysis recommends that all airfield pavements designed for use by the B-II design aircraft should have a SW rating of approximately 30,000 pounds, with dual wheel (DW) ratings in the 50,000 to 60,000 pound range. The ability to accommodate periodic use by heavier aircraft would be addressed in the pavement design. It may be possible to selectively build taxiways and aircraft parking areas to accommodate heavier aircraft based on the specific operational needs of those aircraft, with the remaining airfield pavements designed to accommodate the airport's overall design aircraft.

Aircraft Parking

The concrete hardstands located along the east side of the parallel taxiway will be used for large aircraft parking. Taxiway connections designed to accommodate heavier aircraft will be required to connect the parking pads to the parallel taxiway. There are seven hardstands located from the new hangar to the north end of the parallel taxiway that may be used for aircraft parking.

TABLE A-1: LARGE AIRCRAFT AIRPORT DESIGN STANDARDS SUMMARY (DIMENSIONS IN FEET)

		Douglas DC-6	**Lockheed C130**
FAA Standard	**Runway 16/34** ***Existing B-II Standards***	**Airplane Design Group III** ***A&B Aircraft Approach Visibility ≥ 3/4 mile***	**Airplane Design Group IV** ***C&D Aircraft***
Runway Length	5,089	5,870	5,870
Runway Width	75	100	100
Runway Shoulder Width	10	20	10
Runway Safety Area Width	150	300	300
Runway Safety Area Length (Beyond Runway End/Prior to Landing Threshold)	300	600	600
Obstacle Free Zone Width	400	400	400
Obstacle Free Zone Length (Beyond Runway End)	200	200	200
Object Free Area Width	500	800	800
Object Free Area Length (Beyond Runway End)	300	600	600
Primary Surface Width	500	500	1,000
Primary Surface Length (Beyond Rwy End)	200	200	200
Runway Protection Zone Length	1,000	1,000/1,700	1,700
Runway Protection Zone Inner Width	500	500	500
Runway Protection Zone Outer Width	700	700/1,010	1,010
Runway Centerline to: Parallel Taxiway/Taxilane Centerline	680 *(existing)*	300	400
Taxiway Width	35	50	75
Radius of Taxiway Turn	75	100	150
Taxiway Shoulder Width	10	20	20
Taxiway Safety Area Width	115	118	171
Taxiway Object Free Area Width	131	186	259
Taxiway Centerline to Fixed/Movable Object	65.5	65.5	65.5
Taxilane Object Free Area Width	115	162	225
Taxilane CL to Fixed/Movable Object	57.5	81	112.5

Appendix B

APPENDIX B
MADRAS MUNICIPAL AIRPORT
AIRPORT AND RUNWAY DATA

Airport elevation . . . . 2437 feet
Mean daily maximum temperature of the hottest month . . . . 86.70 F.
Maximum difference in runway centerline elevation . . . . 7 feet
Length of haul for airplanes of more than 60,000 pounds . . . . 500 miles
Dry runways

Runway Lengths Recommended for Airport Design

Small airplanes with approach speeds of less than 30 knots . . . . 370 feet
Small airplanes with approach speeds of less than 50 knots . . . . 990 feet
Small airplanes with less than 10 passenger seats
75 percent of these small airplanes . . . . 3310 feet
95 percent of these small airplanes . . . . 4050 feet
100 percent of these small airplanes . . . . 4580 feet
Small airplanes with 10 or more passenger seats . . . . 4720 feet

Large airplanes of 60,000 pounds or less
75 percent of these large airplanes at 60 percent useful load 5290 feet
75 percent of these large airplanes at 90 percent useful load 7250 feet
100 percent of these large airplanes at 60 percent useful load 6390 feet
100 percent of these large airplanes at 90 percent useful load 8980 feet

Airplanes of more than 60,000 pounds . . . . Approximately 5870 feet

REFERENCE: Chapter 2 of AC 150/5325-4A, Runway Length Requirements for Airport Design, no Changes included.

Appendix C

APPENDIX C
SECTION 418 - AIRPORT PROTECTION

418.1 Purpose

The purpose of the airport protection regulations is to reduce risks to aircraft and nearby land uses by limiting development at the ends of runways and by prohibiting structures, trees and other objects from penetrating airport imaginary surfaces, which are established in relation to airport runways and heliports in order to preserve and protect airspace for the take-off, flight pattern and descent of aircraft.

418.2 Applicability

The requirements of this section apply to proposed uses and structures within the protection zone areas shown in Sections 418.6, 418.7, 418.8 and 418.9, as follows:

A. The protection zone for the Madras City – County airport and Lake Billy Chinook airport shall be as shown and described in Sections 418.6 and 418.9.

B. The protection zone for the Ochs private airport shall be as shown and described in Sections 418.7 and 418.9;

C. The protection zone for heliports shall be as shown and described in Section 418.8.

418.3 Penetration of Imaginary Surfaces

A. Any structure that would penetrate the Approach, Transitional, Horizontal, or Conical surface of an airport or heliport is prohibited unless specifically exempted under Section 418.4 or unless:

   1. A statement from the Oregon Department of Aviation is submitted which clearly states that the proposed use or structure complies with state regulations; and

   2. A statement from the airport director or airport owner or operator is submitted verifying that the proposed use or structure will not impact aviation activities at the airport.

B. The best information available to the County (i.e., GIS and USGS topographic maps) shall be used to determine whether a structure will penetrate the Approach, Transitional, Horizontal or Conical surface. If the County cannot conclusively determine whether the structure will penetrate the surface, the owner may be required to submit the following information to assist the County in making this determination:

1. A certificate from an Oregon registered professional engineer or land surveyor which clearly states that no airspace obstruction will result from the proposed use; and

2. Either or both of the following:
   a. The maximum elevations of proposed structures based upon a survey by an Oregon registered professional engineer or land surveyor, accurate to plus or minus one foot, shown as mean sea level elevation.
   b. A map of topographic contours at two foot intervals, showing all property within 100 feet of the proposed structure for which the permit is being sought. This map shall bear the verification of an Oregon registered professional engineer or land surveyor.

418.4 Exemptions

A. For areas in the protection zone, but outside the Approach and Transition surface, where the terrain at the proposed building site is higher in elevation than the airport runway surface, buildings or structures up to 35 feet in height are permitted.

B. These regulations do not require a property owner to remove, lower, or make changes or alterations to any structure which lawfully existed prior to April 10, 2003. Such structures shall be considered nonconforming if they are in conflict with the requirements of this section. However, if the structure has had an adverse effect on air navigational safety as determined by the Oregon Department of Aviation, the property owner shall install or allow the installation of obstruction markers as deemed necessary by the Department of Aviation, so that the structure becomes more visible to pilots.

418.5 Airport Protection Regulations

The following regulations apply in the Airport Protection areas shown and described in Sections 418.6, 418.7, 418.8 and 418.9:

A. New residential development and public assembly uses are prohibited within a runway protection zone.

B. New industrial uses and the expansion of existing industrial uses are prohibited if, as part of regular operations, the use would cause emissions of smoke, dust, or steam that would obscure visibility within the airport approach corridor.

C. New sanitary landfills, sewage lagoons, sewage sludge disposal facilities and similar facilities are prohibited within 5,000 feet from any airport runway used by only piston-type aircraft, or within 10,000 feet of any airport runway used or capable of being used by turbojet aircraft. The expansion of existing landfill or sewage treatment or disposal facilities within these distances shall be permitted only upon demonstration that the facility is designed and will operate so as not to increase the likelihood of bird/aircraft collisions. Notice of any proposed expansion shall be provided to the airport sponsor, Department of Aviation and the FAA, and any approval will be accompanied by such conditions as are necessary to ensure that an increase in bird/aircraft collisions is not likely to result.

D. New water impoundments of one-quarter acre or larger are prohibited within an approach corridor and within 5,000 feet of the end of a runway. Such impoundments are also prohibited on land owned by the airport or the airport sponsor where the land is necessary for airport operations. This prohibition does not apply to:

   1. wetlands mitigation projects required for projects located within the approach corridor and within 5,000 feet of the end of the runway where it is not practicable to provide off-site mitigation;

   2. a stormwater management basin established by the airport;

   3. seaplane landing areas; or

   4. agricultural water impoundments in which the water is used directly for growing crops such as cranberries or rice.

E. Proposals for new water impoundments of one-quarter acre or larger that will be outside the approach corridor but within an airport protection area shall be reviewed under the Administrative Review procedures of Section 903.4. The proposed impoundment will be approved if evidence provided by the applicant shows that the impoundment is unlikely to result in a significant increase in hazardous movements of birds feeding, watering or roosting in the airport protection area. As used in this Section, “significant” means a level of increased flight activity by birds across approach corridors and runways that is more than incidental or occasional, considering the existing ambient levels of flight activity by birds in the vicinity. Effects of mitigation measures or conditions that could reduce safety risks and incompatibility will be considered. Any information and supporting evidence that is received that alleges a significant increase in hazardous movements of birds shall be forwarded to the FAA for review and comment prior to any final decision.

F. Radio, cellular communication, television and other similar transmission facilities and electrical transmission lines are permitted only when a statement is submitted from the Department of Aviation approving the height and location of the proposed facility.

G. No use or activity shall create electrical interference with navigational signals or radio communication between airport and aircraft; make it difficult for pilots to distinguish between airport lights and others; result in glare in the eyes of pilots using the airport; impair visibility in the vicinity of the airport; or otherwise create a hazard which may in any way endanger the landing, take-off, or maneuvering of aircraft using the airport.

418.6 Public Use Airport Protection Area

The protection area for the Madras City – County airport and Lake Billy Chinook airport shall be as described and illustrated in this section:

A. Airport Approach Zone means the land that underlies the approach surface, excluding the Runway Protection Zone.

B. Airport Imaginary Surfaces means surfaces established with relation to the airport and to each runway based on the category of each runway according to the type of approach available or planned for that runway. The slope and dimensions of the approach surface applied to each end of a runway shall be determined by the most precise approach existing or planned for that runway end.

C. Approach Surface means a surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface. An approach surface is applied to each end of each runway based upon the type of approach available or planned for that runway end.

1. The inner edge of the approach surface is the same width as the primary surface and it expands uniformly to a width of:
   a. 1,250 feet for that end of a utility runway with only visual approaches.
   b. 1,500 feet for that end of a runway other than a utility runway with only visual approaches.
   c. 2,000 feet for that end of a utility runway with a non-precision instrument approach.

d. 3,500 feet for that end of a non-precision instrument runway other than utility, having visibility minimums greater than three-fourths statute mile.
e. 4,000 feet for that end of a non-precision instrument runway, other than utility, having a non-precision instrument approach with visibility minimums as low as three-fourths statute mile.
f. 16,000 feet for precision instrument runways.

2. The approach surface extends for a horizontal distance of:
   a. 5,000 feet at a slope of 20 to 1 for all utility and visual runways.
   b. 10,000 feet at a slope of 34 to 1 for all non-precision instrument runways other than utility.
   c. 10,000 feet at a slope of 50 to 1 with an additional 40,000 feet at a slope of 40 to 1 for all precision instrument runways.

3. The outer width of an approach surface to an end of a runway will be that width prescribed in this subsection for the most precise approach existing or planned for that runway end.

D. Conical Surface means a surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

E. Horizontal Surface means a horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway of each airport and connecting the adjacent arcs by lines tangent to those arcs. The radius of each arc is:

1. 5,000 feet for all runways designated as utility or visual.

2. 10,000 feet for all other runways.

3. The radius of the arc specified for each end of a runway will have the same arithmetical value. That value will be the highest determined for either end of the runway. When a 5,000 foot arc is encompassed by tangents connecting two adjacent 10,000 foot arcs, the 5,000 foot arc shall be disregarded on the construction of the perimeter of the horizontal surface.

F. Primary Surface means a surface longitudinally centered on a runway. When the runway has a specially prepared hard surface, the primary surface extends 200 feet beyond each end of that runway; but when the runway has no specially prepared hard surface, or planned hard surface, the primary surface ends at each end of that runway. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline. The width of the primary surface of a runway will be that width prescribed in this section for the most precise approach existing or planned for either end of the runway. The width of a primary surface is:

1. 250 feet for utility runways having only visual approaches.

2. 500 feet for utility runways having non-precision approaches.

3. For other than utility runways the width is:
   a. 500 feet for visual runways having only visual approaches.
   b. 500 feet for non-precision instrument runways having visibility minimums greater than three-fourths statute mile.
   c. 1,000 feet for a non-precision instrument runway having a nonprecision instrument approach with visibility minimum as low as three-fourths of a statute mile, and for precision instrument runways.

G. Transitional Surface means those surfaces which extend upward and outward at 90 degree angles to the runway centerline and the runway centerline extended at a slope of seven (7) feet horizontally for each foot vertically from the sides of the primary and approach surfaces to the point of intersection with the horizontal and conical surfaces. Transitional surfaces for those portions of the precision approach surfaces, which project through and beyond the limits of the conical surface, extend a distance of 5,000 feet measured horizontally from the edge of the approach surface and at a 90 degree angle to the extended runway centerline.

H. Non Precision instrument runway means a runway having an existing instrument approach procedure utilizing air navigation facilities with only horizontal guidance, or area type navigation equipment, for which a straight-in nonprecision instrument approach procedure has been approved, or planned, and for which no precision approach facilities are planned, or indicated on an FAA planning document.

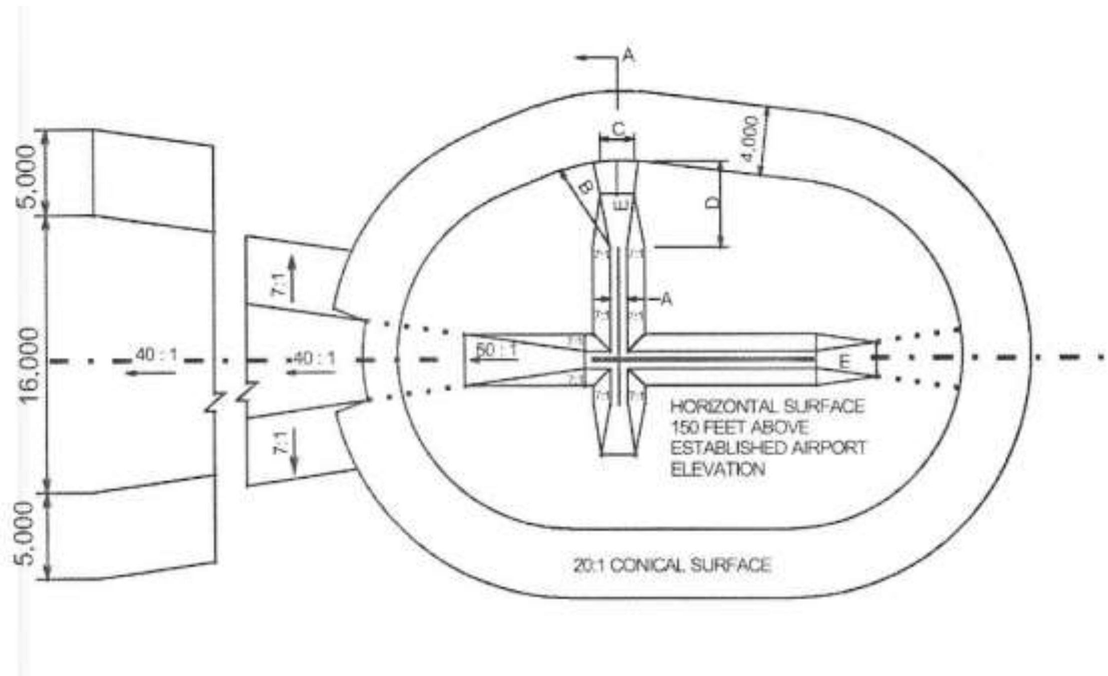
I. Precision instrument runway means a runway having an existing instrument approach procedure utilizing an instrument approach procedure utilizing an Instrument Landing System (ILS), or a Precision Approach Radar (PAR). It also means a runway for which a precision approach system is planned and is so indicated by an FAA approved airport layout plan or any other FAA planning document.

J. Runway Protection Zone (RPZ) means an area off the runway end to enhance the protection of people and property on the ground. The dimensions of the RPZ for Public-use airports shall be as depicted in attachment # 4 of these rules.

K. Utility runway means a runway that is constructed for and intended to be used by propeller driven aircraft of 12,500 maximum gross weight and less.

L. Visual runway means a runway intended solely for the operation of aircraft using visual approach procedures, with no straight-in instrument approach procedure and no instrument designation indicated on an FAA approved airport layout plan, or by any planning document submitted to the FAA by competent authority

PUBLIC USE AIRPORT PROTECTION AREA



DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:	34:1	34:1	*

A. UTILITY RUNWAYS
B. RUNWAYS LARGER THAN UTILITY
C. VISIBILITY MINIMUMS GREATER THAN ¾ MILE
D. VISIBILITY MINIMUMS AS LOW AS ¾ MILE
* PRECISION INSTURMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET

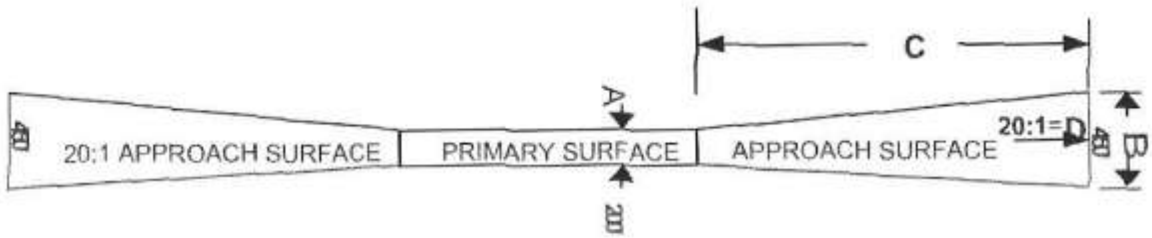
418.7 Private Use Airport Protection Area

The protection area for the Ochs private airport shall be as described and illustrated in this section:

A. Airport Imaginary Surfaces means surfaces established with relation to the airport and to each runway based on the category of each runway according to the type of approach available or planned for that runway. The slope and dimensions of the approach surface applied to each end of a runway shall be determined by the most precise approach existing or planned for that runway end.

B. Approach Surface means a surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface. An approach surface is applied to each end of each runway. The inner edge of the approach surface is the same width as the primary surface and expands uniformly to a width of 450 feet for that end of a private use airport with only visual approaches. The approach surface extends for a horizontal distance of 2,500 feet at a slope of 20 to one.

C. Primary Surface means a surface longitudinally centered on a runway. The primary surface ends at each end of the runway. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline. The width of the primary surface is 200 feet for Private Use airport runways.



Dimension	Item	Dimensional Standard
A	Width of primary surface and approach surface width at inner end	200 feet
B	Approach surface width at end	450 feet
C	Approach surface length	2,500 feet
D	Approach slope	20 to 1

418.8 Heliport Protection Areas

The protection area for heliports shall be as described and illustrated in this section:

A. Heliport means an area of land, water, or structure designated for the landing and take-off of helicopters or other rotorcraft.

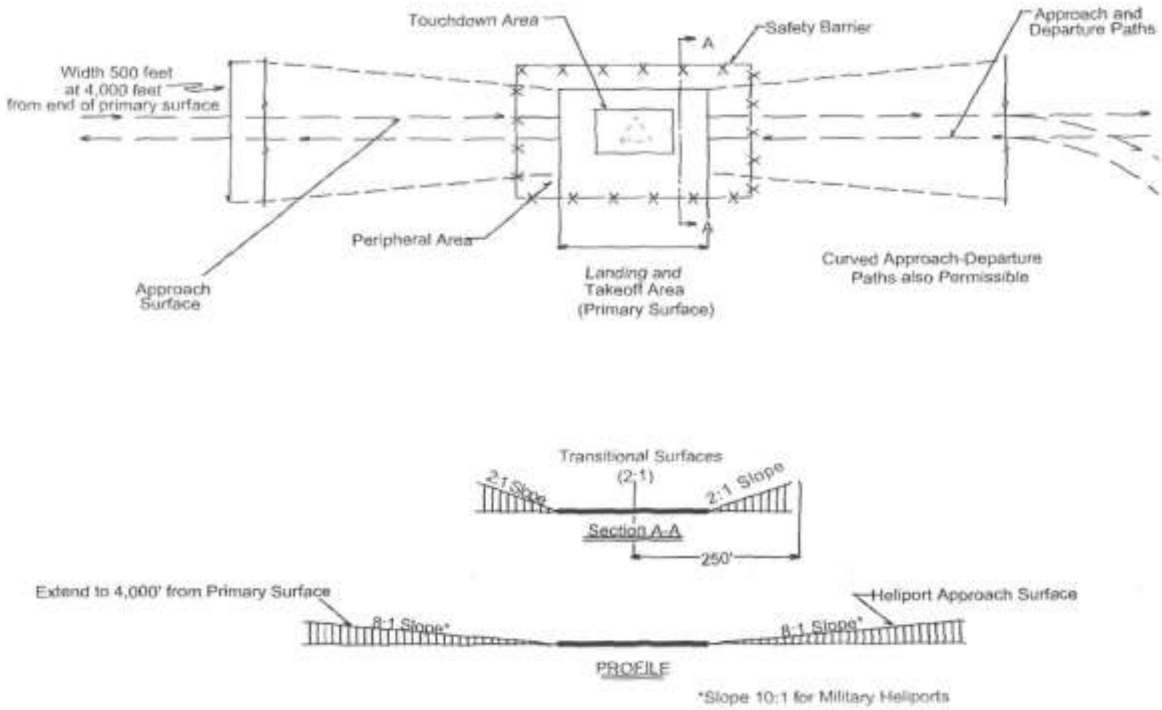
B. Heliport Imaginary Surfaces means airport imaginary surfaces as they apply to heliports.

C. Heliport Approach Surface means the approach surface beginning at each end of the heliport primary surface and has the same width as the primary surface. The surface extends outward and upward for a horizontal distance of 4,000 feet, where its width is 500 feet. The slope of the approach surface is 8 to 1 for civil heliports and 10 to 1 for military heliports.

D. Heliport Instrument Procedure Surfaces means the criteria for heliports set forth in the United States Standard for Terminal Instrument Procedures.

E. Heliport Primary Surface means the area of the primary surface that coincides in size and shape with the designated takeoff and landing area of a heliport. This surface is a horizontal plane at the established heliport elevation.

F. Heliport Transitional Surfaces means surfaces extending outward and upward from the lateral boundaries of the heliport primary surface and from the approach surfaces at a slope of 2 to 1 for a distance of 250 feet measured horizontally from the centerline of the primary and approach surfaces.



418.9 Runway Protection Areas

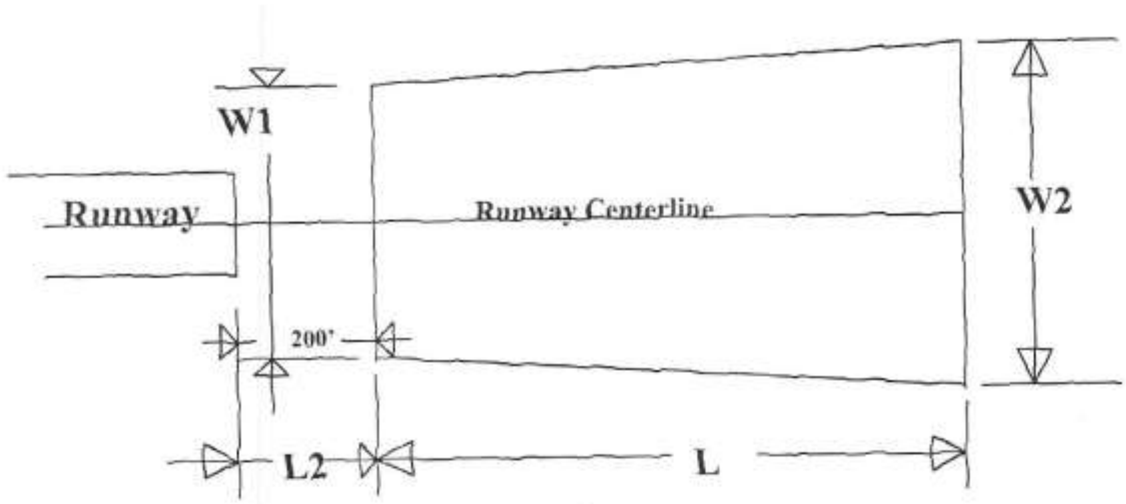
Runway protection areas, which apply to both public and private use airports, shall be as described and illustrated in this section. Runway Protection Zone (RPZ) means an area off the runway end to enhance the protection of people and property on the ground. The Runway Protection Zone is trapezoidal in shape and centered about the extended runway centerline. The RPZ dimension for a particular runway end is a function of the type of aircraft and approach visibility minimum associated for that runway end. The RPZ extends from each end of the primary surface for a horizontal distance of:

A. 1,000 feet for all utility and visual runways.

B. 1,700 feet for all non-precision instrument runways other than utility.

C. 2,500 feet for all precision instrument runways.

RUNWAY PROTECTION AREA DIMENSIONS



L2 = 200 feet for paved runways; 0' for unpaved runways.

Visibility Approach Minimums 1/	Facilities Expected To Serve	Dimensions			
		Length L Feet (meters)	Inner Width W1 Feet (meters)	Outer Width W2 Feet (meters)	RPZ Acres
Visual and Not Lower Than 1-mile (1,600 m)	Small Aircraft Exclusively	1,000 (300)	250 (75)	450 (135)	8.035
	Aircraft Approach Categories A&B	1,000 (300)	500 (150)	700 (210)	13.770
	Aircraft Approach Categories C&D	1,700 (510)	500 (150)	1,010 (303)	29.465
Not Lower than 3/4-mile (1,200m)	All Aircraft	1,700 (510)	1,000 (300)	1,510 (453)	48.978
Lower than 3/4-mile (1,200m)	All Aircraft	2,500 (750)	1,000 (300)	1,750 (525)	78.914

1/ The RPZ dimensional standards are for the runway end with the specified approach visibility minimum
Aircraft Approach Categories:
Category A: Speed less than 91 knots
Category B: Speed 91 knots or more but less than 121 knots
Category C: Speed 121 knots or more but less than 141 knots
Category D: Speed 141 knots or more but less than 166 knots

Glossary of Aviation Terms

CENTURY WEST
ENGINEERING CORPORATION

Madras Municipal Airport

GLOSSARY OF AVIATION TERMS

The following glossary of aviation terms was compiled and edited by David Miller, AICP for use in aviation planning projects.

Accelerate Stop Distance Available (ASDA) – The length of the takeoff run available plus the length of a stopway, when available.

Agricultural Aviation – The use of fixed-wing or rotor-wing aircraft in the aerial application of agricultural products (i.e., fertilizers, pesticides, etc.).

Air Cargo - All commercial air express and air freight with the exception of airmail and parcel post.

Air Carrier/Airline - All regularly scheduled airline activity performed by airlines certificated in accordance with Federal Aviation Regulations (FAR Part 121).

Air Taxi - Operations of aircraft "for hire" for specific trips, commonly referred to an aircraft available for charter (FAR Part 135).

Aircraft Approach Category - A grouping of aircraft based how fast they come in for landing. As a rule of thumb, slower approach speeds mean smaller airport dimensions and faster speeds mean larger dimensions from runway widths to the separation between runways and taxiways.

The aircraft approach categories are:

Category A - Speed less than 91 knots;

Category B - Speed 91 knots or more but less than 121 knots

Category C - Speed 121 knots or more but less than 141 knots

Category D - Speed 141 knots or more but less than 166 knots

Category E - Speed 166 knots or more

Aircraft Operation - A landing or takeoff is one operation. An aircraft that takes off and then lands creates two aircraft operations.

Aircraft Owners and Pilots Association (AOPA) – International aviation organization.

Aircraft Holding Area – An area typically located adjacent to a taxiway and runway end designed to accommodate aircraft prior to departure (for pre–takeoff engine checks, instrument flight plan clearances, etc.). Per FAA design standards, aircraft holding areas should be located outside the runway safety area (RSA) and obstacle free zone (OFZ) and aircraft located in the holding area should not interfere with normal taxiway use (taxiway object free area). Sometimes referred to as holding bays or "elephant ear." Smaller areas (aircraft turnarounds) are used to facilitate aircraft movement on runways without exit taxiways where back-taxiing is required.

Airplane Design Group - A grouping of airplanes based on wingspan. As with Approach Category, the wider the wingspan, the bigger the aircraft is, the more room it takes up for operating on an airport. The Airplane Design Groups are:

Group I:	Up to, but not including 49 feet
Group II:	49 feet up to, but not including 79 feet
Group III:	79 feet up to, but not including 118 feet
Group IV:	118 feet up to, but not including 171 feet
Group V:	171 feet up to, but not including 214 feet
Group VI:	214 feet up to, but not including 262 feet

Airport - A landing area regularly used by aircraft for receiving or discharging passengers or cargo, including heliports and seaplane bases.

Airport Improvement Program (AIP) - The funding program administered by the Federal Aviation Administration (FAA) with user fees which are dedicated to improvement of the national airport system. This program currently provides 95% of funding for eligible airport improvement projects. The local sponsor of the project (i.e., airport owner) provides the remaining 5% known as the "match."

Airport Layout Plan (ALP) - The FAA approved drawing which shows the existing and anticipated layout of an airport for the next 20 years or so. An ALP is prepared using FAA design standards.

Airport Reference Code (ARC) - An FAA airport coding system. The system looks at the types of aircraft which use an airport most often and then based upon the characteristics of those airplanes (approach speed and wing span), assigns a code. The code is then used to determine how the airport is designed and what design standards are used. An airport designed for a Piper Cub (an aircraft in the A-I approach/design group) would take less room than a Boeing 747 (an aircraft in the D-V approach/design group).

Airport Reference Point (ARP) – The approximate mid-point of an airfield that is designated as the official airport location.

Airports District Office (ADO) - The "local" office of the FAA that coordinates planning and construction projects. Staff in the ADO is typically assigned to a particular state, i.e., Oregon, Idaho, or Washington. The ADO for Oregon, Washington and Idaho is located in Renton, Washington.

Airspace - The area above the ground in which aircraft travel. It is divided into corridors, routes, and restricted zones for the control and safety of traffic.

Alternate Airport – An airport that is available for landing when the intended airport becomes unavailable. Required for instrument flight planning in the event that weather conditions at destination airport fall below approach minimums (cloud ceiling or visibility).

Annual Service Volume (ASV) - An estimate of how many airplanes and airport can handle based upon the number and types of runways, the aircraft mix (large vs. small, etc), and weather conditions with a “reasonable” amount of delay. ASV is a primary planning standard used to determine when a runway (or an airport) is nearing its capacity, and may require new runways or taxiways. As operations levels approach ASV, the amount of delay per operation increases; once ASV is exceeded, “excessive” delay generally exists.

Approach End of Runway - The end of the runway used for landing. Pilots generally land into the wind and choose a runway end that best aligns with the wind.

Approach Surface - Also FAR Part 77 Approach or Obstacle Clearance Approach - An imaginary (invisible) surface which rises off the ends of a runway which must be kept clear to provide airspace for an airplane to land or take off in. The size of the approach surface will vary depending upon how big and how fast the airplanes are, and whether or not the runway has an instrument approach for landing in bad weather.

Apron - An area on an airport designated for the parking, loading, fueling, or servicing of aircraft (also referred to as tarmac and ramp).

ARFF - Aircraft Rescue and Fire Fighting, i.e., an on airport response required for certificated commercial service airports (see FAR Part 139).

Automated Surface Observation System (ASOS) and Automated Weather Observation System (AWOS) – Automated observation systems providing continuous on-site weather data, designed to support aviation activities and weather forecasting.

AVGAS - Gasoline used in airplanes with piston engines.

Avigation Easement - A form of limited property right purchase that establishes legal land use control prohibiting incompatible development of areas required for airports or airport-related purposes.

Back-Taxiing – The practice of aircraft taxiing on a runway before takeoff or after landing, normally, in the opposite direction of the runway's traffic pattern. Back-taxiing is generally required on runways without taxiway access to both runway ends.

Based Aircraft - Aircraft stationed at an airport on an annual basis. Used as a measure of activity at an airport.

Capacity - A measure of the maximum number of aircraft operations that can be accommodated on the runways of an airport in an hour.

Ceiling – The height above the ground or water to base of the lowest cloud layers covering more than 50 percent of the sky.

Charter - Operations of aircraft "for hire" for specific trips, commonly referred to an aircraft available for charter.

Circle to Land or Circling Approach – An instrument approach procedure that allows pilots to "circle" the airfield to land on any authorized runway once visual contact with the runway environment is established and maintained throughout the procedure.

Common Traffic Advisory Frequency (CTAF) – A frequency used by pilots to communicate and obtain airport advisories at an uncontrolled airport.

Conical Surface - One of the "FAR Part 77 "Imaginary" Surfaces. The conical surface extends outward and upward from the edge of the horizontal surface at a slope of 20:1 to a horizontal distance of 4,000 feet.

Critical Aircraft - Aircraft which controls one or more design items based on wingspan, approach speed and/or maximum certificated take off weight. The same aircraft may not be critical to all design items.

Crosswind - When used concerning wind conditions, the word means a wind not parallel to the runway or the path of an aircraft. Sometimes used in reference to a runway as in "Runway 7/25 is the crosswind runway" meaning that it is not the runway normally used for the prevailing wind condition. As an aeronautical term, a direct crosswind is exactly 90-degrees opposite the direction of flight; more acute crosswind angles are known as quartering headwinds or tailwinds. From an airport planning perspective, crosswind runways are generally justified when a primary runway accommodates less than 95 percent of documented wind conditions (see wind rose).

Crosswind Runway – A secondary runway that is oriented to allow aircraft to safely take off or land when wind conditions do not favor the primary runway.

Decision Height (DH) – For precision instrument approaches, the height (typically in feet or meters above runway end touchdown zone elevation) at which a decision to land or execute a missed approach must be made by the pilot.

Departure Surface – A surface that extends upward from the departure end of an instrument runway that should be free of any obstacle penetrations. For instrument runways other than air carrier, the slope is 40:1, extending 10,200 feet from the runway end. Air carrier runways have a similar surface designed for one-engine inoperative conditions with a slope of 62.5: 1.

Displaced Threshold – A landing threshold that is located at a point other than the runway end. Usually provided to mitigate close-in obstructions to runway approaches for landing aircraft.

DNL - Day-night sound levels, a method of measuring noise exposure.

Easement – An agreement that provides use or access of land or airspace (see avigation easement) in exchange for compensation.

Enplanements - Domestic, territorial, and international revenue passengers who board an aircraft in the states in scheduled and non-scheduled service of aircraft in intrastate, interstate, and foreign commerce and includes intransit passengers (passengers on board international flights that transit an airport in the US for non-traffic purposes).

Entitlements - Distribution of Airport Improvement Plan (AIP) funds from the Airport & Airways Trust Fund to commercial service airport sponsors based on enplanements or cargo landed weights. Also, Non-Primary General Aviation Entitlements now incorporated in AIP funding for general aviation airports.

Federal Aviation Administration (FAA) - The FAA is the branch of the U.S. Department of Transportation that is responsible for the development of airports and air navigation systems.

FAR Part 77 - Federal Aviation Regulations which establish standards for determining obstructions in navigable airspace. FAR stands for Federal Aviation Regulations, Part 77 refers to the section in the regulations, i.e., #77. FAR Part 77 is commonly used to refer to imaginary surfaces, the primary, transitional, horizontal, conical, and approach surfaces. These surfaces vary with the size and type of airport.

FAR Part 139 - Federal Aviation Regulations which establish standards for airports with scheduled passenger commercial air service. Airports accommodating scheduled passenger service with aircraft more than 9 passenger seats must be certified as a "Part 139" airport. Airports that are not certified under Part 139 may accommodate scheduled commercial passenger service with aircraft having 9 passenger seats or less.

Final Approach Fix (FAF) – The fix (location) from which the final instrument approach to an airport is executed; also identifies beginning of final approach segment.

Final Approach Point (FAP) – For non-precision instrument approaches, the point at which an aircraft is established inbound for the approach and where the final descent may begin.

Fixed Base Operator (FBO) - An individual or company located at an airport providing aviation services. Sometimes further defined as a "full service" FBO or a limited service. Full service FBOs typically provide a broad range of services (flight instruction, aircraft rental, charter, fueling, repair, etc) where a limited service FBO provides only one or two services (such as fueling, flight instruction or repair).

Fixed Wing - A plane with one or more "fixed wings," as opposed to a helicopter that utilizes a rotary wing.

Flexible Pavement – Typically constructed with an asphalt surface course and one or more layers of base and subbase courses that rest on a subgrade layer.

Flight Service Station (**FSS) -** An office where a pilot can call (on the ground or in the air) to get weather and airport information. Flight plans are also filed with the FSS.

General Aviation (GA) - All civil (non-military) aviation operations other than scheduled air services and non-scheduled air transport operations for hire.

Glide Slope (GS) – For precision instrument approaches, such as an instrument landing system (ILS), the component that provides electronic vertical guidance to aircraft. Visual guidance indicators (VGI) define a glide slope (glide path) through a series of colored lights that are visible to pilots when approaching a runway end for landing.

Global Positioning System (GPS) - GPS is a system of navigating which uses satellites (SATNAV) to establish the location and altitude of an aircraft. GPS supports both enroute flight and instrument approach procedures.

Helicopter Landing Pad (Helipad) – A designated landing area for rotor wing aircraft. Requires protected FAR Part 77 imaginary surfaces, as defined for heliports (FAR Part 77.29).

Helicopter Parking Area – A designated area for rotor wing aircraft parking that is typically accessed via hover-taxi or ground taxiing from a designated landing area (e.g., helipad or runway-taxiway system). If not used as a designated landing area, helicopter parking pads do not require dedicated FAR Part 77 imaginary surfaces.

Heliport – A designated helicopter landing facility (as defined by FAR Part 77).

Height Above Airport (HAA) – The height of the published minimum descent altitude (MDA) above the published airport elevation. This is normally published in conjunction with circling minimums.

High Intensity Runway Lights (HIRL) - High intensity (i.e., very bright) lights are used on instrument runways where landings are made in foggy weather. The bright runway lights help pilots to see the runway when visibility is poor.

High Speed (Taxiway) Exit – An acute-angled exit taxiway extending from a runway to an adjacent parallel taxiway which allows landing aircraft to exit the runway at a higher rate of speed than is possible with standard (90-degree) exit taxiways.

Hold/Holding Procedure – A defined maneuver in controlled airspace that allows aircraft to circle above a fixed point (often over a navigational aid or GPS waypoint) and altitude while awaiting further clearance from air traffic control.

Home Built Aircraft - An aircraft built by an amateur; not an FAA Certified factory built aircraft.

Horizontal Surface - One of the FAR Part 77 Imaginary (invisible) Surfaces. The horizontal surface is an imaginary flat surface 150 feet above the established airport elevation. Its perimeter is constructed by swinging arcs (circles) with a radius of 5,000 feet for all runways designated as utility or general; and 10,000 feet for all other runways from the center of each end of the primary surface and connecting the adjacent arc by straight lines. The resulting shape looks like a football stadium. It could also be described as a rectangle with half circles on each end with the runway in the middle.

Initial Approach Point of Fix (IAP/IAF) – For instrument approaches, a designated point where an aircraft may begin the approach procedure.

Instrument Approach Procedure (IAP) – A series of defined maneuvers designed to enable the safe transition between enroute instrument flight and landing under instrument flight conditions at a particular airport or heliport. IAPs define specific requirements for aircraft altitude, course, and missed approach procedures. See precision or nonprecision instrument approach.

Instrument Flight Rules (IFR) - IFR refers to the set of rules pilots must follow when they are flying in bad weather. Pilots are required to follow these rules when operating in controlled airspace with visibility (ability to see in front of themselves) of less than three miles and/or ceiling (a layer of clouds) lower than 1,000 feet.

Instrument Landing System (ILS) - An ILS is a system used to guide a plane in for a landing in bad weather. Sometimes referred to as a precision instrument approach, it is m designed to provide an exact approach path for alignment and descent of aircraft. Generally consists of a localizer, glide slope, outer marker, middle marker, and approach lights. This type of precision instrument system is being replaced by Microwave Landing Systems (MLS).

Instrument Meteorological Conditions (IMC) - Meteorological conditions expressed in terms of visibility, distance from clouds, and ceiling less than minima specified for visual meteorological conditions.

Instrument Runway - A runway equipped with electronic and visual navigational aids that has been designated for a straight-in precision or nonprecision instrument approach.

Itinerant Operation - All aircraft operations at an airport other than local, i.e., flights that come in from another airport.

Jet Fuel – Highly refined grade of kerosene used by turbine engine aircraft. Jet-A is currently the common commercial grade of jet fuel.

Landing Area - That part of the movement area intended for the landing and takeoff of aircraft.

Landing Distance Available (LDA) – The length of runway which is available and suitable for the ground run of an airplane landing.

Left Traffic – A term used to describe which side of a runway the airport traffic pattern is located. Left traffic indicates that the runway will be to the pilot's left when in the traffic pattern. Left traffic is standard unless otherwise noted in facility directories at a particular airport.

Large Aircraft - An aircraft that weighs more than 12,500 lbs.

Local Area Augmentation System (LAAS) – GPS-based instrument approach that utilizes ground-based systems to augment satellite coverage to provide vertical (glideslope) and horizontal (course) guidance. LAAS approaches have the technical capabilities to provide approach minimums comparable to a Category I and II instrument landing system (ILS). The FAA indicates that a LAAS system can support approaches to multiple runways and potentially multiple airports within a range of approximately 30 nautical miles.

Local Operation - Aircraft operation in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from flight in local practice areas, or aircraft executing practice instrument approaches at the airport.

Localizer – For precision instrument approaches, such as an instrument landing system (ILS), the component that provides electronic lateral (course) guidance to aircraft.

LORAN C - A navigation system using land based radio signals, which indicates position and ground speed, but not elevation. (See GPS)

Localizer Performance with Vertical Guidance (LPV) – Satellite navigation (SATNAV) based GPS approaches providing "near category I" precisions approach capabilities with course and vertical guidance LPV approaches are expected to eventually replace traditional step- down, VOR and NDB procedures by providing a constant, ILS glideslope-like descent path. LPV approaches use high-accuracy WAAS signals, which allows narrower glideslope and approach centerline obstacle clearance areas, safely providing decision altitudes as low as 250 feet, compared with 200 feet for ILS.

Magnetic Declination – Also called magnetic variation, is the angle between magnetic north and true north. Declination is considered positive east of true north and negative when west. Magnetic declination changes over time and with location. Runway end numbers, which reflect the magnetic heading/alignment (within 5 degrees +/-) occasionally require change due to declination.

MALSR - **M**edium-intensity **A**pproach **L**ighting **S**ystem with **R**unway alignment indicator lights. An airport lighting facility which provides visual guidance to landing aircraft.

Medevac - Fixed wing or rotor-wing aircraft used to transport critical medical patients. These aircraft are equipped to provide life support during transport.

Medium Intensity Runway Lights (MIRL) - Runway lights which are not as intense as HIRLs (high intensity runway lights). Typical at medium and smaller airports which do not have sophisticated instrument landing systems.

Microwave Landing System (MLS) - An instrument landing system operating in the microwave spectrum, which provides lateral and vertical guidance to aircraft with compatible equipment. It was touted as the replacement for the ILS but never achieved this status.

Minimum Descent Altitude (MDA) – The lowest altitude in a nonprecision instrument approach that an aircraft may descend without establishing visual contact with the runway or airport environment.

Minimums - Weather condition requirements established for a particular operation or type of operation.

Missed Approach – A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing.

Missed Approach Point (MAP) – The defined location in a nonprecision instrument approach where the procedure must be terminated if the pilot has not visually established the runway or airport environment.

Movement Area - The runways, taxiways and other areas of the airport used for taxiing, takeoff and landing of aircraft, i.e., for aircraft movement.

MSL - Elevation above Mean Sea Level.

National Plan of Integrated Airport Systems (NPIAS). The NPIAS is the federal airport classification system that includes public use airports that meet specific eligibility and activity criteria. A “NPIAS designation” is required for an airport to be eligible to receive FAA funding for airport projects.

Navigational Aid (Navaid) - Any visual or electronic device that helps a pilot navigate. Can be for use to land at an airport or for traveling from point A to point B.

Noise Contours – Continuous lines of equal noise level usually drawn around a noise source, such as runway, highway or railway. The lines are generally plotted in 5-decibel increments, with higher noise levels located nearer the noise source, and lesser exposure levels extending away from the source.

Non-directional Beacon (NDB) - Non-Directional Beacon which transmits a signal on which a pilot may "home" using equipment installed in the aircraft.

Non-Precision Instrument (NPI) Approach - A non-precision instrument approach provides horizontal (course) guidance to pilots for landing. NPI approaches often involve a series of “step down” sequences where aircraft descend in increments (based on terrain clearance), rather than following a continuous glide path. The pilot is responsible for maintaining altitude control between approach segments since no "vertical" guidance is provided.

Obstacle Clearance Surface (OCS) – As defined by FAA, an approach surface that is used in conjunction with alternative threshold siting/clearing criteria to mitigate obstructions within runway approach surfaces. Dimensions, slope and placement depend on runway type and approach capabilities. Also know as Obstacle Clearance Approach (OCA).

Obstruction - An object (tree, house, road, phone pole, etc) that penetrates an imaginary surface described in FAR Part 77.

Obstruction Chart (OC) - A chart that depicts surveyed obstructions that penetrate an FAR Part 77 imaginary surface surrounding an airport. OC charts are developed by the National Ocean Service (NOS) based on a comprehensive survey that provides detailed location (latitude/longitude coordinates) and elevation data in addition to critical airfield data.

Parallel Taxiway – A taxiway that is aligned parallel to a runway, with connecting taxiways to allow efficient movement of aircraft between the runway and taxiway. The parallel taxiway effectively separates taxiing aircraft from arriving and departing aircraft located on the runway. Used to increase runway capacity and improve safety.

Passenger Facility Charge (PFC) – A user fee charged by public agencies controlling a commercial service airport can charge enplaning passengers a fee facility charge. Public agencies must apply to the FAA and meet certain requirements in order to impose a PFC.

Precision Approach Path Indicator (PAPI) - A system of lights located by the approach end of a runway that provides visual approach slope guidance to aircraft during approach to landing. The lights typically show green if a pilot is on the correct flight path, and turn red of a pilot is too low.

Precision Instrument Runway (PIR) - A runway served by a "precision" instrument approach landing system. The precision landing systems allows property equipped airplanes and trained pilots to land in bad weather.

Precision Instrument Approach - A precision instrument approach is a system which helps guide pilots in for a landing in thick fog and provides "precise" guidance as opposed to a non-precision approach that is less precise.

Primary Runway - That runway which provides the best wind coverage, etc., and receives the most usage at the airport.

Primary Surface - One of the FAR Part 77 Imaginary Surfaces, the primary surface is centered on top of the runway and extends 200 feet beyond each end. The width is from 250' to 1,000' wide depending upon the type of airplanes using the runway.

Procedure Turn (PT) - A maneuver in which a turn is made away from a designated track followed by a turn in an opposite direction to permit an aircraft to intercept the track in the opposite direction (usually inbound).

Relocated Threshold – A runway threshold (takeoff and landing point) that is located at a point other than the runway end. Usually provided to mitigate nonstandard runway safety area (RSA) dimensions beyond the end of a runway.

Rigid Pavement – Typically constructed of Portland cement concrete (PCC), consisting of a slab placed on a prepared layer of imported materials.

Rotorcraft - A helicopter.

Runway – A defined area intended to accommodate aircraft takeoff and landing. Runways may be paved (asphalt or concrete) or unpaved (gravel, turf, dirt, etc.), depending on use. Water runways are defined takeoff and landing areas for use by seaplanes.

Runway End Identifier Lights (**REILs)** - These are distinctive flashing lights that help a pilot identify the runway.

Runway Object Free Area (OFA) – A defined area surrounding a runway that should be free of any obstructions that could in interfere with aircraft operations. The dimensions for the OFA increase for runways accommodating larger or faster aircraft.

Runway Protection Zone (RPZ) - An area off the end of the runway that is intended to be clear in case an aircraft lands short of the runway. The size is small for airports serving only small airplanes and gets bigger for airports serving large airplanes. The RPZ used to be known as a clear zone – which was a good descriptive term because you wanted to keep it clear.

Runway Safety Area (RSA) – A prepared ground area surrounding a runway that is intended to accommodate inadvertent aircraft passage without causing damage. The dimensions for the RSA increase for runways accommodating larger or faster aircraft.

Segmented Circle - A system of visual indicators designed to show a pilot in the air the direction of the traffic pattern at that airport.

Small Aircraft - An aircraft that weighs less than 12,500 lbs.

Straight-In Approach – An instrument approach that directs aircraft to a specific runway end.

Stop and Go – An aircraft operation where the aircraft lands and comes to a full stop on the runway before takeoff is initiated.

T-Hangar – A rectangular aircraft storage hangar with several interlocking "T" units that minimizes building per storage unit. Usually two-sided with either bi-fold or sliding doors.

Takeoff Distance Available (TODA) – the length of the takeoff run available plus the length of clearway, if available.

Takeoff Run Available (TORA) – the length of runway available and suitable for the ground run of aircraft when taking off.

Threshold – The beginning of that portion of a runway that is useable for landing.

Tiedown - A place where an aircraft is parked and "tied down." Surface can be grass, gravel or paved.

Touch and Go – An aircraft operation involving a landing followed by a takeoff without the aircraft coming to a full stop or exiting the runway.

Traffic Pattern - The flow of traffic that is prescribed for aircraft landing and taking off from an airport. Traffic patterns are typically rectangular in shape, with upwind, crosswind, base and downwind legs and a final approach surrounding a runway.

Transitional Surfaces - One of the FAR Part 77 Imaginary Surfaces, the transitional surface extend outward and upward at right angles to the runway centerline and the extended runway centerline at a slope of 7:1 from the sides of the primary surface and from the sides of the approach surfaces.

Transport Airport - An airport designed and constructed to serve large commercial airliners. Portland International and SEATAC are good examples of transport airports.

Utility Airport - An airport designed and constructed to serve small planes. Aurora State Airport in Oregon, Nampa Airport in Idaho, or Arlington Airport in Washington are examples of utility airports.

Vertical Navigation (VNAV) – Vertical navigation descent data or descent path, typically associated with published GPS instrument approaches. The use of any VNAV approach technique requires operator approval, certified VNAV-capable avionics, and flight crew training.

Visual Approach Slope Indicator (VASI) - A system of lights located by the approach end of a runway which provides visual approach slope guidance to aircraft during approach to landing. The lights typically show some combination of green and white if a pilot is on the correct flight path, and turn red of a pilot is too low.

Visual Flight Rules (VFR) - Rules that govern the procedures to conducting flight under visual conditions. The term is also used in the US to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

Visual Guidance Indicator (VGI) – Equipment designed to provide visual guidance for pilots for landing through the use of different color light beams. Visual Approach Slope Indicators (VASI) and Precision Approach Path Indicators (PAPI) defined above are examples.

Waypoint – A specified geographical location used to define an area navigation route or the flight path of an aircraft employing area navigation.

Wide Area Augmentation System (WAAS) – GPS-based instrument approach that can provide both vertical (glideslope) and horizontal (course) guidance. WAAS-GPS approaches have the technical capabilities to provide approach minimums nearly comparable to a Category I instrument landing system (ILS).

Wind Rose - A diagram indicating the prevalence of winds from various directions in relation to existing or proposed runway alignments.