Federated States of Micronesia

Department of Transportation,
Communication and Infrastructure

Kosrae International Airport

Final

Master Plan

JUNE 2012

KOSRAE

LEO A DALY

PLANNING ARCHITECTURE ENGINEERING INTERIORS

Table of Contents

FIGURES

TABLES

Acronyms

ACHP	Advisory Council on Historic Preservation
AFIS	Aeronautical/Aerodrome Flight Information Service
AGL	Above Ground Level
AIP	Airport Improvement Program
ALP	Airport Layout Plan
AMP	Airport Master Plan
APA	Asia Pacific Airlines
ARC	Airport Reference Code
ARFF	Aircraft Rescue and Fire Fighting
ARP	Airport Reference Point
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CIP	Capital Improvement Program
CTAF	Common Traffic Advisory Frequency
DME	Distance Measuring Equipment
DOI	United States Department of Interior
DRC	Development Review Commission
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMAS	Engineered Materials Arresting System
EOC	Emergency Operations Center
ESA	Endangered Species Act
FAA	United States Federal Aviation Administration
FAR	Federal Aviation Regulations
FSM	Federated States of Micronesia
GRT	Gross Register Tonnage
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rule
ILS	Instrument Landing System
KSA	Kosrae International Airport
KUA	Kosrae Utility Authority
MIRL	Medium Intensity Runway Lights
MPC	Micronesia Petroleum Corporation
MSL	Mean Sea Level

MTOW	Maximum Takeoff Design Weight
NAVAIDS	Navigational Aids
NDB	Non-directional Beacon
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Association
NPIAS	National Plan of Integrated Airport Systems
NRHP	National Register of Historic Places
PAPI	Precision Approach Path Indicator
PCC	Portland Cement Concrete
PVC	Poor Visibility and Ceiling
REILs	Runway End Identifier Lights
ROM	Rough Order of Magnitude
RPZ	Runway Protection Zone
RSA	Runway Safety Area
SHPO	State Historic Preservation Officer
TSA	Transportation Security Administration (US Dept. of Homeland Security)
USDA	United States Department of Agriculture
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rule
VISAIDS	Visual Aids
VOR	Omnidirectional Range

CHAPTER 1: INTRODUCTION

1.1 PURPOSE OF THE MASTER PLAN

The Federated States of Micronesia (FSM) retained LEO A DALY to develop the Kosrae International Airport Master Plan and to identify potential and evaluate necessary improvements to the existing airfield and terminal facilities. These facility improvements are in response to the projected growth of tourism affecting Kosrae and associated future growth in aviation activities.

The Master Plan establishes a developmental approach to respond to current conditions and includes appropriate conceptual plans to assist the Federated States of Micronesia (FSM) with implementing technically sound programs for the short and long term development of Kosrae International Airport. Principal concerns are to:

- Enhance the safety of aircraft operations
- Be reflective of community and regional goals, needs, and policies
- Ensure that future development is environmentally compatible
- Prioritize development and improvements that are consistent with the master plan
- Develop a plan that is responsive to air transportation needs and expectations
- Develop an orderly plan for use of the airport
- Coordinate this master plan with local, regional, state, and federal agencies objectives
- Develop active and productive public involvement throughout the planning process.

1.2 SCOPE OF THE MASTER PLAN

The airport master plan can be thought of as a flight map into the future. The FAA methodology is followed for the core elements of the master plan, as this has been a reliable method to identify existing and forecasted conditions and aids in identifying the various facility upgrades that will be needed to address the specific needs of the airport. In addition to a flight map, the master plan can be used successfully as a funding document. In other words, funding agencies, whether they are government, commercial, or private, typically require that the projects are evaluated and approved by an official, responsible authority. Thus, the master plan that is approved by the FAA can additionally serve the airport by providing formal justification to various funding agencies and facilitate the securing of funding for the important capital improvements recommended in the planning document.

1.3 SCOPE OF PROJECT WORK

The following tasks represent the core elements of the master plan. These are the typical elements called for in all FAA funded master plans and master plan updates.

1.3.1 Existing Conditions/Inventory

Collect and assess all relevant information, historical and current, to evaluate existing facilities and equipment and to form the factual baseline for an informed judgment about the airport and its environment.

1.3.2 Aviation Forecasts

Utilize the most current information available to develop a reasonable aviation forecast for a 20 year planning horizon with five and ten year milestones. Basis of forecasts will be customized to reflect the unique nature of Kosrae's projected growth rather than the population/business growth model applied to mainland US airports. FAA approval for this unique modeling/forecasting effort will be obtained.

1.3.3 Airport Operations

Aviation forecasts for Kosrae will consider numerous factors and will ultimately be expressed in passenger counts to the island. Once the forecasting methodology and anticipated rates of growth have been reviewed and approved by the Federated States of Micronesia and FAA, this data is converted into peak hour demand so that FAA formulae can be used accurately to determine capacity of airside, landside and terminal facilities. Converting forecast data into peak hour operations involves estimates of airline aircraft mix--both current and future. Discussions will be held with the various airlines to best estimate their future aircraft mix.

1.3.4 Demand/Capacity Analysis

This analysis is a key element of the master plan process. Essentially, existing and anticipated levels of activity (demand) will be assessed to determine the facility's ability to handle the demand (capacity). Three separate analyses will be done:

- Airside demand/capacity
- Landside/access demand/capacity

- Terminal facility demand/capacity

These analyses are useful tools that give an indication of which facilities will need upgrading to serve the projected level of activity, and when those facilities need to come on line.

FAA has mathematical models and formulae to guide the efforts for airside capacity and terminal capacity. The landside demand/capacity analysis is less well defined, but this will be supplemented with accepted standards for roadway/access capacity to provide an accurate overall picture of the airport's present and future needs.

1.3.5 Land Use Planning

Review of present airport land use, identification of airport property, and alternate development schemes for aviation related developments on and near airport property will be incorporated within this task. Conducting "think-tank" sessions with airport officials and stakeholders will be encouraged to maximize community participation and help to get the best conceptual ideas going forward.

1.3.6 Utilities Survey

Existing utilities serving the airport will be inventoried and an overall utility plan will be developed for planning purposes. Fuel farms and fuel distribution networks to apron areas will also be included in this effort. Needs for future upgrades will be identified for all appropriate utilities.

1.3.7 Environmental Impacts

For the various land use ideas and for various facility upgrades, environmental impacts will be discussed and rough mitigation guidelines provided to ensure development is implemented in an environmentally responsible manner.

1.3.8 Capital Improvement Program/Facility Requirements Plan

A Facilities Requirement Plan will be developed to provide a comprehensive implementation plan over the twenty-year planning horizon with five and ten years milestones. This plan will identify the recommended capital improvements and when they are anticipated. Rough Order of Magnitude (ROM) budget estimates will be provided for each capital improvement project.

1.3.9 Airport Layout Plan Drawing Set

The Airport Layout Plan (ALP) will be updated to illustrate existing and future developments. The new FAA criteria for ALPs will be followed and will include the various airspace drawings required per the FAA advisory circulars.

1.4 FEDERAL AND LOCAL APPROVAL

The preparation of this master plan is based upon guidelines established by the U.S. Department of Transportation, FAA Advisory Circular AC 150/5070, Airport Master Plans. Preparation of airport layout plans and identification of significant planning data are based on FAA Advisory Circular AC150/5360-9, Planning and Design of Airport Terminal Facilities at Nonhub Locations.

The work for this Master Plan is supported by AIP Grant Project No.3-64-0000-01 and is sponsored by the Federated States of Micronesia in accordance with the terms and conditions of a Grant Agreement under the Airport and Airway Improvement Act as amended by the Airport and Airways Safety Expansion Act of 1987, and the regulations of the FAA.

CHAPTER 2: INVENTORY

2.1 GENERAL BACKGROUND

This planning project is for Kosrae International Airport (KSA). The airport is situated on the Island of Kosrae, which is the only island included in the State of Kosrae.

Kosrae State is the eastern-most of the four states in the Federated States of Micronesia (FSM), located in the North Pacific Ocean 370 miles (590 km) north of the equator between Guam and the Hawaiian Islands. The FSM is a sovereign nation in free association with the United States. Its geographic coordinates are approximately 5 degrees north latitude and 163 degrees east longitude. With an area of 42.3 square miles, Kosrae is the second largest single island in the FSM (after Pohnpei). It is the southeastern-most state of the FSM and is made up of 5 municipalities: Lelu, Malem, Utwe, Walung, and Tafunsak.

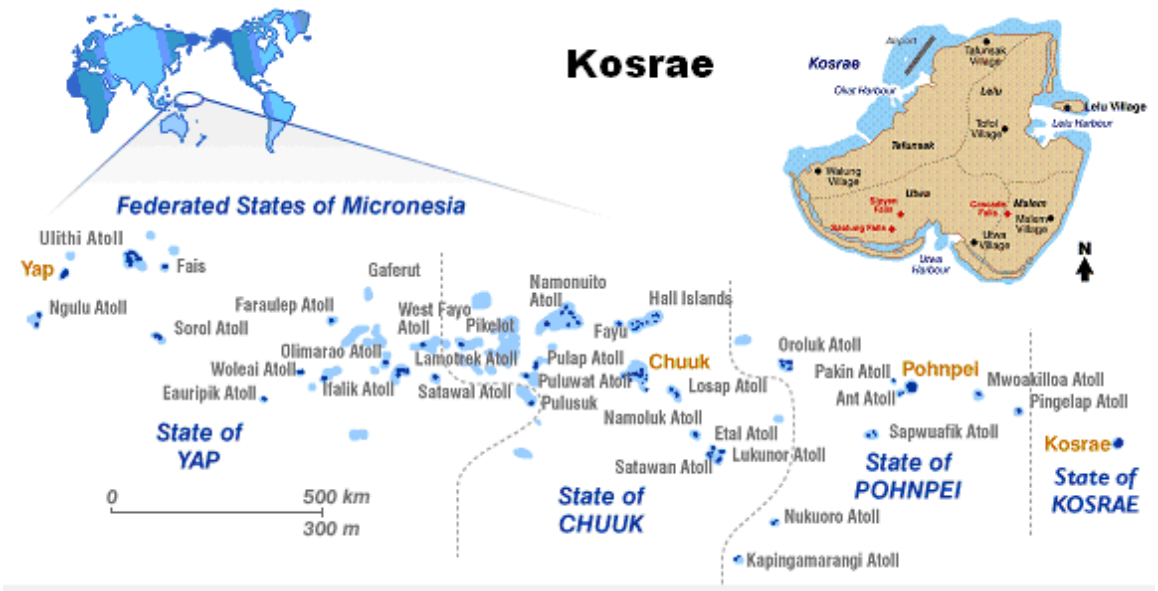


Figure 2-1. Map of the Federated States of Micronesia

Kosrae is known for its amazing dive sites. The waters surrounding Kosrae have great visibility and the reefs are populated with countless fish, sea turtles, and bottlenose dolphins.

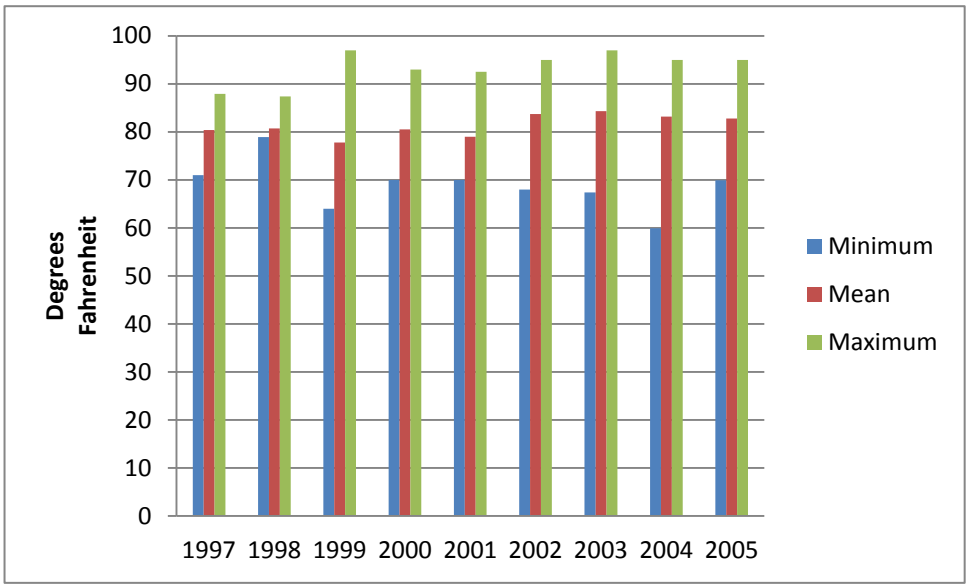
Figure 2-2. Map of Kosrae

2.2 AIRPORT ENVIRONMENT

2.2.1 Climate and Wind Conditions

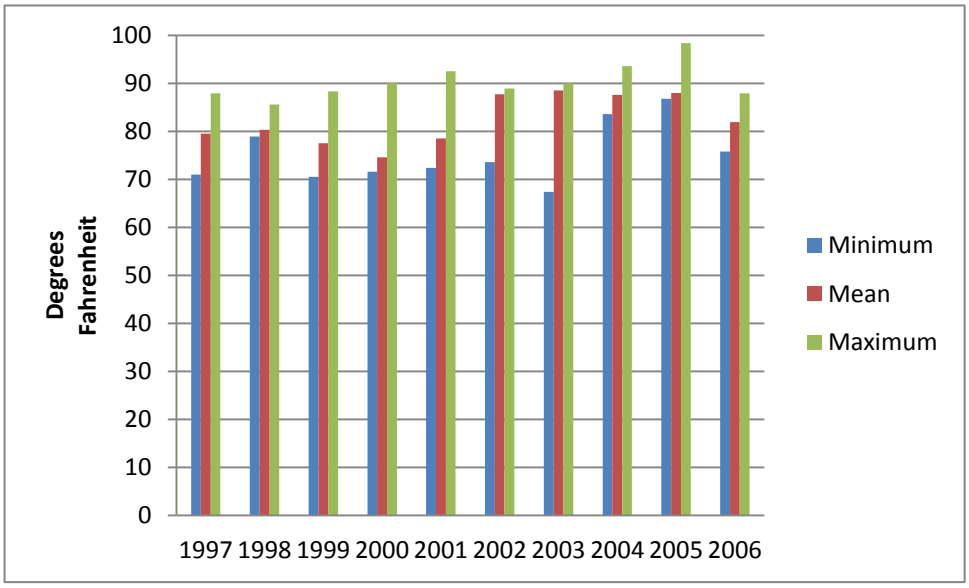
Kosrae's weather, like the other three FSM states, is characteristic of a tropical climate, with the average temperature around 80 degrees Fahrenheit. Kosrae has a wet season and a dry season. The wet season occurs during the winter and spring months while the dry season takes place during late spring through fall. Rain tends to fall every day and can be in excess of 300 inches per year. Trade winds flow over Kosrae from the east and typically occur from late fall to early summer. Fortunately for Kosrae, its location is not as prone to typhoons as other states of the FSM. Typhoons almost always form west of Kosrae and then usually travel even further west.

Table 2-1. FSM Temperature



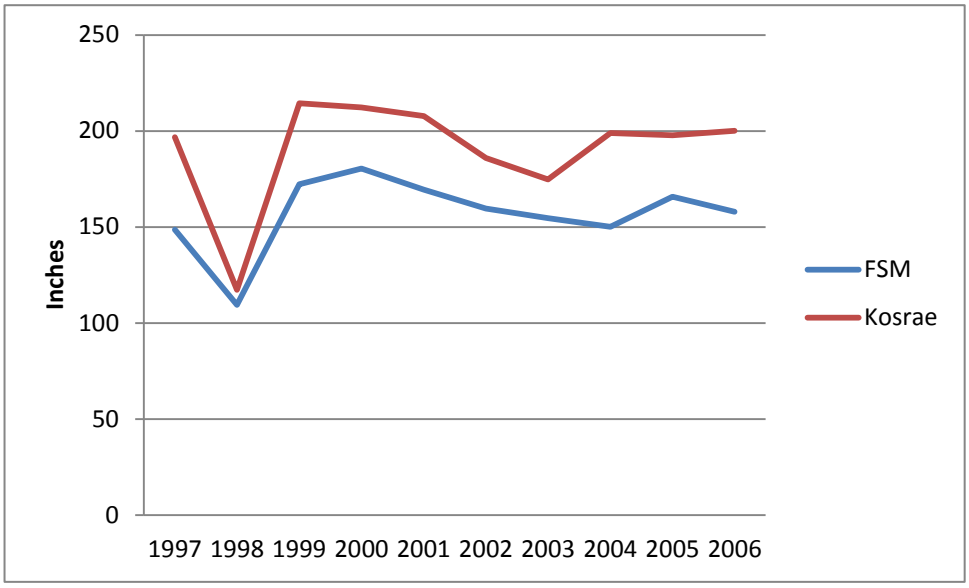
Source: FSM Office of Statistics, 2008

Table 2-2. Kosrae Temperature



Source: FSM Office of Statistics, 2008

Table 2-3. Average Rainfall



Source: FSM Office of Statistics, 2008

2.2.2 Land Formation and Topography

Kosrae is made up of one roughly triangular shaped high island, making it the only state in the FSM that does not have any outer islands. It is the easternmost state in the FSM. Like the other islands, Kosrae has a variety of land formations including both towering mountains and white sandy beaches. Kosrae's highest peak reaches over 2,000 feet.

2.2.3 Land Ownership

Land ownership in the FSM can best be characterized as one of small holdings. Most property is held in family trusts and land use rights are passed down from generation to generation within the extended family system. Land ownership is limited by the Constitution to citizens only. Therefore, domestic corporations which have non-citizen shareholders may not own land. Non-citizen individuals and corporations may lease either public or private lands. The airport is located on public land that is owned by the Kosrae Port Authority.

2.2.4 Socio-Economic Conditions

a) Population:

According to the 2000 FSM National Census Report, Kosrae, with less than 8,000 people, had the smallest population of all the states. The percentage of Kosrae residents versus the total population of the FSM was a little more than 7 percent. It has grown by less than 5 percent since 1920. Similar to Yap State, Kosrae's population is steadily increasing, albeit by a miniscule amount.

b) Local Economy:

Due to the small population of Kosrae, the state tends to be more dependent on U.S. funds than some of the other FSM states. As with the other FSM states, the main economic sources include tourism and agriculture. Kosrae originally had a balanced economy with the compact funds, but attempts to diversify their capital investments have resulted in a weaker economy. Kosrae is dealing with these issues to hopefully regain economic balance in the future.

The labor force in Kosrae actually decreased a fraction of a percent between the years 1994 and 2000 (from 48.9 to 48.2 respectively). These numbers also represent the smallest population contributing to the labor force in the entire FSM. Kosrae also had the least amount of people participating in subsistence living activities, with only about four percent.

2.3 EXISTING LAND USE

Kosrae International Airport (KSA) is located on a strip of land that is connected to the main island by a single causeway. The land surrounding the airport is zoned for industrial use. Almost everything on this strip is owned by the Kosrae Port Authority including the airport property. FSM Petroleum Corporation (FSMPC) is located across the street from the airport and occupies the majority of the remaining land. Adjacent to FSMPC are a few buildings that are being used for various FSMPC and airport offices, governmental functions and a temporary housing structure for the ARFF vehicles. Okat Harbor is located between the airport land and the main island.

2.4 KOSRAE INTERNATIONAL AIRPORT – Existing Conditions

Kosrae International Airport (KSA) is the only airport located within the State of Kosrae. The airfield is located on the north-central portion of the Island of Kosrae, near the "tip" of its triangular shape. The airport is at an elevation of 11 feet above mean sea level (MSL) on a small strip of land that is physically separated from the rest of Kosrae.

2.4.1 Airport Reference Point (ARP):

The airport reference point is the latitude and longitude of a point that is the approximate center of all existing and proposed landing and takeoff areas. The ARP for Kosrae International Airport is Longitude N05°21.42', Latitude E162°57.50' (2010 Pacific Chart Supplement).

2.4.2 Runway

KSA consists of a single runway: 5-23, which is 5751 feet long by 150 feet wide. The runway is paved with asphalt, grooved, and currently in poor condition and is undergoing a complete reconstruction. The runway is currently labeled with non-precision markings. The surface is bituminous with a a flexible PCN value of 62/F/C/X/T and a rigid PCN value of 72/R/B/X/T. .

2.4.3 Taxiway

There is one stub taxiway that connects the runway to the terminal apron. The taxiway is 65 feet wide and is located closer to the eastern side of the runway leading south to the apron. There are 12-foot wide bituminous shoulders on all sides. There are two fillets with a radius of 175 feet between the runway and the taxiway and two fillets with a radius of 75 feet between the taxiway and the apron. However, the runway repair construction contract will also be modifying and repairing the existing taxiway.

2.4.4 Apron

The existing apron is bituminous paved and 417 feet long parallel to the runway centerline and 280 feet wide parallel to the taxiway centerline. There is one Portland Cement Concrete (PCC) hardstand within the apron. This hardstand is 100 feet long parallel to the runway centerline and 60 feet wide parallel to the taxiway centerline. However, the runway repair construction contract will also be modifying and repairing the existing apron.

2.4.5 Airport Lighting, Visual Navigation Aids

Runway 5-23 uses Medium Intensity Runway Lights (MIRL); each end of the runway is equipped with runway end identifier lights (REILs). For approach purposes, the runway also has a 4-light precision approach path indicator (PAPI) for each runway end. There is also a non-directional beacon (NDB) for navigational purposes located due south of the runway, in the vicinity of the terminal area. As with all of the airports located in the FSM, Kosrae is an uncontrolled airport with

no air traffic control tower. Runway lighting can be activated by the pilot via the Common Traffic Advisory Frequency (CTAF). The airport is furnished with a lighted rotating beacon that flashes green and white to indicate that KSA is a land based airport.

2.4.6 Design Aircraft

The critical design aircraft for KSA is the Boeing 737-800 series operated by Continental Airlines. The Boeing 737-800 series aircraft is the only scheduled aircraft that flies into Kosrae and, with more than 250 arrivals and departures per year, meets the FAA criteria for critical design aircraft.

2.4.7 Airport Reference Code

The airport reference code (ARC) is a system established by the FAA to relate airport design criteria to the operational and physical characteristics of the aircraft currently operating and/or forecast to operate at the airport. The ARC has two components relating to the airport design aircraft. The first component, depicted by a letter, is the aircraft approach category and correlates to the aircraft approach speed (an operational characteristic). The second component, depicted by a Roman numeral, is the aircraft design group and relates to aircraft wingspan and tail height (physical characteristics). Generally, aircraft approach speed applies to runways and runway facilities and aircraft wingspan or tail height applies to taxiway and taxi lane separation criteria. The ARC for Kosrae International Airport is D-III. The Airport Reference code is discussed in greater detail in Chapter 5 Facility Requirements.

2.5 AIRPORT TRANSPORT FACILITIES AND AIR CARRIERS

Kosrae International Airport is owned and run by the Kosrae Port Authority which includes both the airport and seaport. Presently, Kosrae International Airport is served by Boeing 737 series aircraft. The airport principally provides its services to commercial air carriers. General aviation operations do not account for a significant percentage of operations.

2.5.1 Aircraft Operations

a) Scheduled Air Carriers:

Continental Micronesia provides essential air service for Kosrae. Kosrae is serviced via the “island hopper” flight which flies back and forth between Guam and Honolulu. Since January 2011, Continental Airlines has suspended its Tuesday and Wednesdays

operations. Previously, the "island hopper" route lands in Kosrae three times per week from each direction (total of six times per week). Kosrae is presently serviced by Boeing 737 series aircraft. Following are a Continental Micronesia Route Map and Timetables for its Flights 956 and 957:

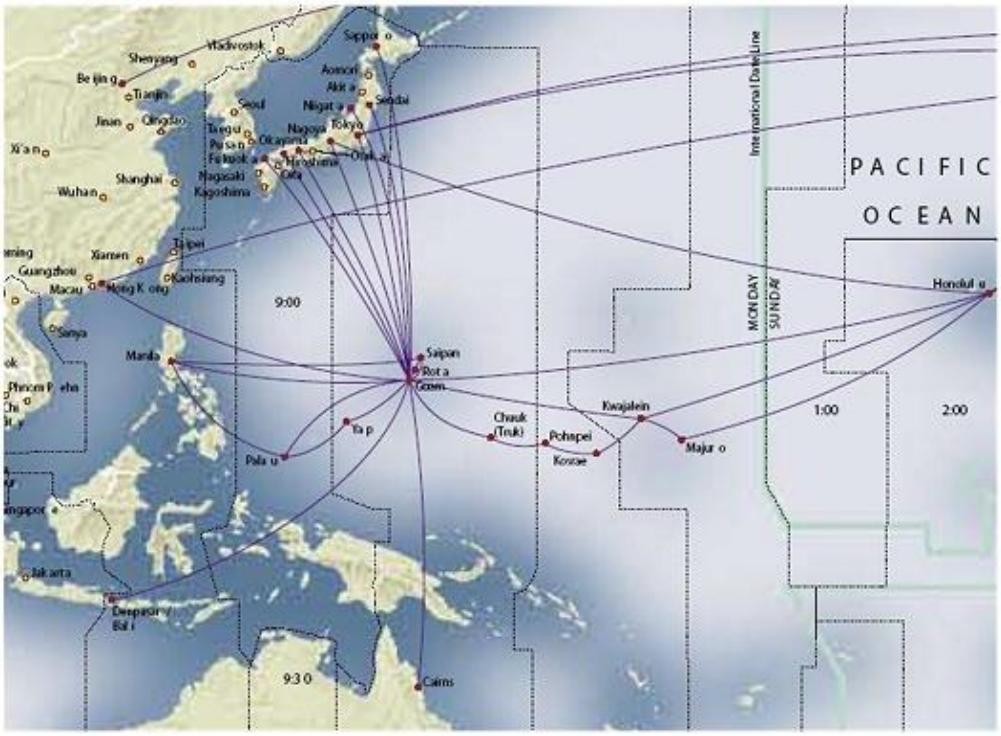


Figure 2-3. Continental Micronesia Route Map

Table 2-4. Continental Flight 956 Timetable

	Mon	Tues	Weds	Thurs	Fri	Sat	Sun
KSA	A 2:46PM				A 2:46PM		
	D 3:30PM				D 3:30PM		

Table 2-5. Continental Flight 957 Timetable

	Mon	Tues	Weds	Thurs	Fri	Sat	Sun
KSA		A 12:45PM				A 12:45PM	
		D 1:20PM				D 1:20PM	

b) Commuter Airlines:

Since Kosrae state is comprised of only a single island, there is no need for commuter airlines to outer islands. Kosrae also does not have any commuter airlines going to the different states within the FSM.

c) Cargo Carriers:

Currently the primary cargo carrier servicing Kosrae is Continental Micronesia. Asia Pacific Airlines occasionally provides air freight services to Kosrae with Boeing series 727-200 aircraft, although this service is infrequent. Asia Pacific Airlines operates on an as-needed, on-demand basis and has not flown to Kosrae in a number of years.

d) General Aviation, Business Jets, etc.:

General Aviation at Kosrae International Airport is a small fraction of the overall aviation activity and rarely occurs. There are presently no single-engine aircraft permanently based at the airport.

e) Other, Including Military Operations:

No other services, such as aircraft flight schools or helicopter sight-seeing services, operate from Kosrae International Airport. Although there have been military operations at the airport in the past, military operations have decreased to approximately three to four annual operations at Kosrae International Airport in recent years.

2.6 AVIATION RELATED FACILITIES

2.6.1 Passenger Terminal

The Kosrae International Airport terminal is located to the south of the runway, close to the approach end of Runway 5. The terminal building is a one-story structure approximately 12,590 square feet in area. It was completed in the late 1980s. The terminal is currently divided into three different sections for departures, arrivals, and airline operations/passenger processing center area. The building is actually not fully enclosed as the three sections are primarily open pavilions. Major additions since completion include expansion of the Arrivals Lobby and

Immigration and Customs area, addition of an entry canopy and Porte Cochere, reroofing of the central lobby, and installation of a photovoltaic system.

2.6.2 Aircraft Rescue and Fire Fighting (ARFF) Facility

A new 6.3 million dollar ARFF Station was recently completed for KSA with four (4) vehicle bays and support rooms, Aeronautical/Aerodrome Flight Information Service (AFIS) on the second floor, as well as an Emergency Operations Center (EOC). The station is situated just south of the airline terminal and aircraft apron, some 650 feet from the runway 5 – 23 centerline. Access to the runway is via the aircraft apron and the taxiway.

2.6.3 Cargo Building

The existing cargo building is located next to the ARFF facility and is run by Continental Airlines. The structure is approximately 1,000 square feet and was constructed at the same time as the ARFF.

2.7 FUEL SYSTEM

The aircraft are serviced by a simple hose and pump facility at the south apron edge. The fuel is stored in the fuel storage area inside the harbor security fence just southeast of the terminal. The fuel is transferred from the fuel storage yard to the delivery hose via an underground pipe. An underground fuel pipe and valve pit was constructed within the Portland Cement Concrete portion of the apron. It has never been used.

2.8 ACCESS AND PARKING

There is one airport access road built upon a causeway leading to Kosrae International Airport. The road crosses over the boat channel with a series of bridges closer to the eastern end of the airfield. The access road then runs west along the south of the airfield to the parking facility and terminal area. The parking area is a small-sized parking lot with approximately 20 parking stalls available. About five of these stalls are reserved for government-related persons. The lot is directly in front of the passenger terminal and is connected with a covered walkway to the center terminal pavilion. There is also a three-minute parking loading area directly in front of the walkway to the center pavilion. The lot is unpaved and consists of dirt and gravel.

2.9 EXISTING UTILITIES

2.9.1 Water Supply

Public water systems are not widely available in Kosrae. The airport receives water from the main island. Water lines run from the utility distribution system underneath the road to the airport.

2.9.2 Sewer System

Sanitary sewer connectors are required for the Main Terminal Building and the Aircraft Rescue and Firefighting Facility (ARFF). Sanitary sewer lines are routed from each of the facilities to a septic tank system for collection.

A leech field on the secure side of the Main Terminal Building dispenses fluids from the septic tank systems.

2.9.3 Electrical Power

Electricity is generated in Kosrae by the Kosrae Utility Authority who employs diesel generators for power generation. Six diesel generators are located at the Tofol power plant to provide the island's demands. Electrical power is supplied from the main island to the airport. Utility lines are underground below the existing access road.

2.9.4 Communications

FSM Telecommunications Corporation is the only telecommunication company that services all of the states of the FSM with telephone, internet, and cable TV. FSM Telecom utilizes earth stations on each of the main islands to service all of the subscribers. Telephone service is available at the airport.

CHAPTER 3: AVIATION FORECASTS

3.1 INTRODUCTION

This chapter describes the objectives, methodology, and preliminary findings of future aviation demands on Kosrae International Airport.

3.2 OBJECTIVES

The Master Plan sets forth the short, intermediate and long-range (5-, 10-, and 20-year) development plans for the Kosrae International Airport. A primary objective of the Master Plan is to identify the present and future needs for a full range of facilities to serve anticipated demands of air carriers, commuters and general aviation. To achieve this objective, an aviation forecast is developed to identify the magnitude of potential future civil aircraft operations. Aggregated demand from commercial aviation activity, including aircraft mix, enplaned passengers, and type of flight operations will be of specific interest in this chapter.

This forecast identifies the various drivers of Kosrae' s economy and evaluates the potential for major economic growth. The validity of this forecast is dependent upon properly identifying the various drivers to the economy and their relative weight upon the overall forecast. Typically, for a U.S. mainland airport, the significant variables in the determination of demand are population, employment and income of the community being served, along with the potential for business development. In the unique case of Kosrae International Airport, tourism and tourism growth must also be explored as these are Kosrae' s primary drivers of growth.

A reasonable forecast of aviation activity is essential in determining future aviation facility's needs. Forecasts of commercial airline passengers are the basis for sizing and phasing of airside, landside and terminal facilities. The adequacy of existing airfield facilities is assessed using the number and types of current and projected aircraft activity. The adequacy of both air and landside facilities is influenced by the estimated level of activities at peak arrival and departure periods. For example, this level of detail is helpful specifically when evaluating the size of terminal hold-rooms needed to meet future demand.

The validity of any forecast may be affected by numerous variables and is dependent upon the uncertainty of future events. As such, the potential of demand forecasts is dependent on some known and some unforeseeable factors, and these forecasts become more speculative as one looks further into the future. It may be reasonable to predict as much as three to five years out

with a relatively high level of confidence, but with less confidence for projections beyond five years, particularly in an air travel and tourism industry subject to dynamic fluctuations.

In some instances, it is appropriate to present three different growth scenarios for aviation activity: a constrained (low), base (medium), and an optimized (high) case. The research that has been done to develop this aviation forecast for Kosrae International Airport, indicates that only one case, the base case, is needed since the variations of future aviation activity for Kosrae are expected to be minimal and will not affect the demand capacity of the airport's operations or facilities.

3.2.1 Base Case

The assumptions made for this "base case" forecasting is summarized as follows:

- That Kosrae will sustain its current level of airport operations
- That the economies of both Japan and the United States specifically, and the global economy generally, will stabilize
- That Kosrae' s tourism industry will maintain its current levels and/or slightly increase over the forecasted period of time
- That the U.S. military buildup in Guam will increase tourism
- That the private sector will slowly begin to grow and to produce more exports and passengers traveling for business
- Cargo will increase as the private sector begins to grow

3.3 METHODOLOGY

Forecasting associated with a typical system or master plan for a business-oriented U.S. mainland airport is based on economic growth factors, population growth, income, employment, domestic and business oriented enplanements and international travel. However, these forecasting tools, which include those published in the applicable FAA Advisory Circulars, do not apply all that well to the FSM. The Federated States of Micronesia has a unique passenger and travel profile. The factors that affect the FSM economic growth are based more on travel and tourism. Therefore, the economic forecast and growth trends for the Master Plan are weighted more toward tourism, travel, and the world events and natural disasters that drive these factors.

3.3.1 Forecast Resources

Several sources served as bases for the evaluation of future demand:

- FSM Division of Statistics 2008 Yearbook
- Meeting with Kosrae Planning and Statistic Office
- Meeting with Kosraean Government officials
- Meeting with Kosrae Visitors Bureau
- Kosrae Tourism Project Implementation Plan 2009- 2013
- 2000 FSM Census
- Continental Airlines Website and Station Managers
- FAA Terminal Area Forecast
- Interview with Kosrae Port Authority Controller
- Interview with Micronesia Petroleum Corporation
- International Visitor Arrivals Report for October 2007 to December 2008
- 2005 Household and Income Survey Report
- Asian Development Bank: Asian Development Outlook 2009: Rebalancing Asia's Growth
- Asian Development Bank - Country Operations Business Plan Federated States of Micronesia 2007–2009
- United States of America, Department of the Interior - Insular Areas Energy Assessment Report 2006

3.3.2 Commercial Aviation Trends

The Federated States of Micronesia continue to be serviced by only one major carrier - Continental Micronesia. Continental continues to operate Boeing 737-800 series aircraft to each of the four states of the FSM. Continental services the Micronesia region through Honolulu, Guam, and Manila. Kosrae can be reached through Guam with stops in Chuuk and Pohnpei or through the Honolulu "island hopper" route. The island hopper route begins in Honolulu and makes stops in Majuro and Kwajalein before stopping in Kosrae.

3.3.3 Corporate, Commuter, Military and General Aviation Trends

General aviation, corporate, and commuter flights have steadily decreased over the past ten years to the point that the data supplied by the FSM Office of Statistics shows no aviation activity other than the commercial flights flown by Continental Micronesia since 2004. According to the Airport Manager at Kosrae, the only other operations into KSA are U.S. military flights that occur approximately once every four months or about three to four flights per year.

3.3.4 Foreign Tourism Trends

Kosrae's tourism industry has been stagnant and declining since 2001. In 2000 Kosrae received 1703 tourist arrivals. In 2006 tourist arrivals dropped to 1173. However, in 2007 Kosrae started to see a recovery with 1666 tourist arrivals. During the most severe segment of visitor arrival down turn, Kosrae lost a number of assets, international quality rooms (Kosrae Visitor Bureau term) were reduced from approximately 65 to 46, several restaurants, taxi companies and rental car operations closed during this time. Currently Kosrae has approximately 46 international quality hotel rooms, 4 restaurants, 5 car rental companies and 3 taxi companies. (Source: Kosrae Tourism Project Implementation Plan.)

The Government of Kosrae has placed increasing importance on tourism as a means of generating foreign exchange monies and creating employment opportunities for local residents. The Tourism Project Implementation Plan provides the framework and direction for the Kosrae Visitors Industry, working in partnership, to develop a sustainable tourism industry that will bring real and lasting economic, cultural and environmental benefits to Kosrae.

The Kosraean Government realizes the important economic benefit that tourism can bring to Kosrae. Tourist spending stimulates local businesses and results in the provision of a greater variety of goods and services than would otherwise be available. Tourism is one industry that can provide employment opportunities for those that may be vulnerable to unemployment such as women, youth and unskilled workers. Additionally, many tourism enterprises employ part time and casual labor across a wide range of job skills, thus creating opportunities for people unable to undertake full-time employment. Tourism is a decentralized industry and its enterprises can be established outside the major population centers. It is also an industry where small businesses can operate effectively with relatively low capital investment. And it has the potential to bring on line a wide range of tourism products that are competitive both domestically and internationally.

Between the years 1997 and 2006, Kosrae has averaged approximately 1,592 tourists and visitors annually. The majority of foreigners (non-Pacific Islanders) visiting Kosrae have come from the United States and Japan. The combination of the U.S. and Japanese travelers has accounted for more than 60 percent of the total travelers to Kosrae throughout the years.

Table 3-1. Tourism and Visitors to Kosrae by Region of Citizenship: 1999 to 2008

Citizenship	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008 *
International & Interstate Visitor Arrivals	2,385	3,516	2,194	2,273	2,075	2,112	1,899	1,948	2,154	2,094
Australia	93	71	114	90	68	83	75	92	100	117
Canada	27	36	29	22	24	23	20	22	32	31
China	58	15	19	10	2	8	10	14	68	100
Europe	105	128	112	141	87	115	94	348	118	129
Japan	333	221	171	239	211	323	252	191	286	185
New Zealand	18	16	19	19	24	23	15	22	29	13
Other Asia	99	71	88	67	94	95	81	40	51	100
Pacific Islands	391	487	324	359	472	282	313	161	197	106
Philippines	162	156	159	157	141	160	139	138	177	309
USA	1,092	2,289	1,144	1,159	948	983	894	913	1,084	999
Other	7	26	15	10	4	17	6	7	12	5

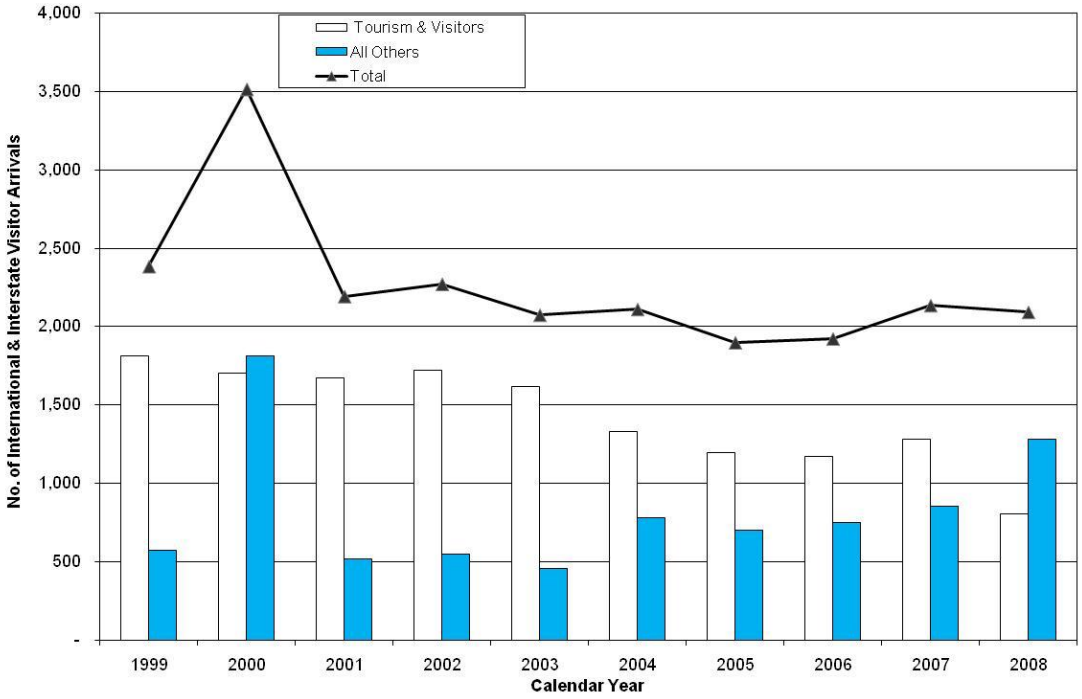
Source: International Visitor Arrivals Report for October 2007 to December 2008

Table3-2. Visitors by Purpose to Kosrae: 1999 to 2008

Purpose	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008 *
Total	2,385	3,516	2,194	2,273	2,075	2,112	1,899	1,972	2,160	2,094
Tourism & Visitors	1,812	1,703	1,675	1,722	1,620	1,330	1,198	1,173	1,281	809
Business & Employment	471	598	400	419	365	676	621	644	761	415
Volunteer, Religious, etc.	61	67	71	108	76	71	62	93	69	55
Seamen & crew	41	1,148	48	24	14	35	18	14	25	208
Other	-	-	-	-	-	-	-	48	24	600

Source: International Visitor Arrivals Report for October 2007 to December 2008

Table 3-3. Tourism and Visitors to Kosrae: 1999 to 2008



Source: International Visitor Arrivals Report for October 2007 to December 2008

There are several reasons that the Kosrae tourism and visitor industries have struggled to grow. The main reason is that reliance on a single air carrier operating high priced flights in a remote geographical location has repressed the growth of tourism. A coach ticket on Continental Airlines from the United States (Los Angles, California) currently varies from two to four thousand dollars. The same ticket to Kosrae leaving from Tokyo, Japan costs between one thousand four hundred to three thousand five hundred dollars. With Japan and the United States being the two largest groups of visitors to the State of Kosrae, prices like these have a direct impact on Kosrae's ability to attract visitors.

Table 3-4. Cost of Airfare to Kosrae

Flights	Price (US Dollars)
Los Angles, California to Kosrae State	$2,000 to $4,000
Tokyo, Japan to Kosrae State	$1,400 to $3,500
Hawaii to Kosrae	$1,200 to $1,300
Kosrae to Pohnpei	$400 to $500

*Prices taken from Continental.com – Round Trip Fare

These prices also affect domestic travel as a ticket to Pohnpei (the capital of the FSM and closest island) costs approximately 450 dollars. Not only do these prices make it difficult to promote tourism in Kosrae, it makes travel almost unattainable for the people of Kosrae. With over 50% of the population making less than 4,000 dollars a year, the cost of airfare is out of the reach of the average Kosraean.

Also, many of the hotels and other facilities offer a standard of accommodation that is unattractive to international travelers. Kosrae lacks the infrastructure and amenities to attract the average vacationer looking for relaxation.

However, Kosrae does offer interesting and different vacation experiences for those interested in snorkeling or scuba diving. Kosrae has a magnificent coral reef system teaming with a huge variety of fishes. It is also home to the Lelu Ruins, an ancient city built of basalt stones. Kosrae' s variety of land features also allows visitors to experience beautiful hikes through mountainous valleys with numerous waterfalls. With the right investments and marketing by the State and National Government, there is real potential for the growth of tourism in Kosrae.

3.4 SOCIO-ECONOMIC REVIEW

The propensity to travel, by air or any other transportation mode, generally correlates closely with three principal statistically significant variables – population, employment, and income. An evaluation of the forecast population and income of Kosrae' s residents can help establish trends useful in the forecasting of commercial and general aviation activity.

3.4.1 Local Demographic Characteristics

a) Population:

Kosrae has continued to have the lowest percentage of the overall population in the Federated States of Micronesia. It has slowly, but steadily increased and currently stands at just under 7 percent of the total FSM population.

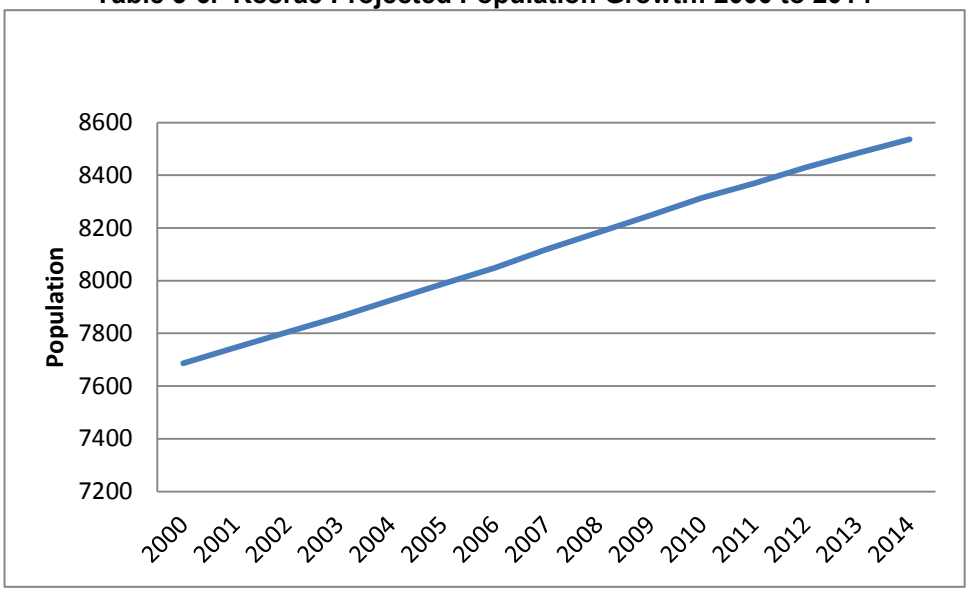
Table 3-5. Population Distribution: 1930 to 2008

State	1930	1958	1967	1973	1980	1989	1994	2000	2008 proj.
Total	29,727	39,284	50,172	62,731	73,159	95,551	105,506	107,008	108,100
Yap	6,486	5,540	6,761	7,870	8,099	10,431	11,178	11,241	11,700
Chuuk	15,200	20,124	25,107	31,609	37,488	47,616	53,319	53,595	53,300
Pohnpei	7,051	11,253	15,044	19,263	22,081	30,669	33,692	34,486	34,900
Kosrae	990	2,367	3,260	3,989	5,491	6,835	7,317	7,686	8,200

Source: FSM Office of Statistics

Over the years, Kosrae's population has been growing at a rate of approximately 1.4 percent. More recently, the rate of growth has been slower, at just a little more than 1 percent. The 2008 projected population growth shows a continued slight increase of approximately 1.07 percent for the year. Kosrae continues to have the smallest population of all of the states in the FSM. In the year 2015, the FSM Office of Statistics is projecting that Kosrae's population will be slightly more than 8,000 people.

Table 3-6. Kosrae Projected Population Growth: 2000 to 2014



Source: FSM Office of Statistics, 2008

In talks with officials of the State Division of Planning and Statistics and with the Kosrae Department of Health Services, it was learned that the 2010 census will likely show a drop in the population of Kosrae. With the outward migration of Kosraean looking for work, combined with better education and an improved awareness, there has been a decrease in the birth rate among younger women. The actual population is closer to 6,500 people.

According to the 2008 FSM statistical year book, the percentage of male/female population was 52% males to 48% females in 1994. In the 2000 census the data shows that the gap between the percentages of males to females has closed, with 50% males to 50% females. This is most likely due to the fact that young males are leaving the island, taking advantage of the Compact of Free Association with the United States that allows them to work in the United States without a visa.

Table 3-7. Kosrae Population by Sex (1994, 2000)

Year	Total	Male	Female
1994	7,317	3,806	3,511
2000	7,686	3,859	3,827

In 1994 the total population of Kosrae was 7,317, of those 3,846 were under the age of 20, which is approximately 53% of the total population. In 2000 the percent of the population under the age of 20 dropped to 52% totaling 3,997 of the total population of 7,686. With such high percentage of it population in its teens there is potential for aviation activity to increase as the population ages into adult hood and becomes a part of the potential traveling community.

Table 3-8. Population by Five Year Age Group and Gender 1994 and 2000

	1994			2000		
Age Group	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**
0-4	**922**	462	460	**1,026**	528	498
5-9	**1,078**	572	506	**953**	486	467
10-14	**1,066**	540	526	**1,079**	569	510
15-19	**780**	386	394	**939**	493	446
20-24	**535**	274	261	**604**	281	323
25-29	**524**	276	248	**497**	238	259
30-34	**483**	279	204	**474**	207	267
35-39	**471**	244	227	**445**	229	216
40-44	**376**	198	178	**435**	220	215
45-49	**318**	191	127	**365**	182	183
50-54	**204**	100	104	**265**	152	113
55-59	**179**	86	93	**181**	82	99
60-65	**149**	83	66	**144**	66	78
65 +	**232**	115	117	**279**	126	153

Source: 2008 FSM Statistical Year Book

Table 3-8 also shows that the decrease in the population between the ages of 25 to 39 especially in males, would seem to be an indication that adult males are leaving Kosrae for employment and for other reasons. If this trend continues throughout the 10 years between, the 2000 census and 2010 census, it would support the State Division of Planning and Statistics and Department of Health Services concern that the overall population of Kosrae is decreasing.

b) Employment:

According to the 2000 census there were 4,628 persons aged 15 and older available for the work force. There were 2,232 persons in the work force, with 48.2% (1,864 persons) employed. Of those employed, 1,468 were in formal employment and 396 were in subsistence farming or fishing jobs. There were 1,876 people over the age of 15 that were not available in the work force for various reasons. The number of persons and percentage of the work force in subsistence farming and fishing has been relatively consistent since 1994. The percentage of unemployment has increased slightly, with 15.1% of the labor force being unemployed in 1994 and 16.5% in 2000. The workforce is approximately 61.7% male and 38.3% female. There has been an increase in the size of the labor force (reflecting Kosrae's youthful age demographic and the growing population over 15 years). However, employment has not kept pace with the available workforce, leading to increased unemployment. The unemployment rate is higher in Utwe and Tafunsak (where it exceeds 20%) and amongst 20 to 24 year olds (where it exceeds 50%). (Source: DOI 2006 Energy Assessment)

With limited employment in the private sector, there is a heavy reliance on the public sector to provide jobs for the people of Kosrae. This dependence has caused the State of Kosrae to have severe budgetary issues, which can only be addressed by reducing the government's expenses. (Source: Asian Development Bank) Losses of jobs or the reduction of wage hours will be difficult to replace, unless Kosrae can develop its private sector opportunities.

While the domestic market is limited, Asian Development Bank has identified the following industries as profitable opportunities for the discerning investor:

- **Fisheries:** Fisheries, mainly controlled by overseas companies operating in the Federated States of Micronesia's Exclusive Economic Zone, currently dominate the domestic economy and have the potential to expand. In particular, downstream processing of the available fish stocks and other marine life would provide enormous opportunities. The investment required to commence such an operation, including the

establishment of the necessary infrastructure, such as freezer facilities and a processing plant, would be sizeable, but the potential is substantial.

- **Tourism:** The Federated States of Micronesia's current tourist facilities are inadequate and do not compete with destinations such as Palau and Guam. Because of its unique environment, there is potential to attract dive and eco-tourism businesses from the United States and Japan.
- **Aquaculture:** Recent research has highlighted that there are opportunities for farming of the giant clam, soft coral aquaculture, sponge farming, pearl, as well as oyster and mangrove crab cultivation.
- **Garment Manufacture:** Garment manufacturing for the local and overseas markets (particularly the United States, given the FSM's preferential access) has been identified as a viable new industry. A number of other small import replacement activities including the processing of seafood and agricultural products, is also being encouraged.
- **Agriculture:** There is a potentially viable commercial agricultural industry in the FSM. Landowners are being encouraged to form cooperatives for land use for the production of pepper, citrus fruit, betel nut and medicinal plants, including noni, kava and sakau.

The State government has already taken steps to help improve the private sector. On a smaller scale, local residents have begun to export agriculture goods such as sakau and other aquaculture goods such as mangrove crab. While only in the beginning stages, this exporting demonstrates the opportunities available to the private sector.

c) Income:

The average wage of those employed in the formal employment sector in Kosrae in 2004 was $5,514 per year. Persons employed in the private sector had an average wage of $3,003 per year, while those in public sector enterprises such as utilities and telecommunications had an average wage of $9,072. The State government average wage was $7,669; Municipal government $3,435; other government agencies $2,392; and non-profit organizations $5,186. The large number of low to mid-income wage earners indicates that the resident population of Kosrae will not be able to contribute to any major growth in air traffic. Almost all such growth will have to come from attracting outside visitors. (Source DOI Energy Assessment)

3.5 HISTORICAL AVIATION ACTIVITY

3.5.1 Aircraft Operations

With no fixed base operators or general aviation aircraft based at Kosrae International Airport, it is safe to assume that the number of departures will match the number of arrivals. Tables 3-9 and 3-10 below show the number of operations by aircraft at KSA. Since 2000, arrivals of commercial aircraft have remained fairly steady, while all other types of aircraft arrivals have declined. The average number of commercial aircraft operations over the nine-year period is approximately 308 per year, but has stayed constant at 312 flights per year over the past three years. The highest number of commercial aircraft to arrive over the nine-year period was 313 aircraft in 2004. Freighter, military, private, and other classifications of aircraft have almost completely diminished after the year 2001. In 2005, there was only one private aircraft arrival, while all the other classifications had no arrivals.

Table 3-9. Continental Airlines Aircraft Operations 2000-2008

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Arrival	311	309	311	311	313	282	312	312	312
Departure	311	309	311	311	313	282	312	312	312

Source: Continental Airlines

Table 3-10. Non Commercial Aircraft Operations

Year	1998	1999	2000	2001	2002	2003	2004	2005
Freighter	33	41	8	16	0	0	0	0
Military	11	12	10	10	9	7	1	0
Private	4	0	0	4	1	0	0	1
Other	0	0	0	1	0	0	1	0
Total	**48**	**53**	**18**	**31**	**10**	**7**	**2**	**1**

Source: 2008 FSM Statistical Yearbook

While the data from the 2008 FSM Statistical Yearbook reports that there were no military aircraft to operate in KSA in 2005, the Airport Manager reported that there were about three to four military flights a year for the years 2007 and 2008, and there were been two flights for the first three quarters of 2009 (January through September).

3.5.2 Based Aircraft and Aircraft Mix

There are no based aircraft at Kosrae International Airport. The only type of aircraft currently operating in Kosrae on a regular schedule is Continental Micronesia's Boeing 737-800 series. The only other aircraft reported to use the airport according to the airport manager is a C-130 flown by the U.S. Military.

3.5.3 Enplaned Passengers

With only one commercial carrier in Kosrae, the total number of enplaned passengers is derived from the Continental Micronesia flight. Table 3-11 below shows the number of enplaned passengers departing from KSA.

Table 3-11. Enplaned Passengers per Year 2000 to 2008

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Departures	6,452	5,918	6,046	6,433	8,671	5,952	6,762	6,622	6,400

The number of passengers departing Kosrae has averaged 6,584 passengers per year over a nine year time span. The peak of these departures was in the year 2004, when approximately 2,000 more people departed from KSA. It is not known why there was such an increase that year as there was only one more flight that year (313 flights) compared to the past three years (312 flights). Other than 2004, the number of enplaned passengers has remained fairly consistent over the past eight years (2000-2003, 2005-2008) ranging from 5,918 in 2001 to 6,762 in 2006. No data was available for 2004.

3.5.4 Aircraft Load Factors

Aircraft load factors essentially equate to the average number of passengers per flight. To arrive at a realistic ratio of numbers of passengers per flight, we derive a correlation between aircraft departures and the number of departing passengers, using historic data for visitor/transit passengers, as well as historic data for the number of aircraft departures.

Continental Airlines uses a Boeing 737-800 series aircraft which has a total capacity of 155 passengers. There are 14 First/Business Class seats and 141 economy seats. With Kosrae International Airport being just one of four stops on Continental's "island hopper flight," not all of the 155 seat final destination is Kosrae.

Table 3-12. Average Number of Passengers per Flight Departing Kosrae: 2000 to 2008

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Flights	310	309	311	311	313	282	312	312	312
Departures	6,452	5,918	6,046	6,433	8,671	5,952	6,762	6,622	6,400
Average*	21	19	19	21	28	21	22	21	21

Source: Continental Airlines
*Average number was rounded to the closest whole number

With little variations of flights departing Kosrae, the average passengers per flight has continued to follow the same trend. The highest average passenger count over the nine year period was 28 passengers per flight departing in the year 2004. For the rest of the years between 2000 and 2008 the average number of passengers remains pretty constant between 19 to 21 passengers per flight. Table 3-13 shows the number of passengers arriving at Kosrae per flight. The average number of passengers per flight for arrivals over the past three years (2006-2008) has been 15 passengers.

Table 3-13. Average Passenger Arrivals per Flight to Kosrae: 2000 to 2008

Year	2006	2007	2008	2009**
Flights	312	312	312	234
Arrivals	5246	4806	4587	3644
Average*	17	15	15	15

Source: Continental Airlines
* Average number was rounded to the closest whole number
** 2009 only for the months January through September

3.5.5 Air Cargo

The air freight data from the ten year time span of 1998 – 2007 in Table 3-14 demonstrates that the average amount of air freight brought into Kosrae is approximately 60 tons per year. The most inbound air freight was recorded at 122 tons in 1998, while the least amount was 42 tons in 2000. Outbound air freight has been significantly less over the years. The average outbound freight over the ten year span was approximately 15 tons per year. The result is inbound air freight has been exceeding outbound airfreight.

Table 3-14. Inbound and Outbound Airfreight by Tonnage (000) Kosrae: 1997 to 2006

Year	Inbound	Outbound	Difference
1998	122	14	108
1999	70	7	63
2000	42	4	38
2001	47	4	43
2002	44	21	23
2003	61	30	31
2004	56	26	30
2005	48	18	30
2006	48	15	33
2007	66	14	52

Source: FSM Office of Statistics, 2008
Note: 2002 to 2005 do not include airmail

3.6 AVIATION FORECAST

Using demographic indicators of population, employment, income, and tourism as potential drivers for aviation demand, the projected outlook predicts that Kosrae will be able to sustain its current level of aviation activity in the short term (0-5 years), while maintaining a slight growth of one percent in the medium term (5-15 years), and a growth rate of 0.5 percent in the long term (15-20 years).

Table 3-15. Aviation Forecast

Short Term	Medium Term	Long Term
0% Growth	1% Growth	0.5% Growth

While there is potential for a slight growth in aviation activity, it is unlikely that it will develop in the near future, as it will take Kosrae time to develop its tourism industry and its private sector. Also factoring in the 0% percent growth in the short term is the time that the worldwide economy will take time to recover and stabilize, especially that of Japan and the United States.

During the 5 to 15 year forecast period the Kosrae Visitors Bureau's Kosrae Tourism Project Implementation Plan will have been in effect for five years and should be able to attract new visitors to the islands. The private sector will have had time to develop, including agriculture and aquaculture operations, which will create jobs and products that can be exported. The long term forecast projects that the growth gained in the 5 to 15 years forecasted period will begin to taper, stabilizing at a growth rate of 0.5%.

3.6.1 Aircraft Operations Forecast

a) Commercial Airlines:

Continental Micronesia Airlines is the only commercial airline that flies into Kosrae International Airport. It is expected to remain so as there is a lack of demand for more carriers into the Western Pacific. The number of commercial flights into KSA should remain constant, even as the State of Kosrae develops its private sector and improves its infrastructure to potentially support new opportunities for tourism. Any increase in visitors is not expected to demand an increase in Continental's service into Kosrae.

b) Corporate, Commuter, Military and General Aviation:

In addition to commercial airlines and a few military operations there are no other flights into Kosrae. Currently, the airport manager said that approximately three to four C-130's land at KSA per year. With the U.S. Military buildup in Guam it is assumed that the number of military aircraft, most likely C-130, will increase at Kosrae Airport for refueling and other operations.

c) Cargo Carriers

According to the Airport Manager there have not been any cargo flights into KSA for the past four to five years. As the private sector in Kosrae begins to develop, the State government has realized that there will be a need for a cargo carrier to help export the products produced by the private sector. The Governor's office has conferred with Asia Pacific Airlines on returning to Kosrae for this purpose. APA has expressed some interest, but would like Kosrae to extend the airport's runway to address their safety concerns.

3.6.2 Based Aircraft and Aircraft Mix Forecast

Presently there are no based aircraft at Kosrae International Airport and there is no expectation that any aircraft will be based at KSA during the forecasted period. Currently, there are only two types of aircraft that use the airport, a 737-800 series flown by Continental and C-130's used by the U.S. Military. As the private sector grows and the need for air cargo and air freight increase, the need for an air cargo carrier will develop. Asia Pacific Airlines, the regional carrier, uses a 727-200 series aircraft and is the most likely aircraft that would be used. As the tourism industry matures it is expected that there may be private/business jets used to fly visitors to Kosrae.

Table 3-16. Aircraft Mix Forecast

Year	2010	2015	2020-2030
Aircraft Type	737-800 C-130 C-17	737-800 C-130 C-17 Private Jets*	737-800 C-130 C-17 727-200 Private Jets*

*Type of Jets not described as style and size of aircraft likely to change over forecasted period.

3.6.3 Critical Aircraft Forecast

Continental Micronesia currently uses a Boeing 737-800 series aircraft. This is the only regularly scheduled aircraft into KSA and is projected to be the only scheduled aircraft to meet the requirements for critical design aircraft. The critical design aircraft is discussed in greater detail in Chapter 5 Facility Requirements.

3.6.4 Enplaned Passenger Forecast

Forecasts of enplaned passengers for KSA are set forth in Table 3-17. The table shows a projected growth rate over the forecasted period. It is assumed that Continental will remain the only commercial air carrier at Kosrae and that the level of aircraft operated by Continental into Kosrae will remain the same, as there has been no indication that either will increase.

Table 3-17. Forecast of Enplaned Passengers

Year	Passengers	
	Arrivals	Departures
2010	4,880*	6,584**
2015	4,880	6,584
2020	5129	6920
2025	5391	7273
2030	5527	7456

* Past Three Years Average Passengers
**Past Nine Year Average Passengers

Table 3-18 shows the forecast growth for passengers per flight for both departing and arriving aircraft. The number of aircraft operations by Continental airlines at Kosrae is expected to remain constant at 312 operations per year. The number of passengers per flight was derived from the projected number of flights by the forecast of enplaned passengers.

Table 3-18. Forecast Aircraft Occupation Per Flight

Year	Passengers per Flight*	
	Arrivals	Departures
2010	15	21
2015	15	21
2020	16	22
2025	17	23
2030	18	24

*Numbers rounded to the nearest whole number

3.6.5 Air Cargo Forecast

With the Government's commitment to the growth of the private sector, there is the possibility that Asia Pacific Airlines will again start services to Kosrae International Airport. Before APA can begin services, however, Kosrae's runway needs to be extended. It is expected that air cargo/freight will increase over the forecasted period. Table 3-19 shows the forecasted growth.

Table 3-19. Forecast Air Cargo

Year	Cargo by Tonnage	
	Inbound	Outbound
2010	66	14
2015	66	14
2020	69	15
2025	73	15
2030	75	16

*Numbers rounded to the nearest whole number

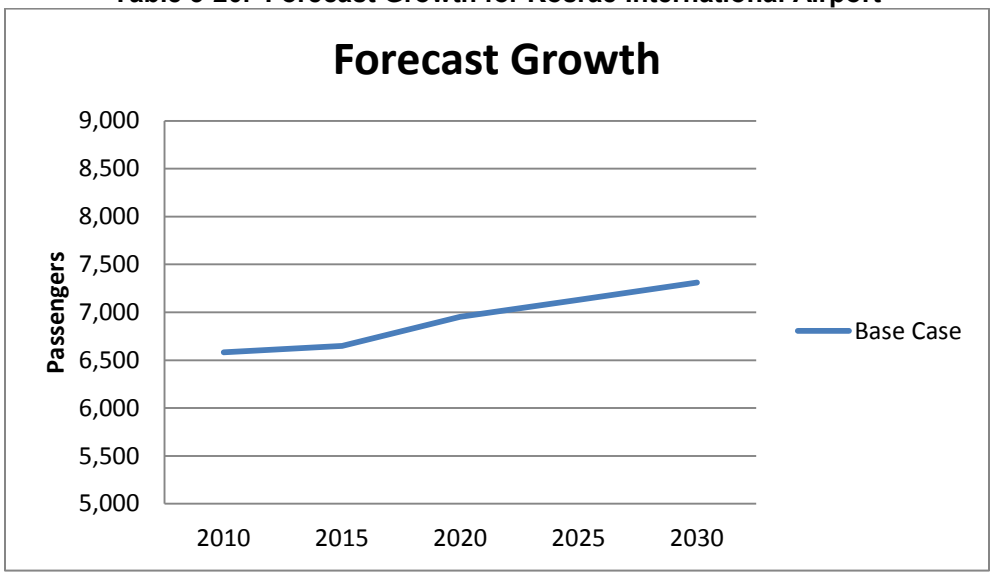
3.6.6 Peak Hour Activity Forecast

An additional measure of airport activity is hourly peaking. Hourly peaking can be defined in different ways. The typical approach is to develop "design hour" flows of passengers and aircraft. The design hour is the estimate of the peak hour of the average day of the busiest month. Kosrae International has only one scheduled air carrier and currently only one flight per day, six days a week, which basically makes the hour when Continental arrives, the peak hour. So, for Kosrae the peak operations are normally two operations per hour. If APA does operate in Kosrae in the future, there may be rare occasions when Continental Micronesia and an APA flight might arrive or depart during the same hour. This would be extremely rare, and will remain so for many years due to restrictions applied to the airspace surrounding this region of the Pacific.

3.6.7 Aviation Forecast Summary

With the State's commitment to developing the private sector and the implementation of the Kosrae Visitors Bureau's Tourism Plan, there is potential for aviation related growth at Kosrae International Airport. While in the short term there is expected to be no real growth, in the long term the forecast projects positive growth. Table 3-20 shows the projected growth rate.

Table 3-20. Forecast Growth for Kosrae International Airport



The forecasted growth is shown with a flat growth rate in the short term, with a one percent growth in the medium term and a half percent growth in the long term.

Subsequent chapters will utilize this growth rate as this applies to passenger counts, numbers of flight operations, peak hour conditions, and other parameters that will be useful in determining when facility improvements are needed.

CHAPTER 4: DEMAND CAPACITY ANALYSIS

AIRPORT CAPACITY: AIRSIDE

4.1 INTRODUCTION

The demand/capacity analysis examines the capability of the airfield system at Kosrae International Airport to address existing levels of activity as well as determine the capability of the airfield to meet the projected future levels of demand without incurring adverse levels of aircraft delay stemming from an airfield deficiency. Airport capacity can be calculated using the procedures in FAA Advisory Circular 150/5060-5. The title of this Advisory Circular is "Airport Capacity and Delay." The Advisory Circular is over 20 years old, but the procedures, methodology and principles included therein are reasonably appropriate for today's aircraft and operations. However, because this document is primarily applicable to high volume/high operations airports that are approaching capacity, and plan to increase their capacity, or develop an entirely new airport, it is not appropriate for calculating annual capacity since the demand at Kosrae International Airport is so far below even the most restricted IFR capacity.

The FAA methodology for capacity analysis involves a step-by-step process that addresses three components of the airfield's capacity which are determined using the method in FAA AC 150/5060-5, which are the hourly capacity of the runways, the annual service volume, and the annual aircraft delay.

Hourly Capacity of Runways: This basic measure of capacity is related to peak hour activity, and regulates the maximum number of aircraft operations that can take place in one hour.

Annual Service Volume: This number refers to the annual capacity or maximum level of aircraft operations that can occur at an airport during one year. This volume can be used as a reference in planning the runway system.

Annual Aircraft Delay: This is a measure of the total delays incurred by all aircraft on the airfield in one year.

4.2 FACTORS AFFECTING CAPACITY

Airfield capacity is defined as the number of aircraft operations that an airfield configuration can process or accommodate during a specified interval of time when there is a continuous demand

for service (i.e., an aircraft is always waiting to depart or land). The capacity of an airport is affected by several factors including the runway/taxiway system (airfield layout), meteorological conditions, aircraft mix, touch and go operations, and percentage of arrivals. These items are described below.

4.2.1 Runway/Taxiway System Capacity

The capacity of the runway/taxiway system is a primary determinant of the level of activity that can take place at the airport. An airport is assumed to reach capacity when the average delay for an arrival or departure exceeds a certain predetermined level. KSA has one runway (5-23) and a single stub taxiway. The layout of both the runway and taxiway are constrained to the current configuration by the lack of available land and Kosrae's geographical terrain.

4.2.2 Meteorological Condition

Aircraft operating parameters are dependent upon the weather conditions, such as the cloud ceiling height and visibility range on and near the airfield, and more importantly wind, because aircraft land and takeoff into the wind. As weather conditions deteriorate, pilots must rely on instruments to define their position both vertically and horizontally. Capacity is lowered during such conditions because aircraft are spaced further apart when they cannot see each other. Also, some airports, such as Kosrae International Airport, may have limitations with respect to their instrument approach capability which impacts capacity during bad weather. The FAA defines three general weather categories, based upon the height of the clouds above ground level and the visibility:

- Visual Flight Rule (VFR): Cloud ceiling is greater than 1,000 feet above ground level (AGL) and the visibility is at least three statute miles. All airports are able to operate under these conditions.

- Instrument Flight Rule (IFR): Cloud ceiling is at least 500 AGL but less than 1,000 feet AGL and/or the visibility are less than three statute miles but more than one statute mile. Aircraft operations are limited if the aircraft and the airport are not equipped with the proper instrument facilities.

- Poor Visibility and Ceiling (PVC): Cloud ceiling is less than 500 feet AGL and/or the visibility is less than one statute mile. Most airports, even those with precision instrument capabilities, have limited operations during these conditions.

This factor is important in determining the percent of time that aircraft operations are conducted under VFR and IFR conditions or below visibility minimums, as the capacity of the airport differs under VFR versus IFR conditions.

4.2.3 Aircraft Mix Index

The operational fleet at an airport influences an airfield's capacity based upon differing aircraft requirements. Various separations are set by the FAA for a number of safety reasons. For example, an airfield's capacity is influenced by the time needed for the aircraft to clear the runway either on arrival or departure. As aircraft size and weight increases, so does the time needed for it to slow to a safe taxiing speed or to achieve the needed speed for takeoff. Therefore, a larger aircraft generally requires more runway occupancy time than a smaller aircraft does. Thus, as additional larger aircraft enter an airport's operating fleet, the capacity for that airfield will be lowered.

There are four categories of aircraft used for capacity determinations under the FAA criteria. These aircraft classifications are based upon the maximum certificated takeoff weight, the number of engines, and the wake turbulence classifications.

Table 4-1. Aircraft Classifications

Aircraft Class	Maximum Certificated Takeoff Weight (lbs)	Number of Engines	Wake Turbulence Classifications
A	12,500 or less	Single	Small
B	12,500 or less	Multi	Small
C	12,500 – 300,000	Multi	Large
D	Over 300,000	Multi	Heavy

Source: FAA AC 5360-5, Change 2, "Airport Capacity and Delay".

The aircraft mix at Kosrae International Airport contains only a class C aircraft. Continental Airlines 737-800 series is the only aircraft currently using the airport. The mix index is the mathematical expression of the aircraft mix, and is the percent of C aircraft plus three (3) times the percent of D aircraft [%(C+3D)]. The mix index for Kosrae International Airport is 100 percent.

4.2.4 Percentage of Arrivals and Percentage of Touch and Goes

The percentage of aircraft arrivals is a factor of the ratio of landing operations to the total operations of the airport. This percentage is considered because aircraft approaching an airport for landing require more runway occupancy time than an aircraft departing the airfield. The percentage of touch and goes is the ratio of landings with an immediate takeoff to total operations. There are currently no touch and goes at KSA. Arrivals and Departures at the airport are equal, thus arrivals comprise 50 percent of the total operations.

4.3 AIRFIELD CAPACITY ANALYSIS

Kosrae International Airport was designed with a paved runway together with connecting taxiways to the terminal apron to be used for Commercial Service operations (Airport Classification, ARC, D-III).

The aircraft critical/design runway length (discussed in Chapter 5 Facility Requirements) is determined using the US FAA National Plan of Integrated Airport Systems (NPIAS) criteria to support programming and use of Federal Aviation Administration, Airport Improvement Program (AIP) funds. The capacity of the single runway configuration was evaluated within the parameters of US FAA Advisory Circular, AC 150/5060-5 together with the National Plan of Integrated Airport Systems service level criteria and has been determined to be adequate for the foreseeable future.

It is noted that Kosrae is very limited in available real estate. Construction of a parallel taxiway would not be feasible due to the required standard separation distance from the runway centerline to the parallel taxiway centerline for the critical/design aircraft (B737-800).

The one Air Carrier, Index III flight per day is managed through the prior notification process for arriving and departing aircraft at the airport. Ground Communication Facilities under airfield jurisdiction, required operating procedures, the Common Traffic Advisory Facility (CTAF), observation from airport ground vehicles and the Aircraft Rescue and Fire Fighting Station assure the runway is clear.

The runway capacity is assured and adequate for the foreseeable future, subject to the above capability of airport management.

4.4 AIRPORT CAPACITY LANDSIDE

"Landside" relates to the terminal area facilities that are used primarily for passenger movements. This area includes the terminal/administrative buildings, aircraft aprons, fueling area, the ARFF facility, general aviation facilities, parking and access roads. The following subsections address the abilities of these landside facilities to accommodate existing demand, and to identify the requirements needed to handle future projections.

FAA's AC 150/5360-7, "Planning and Design Considerations for Airport Building Development", describes a methodology for translating forecasted passenger activity into design peak hour demands. The procedure utilizes historic and projected passenger levels and aircraft movements to develop a hypothetical design day activity table from which passenger peaking activity can be analyzed. The circular also provides "average" peaking charts and rules-of-thumb for rough estimating of various peak (high level of activity) hour demand activities.

Airport terminals and related vehicle access and parking are planned, sized, and designed to accommodate peak passenger demands of the forecasted period. But planning for absolute peak demands (the greatest demands anticipated); will result in impractically oversized and under-utilized facilities except on rare occasions.

In the case of Kosrae International Airport, the uses of AC 150/5360's methodology for finding peak hour design are unnecessary as there is only one flight a day into Kosrae. This flight, Continental's "Island Hopper" is the only current aircraft flying into KSA. This aircraft is a 737-800 series, which has a total capacity of 155 passengers. Since this is not a direct flight—it makes two stops when flying westbound and two stops on its east bound route--it is highly unlikely that all of the 155 passengers' final destinations will be Kosrae.

Based upon observations of peak hour operations, the landside and access facilities should accommodate both existing and forecasted demand through the planning horizon. However, there is a correlation between the capacity of landside/access facilities and airline arrivals/departures. It is important to emphasize the role of airport management in taking a proactive role in establishing operational time slots for airlines' arrivals/departures as necessary. Operational control emanating from airport management is crucial in regulating the arrivals/departures throughout the day to avoid congestion and situations that could overwhelm the terminal and landside capacity. A good example would be to avoid having more than two aircraft at a time proceeding with arrival/departure operations simultaneously; this scenario would overtax KSA facilities.

4.4.1 Apron Parking Area

An aircraft parking apron is usually located adjacent to the passenger terminal. The loading and unloading of passengers, baggage, cargo, and mail, as well as the fueling, servicing, and light maintenance of the aircraft take place at the aircraft parking apron. The distance between the passenger terminal and adjacent runways and taxiways is determined in part by the depth of apron required for the maneuvering and parking of the aircraft. Adequate depth for the apron should be preserved for maneuvering and parking of both current and future aircraft and for apron activities.

At KSA the aircraft parking apron is located on the eastern side of the runway and to the south. Currently, the parking apron can accommodate two aircraft of 737 size aircraft, which is sufficient for operations at Kosrae International Airport. Under a current CIP project, the apron area is being expanded to allow for both aircrafts parked on the apron to both power in and power out.

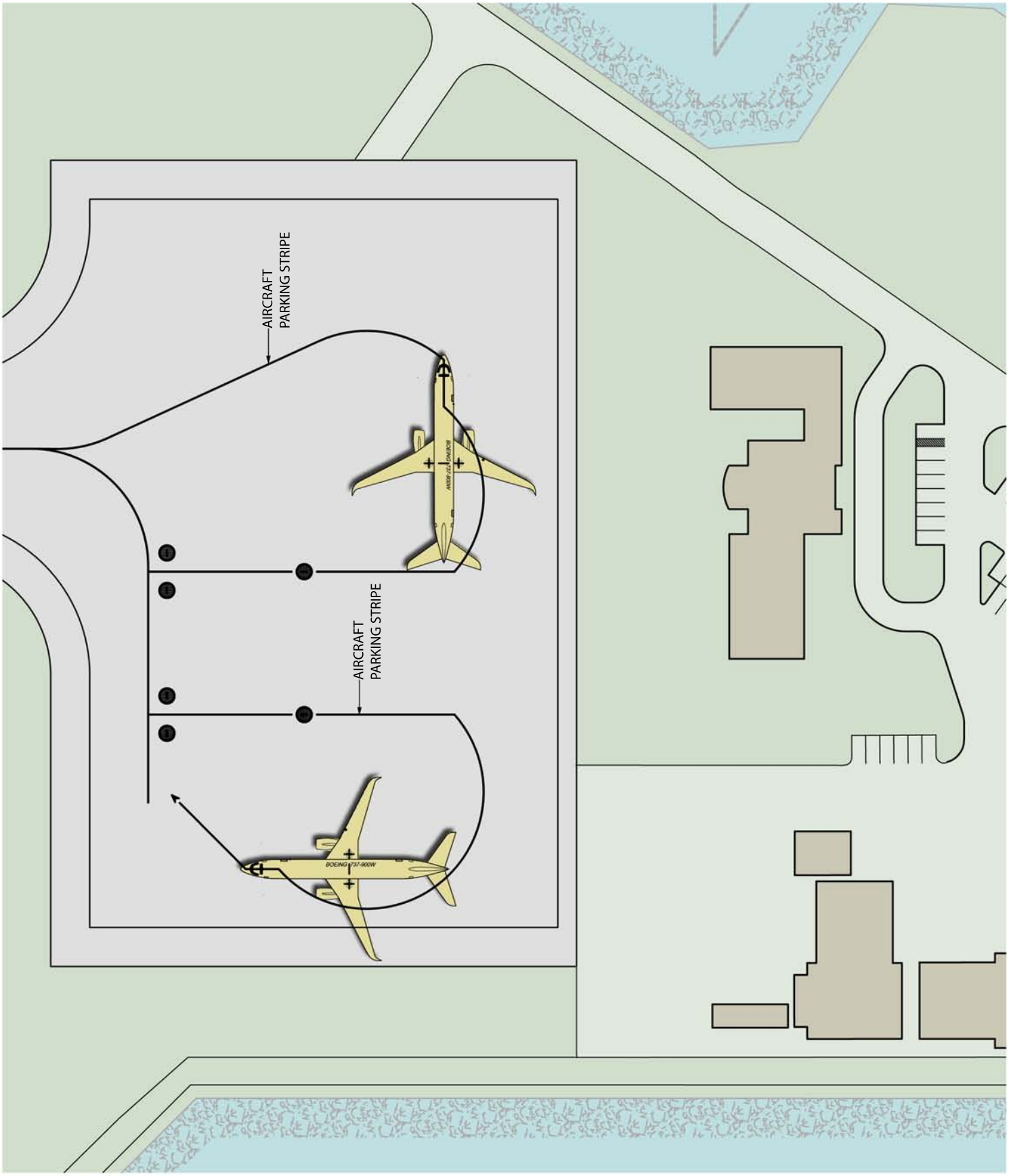
4.4.2 Fueling Area

The aircraft fuelling system at KSA is accessed by a fuel depot that is located on the aircraft parking apron. The fuel depot is currently located in a hazardous location that is directly in the jet blasts of aircraft leaving the parking apron. In addition to the depot, Kosrae International Airport also has a fuel hydrant system that is currently not being used due to its age and condition. The existing fuel situation meets current and future demand.

4.4.3 Air Rescue/Firefighting Station

Requirements for aircraft rescue and firefighting (ARFF) services at an airport are established under Federal Aviation Regulations (FAR) Part 139. An airport's ARFF Index determines the minimum ARFF equipment and extinguishing agents to comply with FAR Part 139.315. The Index is determined by a combination of factors including aircraft length and an average of five daily departures by the largest air carrier aircraft using the airport over a recent consecutive three month period. In the case of KSA, where there are less than five (5) daily departures of the largest air carrier aircraft using the airport, § 139.319 (c) is applicable:

"…the certificate holder may reduce the rescue and firefighting to a lower level corresponding to the Index group of the longest air carrier aircraft being operated…"



LEO A DALY
PLANNING
ARCHITECTURE
ENGINEERING
INTERIORS
EST. 1915

1357 Kapiolani Boulevard
Suite 1230
Honolulu, Hawaii 96814 USA
Tel 808-521-8889
Fax 808-521-3757

KOSRAE INTERNATIONAL AIRPORT

FEDERATED STATES OF MICRONESIA

FIGURE 4-1. APRON LAYOUT PLAN

The largest air carrier aircraft operating at the airport is the B 737-800, which is 129.6 feet long. Thus, according to § 139.315 (b), KSA is currently an Index C airport. A new state of the art ARFF Station was completed in 2009 and meets all requirements for an Index C airport.

4.4.4 Commuter, General Aviation, and Business Jet Facility Requirements

When placing general aviation parking, airport security will in large part determine the location of the parking area. Since persons using these aircraft have usually not been screened for security, their movement in the aircraft operational areas and their access to the terminal building must be controlled. In addition, provisions must be made to permit unscreened individuals deplaning from general aviation aircraft to have access to terminal facilities without passing through “sterile” secure areas.

Currently there is no general aviation based out of Kosrae International Airport and none is expected over the forecasted period.

4.4.5 Parking

The parking area is a small-sized parking lot with approximately 20 parking stalls available. About five of these stalls are reserved for government-related persons. The lot is directly in front of the passenger terminal and is connected with a covered walkway to the center terminal pavilion. There is also a three-minute parking loading area directly in front of the walkway to the center pavilion. The lot is unpaved and consists of dirt and gravel. In addition, many people coming to the Airport like to park along the airfield security fence line to watch passengers board and deplane and to watch the aircraft land and take off.

The existing parking area should be paved and marked to allow for the maximum number of stalls. An estimated paved and marked 20 stalls within the parking area will meet the parking demands of KSA.

4.4.6 Airport Access Road Requirements

The terminal roadway system includes the roadway serving the terminal building and associated parking areas, and the service roads which provide access to terminal support facilities, to the airfield and other nonpublic areas.

The airport access road to the airport was constructed at the same time as the airfield and harbor. The pavement is bituminous paved 24 feet wide with 5 foot wide unpaved shoulders on each side. The road is placed on an embankment that is protected with a shore protection structure. The road is approximately 4750 lineal feet long. The access road consists of two single lane bridges.

The single lane bridges need to be expanded, to allow for two lanes. The access road is the only way to reach the airport from the main island of Kosrae. Having to alternate vehicle access in ether directions can cause unneeded traffic. In an emergency situation, the bridges will have a negative effect on response times.

There is a new Portland Cement Concrete access road from the bituminous road to the new ARFF building. This road also serves as a paved route onto the airport apron. This is a recent addition and it is now possible for vehicles to drive onto the airfield pavement without traversing unpaved areas. This road was constructed in 2009 and is in excellent condition. A new Portland Cement Concrete secure access road to the apron is planned on the east side off the apron. The primary purpose of this road is for access to the apron from either side, as may be required in an emergency condition. This road will be constructed in 2010.

4.5 TERMINAL CAPACITY

The Kosrae International Airport terminal is located to the south of the runway, closer to the approach end of Runway 5. The terminal was built in the early 1980's and is divided into three different sections: departures, arrivals, and the center area. The building is not enclosed as the three sections are airy pavilions. With the east end of the terminal used for arrivals and the west end for departures, the middle of the terminal is used for ticketing and a lobby area where handmade crafts are sold. The Terminal is capable of handling the current and future capacity needs, but due to security and safety reasons, needs to be updated.

There are functional problems with the current terminal building. The departure hold room has enough capacity for departing passengers, but due to TSA requirements, half of all passengers destined to locales beyond Kosrae already on the Continental's flight must get off the plane along with all personal items (including carry-on luggage) and proceed to the hold room while security personnel perform a search of the aircraft. This requirement tends to stress the room's capacity, causing the room to overcrowd and become uncomfortable. To ease the congestion, the Main Terminal area is closed and passengers from the aircraft and hold room are allowed to wait in the lobby. The Departures Lounge is not of the proper scale to needs to be increased in size to

handle the additional in transit passengers. Also, a VIP Lounge is currently located off of the Ticketing Lobby outside of the sterile environment. The VIP Lounge needs to be relocated on the sterile side of security screening adjacent to the Departures Lounge.

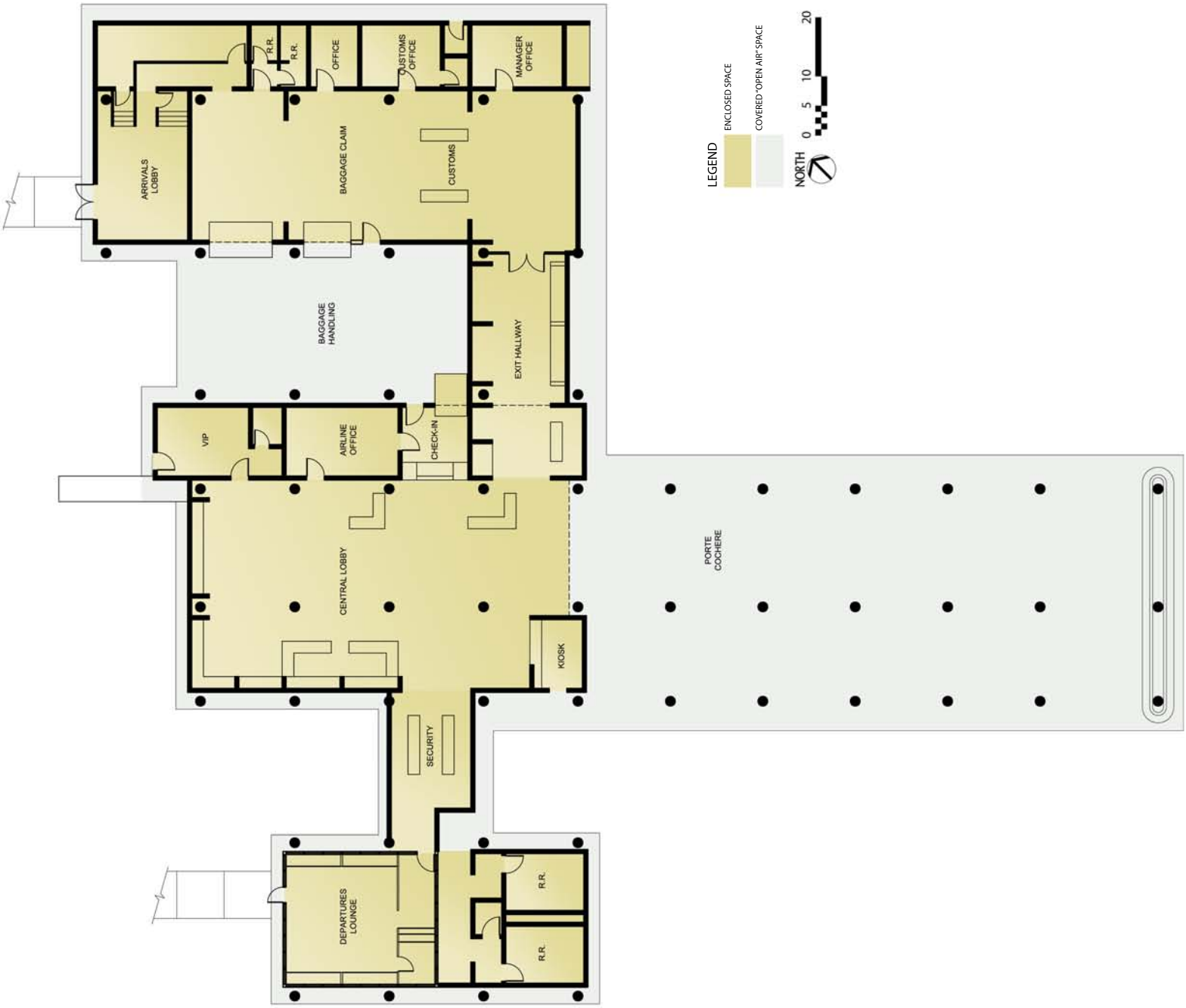
Another functional problem is the lack of separation between the Arrivals zone and the Departures zone, imposing an increase in the security risk. Passengers waiting to depart are currently forced to wait in the lobby area while the aircraft is searched, at the same time arriving passengers must exit through that same lobby area. This situation causes congestion and a potential security breach. The Terminal needs to be upgraded to allow for arriving passengers to exit directly from the arrival area without comingling with departing passengers.

The security screening area at KSA also meets capacity demands, but with no advanced x-ray machines or explosives detection devices exist at the airport. Airline staff currently have to perform manual checks on all baggage, causing delays and leaving the airport and airlines vulnerable to potential dangers arising from contraband concealed with checked or carry-on bags. The delays caused by hand searches of passengers and carry-on baggage cause the security line to back up into the main terminal lobby, thus causing congestion and passenger processing inefficiencies.

The existing facility is currently in poor condition. The wood structure is in disrepair and currently lacks a lockable front entrance. All of the electrical work needs to be replaced. Also, the wall and floor finishes, as well as the casework at the ticketing counter and baggage claim, are not holding up well. The result is a facility which needs a large amount of repairs, improvements, and updates, to the degree of recommending a new terminal structure.

Another concern is the lack of proper drainage. During heavy rains, which occur frequently, water enters the terminal building. This is problematic due to the safety concerns of passengers and airport employees, and is also accelerating further deterioration of the facility.

A Terminal Study was completed as part of this master plan study; its findings and recommendations can be found in Appendix A. The existing terminal layout and proposed layout out of a new terminal are attached in Figure 4-2 and Figure 4-3.



LEO A DALY
PLANNING
ARCHITECTURE
ENGINEERING
INTERIORS
EST. 1915

1357 Kapiolani Boulevard
Suite 1230
Honolulu, Hawaii 96814 USA
Tel 808-521-8889
Fax 808-521-3757

KOSRAE INTERNATIONAL AIRPORT
FEDERATED STATES OF MICRONESIA

FIGURE 4-2. EXISTING TERMINAL PLAN

LEO A DALY
PLANNING
ARCHITECTURE
ENGINEERING
INTERIORS
EST. 1915

1357 Kapiolani Boulevard
Suite 1230
Honolulu, Hawaii 96814 USA
Tel 808-521-8889
Fax 808-521-3757

KOSRAE INTERNATIONAL AIRPORT

FEDERATED STATES OF MICRONESIA

FIGURE 4-3. RECOMMENDED TERMINAL PLAN

CHAPTER 5: FACILITY REQUIREMENTS

5.1 DESIGN STANDARD ISSUES

Airport design standards are spelled-out in several FAA publications. Design standards for civil airports are set forth in the FAA's Airport Design Advisory Circular. FAA geometric design standards ensure the safety, economy, efficiency, and longevity of an airport. These standards have been applied in the determination of facilities requirements for Kosrae International Airport. These circulars also recognize that each airport is unique and that some adjustments need to be made to best fit each airport's needs.

5.2 AIRSIDE FACILITIES

"Airside" relates principally to the airfield facilities, which include the runways, taxiways, runway approach surfaces, runway protection zones and navigational aids (NAVAIDS). The following subsections address the ability of airside facilities to accommodate existing and future traffic loads, and to identify the requirements needed to handle future traffic.

5.2.1 Critical Design Aircraft

FAA AC 150/5325-4B provides guidance for determining the potential range of critical design airplanes through establishing a "substantial use threshold" of 500 or more annual itinerant operations at the airport (landings and takeoffs are considered separate operations). If an aircraft were to meet this substantial use threshold, it would be eligible for consideration as a design aircraft. The critical design aircraft for this study is the Boeing 737-800 series. The Boeing 737-800 series aircraft is the only scheduled aircraft that flies into Kosrae and with more than 250 arrivals and departures meets the FAA criteria for critical design aircraft. Continental Airlines--the one scheduled air service provider--has talked about the possibility of change from the 737 aircraft to a 757 aircraft. If this change were to happen it would switch the critical design aircraft from the 737 to the 757.

Table 5-1. Design Aircraft Criteria

Aircraft	Approach Speed (Knots)	Maximum Takeoff Weight (LB)	Maximum Landing Weight (LB)	Wingspan (Feet)	Length (Feet)	Max Tail Height (Feet)
Boeing 737-800	142	174,200	146,300	112.6	129.5	41.4
Boeing 757-300	143	273,000	224,000	124.8	178.6	44.8

5.2.2 Airport Reference Code

The FAA Advisory Circular 150/5300-13, *Airport Design*, has established a coding system to relate airport design criteria to the operational and physical characteristics of aircraft expected to use the airport. This code, the airport reference code (ARC), has two components. The first component, depicted by a letter, is the aircraft approach speed (operational characteristic); the second component, depicted by a Roman numeral, is the airplane design group and relates to aircraft wingspan (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while aircraft wingspan primarily relates to separation criteria involving taxiways, taxi lanes, and landside facilities. Aircraft in lower ARC would be accommodated by a higher ARC (i.e., A-I or a B-II fits into a D-III).

According to AC 150/5300-13, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The five approach categories used in airport planning are as follows:

- ***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 greater than 166 knots.

Based on the critical design aircraft's tail height and wingspan, the airplane design group for Kosrae is Airport Design Group III.

Table 5-2. Airplane Design Groups

Airplane Design Groups (ADG)		
Group #	**Tail Height (ft)**	**Wingspan (ft)**
I	<20	<49
II	20 - <30	49 - <79
III	30 - <45	79 - <118
IV	45 - <60	118 - <171
V	60 - <66	171 - <214
VI	66 - <80	214 - <262

The design aircraft (737-800) would give the airport an existing airport reference code (ARC) of D-III. The ARC is not anticipated to change throughout the planning period. However, there is a possibility that Continental Micronesia Airlines, the only commercial carrier into KSA, is looking into the possibility of using a Boeing 757 for its route through Micronesia. If Continental were to

change aircraft, the ARC would change to C-IV. Table 5-3 is a summary of design requirements for ARC D-III and ARC C-IV airports.

Table 5-3 Design Standards for ARC C-III/C-IV

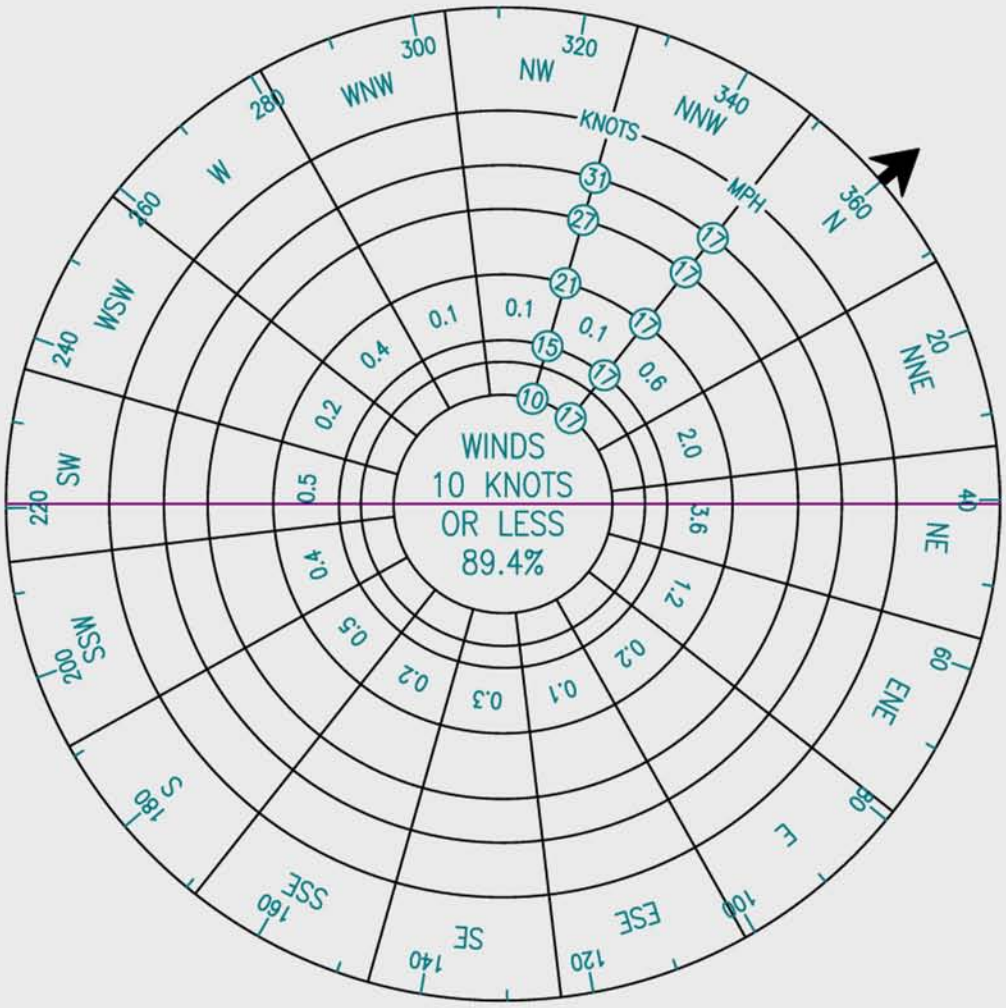
Design Standards	Airport Reference Code	
	D-III	C-IV
Runway Width	100 ft.	150 ft.
Runway Shoulder Width	20 ft.	25 ft.
Runway Blast Pad Width	140 ft.	200 ft.
Runway Blast Pad Length	200 ft.	200 ft.
Runway Safety Area Width	500 ft.	500 ft.
Runway Safety Area Length Beyond Runway End	1,000 ft.	1,000 ft.
Obstacle Free Zone Width	400 ft.	400 ft.
Obstacle Free Zone Length Beyond Runway End	200 ft.	200 ft.
Runway Object Free Area Width	800 ft.	800 ft.
Object Free Area Length Beyond Runway End	1,000 ft.	1,000 ft.
Taxiway Width	50 ft.	75 ft.
Taxiway Shoulder Width	20 ft.	25 ft.
Taxiway Safety Area Width	118 ft.	171 ft.
Taxiway Object Free Area Width	186 ft.	259 ft.

Source: FAA AC 150/5300-13 Airport Design

5.3 FACILITY REQUIREMENTS

5.3.1 Wind Analysis

A factor influencing runway orientation and number of runways is wind. Ideally, a runway should be aligned with the prevailing wind. Wind conditions affect all airplanes in varying degrees. The most desirable runway orientation based on wind is the one which has the largest wind coverage and minimum crosswind components. Wind coverage is the percent of time crosswind components are below an acceptable velocity. Wind coverage is calculated using a wind rose, which graphically depicts wind data collected from the National Oceanographic and Atmospheric Administration (NOAA). The wind rose is essentially a compass rose with graduated concentric circles representing wind speed. Each box in the wind rose represents a compass direction and, when filled, indicates the percentage of time wind travels in that direction at that speed. The desirable wind coverage for an airport is 95 percent, based on the total number of weather



WIND ROSE

WIND DATA PERIOD
1946 – 1963

CALM	18.9%
0–4 KNOTS	12.9%
4–10 KNOTS	57.6%
10–12 KNOTS	9.8%
RUNWAY 5–23	99.2% COVERAGE

SOURCE: U.S. DEPARTMENT OF COMMERCE

LEO A DALY
PLANNING
ARCHITECTURE
ENGINEERING
INTERIORS
EST. 1915

1357 Kapiolani Boulevard
Suite 1230
Honolulu, Hawaii 96814 USA
Tel 808-521-8889
Fax 808-521-3757

KOSRAE INTERNATIONAL AIRPORT
FEDERATED STATES OF MICRONESIA

FIGURE 5-1. WIND ROSE

observations. Unfortunately, NOAA does not have recent wind coverage data for KSA. Because prevailing wind patterns do not usually change, this master plan effort will utilize the existing wind data for wind coverage for Kosrae International Airport. Using the existing wind coverage data (data taken between 1946-1963) KSA exceeds the desired wind coverage with 99.2 percent coverage. The wind rose is depicted in Figure 5-1.

5.3.2 Runway Length Analysis

The runway length required is based on standards presented in FAA AC 150/5300-13, *Airport Design*, Chapter 3 and FAA AC 150/5325-4A, *Runway Length Requirements for Airport Design*. The recommended length for a primary runway at an airport is determined by considering either the family of airplanes having similar performance characteristics, or a specific aircraft requiring the longest runway. This need is based on the aircraft or family of aircraft that use the airport on a regular basis, where regular basis is typically defined as a minimum 500 itinerant operations per year. Additional factors considered include critical aircraft approach speed, its maximum certificated takeoff weight, useful load and length of haul, the airport's field elevation above sea level, the mean daily maximum temperature at the airfield, and typical runway surface conditions, such as wet and slippery.

Kosrae International Airport has a single runway, Runway 5-23 which is 5,751 feet. The design aircraft 737-800 series needs a runway at maximum takeoff weight (174,200 lbs) of 7,500 feet during VFR conditions.

The originally planned runway length for Kosrae International Airport was originally 7,000 feet. The Master Plan and the Environmental Assessment performed in 1977 reflect this proposal. The runway length was reduced to 5751 feet based on the project engineer‘s design and the US Navy evaluation of the forecast and planned services to Kosrae, together with available funds.

The current critical design aircraft for KSA is the Boeing B-737-800. It is the design aircraft based on current operations and determinations based on application of the Federal Aviation Administration-National Plan of Integrated Airports System Plan (NPIAS) and grant funding priority under the Airport Improvement Program as amended. The above parameters are within programming planning criteria even though this location may have less than 500 total annual operations and less than a minimum of 2,500 enplanements. This location is grandfathered based on prior grants and being programmed within the NPIAS.

5.3.3 Aircraft Landing and Takeoff Calculations

Aircraft Performance is calculated from guidance in US FAA Advisory Circular AC 150/5325-4B, "Runway Length Requirements for Airport Design" for the Boeing B 737-800 Aircraft. The Advisory Circular Guidance for runway design is not to be used for flight operations. Flight operations must be conducted in accordance with applicable aircraft flight manuals.

Table 5-4 - Airport and Aircraft Data

Airport and Aircraft Data		
Airport Elevation - Sea Level	Zero Wind	Maximum Temp - 86˚F(Standard Day + 27˚F)
Auto Spoilers Operating	Anti-Skid Operating	Maximum Differences in Runway Elevation – 2 ft. (Pacific Supplement)

Table 5-5 - Aircraft Landing and Takeoff Calculations

Boeing B-737-800	
Max. Landing Design Weight	146,000 lbs.
Max. Takeoff Design Weight	174,200 lbs.
Landing Length - 30˚ Flaps	Wet Runway 6,200 feet, Dry Runway 5,800 feet
Takeoff Length	8,100 feet

The FAR Landing and Takeoff Runway Length Requirements for landing aircraft indicate a dry runway requirement of 5800 feet and wet runway requirement of 6200 feet and a 8100 foot takeoff requirement for a maximum takeoff design weight (MTOW) of 174,000 lbs. The Advisory Circular guidance is for airport runway design and is not to be used for flight operations. Flight operations must be operated in accordance with the applicable aircraft manual.

5.3.4 User Aircraft Landing and Takeoff Recommendations-System Operation Data

Commercial Air Carrier Service for Kosrae International Airport is provided by Continental Micronesia Airlines. The data in Table 5-6, Runway Landing Length-Airline User Data, includes the landing distances for various aircraft operational configurations and runway conditions. Local and area weather may cause variation in the airport environs and impact aeronautical operations. The scenarios in Table 5-6 include ground operational changes based on a dry runway with light rain, with moderate rain or heavy rain causing a wet runway surface resulting in poor braking action. The data in the table specifies the Runway Condition and Braking Action associated with Normal and Non Normal Landing Conditions.

Table 5-6 - Runway Landing Length – Airline User Planning Data

Runway Landing Length - Airline User Planning Data				
Runway Conditions	Normal Landing	Non Normal Landing	Landing	Non Normal Landing
Braking Action (BA)	Configuration	Configuration	Configuration	Configuration
	Flap 40 degree	One-Engine Inoperative	Anti-Skid Inoperative	One Engine Inoperative
	Braking Maximum V Ref 40 knots	Flaps 1 to 15 degrees	Flap 1 to 40 degrees	Hydraulics A/B System Inoperative
	Landing Distance	Landing Distance	Landing Distance	Landing Distance
New, Dry, Clean, Normal (BA)	3,298 feet	3,338 feet	5,302 feet	4,956 feet
Island, Day, Intermittent Rain, Good (BA)	4,618 feet	4,730 feet	5,922 feet	6,158 feet
Moderate Rain, Fair (BA)	6,235 feet	6,814 feet	7,524 feet	8,550 feet
Heavy Rain, Poor (BA)	8,758 feet	9,354 feet	10,100 feet	11,058 feet

Two major impacts to planning aeronautical facilities and aircraft operations in Micronesia are the distances between airports and changes in the weather. The Weather Forecast Office (WFO-Guam) provides routine daily forecasts for the FSM. Heavy weather alerts and Tsunami forecasting are also part of their services.

Normal operations are conducted in light to moderate rain. All runways are grooved to increase braking action. The non-normal and anti-skid inoperative landing distance in moderate rain covers a range of 6,235 to 7,524 feet. For planning purposes the landing length for the design aircraft Boeing B 737-800 at maximum design landing weight on a dry runway is 5,800 feet and for the wet runway is 6,200 feet. In a balanced runway concept, a runway landing length between 6,235 and 6,814 feet, fair breaking action in moderate rain (wet runway) is an applicable planning parameter for a normal and/or non-normal landing with one engine inoperative. Based on consideration of available land area, a cost analysis and using the balanced runway concept, a 6500 foot landing runway length would be acceptable in the initial 5 year planning time period. This allows the air carrier to plan for enroute landing weights at those airports with lesser loads and variable operational cycles.

The following landing runway length for a Current (5 year), Intermediate (6 to 10 year), and Long Term (10 to 20 year) plan for Kosrae International Airports is based on the design aircraft operational requirements and to meet forecast utilization and needs.

Table 5-7 - State Airport System Planning

Runway Length			
State Airport	0 to 5 years	6 to 10 years	10 to 20 years
Kosrae International Airport	6,500 feet	6,500 feet	6,500 feet

All of the FS
M runways are somewhat “challenged” in terms of overall runway length. This is an increasingly important topic of discussion with the airlines that serve these airports. Unfortunately for many of the FSM airports, the physical terrain is somewhat prohibitive, economically, in terms of viable runway extensions. Kosrae International Airport, having the shortest runway among the four main airports in FSM (less than 6,000 feet), would certainly benefit from an increase in runway length to provide a greater margin of safety for arriving/departing aircraft.

5.3.5 Runway Width

Runway width is a dimensional standard that is based upon the physical characteristics of the aircraft using the Airport. The most important physical characteristic is the wingspan. The FAA Advisory Circular 150/5300-13, “Airport Design,” recommends a runway width for a Design Group III aircraft of 100 feet with 20 foot shoulders, unless the airport is used by aircraft exceeding 150,000 pounds, in which case the runway width should be increased to 150 feet and the shoulders increased to 25 feet. Presently, Runway 5-23 is 150 feet wide with 25 foot shoulders. Thus, a runway widening is not necessary.

5.3.6 Pavement Strength

Aircraft weight characteristics also affect the design of an airport. Pavement design of the runways, taxiways, and aprons is based on a design aircraft. The design aircraft is different from the critical aircraft described previously. The design aircraft is determined by landing gear configuration (i.e., single wheel, double tandem, etc.), and the known or forecast number of operations of aircraft with the heaviest maximum gross takeoff weights. The dual wheel main gear, 174,200 pound maximum takeoff weight Boeing 737-800 series is expected to be the most demanding aircraft to frequent KSA. The current strength rating on Runway 5-23 is 152,000 pounds.

The International Civil Aviation Agency, (ICAO), standard for reporting airfield pavement strength is the Pavement Classification Number, (PCN). The United States FAA is presently transitioning airport pavement strength reporting into this international system. The information and guidance for determining the PCN is provided in FAA Advisory Circular AC 150-5335-2B. Two approaches may be used to calculate the airport PCN. These are the “using” aircraft method or the “technical” evaluation method. Briefly, the “using” aircraft method determines the Aircraft Classification Number (ACN), of the most critical aircraft using the airport. See the Advisory Circular for more information on the definition and determination of the aircraft ACN. Generally this aircraft ACN number is then published as the airport PCN. The “technical” method allows

evaluation of a range of aircraft including those that might use the airport in an emergency situation or for expansion of air services to the community. This method provides a PCN value that considers the aircraft wheels and the pavement structure that must support the aircraft loads.

The "technical" evaluation method was used to prepare KSA's PCN values. All Kosrae airport pavements are currently being overlaid, replaced and enlarged. Therefore, this evaluation has been made on the assumption that the construction work is completed as designed.

The Kosrae International Airport has a flexible PCN value of 62/F/C/X/T and a rigid PCN value of 72/R/B/X/T. These values will permit reasonable unrestricted use by any civilian or military aircraft that might chose to operate at the airport. Requests to permit aircraft requiring higher PCN values might be considered favorably on an individual basis.

5.3.7 Runway Grades

The FAA Advisory Circular 150/5300-13, "*Airport Design*," allows a maximum longitudinal grade of 2.0% for A and B type runways and 1.5% for C and D runways. Gradient changes shall be such that any two points five feet above the runway centerline shall be mutually visible for the complete length of the runway. The effective gradient of the existing runway is 0.00% according to the Airport Layout Plan.

5.3.8 Runway Blast Pad

Runway Blast Pads for ARC D-III airports are required to be 140 feet wide, except when serving Group III aircraft with a maximum takeoff weight greater than 150,000 pounds; for these aircraft the width of the blast pad is required to be 200 feet wide, which is the same required width for ARC D-IV airports. The required length for runway blast pads for both ARC D-III and C-IV is 200 feet. The existing blast pads on runway 5-23 are 200 feet in width and length meeting the requirements set forth in AC 150/5300-13.

5.3.9 Runway Safety Area (RSA)

RSA standards are defined in AC 150/5300-13 Section 305 and construction standards are found in AC 150/5370-10 P-152. According to AC 150/5300-13 Section 503, the RSA must be centered on the same line as the center of the runway and the RSA must be cleared, graded and have no hazardous surface variations. For ARC D-III airports the RSA length must be 1,000 feet beyond

the runway end, and its required width is 500 feet, these requirements are also the design standards for an ARC C-IV airport.

The current RSA are non-standard, falling well short of the dimensions mandated by AC 150/5300-13.

Table 5-8. Runway Safety Area

Runway	Required Length	Actual Length	Required Width	Actual Width
5	1,000 ft.	200 ft.	500 ft.	500 ft.
23		200 ft.		500 ft.

Source: FAA AC 150/5300-13 Table 3-3

An Airport Certificate holder in accordance with US Federal Aviation Administration (FAA), Federal Aviation Regulation (FAR) Part 139, Section 139.309, Safety Areas, must maintain for each runway and taxiway that is available for air carrier use, a Safety Area of at least the dimensions that; (1) existed on December 31,1987 if no reconstruction or significant expansion of the runway or taxiway was begun after January 1,1988 or (2) were authorized at the time construction, reconstruction or expansion began after January 1, 1988. With no reconstruction or expansion of the runway since 1987, Kosrae International Airport RSAs are grandfathered under FAR Part 139.

A Runway Safety Area (RSA) Inventory was completed in September 2000 by the Federal Aviation Administration for airports certificated under Federal Aviation Regulation (FAR) Part 139 using guidance included in FAA Order 5200.8, Runway Safety Area Program. The purpose was to identify airports which could provide the standard runway safety area 1000 feet long with a 150 foot extended runway width within the 500 foot wide safety area. A data entry form provided a common data structure for the collection and compilation of the inventory into a national data base. Those runways ends which could not meet the standard due to natural obstacles, property limitations, environmental constraints and local developments required that the evaluation for alternatives to conform to the safety requirements expected from the 1000 foot long and 500 foot wide RSA standard.

A Standard Engineered Materials Arresting System (EMAS) provides a level of safety that is generally equivalent to a full Runway Safety Area (RSA) built to the dimensional standards in US Federal Aviation Administration (FAA) Advisory Circular AC 150/5300-13, Airport Design. At locations with natural obstacles, environmental constraints, local development and/or property limitations to providing the standard 1000 foot safety area at each end of the existing runway or a planned runway extension, the FAA has accepted the use of EMAS subject to an economic or cost benefit evaluation. A 600 foot long EMAS installation is considered by FAA to be functionally comparable to the standard 1000 foot safety area. Airport Planning Charts for certain aircraft are

included in Appendix 2, US FAA Advisory Circular AC 150/5220-2A, Engineering Materials Arresting Systems (EMAS) for Aircraft Overruns.

EMAS is not acceptable for providing additional safety area due to the short runway length at Kosrae international Airport. Installation of EMAS would shorten the operational length of the runway. An EMAS is not a substitute for adequate runway length to accommodate aircraft requirements for maximum takeoff weights (MTOW). It is recommended that the runway safety area be designed to use existing runways and not reduce operational lengths.

5.4 TAXIWAYS REQUIREMENTS

FAA Advisory Circular AC 150/5300-13 provides taxiway and taxi lane criteria for pavement width, shoulder width and safety area width. The criteria also provide dimensions for the distance from the taxiway or taxi lane centerline to any object. The dimensions for taxiways and taxi lanes serving Group III and Group IV aircraft are:

Table 5-9. Taxiway Requirements

CRITERIA	REQUIRED WIDTH (FEET)		CENTERLINE TO EDGE (FEET)	
	Group III Aircraft	Group IV Aircraft	Group III Aircraft	Group IV Aircraft
Pavement width	50	75	25	37.5
Shoulder width	20	25	45	62.5
Safety area width	118	171	59	85.5
Taxiway Object free area width	186	259	93	129.5
Taxilane Object free area width	162	225	81	112.5

There is one stub taxiway located towards the eastern end of the runway. The taxiway for KSA is 65 feet wide and connects the terminal apron to the south of the runway. The required width for ARC D-III taxiway is 50 feet, except for class III airplanes with a wheel base greater than or equal to 60 feet, the standard taxiway width for these aircraft is 60 feet. Currently this stub taxiway is sufficient for operations at Kosrae International Airport; construction has begun to increase the width of the taxiway to 87 feet to meet design criteria for ARC C-IV aircraft. Due to the limited land available at the airport, there are no plans for parallel taxiways or additional stub taxiways.

Taxiway Safety Areas. The taxiway safety area, centered on the taxiway centerline, is 118 feet wide for Group III aircraft and 171 feet wide for Group IV aircraft. The largest width is available at the Kosrae taxiway. Except for the 12-foot wide paved shoulders the entire safety area is unpaved. Plants grow on this surface and require constant mowing. The surface becomes soft

during periods of heavy rain extending over several days. Ruts have occurred when vehicles traverse this area during such times.

Taxiway Obstacle Free Areas. There are two criteria that might apply to this taxiway. The taxiway object free area criteria require larger clearances than the taxi lane criteria. Taxi lane criteria are intended to apply to areas where the pilots are aware of limitations and are exercising greater care in maneuvering the aircraft. At Kosrae the pilots are exercising caution, but the plan will use the taxiway criteria. The taxiway object free area width is 186 feet for Group III aircraft and 259 feet for Group IV aircraft. There are no objects within this area.

5.5 APRON AREA

The existing apron is bituminous paved and 417 feet long parallel to the runway centerline and 280 feet wide parallel to the taxiway centerline. There is one Portland Cement Concrete (PCC) hardstand within the apron. This hardstand is 100 feet long parallel to the runway centerline and 60 feet wide parallel to the taxiway centerline. The apron has full safety and object free area clearances on three sides, but there are some small structures close to the edge of the apron on the terminal building side. The ARFF vehicle parking apron connects to the aircraft parking apron at the northwest corner. There is a vehicle road from the apron to the terminal for use by the airline baggage and cargo vehicles. A fuel hydrant with an underground pipe is installed in the hardstand, but has never been placed in service.

Apron Safety Areas. Except on the terminal building side there are no obstacles within 69.5 feet of the other three edges of the apron. This means that assuming the aircraft centerline is at least 37.5 feet inside the edge of the apron, Category III and IV safety area criteria are met. Except for the thirteen foot wide paved shoulders, the entire safety area is unpaved. Plants grow on this surface and require constant mowing. The surface becomes soft during periods of heavy rain extending over several days. Ruts have occurred when vehicles traverse this area at such times. Vehicles crossing this area may track mud and objects onto the pavement.

Apron Object Free Areas. There are two criteria that might apply to the apron. The taxiway obstacle free criteria require larger clearances than the taxi lane criteria. Taxi lane criteria are intended to apply to areas where the pilots are aware of limitations and are exercising greater care in maneuvering the aircraft. Taxi lane criterion applies to the apron. The taxi lane obstacle free dimension width from the centerline used by the aircraft on the apron is 81 feet for Group III aircraft and 112.5 feet for Group IV aircraft.

Apron Wingtip Clearances. These criteria may be used for specific aircraft in specific locations.

At Kosrae these criteria apply to the clearances from the aircraft to the objects on the apron. The required taxi lane clearance for Group III aircraft is 21 feet and 37 feet for Group IV. The existing wingtip clearance meets requirements.

5.6 PAVEMENT CONDITION INDEX

Proper maintenance of airfield pavements is considered an important part of airport safety and economic operation of airports. The Federal Aviation Administration (FAA) has also recognized the significant benefit of having some formal requirement for a pavement maintenance program at all airports and has encouraged airports to have such a program in place. The advantage of using a formal pavement maintenance program with regularly scheduled maintenance activity ensures that the cost of pavement maintenance is reduced and pavement performance optimized.

The MicroPAVER™ procedure describes the pavement condition by assigning a value from 0 – 100 to the represent the pavement condition. This value is known as the Pavement Condition Index (PCI) of the pavement. A brand new pavement is assigned a PCI of 100 at the time of completion. A major project, such as an overlay, is also assigned a PCI of 100. As each subsequent pavement survey is made, the information is used to compute a new PCI. Each individual airport can create its own standards, but the US Air Force guidelines recommend that localized preventive work should be continuous at all times. When the PCI declines to 70 global preventive maintenance work should be undertaken to inhibit further rapid deterioration. In the event the pavement declines to a PCI of 50, major rehabilitation projects should be undertaken.

Two maintenance surveys were conducted using MicroPAVER™, the first in 2009, the second in 2011, the runway PCI was calculated as 55 in 2010 and 50 in 2011. Currently, the airfield is under repair, once completed the pavement will be assigned a PCI of 100.

5.7 AIRFIELD MARKINGS

Guidance for marking airfield pavements is set forth in AC 150/5340-1F, Marking of Paved Areas and Airports. As stated in the AC, “Runway and taxiway markings are essential for the safe and efficient use of airports, and their effectiveness is dependent upon proper maintenance to maintain an acceptable level of conspicuity.”

a) Runway Markings:

The runway at Kosrae International Airport currently has only non-precision markings. The basic elements comprising this type of marking are as follows:

- Marking colors (runway marking is white)
- Runway centerline marking
- Designation marking (runway end identity)
- Threshold marking
- Fixed distance marking (to inform pilot of remaining available pavement)
- Holding position markings (for taxiway/runway intersections)

Non-precision instrument approaches for Kosrae International Airport, and associated runway markings, are adequate, but it is suggested that, eventually, an Instrument Landing System (ILS) and associated runway markings be provided. If a precision instrument approach is installed, the existing markings could be upgraded to precision instrument runway markings. Upgrades to these markings include:

- Touchdown zone markings (an aiming point usually 1,000 feet from the landing threshold)
- Side stripes (edge of runway)

Blast pads, stopways, and paved safety areas must also be appropriately marked in accordance with the AC. It is emphasized that frequent maintenance is essential in assuring that pavement markings are clearly visible.

b) Taxiway Markings:

The current stub taxiway shall continue to be appropriately marked in accordance with the FAA Advisory Circular. These markings include:

- Marking colors (taxiway marking is yellow)
- Taxiway centerline marking
- Taxiway edge marking
- Holding position markings (at runway intersection)

c) Apron Marking

The apron is presently marked with stripes for leading the aircraft into and out of the two

parking positions.

5.8 AIRFIELD LIGHTING

Guidance for airfield lighting is set forth in FAA AC's 150/5340-4C, -19, and -24. These AC's refer to runway and taxiway edge lighting, runway and taxiway centerline lighting, and touchdown zone lighting. Airfield lighting is necessary to operate the airport during periods of darkness and low visibility due to inclement weather conditions.

The existing runway has Medium Intensity Runway Lighting (MIRL). An airport beacon (white/green) signifying a lighted land airport, and a lighted wind indicator/segmented circle are also part of the airfield lighting system. Runway lighting can be activated by the pilot via the CTAF frequency.

Under KSA recent capital improvement projects, the airfield lighting has been updated to meet all design requirements.

5.9 AIRFIELD SIGNAGE

The Standard for Airport Sign Systems, AC 150/5340-18B is the guidance for signage on airports. There are three basic color-coded sign types that provide information to the pilots on the airfield. The three types are as follows:

- Mandatory instruction signs (intersections and critical areas)
- Information signs
- Runway distance remaining signs

Under KSA recent capital improvement project the airfield signage has been updated to meet all design requirements.

5.10 APPROACH SURFACES AND RUNWAY PROTECTION ZONES

The approach surface and the runway protection zone are important elements in the design of runways that help insure the safe operations of aircraft. A brief description of these two areas is as follows:

a) The approach surface is an imaginary inclined plane beginning at the end of the primary surface, and extending outward to distances up to 10 miles, depending on runway use. The approach surface governs the height of objects on or near the airport. Objects should not extend above the approach surface. If they do, they are classified as obstructions and must either be marked, lowered or removed.

b) The runway protection zone (RPZ) is an area at ground level that provides for the unobstructed passage of landing aircraft through the above airspace. The runway protection zone begins at the end of the primary surface, and has a size which varies with the designated use of the runway.

Federal Aviation Regulation Part 77 indicates that the approach surface should be kept free of obstructions to permit the unrestricted flight of aircraft in the vicinity of the airport. As the approach to a runway becomes more precise, the approach surface increases in size, and the required approach slope becomes more restrictive. The existing and ultimate Part 77 surfaces for the runway are listed below in Table 5-10.

The runway protection zone is the most critical safety area under the approach path and should be kept clear of all obstructions. No structure should be permitted within the runway protection zone. It is therefore desirable that the airport owner acquire adequate property interests in the runway protection zone to insure compliance with the above. The required size of the runway protection zone is shown in Table 5-10.

Table 5-10. Runway Protection Zone

Runway Protection Zone			
	Runway End	5	23
	Approach Category	D	D
	Visibility Minimums	Greater Than 1 Mile	Greater Than 1 Mile
RPZ	Length – L	1,700 feet	1,700 feet
	Inner Width – W1	500 feet	500 feet
	Outer Width – W2	1,010 feet	1,010 feet
	Acres	29.5	29.5
Approach	Length	10,000 feet	10,000 feet
	Inner Width	500 feet	500 feet
	Outer Width	4,000 feet	4,000 feet
	Slope (H=Horiz, V+vert.)	34:1	34:1

5.11 AIRSPACE AND NAVIGATION AIDS

Enroute and terminal navigational aids help increase the overall airport and airway systems for VFR pilots, IFR pilots and the general public through increases in communications and in controlled aircraft separations. Typical enroute instrument aids include Non-directional Radio Beacons (NDB), Very High Frequency Omnidirectional Range (VOR), and Distance Measuring Equipment (DME). Typical terminal area visual aids include Visual Approach Slope Indicators (VASI), Precision Approach Path Indicators (PAPI) and Runway End Indicator Lights (REIL).

The lack of visual and navigational aids at an airfield can limit the airport's ability to accommodate aircraft operations during periods of darkness and poor visibility associated with inclement weather. For this reason, an analysis of both visual aids (VISAIDS) and electronic navigational aids (NAVAIDS) is an important part of an airport's expansion planning.

a) Visual Aids (VISAIDS) to Navigation:

The current visual aids at Kosrae International Airport include:

- Runway End Identifier Lights (REIL) for both runways 5 and 23
- Precision Approach Path Indicators (PAPI) for both runways 5 and 23

These visual aids are connected to the airfield lighting circuit and can be activated by pilots in the area via an air to ground interface by utilizing the CTAF frequency. The full complement of airfield lighting and visual aids can be activated without need for on duty ground personnel. This level of airfield lighting and VISAIDS allows night flight operations.

CHAPTER 6: LAND USE PLAN

6.1 INTRODUCTION

The primary objective of the Airport Land Use Plan is to provide a review of the current land use and to develop guidelines for the future land use at and surrounding Kosrae International Airport. The Master Plan contains forecasts of aviation demand to help define the physical requirements for airport development over the next 20 years.

Most airport master plans typically assess airport compatible land use and ways to minimize the number of people exposed to frequent and/or high levels of airport noise, or high cumulative noise levels. However, this chapter does not analyze the effect of noise level to the surrounding land use given the limited number of scheduled and unscheduled operations per day at Kosrae International Airport and the negligible noise level produced at the airport.

This chapter examines the physical setting, existing land use and potential aviation related uses for airport lands and discusses the recommended aviation related uses for these lands.

6.2 PHYSICAL SETTING/EXISTING LAND USE

Kosrae International Airport is located on an island strip of land that is on the northern point of Kosrae connected to the main island of Kosrae by a causeway near the village of Tafunsak. The airport contains one runway, one stub taxiway, one apron, a small terminal and an ARFF Station with a cargo hold located adjacent to it. Along with the Airport, other facilities are located on the island.

Adjacent to the Airport is Okat Harbor. Okat Harbor is the state's primary dock facility and handles all commercial shipping and fishing activities. The Okat harbor and dock complex is large and deep enough to accommodate cargo and fishing vessels up to 10.000 GRT. The dock is 550 ft. long; harbor depth is 30 ft. at low tide with a turning radius of 750 ft. The complex is capable of handling 20 ft. and 40 ft. containers upon request. The facility includes a 6,000 square foot storage warehouse. Cargo service is provided on a monthly basis with Matson's Shipping Line traveling from the west coast of the U.S. (San Francisco, CA), and Kyowa Lines arriving from Korea. Vessels arrive approximately every 20 days.

Figure 6-1. Aerial View of Kosrae International Airport

The harbor facility also includes a small two story office building, from which the Kosrae Port Authority operates out of. The second floor of the building is mainly offices, while the first floor contains storage areas.

There is a fuel farm that is located across the street from Kosrae International Airport. Micronesia Petroleum Corporation is in charge of maintaining and operating the fuel facilities, while Mobil is contracted to supply the fuel. MPC officially took over the facilities from Mobil in 1996. The fuel farm contains a 1.2 million gallon fuel storage facility which supplies fuel to the whole state.

Across from the Airport and Harbor Facility located on the main island of Kosrae is a dry dock with two slip-ways repair facilities for freighter and long line vessels up to 1000 GRT, and a small boat harbor used by local fisherman and diver boat operators. A small boat channel along the south of the airport connects the small boat harbor to Okat harbor.

There is no major industrial, commercial or residential land use near the airport.

6.3 AVIATION RELATED LAND USE

The following narrative discusses the various aviation-related, planned land use facilities, for airside, landside, and the terminal complex. It is noted here that there are a number of recently completed FAA ACIP projects as well as many under construction for Kosrae International Airport. These projects include:

- ARFF Facility and new ARFF Trucks
- Rehabilitated Runway Pavements
- Airport Perimeter Road
- Expanded/Rehabilitated Runway Turnarounds
- Widened Taxiway
- Widened Paved Shoulders
- Expanded Apron and PCC Hardstand Areas
- Upgrades to Drainage Facilities in the Terminal Complex
- Airfield Lighting and Signage
- New Pavement Markings (precision runway)
- Repairs to Shoreline Revetment and Settlement Areas within RSA

6.3.1 Airside

Additional airside improvements that merit consideration at this point are as follows:

a) Runway Extension

Presently the useable runway length at Kosrae International Airport is 5,751 feet. Continental Micronesia has been flying into Kosrae for decades and is currently providing scheduled air service into Kosrae with a Boeing 737-800 aircraft. This runway is the shortest within the FSM and also the shortest useable runway along Continental's island hopper route between Guam to Honolulu, with stops at the four FSM International Airports, Kwajalein, and Majuro International. Continental, Asia Pacific Airlines (cargo) and FSM officials have requested that this runway be lengthened to provide for enhanced payload (fuel, cargo, passengers) capabilities for aircraft serving Kosrae. The preparation of the FSM system plan is in process and will become a stand-alone submittal for system wide assessment / recommendations of the overall aviation system in FSM. The system plan assesses the runway lengths in FSM and makes the recommendation that for airfields where terrain and financial practicality allow. The optimal runway length should be 6,500 feet, with the exception of Pohnpei International Airport. This 6,500 foot runway length recommendation does apply to Kosrae International airport, since the existing terrain, notably the depth of the

reef shelf to the east, is shallow enough such that a modest runway extension could be constructed for a cost that we would consider within the range of “practical”.

It should be noted that the Kosrae State Government fully supports this potential runway extension and is moving forward to update the initial environmental studies, performed in the late 1970’s, in the hopes that the environmental assessments will be available promptly as this runway extension is pursued and funding sources identified.

This potential project is phased fairly early in the twenty-year planning horizon in order to make assessments in real time as to whether there are cost/benefit advantages to the project. The key elements for consideration are:

- Level of aviation activity, both commercial and private

- Cargo/mail payloads as compared to recent and historical trends
  This is a key factor in properly considering the need to lengthen Kosrae International Airport’s runway. Regarding potential increases in cargo payload, an important consideration is Kosrae’s efforts to revive its dormant fishing industry. There are discussions on going between the Kosrae government and third party developers to rebuild the island’s commercial fishing infrastructure. If these efforts are successful, there will be a compelling justification to provide additional runway length for cargo payload, with the focus on the higher grade (fresh) seafood exports targeted for Japan, Hong Kong, and other regional destinations. It should be emphasized that for high grade seafood export, air freight is the most viable method of transport.

- Aircraft in use on the routes throughout FSM
  It is important to monitor these criteria, as the current trend in aviation activities, per Continental’s recent route structures, is to reduce the number of flights per week into Kosrae. It is also important to differentiate between passenger operations, with an apparent trend to down-size frequency of flights and perhaps aircraft types, and future cargo operations. In other words, while passenger operations, frequency of flights, etc. may be on a level plateau, or even a modest decline, potential cargo operations may rise dramatically, underscoring the need for additional runway length at Kosrae International Airport.

b) Runway Safety Area (RSA)

RSA standards are defined in AC 150/5300-13 Section 305 and construction standards are found in AC 150/5370-10 P-152. According to AC 150/5300-13 Section 503, the RSA is centered on the runway centerline and the RSA should be cleared, graded and have no hazardous surface variations. For ARC D-III airports the RSA length criteria is 1,000 feet beyond the runway end, and its width is 500 feet. Even though it is a priority for both FAA and ICAO to ensure standardized RSA's wherever practicable, in the unique case of Kosrae, the RSA requirements have been waived given the nature of the airport, its surrounding ocean on both ends of the runway, and the need to maximize the useable runway length. In the event of a runway extension to 6,500 feet, it is anticipated that this waiver would be continued by both FAA and ICAO, again due to the compelling need for useable runway length and the impracticality (cost) of providing full length RSA's.

The Kosrae International Airport Draft Land Use Plan Overview, Figure 6-2, shows the overall airport layout, including the potential runway lengthening and as well as the non-standard RSA's.

c) AOA Access/Central Security Facility

The Draft Land Use Plan, Terminal/Landside, Figure 6-3, shows the recommended location of this combined AOA access and security facility located adjacent to and west of the terminal building. This is an ideal location for both guard shack/entry control to the AOA as well as the co-joined facility for administration support.

d) Health Center/Quarantine Area

The Draft Land Use Plan Terminal/Landside, Figure 6-3, shows the recommended location of this combined use facility adjacent to and south of the terminal building, and adjacent to the public vehicle parking lot area. This facility will have several dedicated handicapped parking stalls adjacent to the facility. The internal layout and function of the terminal building itself is discussed separately below, under the Terminal section of this chapter.

6.3.2 Landside

a) New Vehicle Parking Lot & Terminal Frontage Road

The existing parking lot area is unpaved, unlit, and in need of major upgrade. Fortunately, there is enough land area south of the terminal site to accommodate a vehicle parking compound within the boundaries of the airport/harbor access road, the terminal site, and the ARFF area to the west. The layout of the parking lot area is shown on the Kosrae Draft Land Use Plan Terminal/Landside Figure 6-3.

The new parking lot has an overall capacity of 42 parking stalls that includes 4 handicap stalls. A frontage road will circle the entrance to the terminal building, and within the overall parking lot there will be three spaces dedicated for the Quarantine/Medical clinic area. In addition, the parking lot area will connect to the ARFF parking area so that the ARFF compound will have two separate access points from the airport/harbor access road.

b) Upgrade of Single Lane Bridges

There are two separate bridges, both located within airport property, that provide the only public access to the airport. Each bridge spans a natural water way and each bridge is single lane. During everyday conditions, the single lane feature does not pose a significant problem. However, in the event of an incident or accident at the airport, these single lane bridges could be a bottleneck for emergency vehicle access to and from the airport. It is recommended that each single lane bridge be widened to two lanes to provide the access needed in the event of such incidents/accidents transpiring.

The bridge closet to the airport has started to fail and is currently weight restricted. The concrete has started to break away and there is an approximate two foot hole in the middle of the bridge. The maximum weight for the bridge is at this time is 20 tons.

c) Maintenance Workshop

Kosrae International Airport needs to have a facility dedicated to the maintenance, repair, and to some degree, storage of equipment typically used in the maintenance and operation of an airport. This facility is even more critical in this highly corrosive environment directly adjacent to the ocean. An excellent site for a maintenance workshop is to the south of the ARFF station, adjacent to the shoreline revetment. This location will have access to the ARFF parking area and access from the airport/harbor access road. This maintenance workshop is shown on Draft Land Use Plan Terminal/Landside, Figure 6-3.

6.3.3 Terminal

The existing terminal building at Kosrae International Airport is aging and in need of replacement. The overall size and scale of the existing terminal is appropriate, but the internal space distribution, passenger throughput, and ability to address security concerns while providing reasonable throughput is marginal. Because of these factors, a terminal study has been conducted. This terminal study is a separate chapter of this Airport Master Plan and the specifics of the terminal layout is discussed in detail as part of the terminal study.

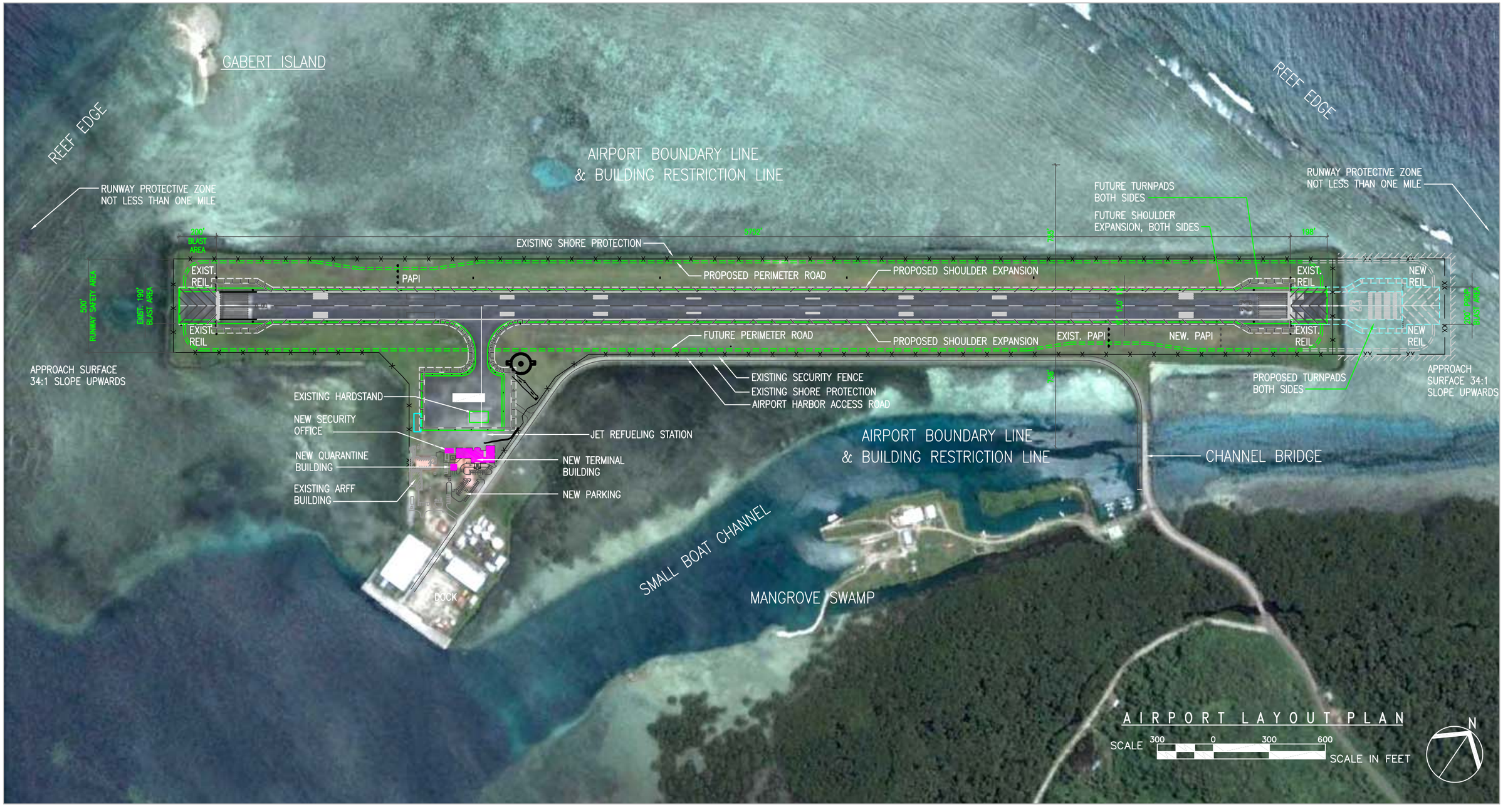
A schematic of the layout is included in this chapter to complete the overview of the three areas of the land use plan; airside, landside and terminal. The recommended terminal building layout is shown on Passenger Terminal Study Recommended Floor Plan, see Appendix A.

6.4 COMPATIBLE LAND USE

When looking at airport compatible land use the major concern is that developments on, near or around the airport comply with accepted restrictions on location, height, and activities that provide for safe aircraft movement and airport operations. It is important to identify those safety risks associated with air transportation in order to minimize the consequences of potential accidents. Also, specific areas near airports are exposed to various levels of accident potential. Identifying and protecting these specific areas through effective land use controls is essential for the safe and efficient operation of an airport. It also protects the public from the impacts of a potential aircraft accident.

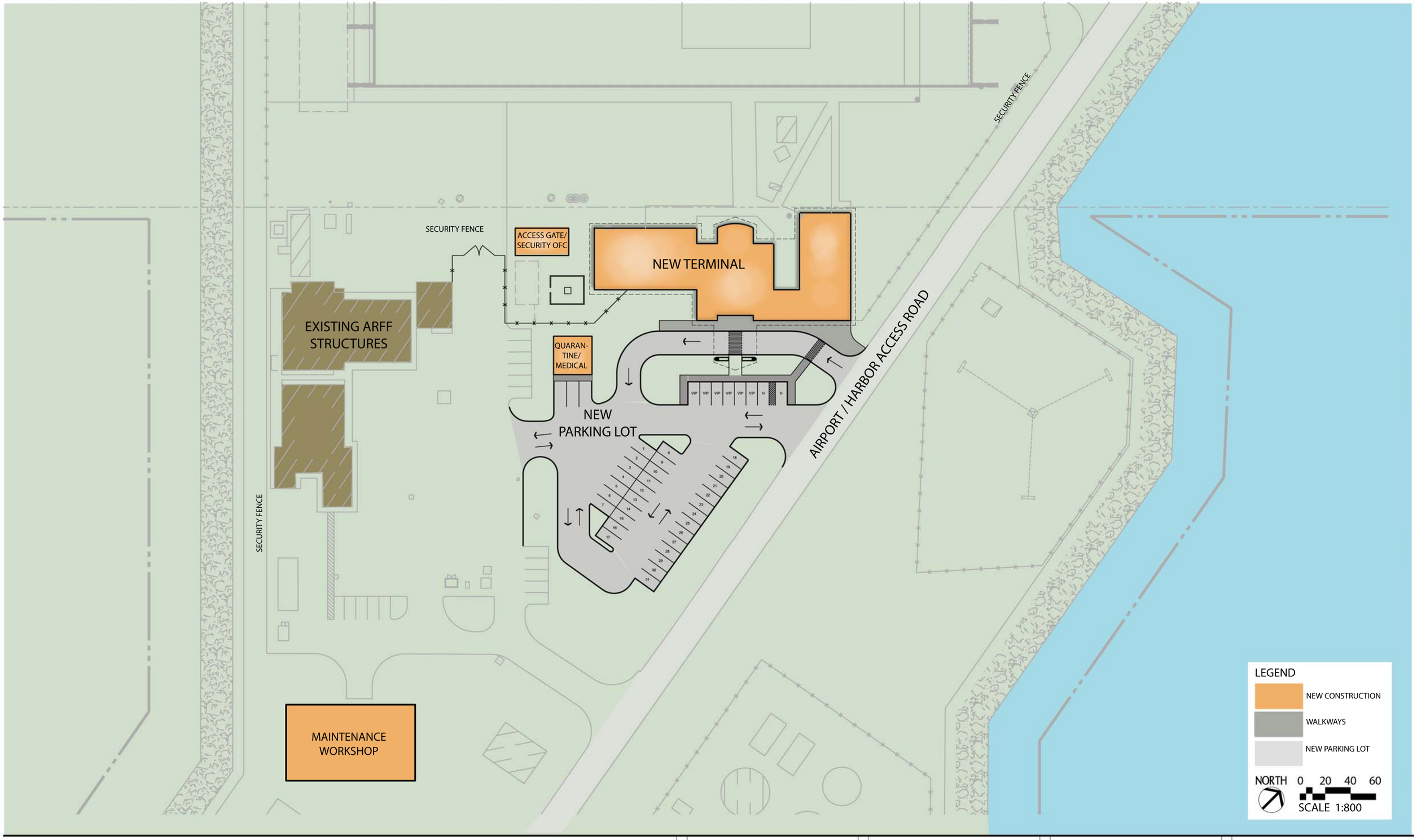
Most of the risk involved with air transportation is associated with the takeoff and landing portions of flights. The critical areas at an airport that need to be secured and protected from a land use compatibility standpoint include the approach paths and departure paths to the runways. To enhance airport safety, it is important to maintain obstruction-free airport airspace and a reasonable amount of vacant land at both ends of each runway.

Safety issues are a primary area of concern with compatible land uses. Areas around the airport should be free of development that could pose a hazard to pilots operating aircraft in the airport environments. Four primary characteristics of land use that reflect safety related issues are:



KOSRAE INTERNATIONAL AIRPORT
FIGURE 6-2 LAND USE PLAN OVERVIEW

FEDERATED STATES OF MICRONESIA	LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915	DECEMBER 2010	LAD PROJECT #081-10015-017
		LAND USE PLAN	KOSRAE, FSM



KOSRAE INTERNATIONAL AIRPORT
FIGURE 6-3 LAND USE PLAN

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT: 081-10015-007

LAND USE PLAN

KOSRAE, FSM

- High Concentrations of People
- Height Obstructions
- Visual Obstructions
- Wildlife and Bird Attractants

Kosrae International Airport has or is currently addressing these four primary areas of concerns. High concentrations of people can be defined as the number of people within a particular land area and is often measured by the number of people per unit of area. Density may be categorized as high, medium, or low depending on the number of people that a development contains. Kosrae State Government has already zoned the airport and its surrounding areas for industrial and commercial use only. There are no residential areas in the approach paths on either end of runway 5-23 or the surrounding airport area. Zoning the airport and surrounding area as Industrial/Commercial Use ensures a low density of people.

An Obstruction Survey is currently under way at Kosrae International Airport in order to update the existing FAA/NOAA database on terrain at and near the airport environment. This data is routinely used to determine the minimum descent altitude (minimums) for published instrument approaches into the airport. NOAA (US Federal Agency) was previously responsible for data collection and providing obstruction surveys to the FAA. Under new guidelines, FAA has taken responsibility for the new obstruction surveys and has developed guidelines for the survey. These guidelines include the need for aerial photography (photogrammetry) along with land based survey efforts.

Height restrictions are necessary to ensure that objects will not impair flight safety or decrease the operational capability of the airport. Federal Aviation Regulation (FAR) Part 77 defines a series of imaginary surfaces surrounding airports. Any object or structure which would penetrate any of these imaginary surfaces is considered by the FAA to be an obstruction to air navigation. While an obstruction to air navigation may not necessarily be a hazard to air navigation, the FAA presumes it to be and treats is as such until an FAA aeronautical study has determined that it does not have a substantial adverse effect upon the safe and efficient use of navigable airspace by aircraft.

Federal Aviation Regulations (FAR) Part 77 imaginary surfaces to determine height restrictions for natural and man-made objects are as follows:

a) *Primary Surface*: A surface longitudinally centered along the runway, extending 200 feet beyond each end of the paved runway and having a total width of 250 feet.

b) *Horizontal Surface*: A horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by scribing an arc 5,000 feet out from the center of each end of the primary surface and connecting the arcs with tangents.

c) *Conical Surface*: 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.

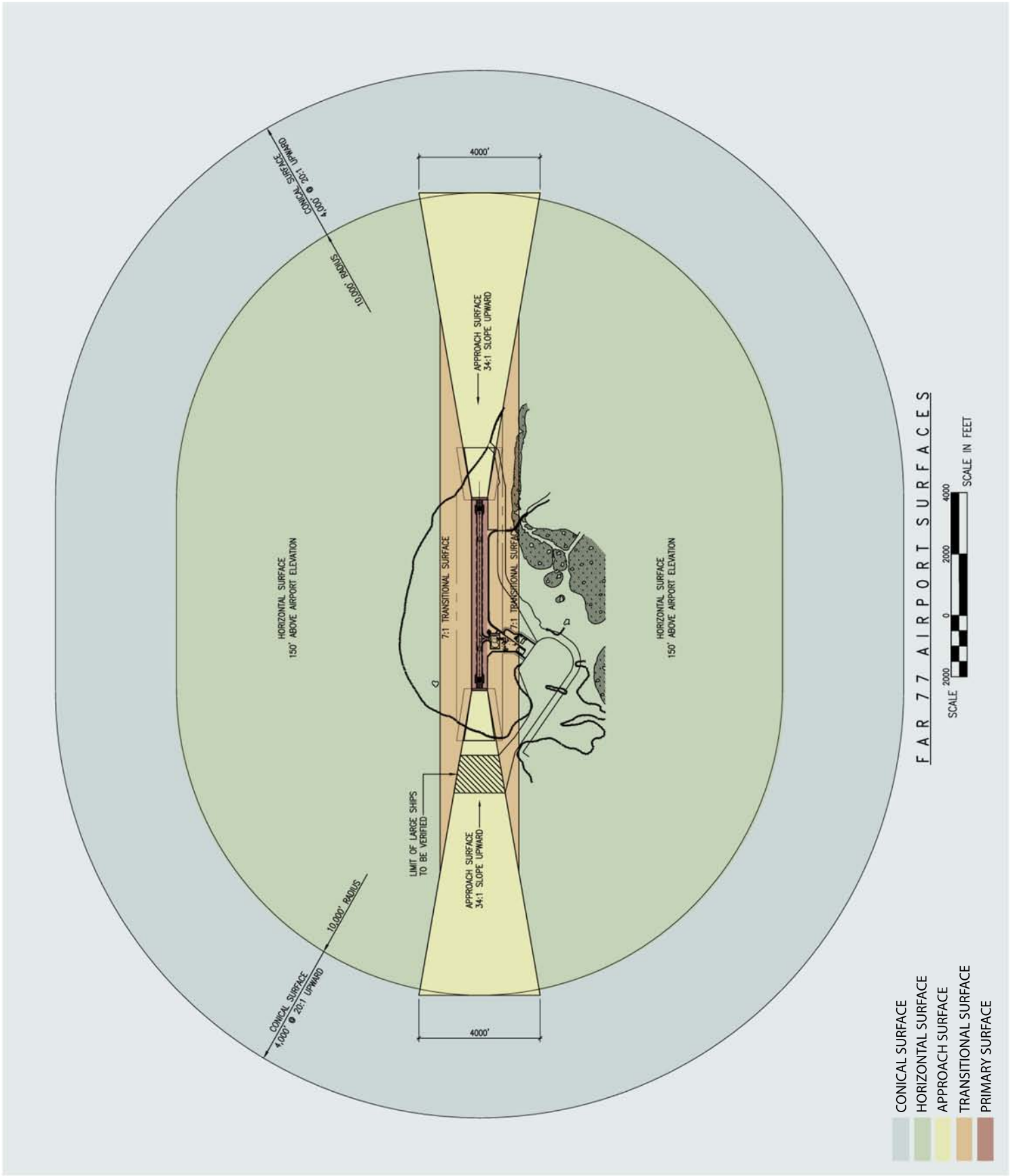
d) *Approach Surface*: A surface longitudinally centered on the extended runway centerline, extending outward and upward from each end of the primary surface at a slope of 20 to 1 for a length of 5,000 feet. The width of this surface starts the same as the Primary Surface, 250 feet, and flares to 1,250 feet at 5,000 feet.

e) *Transitional Surface*: A surface extending outward and upward from the sides of the primary surface and from the sides of the approach surfaces at a slope of 7 to 1.

Figure 6-4 shows the FAR Imaginary Surfaces. Drawing L-4 of the ALP set (Chapter 9) shows the obstructions found during the Obstruction Survey.

Visual obstructions are obstructions that obscure pilot visibility and should be limited to facilitate safe navigation. Visibility can be obscured by a number of items including: dust, glare, light emissions, smoke, and steam. KSA management needs to make sure that any activities that may cause issues with visibility are regulated and do not occur during aircraft approaches and departures.

Bird strikes to aircraft have land been a hazard to aviation safety. This issue is on growing concern, for the island airports in the Western Pacific with several recorded bird strikes within the last year. KSA, with the assistance of the United States Department of Agriculture (USDA), is in the process of developing a Wildlife Hazard Management Plan including a mitigation plan for the airport. Prior to the development of this plan, there will be a data collection phase (for 12 months) to gather actual data on types, quantity, and locations of birds on and near the airport. The data collection for Kosrae International Airport was completed in November 2010; a completed Wildlife Management Hazard Plan will be completed by the early 2012.



LEO A DALY
PLANNING
ARCHITECTURE
ENGINEERING
INTERIORS
EST. 1915

1357 Kapiolani Boulevard
Suite 1230
Honolulu, Hawaii 96814 USA
Tel 808-521-8889
Fax 808-521-3757

KOSRAE INTERNATIONAL AIRPORT

FEDERATED STATES OF MICRONESIA

FIGURE 6-4. FAR 77 IMAGINARY SURFACES

CHAPTER 7: UTILITIES

7.1 POWER

The Kosrae Utility Authority (KUA) manages the state's electricity supply system. KUA's power production facility at Tofol consists of five generators and one portable emergency generator. KUA has a substation with two transformers at the generators to provide power to the distribution power lines. The three distribution circuits that extend in a radial manner from the power plant in Tofol distribute the electricity to the 1,700 customers of Kosrae. The circuit serving the municipality of Lelu is approximately four miles long; the circuit serving the municipality of Tafunsak, the airport and Okat Harbor is approximately nine miles long and the circuit serving the municipalities of Malem/Utwe is 15 miles long. The circuit to Tafunsak was rebuilt in 2001/2002 and the rebuilding of the circuit to Malem/Utwe was just being completed as this report was finalized. The circuit to Lelu had been rebuilt in 2002/2003 and the 40-year old deteriorated overhead circuit is being considered for replacement by FY2007 or FY2008, preferably by an underground circuit.

Table 7-1. KUA Power Station: Generation Capacity

KUA POWER STATION: GENERATION CAPACITY							
Unit	Manufacturer	Model	Year Built	Year Installed	Rated Capacity	Operating Capacity	Current Status
2	Caterpillar	D398		1980	550	450	Operating
3	Caterpillar	D398		1982	550	450	Operating
4	Caterpillar	D398		1986	550	450	Inoperable
5	Caterpillar	D398		1988	550	450	Operating
6	Caterpillar	3606	1992	1993	1600	1600	Operating
7	Caterpillar	3606	1996	1997	1750	1750	Operating
8	Caterpillar	3512D	2006	2006	1080	1080	Under Construction

Source: U.S. DOI Energy Assessment Report Update

The Kosrae International Airport power utility description needs to be divided into several components. Kosrae Utilities Authority (KUA) serves as the local power utility company. KUA energizes different portions of the airport complex independently. KUA provided separate service connections and metering for:

1. The Airfield proper.
2. Federal Aviation Administration (FAA) facilities that support Airfield operations.
3. The Main Terminal Building.
4. The Aircraft Rescue and Firefighting Facility (ARFF).

In addition to normal utility (KUA) supplied power, emergency generator backup power supplies need to be discussed to fully understand the power supply characteristics for Kosrae International Airport Complex.

7.1.1 Airfield Electrical Systems Responsibilities

Responsibilities for electrical systems associated with airfield operations are divided between the Kosrae State, Federated States of Micronesia (FSM) and the U.S. Federal Aviation Administration (FAA). FAA systems are beyond the scope of work for planning purposes. The FAA is ultimately responsible for all their systems.

FAA Electrical Systems Excluded From the Kosrae State Master Plan:

a) Precision Approach Path Indicator (PAPI)
b) Non-Directional Beacon (NDB)
c) Distance Measuring Equipment (DME)
d) Runway End Identifier Lights (REIL)
e) Aeronautical/Aerodrome Flight Information Service (AFIS) Radio and Antenna
f) NDB/DME Antenna Tower
g) FAA power vault located across the Airport/Harbor Access Road from the Main Terminal Building utility structure supporting the PAPI and REIL power supplies including:
    1. Engine-generator set.
    2. Automatic transfer / isolation-bypass switches.
    3. Daytank.

Kosrae State Maintained Electrical Systems:

a) Windsocks – multiple locations on the airfields. All the wind cones are equipped with floodlighting
b) Rotating Beacon – located at the ARFF
c) Series circuit regulator/constant current transformer for runway, threshold, and taxiway edge lights.
d) Edge lighting is provided for taxiway and the main runway. Threshold lights are provided

at both ends of the runway.

e) Illuminated runway distance markers and directional signage are being utilized.

f) Aviation lighting system is energized from a series circuit regulator/constant current transformer. 15 kVA, 208 volt, 60 Hz, 97 FLA, single phase input with 4.8/5.5/6.6 ampere output current steps.

g) There exists two (2) each series circuit regulators/constant current transformers for airfield lighting. One of the units is energized and the second unit serves as an off-line spare.

h) The series circuit for lighting system components that Kosrae State is responsible to maintain (versus FAA responsibility) is located within the generator/power vault located adjacent to the ARFF.

7.1.2 Generator/Power Vault

The Generator/Power Vault Structure houses a generator room, transformer vault, electrical equipment room, and the former APIS office. The AFIS office has been relocated to the new ARFF. However, an operator's office continues to be required to access manual controls for airfield lighting systems. The generator room houses a 150 kVA generator set and Zenith automatic transfer switch. However, both the generator set and transfer switch are out of service.

A rented, trailer-mounted generator set has been parked behind the building to temporarily supply emergency power for airfield electrical systems. Generator power is routed through an Onan automatic transfer switch that has been installed inside of the generator room, with output feeders then routed to the out-of-service Zenith transfer switch for splicing back into the airfield power system. This same temporary generator set is also being used to support the FAA's equipment compound on the other side of the Airport/Harbor Access Road from the Main Terminal Building via underground secondary feeders.

The transformer vault houses a Kosrae Utilities Authority (KUA) 150 kVA pad mounted transformer. The secondary compartment of the transformer includes a 3P500A output circuit breaker, 500:5A current transformers for the KUA billing meter, and KUA billing meter 78715716. The secondary output feeder is routed to the out-of service Zenith automatic transfer switch within the generator room.

The electrical room houses the power supplies and controls for airfield electrical and lighting systems.

7.1.3 Remedial Work Required

The emergency power supply, including engine-generator set, automatic transfer/isolation-bypass switch, fueling system, overcurrent protection equipment, and interconnecting feeders needs to be replaced. The rented temporary generator set, fueling system, transfer switch, and temporary cabling is not recommended to remain in place for any significant duration. The new installation should have interface provisions for future loadbank testing of the generator set.

Consideration should be given to adding sufficient generator capacity to provide at least minimum emergency power support for the Main Terminal Building when the engine-generator set is replaced. See Chapter related to the Main Terminal Building for further discussions.

7.1.4 Main Terminal Building Electrical Systems

a) Incoming Power Service

Incoming power from Kosrae Utilities Authority (KUA) delivered at 13.8 kV, 3 phase, 3 wire. Primary power (13.8 kV) is delivered from the KUA underground distribution system along the public roadway adjacent to the airport compound via underground ductlines to a pad-mounted primary switching arrangement using open fused cutouts on steel framing inside of a rock wall and chain link fenced service transformer enclosure. A three 25-kVA each pole-top service transformer bank (75kVA total capacity) is used to step down from 13.8 kV to the 208Y/120 volts, 3 phase, 4 wire secondary distribution voltage. The transformer bank is mounted on a concrete pad and is located adjacent to the incoming primary power switching framing. Secondary service feeder is routed underground from the transformer bank to the Main Service Switchboard for the Main Terminal Building.

b) Emergency Power Supply

The Main Terminal Building relies solely upon KUA for its power needs. There is not any engine-generator set to support the facility in the event of a utility power outage.

c) Main Service Switchboard

The Main Service Switchboard is manufactured by Electrical Power Products and located within a utility closet at the southeast corner of the Main Terminal Building.

KUA secondary switchboard mounted meter number for billings is 77585251. The Main Service Switchboard receives incoming secondary service from the 75 kVA transformer bank within the transformer enclosure. The main switchboard does not have a main circuit breaker but has less that the six (6) each maximum feeder breakers allowed by code. The distribution section of the Main Service Switchboard includes 2 each 3P200A and 2 each 3P100A feeder breakers.

7.1.5 ARFF Electrical Systems

a) Incoming Power Service

Incoming power from Kosrae Utilities Authority (KUA) delivered at 13.8 kV, 3 phase via underground ductlines from the Airport/Harbor Access Road to a pad-mounted service transformer located within the ARFF compound. A pad-mounted 500 kVA service transformer used to step down from 13.8 kV to the 208Y/120 volts, 3 phase, 4 wire secondary distribution voltage. KUA secondary meter for billings is mounted on the exterior wall of the ARFF facility. 1600:5A current transformers are used by the meter to monitor electrical consumption. The current transformers monitor each phase of the secondary feeder cable sets.

b) Emergency Power Supply

Emergency power is supplied by an engine-generator set. The engine-generator set has a standby rating of 420 kW, 208Y/120 volts, 3 phase, 4-wire, 0.8 PF. The output from the engine-generator set is protected by a 3P1600A main circuit breaker that delivers power to the automatic transfer/isolation-bypass switch (ATS/ISO-BP) located within the main electrical room of the ARFF. The generator set is housed in a dedicated generator room. The engine-generator set supports the entire ARFF facility load. A fixed-mounted loadbank is installed in-line with the generator set radiator exhaust cowling. The loadbank is connected via a 3PI600A circuit breaker mounted along with the generator set output main circuit breaker.

c) Main Electrical Secondary Service

The main electrical secondary service is protected by a 3P1600A main circuit breaker. This main circuit breaker receives incoming service feeders from the pad-mounted transformer and sends normal utility power on to the ATS/ISO-BP located within the main electrical room.

The secondary feeders from both the service disconnect switch and engine-generator set are fed through an automatic transfer/isolation-bypass switch. The ATS/ISO-BP is rated 4P1600A. Output power from the ATS/ISO-BP is routed to a Main Distribution Panel located adjacent to the ATS/ISO-BP within the main electrical room of the ARFF. The Main Distribution Panel utilizes circuit breakers to energize power panels and other significant loads of the ARFF facility.

7.2 TELEPHONE

FSM Telecommunication Corporation serves the telephone, cell-phone, internet and cable TV systems for Kosrae. The state of Kosrae is a shareholder in FSM Telecom. The system provides most households with access to a telephone. Telephone and cell phone service is good, though FSM's long distance service is one of the most expensive for international calls. Internet service is very poor with maximum data transmission speeds of 28k, but often lower. There is a fiber optic cable being planned between Guam and Kwajalein Island in the Marshall Islands, and FSM Telecommunications is expected to obtain a lateral tap to the fiber optic cable in Pohnpei. This will substantially help FSM's data transfer rate.

The Kosrae International Airport complex requires telephone services for the Main Terminal Building, the Aircraft Rescue and Firefighting Facility (ARFF), and Federal Aviation Administration (FAA) facilities that support Airfield operations.

Each of these facilities derives separate telephone service connections directly from Kosrae Utilities Authority (KUA) underground distribution system that is routed along the Airport / Harbors Access Road that is adjacent to the airport complex.

7.3 POTABLE WATER / SANITARY SYSTEM / STORM WATER SYSTEM

The abundant rainfall results in water sources including aquifers, springs, streams, reservoirs and swamps. Fresh water is primarily obtained from mountain stream catchment reservoirs. There are also several wells, springs, and rainwater catchments from roofs of buildings also providing the water supply for Kosrae. There is no treatment of the water. Kosrae has plans and financing arranged through the Asian Development Bank and the U.S. Rural Utility Service to upgrade the water systems in three of the municipalities.

Wells tap a shallow layer of fresh water underlain by saltwater found in some beach strand areas. However, poor water quality often precludes the use of such coastal wells for drinking water.

Three deep upland wells are used for drinking water in the Tafunsak municipality near the airport. Catchment systems that collect water from the roofs of buildings for storage in cement and plastic tanks for household use and drinking are the most common.

The three harbor areas of Utwe, Okat and Lelu are the island's major drainage basins. Freshwater wetlands, which include swamp forests, marshes and bogs, are important natural resources. Swamps protect the water quality of rivers and coastal waters by acting as filters for sediment. Swamps also absorb excess rainwater runoff during storms that might otherwise cause flooding in coastal villages.

Wastewater facilities include a solid waste disposal pond at Tofol in Lelu Municipality. Lelu municipality has a collection system with its effluent being discharged into the outer edge of the reef near Lelu harbor.

7.3.1 Potable Water

Potable water is required for the Main Terminal Building and the Aircraft Rescue and Firefighting Facility (ARFF). Potable water to the airport complex is provided via an underground utility distribution piping system routed along the Airport / Harbor Access Road. Kosrae Utility Authority (KUA) is the utility agency responsible for delivering potable water. Each of the facilities requiring potable water has a separate utility meter connection adjacent to the airport / Harbor Access Road.

7.3.2 Sanitary Sewer

Sanitary sewer connectors are required for the Main Terminal Building and the Aircraft Rescue and Firefighting Facility (ARFF). Sanitary sewer lines are routed from each of the facilities to a septic tank system for collection.

A leech field on the secure side of the Main Terminal Building dispenses fluids from the septic tank system.

7.3.3 Storm Water System

a) Runway Drainage Systems.

Drainage is by sheet flow essentially perpendicular to the centerline of the runway. There are no paved or unpaved drainage ditches within the safety area dimensions. There are no underground drainage systems within the limits of the runway safety areas. The runoff is directed through the shore protection structure except at the apron and road edges. Alongside the road and at the apron drainage just outside the safety area drainage is parallel or at an angle to the runway centerline. There are a few drain culvert structures at the road side of the safety area and also some inlets and underground pipes crossing below the road.

b) Taxiway Drainage Systems

Drainage is by sheet flow. There are no paved or unpaved drainage ditches within the safety area dimensions. There are no underground drainage systems within the limits of the taxiway safety areas. Towards the west the runoff is directed towards the shore protection structure. Alongside the road to the east, drainage beyond the safety areas flow in unpaved ditches to drain inlets. The runoff then flows into the inlets and through culverts under the road.

c) Apron Drainage Systems

Drainage is by sheet flow. There are no paved or unpaved drainage ditches within the safety area. Also there are no underground drainage systems within the limits of the taxiway safety areas. The paved portion of the apron is crowned parallel to the runway centerline near the mid-section. The runoff therefore flows towards the runway on one side and the terminal on the other. The runoff on the runway side is directed towards the shore protection structure to the west and towards the road on the east. Alongside the road, drainage beyond the safety areas flow in unpaved ditches to drain inlets. The runoff then flows into the inlets and through culverts under the road.

d) Area on Airside of the Terminal Building

The elevation of this area is very low relative to the pavement and receives the runoff from some of the paved apron and runoff from portions of the terminal building. There are small

drain structures and paved and unpaved channels in this area. The bituminous paved road to the terminal is used to transport baggage and cargo and is in fair condition. There are sidewalks of varying materials, widths and conditions leading to the terminal building doors.

e) Rainwater Catchment Systems

Rainwater catchment systems are used at both the Main Terminal Building and Aircraft Rescue and Firefighting Facility (ARFF) to reduce storm water runoff and as well as potable water consumption.

7.4 AIRCRAFT FUELING SYSTEM

There is a fuel farm that is located across the street from Kosrae International Airport. Micronesia Petroleum Corporation (MPC) is in charge of maintaining and operating the fuel facilities, while Mobil is contracted to supply the fuel. MPC officially took over the facilities from Mobil in 1996.

Figure 7-1. FSM Petroleum Corporation Fuel Facilities

An underground fueling system was installed at the time the apron pavement was built. It has never been used. It is understood to have been single wall pipe conforming to the then current standards. Having never been in use it is extremely unlikely that the system could be placed in use. The aircraft are serviced by a simple hose and pump facility at the south apron edge. In order to use this hose the aircraft must park facing east and therefore passengers must walk around the front of the aircraft.

At some point the entire system should be replaced with a new double wall monitored system

to prevent a possible fuel leak. Consideration could be given to installing fuel pits in the new apron when it is constructed. One advantage would be that the aircraft could then be parked so that the passenger doors face the terminal building.

7.5 SECURITY FENCING AND INTERNAL ACCESS ROAD

Security fencing encircles the runway, taxiway, apron, and secure side of the Main Terminal Building. Security fencing is also used to protect the Aircraft Rescue and Firefighting Facility (ARFF) compound. As the Main Terminal Building and Aircraft Rescue and Firefighting Facility (ARFF) are located immediately adjacent to the Airport / Harbor Access Road, there is no need for additional roadways within the airport complex.

CHAPTER 8: ENVIRONMENTAL

8.1 INTRODUCTION

The purpose of considering environmental factors in airport master planning is to identify potential key environmental impacts of the various airport development alternatives so that those alternatives can, when possible, avoid or minimize impacts on sensitive resources. The environmental review should provide information that will help expedite subsequent environmental processing.

This environmental review, while not a formal environmental impact assessment (EIA), will consider the environmental elements described in FAA Advisory Circular 150/5070-6B, FAA Order 5050.4B, Airport Environmental Handbook, and any relevant National and State environmental regulations and procedures.

8.2 GENERAL CONDITIONS

8.2.1 History

Anthropologists believe that the people who settled the Caroline Islands, including Kosrae, migrated from Southeast Asia approximately 3,000 years ago. The society was highly stratified at the time of initial contact with the West. Kosrae shared many common cultural features with surrounding islands, including: matrilineal lineages and clans; social rank defined by affiliation with kin groups defined as "noble" or "commoner"; noble control over land worked mainly by commoners; elaborate redistributive exchanges; and settlements oriented around a group of close relatives sharing access to a single cook house.

The Spanish arrived in 1529, but European travelers visited the island infrequently until the great whaling era in the first half of the 19th century. Because of its fine harbors and fresh water supply, Kosrae, then called Strong's Island, became a popular stop-over for sailors. Kosraens were victimized by whaling crews, who made deals with chiefs for the Island's abundant foods, water, and female companionship. The early years were turbulent with sailors provoking several local wars before local rulers restored peace in the 1840s.

In the 1860s, with the decline of the whaling industry, missionaries began their work and Kosrae became the evangelical center for the Caroline and Marshall Islands during the next 30 years. The first missionary established a station in 1852 and virtually the entire population was

Christianized by the 1870s. Germany purchased the island of Kosrae from Spain in 1899 after Spain's influence in the Pacific declined following the Spanish-American War of 1898. The Germans administered the island from Pohnpei, focusing on the copra and sea cucumber industries. They did little for development in Kosrae, but did bring educators and established health clinics on the island.

At the start of World War I, the Japanese entered the war on the side of the Allies. In 1914, Japan sent its fleet to the Caroline Islands and immediately occupied Kosrae along with the other Caroline and Marshall Islands. During the Japanese mandate of 1914-1945, extensive economic development occurred, run by and for the benefit of the Japanese companies and government. The United States was granted control over Micronesia at the end of World War II. Administrated as part of the Trust Territory of the Pacific Islands, Kosrae was considered an outer island of Pohnpei and was part of the Pohnpei district. In 1978, the people of the Trust Territories of the Pacific Islands developed and approved a constitution, written by elected delegates, forming the Federated States of Micronesia government, consisting of the States of Kosrae, Chuuk, Pohnpei, and Yap. Palau and the Marshall Islands chose not to join the newly formed FSM. The capital for the new FSM government was established on the island of Pohnpei. A President, elected by the National Congress, heads the national government, which includes executive, legislative and judicial branches. Each state remains internally self-governing, with its own parliamentary body, and governor.

8.2.2 Air Quality

Observations indicate that Kosrae has good air quality, experiencing excellent visibility throughout the year. Kosrae's consistent trade winds, remote location, and absence of major air polluting activates, help maintain high air quality. Sources for air pollution in the area are emissions from cars and dust from the roadway.

8.2.3 Water Quality

The abundant rainfall results in water sources which include aquifers, springs, streams, reservoirs and swamps. Fresh water is primarily obtained from mountain stream catchment reservoirs. There are also several wells, springs, and rainwater catchments from roofs of buildings which also provide the water supply for Kosrae. There is no treatment of the water. Wells tap a shallow layer of fresh water underlain by saltwater found in some beach strand areas. However, poor water quality often precludes the use of such coastal wells for drinking water. Three deep upland wells are used for drinking water in the Tafunsak municipality near the airport. The most common

catchment systems collect water from the roofs of buildings for storage in cement and plastic tanks for household use and drinking.

8.2.4 Marine Environment

The marine environment for the island of Kosrae is typical of a tropical volcanic island with common habitats including passes, channels, fringing reefs, shallow reef flats, terraces, submerged reefs, slopes, reef holes, embayment, quasi estuaries, sea grass beds, mangroves, mud and sand flats. There are four main harbors situated among the mostly mangrove-ringed island dotted with several strands of sandy beaches and surrounded with a fringing reef. The reef flats that surround Kosrae are considered to be among some of the most pristine remaining in the world, and are home to over 180 species of corals and over 250 species of fish.

The endangered marine species include turtles, lobsters, trochus, sea cucumbers, crabs, corals, and giant clams. Other declining fish species identified by the Fisheries Division include the bump head parrot fish, mullet fish, rabbit fish, napoleon wrasse, and unicorn fish.

The State owns all marine areas out to 12 miles, but residents are able to freely harvest the marine resources within, except in the trochus and Utwa-Walung Marine Park sanctuaries. The trochus sanctuary is located on the reef in the Okat area. This trochus sanctuary also extends protection to other species of marine life as identified in the Shoreline and Reef Management Strategy. The Utwa-Walung Marine Park sanctuary spans a large portion of the mangrove and reef area on the southern side of the island. The Utwa-Walung Marine Park sanctuary area covers 421 hectares. This area encompasses the entire area designated as the Utwa Walung Marine Park. It is bordered by Molsron Tukunsru to the west, Infal Yesron to the east, the 10 meter elevation contour to the north, and the in-shore corals to the south. In this particular area there is no harvesting of mangroves on the ocean-side strip of land of the mangrove channels and in Utwa Lagoon.

8.2.5 Terrestrial Environment

The terrestrial environment is comprised mostly of upland forest, which along with agro forest, accounts for close to 70% of the island's vegetation. The interior of the island is characterized by high, steep, rugged mountains rising to 2064 ft. at Mt. Finkol, and covered with dense tropical rainforests. The steep uninhabitable mountains account for about 70% of the total land area (43 square miles). Several sandy beaches break through the mangrove shoreline to provide easy access to the narrow surrounding lagoon. The mangrove swamps cover 14% of the island.

Some native species of Kosrae include the dusky white eye and the horsfieldia nunu amongst others. The only remaining stand of *Terminalia carolinensis* trees in the world, locally known as Ka, is found in Kosrae. This area, comprised of the Ka stand and mangrove forest, was identified by The Nature Conservancy as a high priority Area of Biological Significance. Endangered species include the fruit bat and the Micronesian pigeon. Some of the common domestic animals include pigs, dogs, and chickens. Invasive species include the African snail, white flies, frogs, rats, and monitor lizards. The island has a small proportion of land available for agriculture. Kosrae State is able to export citrus and bananas to the neighboring islands. The latest survey recorded over 100 plant species; 45 of these are food crops, and include fruits, vegetables, aroids and tubers.

8.2.6 Land Use

a) Traffic:

With its small population and lack of major urban areas, there is no real traffic to speak of on Kosrae. Most of the transportation on Kosrae is by private vehicle around the coastal road that runs approximately 80% of the circumference of the island. The paved road, 19 miles from Utwe to the Okat port/airport, is in excellent condition. The road was paved in 2002 and receives regular maintenance.

b) Noise:

Kosrae is peaceful and quite. There are little to no major noise generating activities on the islands. The two major sources for sound are the airport and the quarry. The noise levels are minimum and only last during airport/quarry operations. In the more developed areas, the noise is similar to any small urban area. The majority of the noise is caused by traffic and local business. In rural areas there is barely any noise. There is no real traffic to speak of and local businesses are limited to small family-operated stores.

8.3 POTENTIAL ENVIRONMENTAL IMPACTS

8.3.1 Methodology for Assessing Impacts

This section looks at the environmental impacts of proposed actions, reasonable alternatives to that action, and environmental effects that cannot be avoided should the proposed actions be

implemented. It is required that consideration of impacts includes the context, intensity, duration, type and measures to mitigate impacts.

Impacts are considered at their local, national, and regional context as appropriate.
Intensity is a measurement of the severity of an impact. The intensity of an impact may be:

- *Negligible* – when the impact is at its lowest level of detection
- *Minor* – when the impact is low but detectable
- *Moderate* – when the impact is evident and considerable
- *Major* – when the impact is severe

The duration of an impact is a measure of how long the effects of an impact will last. The duration of impacts are categorized as short-term and long- term.

- *Short term* – impacts that last less than a year
- *Long term* – impacts that last longer than a year

Types of impact:

- *Adverse* – impacts that change the affected environment in a manner tending away from the natural range of variability
- *Beneficial* – impacts that change the affected environment toward the natural range of variability
- *Direct* – impacts caused by the action and occur at the same time and place
- *Indirect*– impacts caused by the action and are later in time or father removed in distance, but are still reasonably foreseeable
- *Cumulative* – impacts on the environment resulting from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time

8.3.2 Types of Impacts

The following section takes a generic look at possible environmental impacts that may result from the proposed capital improvements recommended by this Master Plan. There will be a need, however, for complete coordination with federal, state, and local agencies when the

recommended projects are initially designed. Without mitigation or implementation of an environmental management plan environmental impacts can occur during both construction and operation of major infrastructure projects. Such impacts are widely documented and are summarized in the matrix shown as Table 8-1.

TABLE 8-1. Potential Impacts Caused by Capital Improvement Projects

Construction Activities	Potential Environmental Impact
Surveying and demarcation of work site	• Loss of vegetation and disruption of historical sites • Social impact on to nearby population
Earth moving activities (digging, excavations, cut and fill activities)	• Accidental discovery of archaeological assets, sites or resources • Soil erosion, slit generation and increased runoff • Sediment contamination of nearby water ways (ocean, rivers, and streams) • Turbidity in near-shore and reef environments • Loss of land uses
Contractor mobilization	• Wastes generated at construction camps • Various social impacts
Aggregate extraction	• Removal of corals damages reef and depletes marine resources • Removal of beach gravels removes shoreline protection, changes littoral drift and accelerates erosion • Dust generated affects air quality • Noise created effect on community
Vehicle Operation (machinery, trucks, etc.)	• Emission of exhaust from vehicles and machinery • Dust generated by heavy vehicles transporting materials • Traffic delays • Noise pollution
Run-off, discharges	• Increased siltation • Water pollution –streams, rivers, ocean • Hazardous effects to marine life
Emergency or accidental spills	• Soil contamination • Potential contamination of water supply sources like groundwater • Risk to people and animals • Air pollution

8.4 NATIONAL AND STATE LAWS

The Federated States of Micronesia national government is responsible for setting minimum standards and providing technical assistants to the state level agencies responsible for environmental protection. The following is a summary of environmental laws that may have an effect on capital improvement projects at Kosrae International Airport.

8.4.1 Federated States of Micronesia

a) Environmental Protection Act:

". . . declares that it is the continuing policy of the Federated States of Micronesia, in cooperation with State and municipal governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of the Federated States of Micronesia."

b) Environmental Impact Assessment Regulations:

"The purpose of these regulations is to implement Section 13 of the Federated States of Micronesia Environmental Protection Act by establishing standard procedures for preparation of an environmental impact assessment statement prior to taking or funding any major action that may significantly affect the quality of the human environment. The environmental impact assessment (EIA) process is intended to help the general public and government officials make decisions with the understanding of the environmental consequences of their decisions, and take actions consistent with the goal of protecting, restoring, and enhancing the environment."

c) Earthmoving Regulations:

All earthmoving activities within the Federated States of Micronesia shall be conducted in accordance with these regulations and in such a way as to prevent accelerated erosion and accelerated sedimentation. To accomplish this, all persons engaging in earthmoving activities shall design, implement and maintain erosion and sedimentation control measures which effectively prevent accelerated erosion and accelerated sedimentation. The erosion and sedimentation control measures must be set forth in a plan, must be available at all times at the site of the project, and must be filed with the Department.

8.4.2 State of Kosrae

a) Environmental Impact Statement (EIS):

An EIS shall be prepared whenever the Development Review Commission (DRC) determines that the project may have a significant impact on the environment, or when there is serious public controversy concerning potential environmental impacts of a project. The preparation of an EIS will be required if one or more of the following criteria are applicable to a project proposal:

(1) It is reasonably foreseeable that the project will cause a significant environmental impact on:
- Marine and coastal resources
- Mangrove resources
- Social/cultural/historical resources
- Als (especially endangered species of snail)
- Human health and welfare

(2) It is reasonably foreseeable that the project will fail to comply with the all applicable minimum and environmental quality standards for water and air quality, waste management and noise control.

(3) It is reasonably foreseeable that the project will disturb more than 10,000 square feet of land surface.

(4) It is reasonably foreseeable that the project will require more than 5,000 cubic yard of fill.

(5) It is reasonably foreseeable that the project will be incompatible with surrounding land and water uses.

(6) It is reasonably foreseeable that the project is controversial and will invoke public opposition.

(7) The project involves a foreign investment permit.

b) Environmental Impact Assessment:

The purpose of an initial EIA is to identify any environmental impacts, and enable the project proponent to modify or mitigate any significant impacts before an Environmental Impacts Statements is conducted. The goal is to eliminate unnecessary EISs. The content of an initial assessment shall include an EIA Checklist, completed by the project proponent and submitted with a completed Development Review Permit application.

c) Development Review Permit:

A Development Review Permit shall be required for development projects that fall within the parameters for development projects that involve any earthmoving activities; located below the mean high water mark (includes mangroves); costs over $5,000; incompatible with surrounding land uses; disposal or removal of dredged materials, including all sand mining operations; use, handling or disposal of toxic or hazardous chemicals, pesticides, petroleum, oil and lubrication.

d) Erosion and Sedimentation Control:

All earthmoving activities within Kosrae State shall be conducted in accordance with these regulations and in such a way as to prevent accelerated erosion and accelerated sedimentation. To accomplish this, all persons engaging in earthmoving activities shall design, implement, and maintain erosion and sedimentation control measures which effectively prevent accelerated erosion and accelerated sedimentation. The erosion and sedimentation control measures must be set forth in a plan, must be available at all times at the site of the project, and must be filed with the DRC.

8.4.3 United States

United States regulations and laws may be applicable for projects that are funded by United States' grants and loans. Below are listed potential environmental regulations that may affect future projects:

a) National Environmental Policy Act (NEPA):

As implemented by Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500-1508); and FAA orders 5050.4B NEPA Instructions for Airport Actions and 1050.1E Environmental Impacts - Policies and Procedures analyzes the

potential impacts of the Proposed Action and reasonable alternatives and is intended to provide sufficient evidence and analysis for determining whether to prepare a Finding of No Significant Impact or the necessity for an Environmental Impact Statement (EIS).

b) National Historic Preservation Act:

The National Historic Preservation Act (NHPA) of 1966, as amended (16 USC 470), recognized the nation's historic heritage and established a national policy for the preservation of historic properties as well as the National Register of Historic Places (NRHP). Section 106 of the NHPA requires agencies to take into account the effects of undertakings on historic properties, and affords the Advisory Council on Historic Preservation (ACHP) and State Historic Preservation Officer (SHPO) a reasonable opportunity to comment on such undertakings. The Section 106 process, as defined in 36 CFR §800, provides for the identification and evaluation of historic properties, for determining the effects of undertakings on such properties, and for developing ways to resolve adverse effects in consultation with consulting parties.

c) Endangered Species Act:

The Endangered Species Act (ESA), as amended (16 USC 1531 *et seq*.) establishes a process for identifying and listing plant and animal species. It requires all Federal agencies to carry out programs for the conservation of federally listed endangered and threatened plants and animals. It also prohibits actions by Federal agencies that would likely jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. Section 7 of the ESA requires Federal agencies proposing actions that may affect listed species or critical habitats to first consult with U.S. Fish and Wildlife Service to ensure that they do not jeopardize listed species or destroy critical habitat.

d) Department of Transportation Act, Section 4(f):

Section 4(f) of the Department of Transportation Act does not allow: "[U]se of any publicly owned land from a public park, recreation area or wildlife and waterfowl refuge of national, state, or local significance or land of an historic site of national, state or local significance as determined by officials having jurisdiction thereof unless there is no feasible and prudent alternatives to the use of such land such program or project includes all possible planning to minimize harm resulting from the use."

CHAPTER 9: LAYOUT PLANS

The Airport Layout Plan (ALP) is a set of drawings that show improvements recommended by this Master Plan. In addition to the proposed airport improvements, the ALP set also shows existing runways, taxiways, airport property boundary, and other existing facilities. The ALP set includes a number of individual drawings. Several of these drawings are required while others may be included in the ALP set to provide detailed drawings that provide a clear picture of recommended capital improvement. Information that is usually included are drawings that show runway details and data, approach and departure profiles, airspace protection surfaces, obstruction information, terminal area plans, land-use information and airport property maps. The ALP is prepared in conformance with the FAA's AC 150/5070-6B, "Airport Master Plans." The FAA provides guidance in the development of the ALP set and is responsible for review and approval of the ALP set.

- Title Sheet –Contains approval signature blocks, airport location maps, and other pertinent information as required by the FAA.
- Airport Layout Plan – illustrates the existing and future airport facilities. The drawing also includes required facility identifications, description labels, imaginary surfaces, runway protection zones, runway safety areas and basic airport and runway data tables.
- Airport Surfaces: Airport Airspace/ Inner Portion of the Approach Surface – 14 CFR Part 77, Objects Affecting Navigable Airspace, define this as a drawing depicting obstacle identification surfaces for the full extent of all airport development. It also should depict airspace obstructions for the portions of the surfaces excluded from the inner portion of the approach surface drawing.
- Terminal Area Layout– Consists of two drawings showing current and planned improvements, presenting a large-scale depiction of areas with significant terminal facility development.
- Land Use Plan Existing and Land Use Plan Proposed. On and off airport drawings that depict the land uses within and adjacent to the airport property boundary.
- Airport Property Map – A drawing depicting the airport property boundary, the various tracts of land that were acquired to develop the airport, and the method of acquisition.

CHAPTER 10: FACILITY REQUIREMENT PLAN AND CAPITAL IMPROVEMENT PROGRAMMING

The Capital Improvement Program (CIP) represents a phasing and cost estimate for implementing the airport improvements that emerged from the AMP process. The CIP is divided into three phases: short-term (2012-2016), near term (2017-2021), and long-term (2022-2031). The CIP must be viewed as a constantly evolving document. Planning for Kosrae International Airport should remain flexible and should incorporate annually updated estimates of costs and priorities. The CIP is structured in a manner that presents a logical sequence of improvements, while attempting to reflect available funding from available sources to the airport. Such as loans and grants from various foreign agencies.

Projects in the ACIP respond to FAA's emphasis on the following goals:

- Ensure that the air transport of people, services and goods is provided in a safe and secure environment.
- Preserve and upgrade the existing airport system in order to allow for increased capacity as well as to ensure reliable and efficient use of existing capacity.
- Improve the compatibility of airports with the surrounding communities.
- Provide sufficient access to an airport for the majority of the population.

Using these emphases, key development projects for the airport's future have been identified and developed. In summary, these projects address existing demands and projected demands on the airport. The initial project phase, addresses many pressing issues on the airside or airfield, and follows a program of development which focused on the landside, i.e., new terminal, new passenger parking and circulation, and so on. They are currently several capital improvement projects that are under construction or recently completed. The following is a list of these projects:

- Air Rescue/Fire Fighting Facility (completed, 2009)
- Perimeter Fence (completed, 2010)
- Upgrades to airfield lighting & signage (completed, 2010)

The following airfield improvements funded by an AIP grant from the FAA are currently under construction. Construction in expected to be completed in 2013.

- Runway overlay
- Upgrades to airfield markings
- Taxiway Extension
- Internal Airfield access road

- Upgraded Fuel Farm and In-pavement Hydrants
- Airfield apron expansion
- Drainage swale upgrades

10.1 Facilities Phasing Plan

The planning horizon for this master plan update is 20 years with 5, 10 and 20-year milestones shown in Table 10-1.

Table 10-1. Facilities Phasing Plan

Phase	Year
Phase I	2012 to 2016
Phase II	2017 to 2021
Phase III	2022 to 2031

The overall phasing and scheduling of developments mentioned in this chapter are a merging of Kosrae International Airport's existing Capital Improvement Program and the recommended facilities and projects that are the output of this Airport Master Plan Update. A cursory review of the CIP project listing, indicates a significant 'front loading' of recommended projects within Phase I, representing the years 2012 to 2016

For airfield upgrade and infrastructure projects, the recommended early phasing of these types of projects is primarily due to the anticipated life span of the FAA ACIP program. This program, implemented by the FAA Airports Division, has literally transformed the airports in the Federated States of Micronesia in terms of bringing up the level of airport infrastructure, airfield paving, signage/lighting, ARFF facilities and trucks, and various training programs to transfer expertise and technical skills to the staff and management of these airports and public works sectors. As such, it is important to achieve the most important airport infrastructure projects remaining for Kosrae International Airport in order to take advantage of the FAA's funding for these elements within the limited time this program will be in place. At this point in time, time extensions for the AIP program coverage of these Pacific airports are unknown and up to the US Congress to decide. The best case scenario is that this program will extend for another three years.

A glance at the CIP phasing also indicates an accelerated schedule for the terminal building improvements. It is recommended that this project go forward without delay, even though this particular project may not, for the most part, be FAA ACIP funding eligible. Nonetheless, it is recommended that Kosrae International Airport go forward with this project quickly, with funding

obtained from other sources. This is discussed in greater detail in the Terminal Building Study, Appendix A of this master plan.

For Kosrae International Airport, a variety of airfield upgrades and improvements will need to be undertaken to improve the basic infrastructure and provide additional measures of safety to support ongoing aircraft operations. Both the Phase 2 and Phase 3 projects listed provide the Airport with an outlook of future needs. However, but as they move into the near term horizon, they need to be re-assessed as demand changes or funding sources become better defined.

Order-of-magnitude engineering costs were developed for each of the master plan projects and can be found in the tables below. The cost estimates associated with the Master Plan projects reflect allowances for Sponsor administration, engineering/design, contingencies, and construction management of 30%. In addition, project costs include an assumption of 5% simple interest to account for future inflation in Phase 2 and Phase 3 projects, interest is applied at the mid phase point 15% for Phase 2 and 45% for Phase 3.

10.2 Phase 1 Improvements (2012 – 2016)

Phase 1 development consists of the following capital projects:

- Runway Extension including Environmental Assessment and Design
- Remove/Mitigate Obstructions: Approach and Airfield Environment
- Terminal Area Vehicle Parking Lot & Area Lighting
- New Airport Access Road into Parking Lot Area
- Fire Hydrants: Public (Landside) Of Terminal Building
- Engine Generator
- Bridges Rehab/Widening

Table 10-2. Capital Improvement Program – Phase I (2012-2016)

Projects	Cost (US Dollars)
Runway Extension including Environmental Assessment and Design	$24,700,000
Remove/Mitigate Obstructions: Approach and Airfield Environment	$130,000
New Airport Access Road	$1,560,000
New Airport parking Lot and Lighting Upgrade	$390,000
Fire Hydrants: Public (Landside) Of Terminal Building	$97,500
Engine Generator	$780,000
Bridges Rehab/Widening	$2,600,000
Total	**$30,257,500.00**

10.3 Phase 2 Improvements (2017 – 2021)

Phase 2 development consists of the following capital projects:

- Remove/Mitigate Obstructions: Approach and Airfield Environment
- Runway Seal Coat and Airfield Marking Upgrade
- Passenger Terminal
- GPS Precision Approach
- LED Upgrade for Airfield Lighting
- New Terminal Construction
- Airport Security Facility/AOA Access
- Quarantine/Medical Facility
- Maintenance Workshop/Yard

Table 10-3. Capital Improvement Program – Phase II (2017-2021)

Project	Cost (US Dollars)
Remove/Mitigate Obstructions: Approach and Airfield Environment	$58,000
Runway Seal Coat and Airfield Marking Upgrade	$1,450,000
New Terminal Construction	$8,700,000
Airport Security Facility/AOA Access	$435,000
Quarantine/Medical Facility	$580,000
GPS Precision Approach	$1,087,500
LED Upgrade for Airfield Lighting	$725,000
Maintenance Workshop/Yard	$1,015,000
Total	**$14,050,500.00**

10.4 Phase 3 Improvements (2022 – 2031)

Phase 3 development consists of the following capital projects:

- Remove/Mitigate Obstructions: Approach and Airfield Environment
- Runway Seal Coat and Airfield Marking Upgrades
- Upgrades to Airfield Lighting & Signage
- Terminal Area Vehicle Parking Lot & Area Lighting
- ARFF Rehabilitation
- Terminal Rehabilitation

Table 10-4. Capital Improvement Program – Phase III (2022-2031)

Projects	Cost (US Dollars)
Remove/Mitigate Obstructions: Approach and Airfield Environment	$70,000
Runway Seal Coat and Airfield Marking Upgrades (X2)	$3,500,000 ($1,750,000 per)
Upgrades to Airfield Lighting & Signage	$2,187,500
Terminal Area Vehicle Parking Lot & Area Lighting	$ 437,500
ARFF Rehabilitation	$2,625,000
Terminal Rehabilitation	$2,625,000
Total	**$11,445,000**

The following is a breakdown of the total cost of the Airport Capital Improvement Plan

10.5 Capital Improvement Plan Total Cost (2012 -2031)

Capital Improvement Program	
Phase 1	$30,257,500
Phase 2	$14,050,500
Phase 3	$11,445,000
Total	**$55,753,000.00**

A schedule for the complete Capital Improvement Plan is shown in Figure 10-5.

KOSRAE INTERNATIONAL AIRPORT

FIGURE 10-1. CAPITAL IMPROVEMENT PROGRAM SCHEDULE

C.I.P. PROJECTS	PHASE I					PHASE II					PHASE III									
	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	FY2025	FY2027	FY2028	FY2029	FY2030	FY2031
AIRSIDE IMPROVEMENTS																				
Runway Extension (east): From 5,750'to 6,500'-																				
LED Upgrade (Airfield Lighting)																				
Remove/Mitigate Obstructions: Approach/Airport Environment																				
GPS Precision Approach																				
Runway Seal Coat/Airfield Markings																				
ARFF Facility Rehabilitation																				
TERMINAL IMPROVEMENTS																				
Passenger Terminal																				
Quarantine/Medical Facility																				
Airport Security Facility/AOA Access																				
LANDSIDE IMPROVEMENTS																				
Engine Generator																				
Terminal Area Vehicle Parking Lot & Area Lighting																				
New Airport Access Road into Parking Lot Area																				
Bridges Rehab/Widening																				
Fire Hydrants: Public (Landside) Of Terminal Building																				
Maintenance Workshop/Yard																				

APPENDIX A

PASSENGER TERMINAL STUDY

Federated States of Micronesia
Dept. of Transportation, Communications and Infrastructure
P.O. Box PS2
Palikir, Pohnpei, FM 96941

KOSRAE INTERNATIONAL AIRPORT

PASSENGER TERMINAL STUDY

Prepared by

LEO A DALY

1357 Kapiolani Boulevard, Suite 1230
Honolulu, Hawaii 96814

December 2010

Table of Contents

SKETCHES

INTRODUCTION

This Passenger Terminal Study is intended to evaluate the functionality and condition of the existing terminal facility, and also to evaluate alternatives regarding rehabilitation and/or a new terminal structure. Since the terminal building's construction in the late 1980s, the airport has been operating using an undersized holding room and a functional layout that poses safety and security risks. Major additions since completion include the expansion of the Arrivals Lobby and Immigration and Customs area, addition of an entry canopy and porte cochere, re-roofing of the central lobby, and installation of a photovoltaic system. Continental Airlines is the only major commercial carrier that presently serves Kosrae, however there are several smaller regional airlines that operate at this location.

Due to problems with the existing condition, functionality, and drainage, this study examines three (3) options for replacing the existing terminal facility. This study also evaluates passenger enplaning and deplaning processes and associated functional and spatial impacts. It concludes with a recommendation for the proposed improvements, including concept drawings which optimize efficiency, safety, and security.

EXISTING OPERATIONS AND CONDITIONS

The existing terminal building was constructed in the late 1980s and is currently in poor condition. It is approximately the correct scale and proportion, however a few areas need to be increased in size or relocated. The terminal currently houses the following functions:

- Airline Ticket Lobby
- Airline Office
- Concessions
- Security Screening
- Departures Lounge
- Arrivals Lobby
- Immigration
- Baggage Claim
- Customs
- Greeting Area

There are a few functional problems with the current terminal building. The Departures Lounge is not of the proper scale and needs to be increased in size. Also, the VIP Lounge is currently

located off of the Ticketing Lobby outside of the sterile environment, however it should be located on the sterile side of security screening adjacent to the Departures Lounge. Another functional problem is the lack of separation between the Arrivals zone and the Departures zone, creating an increase in the security risk. In addition, the number of public restrooms is inadequate and should be increased.

The existing facility is currently in poor condition. The wood structure does not appear to be holding up well. All of the electrical work is also in need of replacement. Also, the wall and floor finishes, as well as the casework at the ticketing counter and baggage claim, are not holding up well. The result is a facility which needs a large amount of repairs, improvements, and updates, to the degree of recommending a new terminal structure.

Another concern is the lack of proper drainage. During heavy rains, which occur frequently, water enters the terminal building. This is problematic due to the safety concerns of passengers and airport employees, and is also causing further deterioration of the facility.

Existing Enplaning Process

The existing enplaning process is summarized as follows:

1. Enter into the Lobby through the Main Entrance.
2. Proceed to the Check-In Counter to obtain boarding pass.
3. Ticketed passengers may enter the VIP Room or proceed through Passport Control, located opposite of the Check-In Counter in the Main Lobby.
4. Process through Passenger/Bag Screening.
5. Screened passengers proceed to the Departures Lounge.
6. Exit through the Departures Lounge and proceed on a walkway to the apron and board the aircraft.

Existing Deplaning Process

The existing deplaning process is summarized as follows:

1. Deplane the aircraft and proceed on a walkway towards the Arrivals Lobby.
2. Proceed through the Arrivals Lobby and INS/Passport Control.
3. Enter the Baggage Claim area and pick up luggage.
4. Process through Customs into the Greeting Area.
5. Passengers who are in the Exit Hallway can arrange for ground transportation, or proceed out the Main Entrance.

PROPOSED TERMINAL IMPROVEMENTS

The proposed terminal improvements are based on the assumption that the existing terminal structure needs to be replaced. Option 1 proposes building a new terminal in the same location as the existing terminal, which is accomplished by separating the construction into several different phases (refer to sketches SK-1.01 through SK-1.07). Option 2 proposes building a new terminal South of and adjacent to the existing terminal (refer to sketches SK-2.01 through SK-2.06). Option 3 proposes erecting a temporary tented structure to house the terminal while a new terminal is built in the same location as the existing terminal (refer to sketches SK-3.01 through SK-3.05). A grade-level loading bridge can be incorporated in all of these options.

Option 1: Phased Construction (Sketches SK-1.01 through SK1.07)

The proposed improvements under Option 1 include a new terminal in the same location as the existing terminal, which is accomplished by separating the construction into four different phases:

Phase 1: The existing Porte Cochere structure is to be enclosed to create a temporary structure. A new Arrivals wing will be built to the East of the existing terminal. (Refer to SK-1.01)

Phase 2: The new Arrivals wing will be in use, the facility under the Porte Cochere will be used as a temporary Lobby facility, and the existing Departures wing will still be in use. The existing Lobby and Arrivals wing will be demolished. (Refer to SK-1.02)

Phase 3: The Lobby and Departures wings of the new terminal will be constructed on the site where the old Terminal was demolished. (Refer to SK-1.03)

Phase 4: The new Terminal will be entirely in use. The old Departures wing and the temporary structure under the Porte Cochere will be demolished. (Refer to SK-1.04)

The new floor plan has been designed to improve the passenger flow and increase security within the terminal (see SK-1.05 for floor plan and SK-1.06 for passenger flow diagram) by separating the Departure and Arrival zones, increasing the size of the Departures Lounge/Holding Room, locating the VIP Lounge within the sterile environment adjacent to the Departures Lounge, and increasing the number and availability of restrooms. The enplaning and deplaning processes are as follows:

Enplaning Process:

1. Enter through the Main Entrance and proceed to the Ticketing counter.
2. Continue to the Departures Fee counter adjacent to the Ticketing Counter.
3. Passengers may remain in the Lobby area to visit the Observation Area, Kiosks, or Restrooms, or continue through to Passport Control.
4. Process through passenger/bag Security Screening.
5. Enter the VIP Lounge or the Departures Lounge, where restrooms, a vending kiosk, and a secure smoking area can be accessed while waiting to enplane.
6. Exit through the VIP Lounge or the Departures Lounge on a walkway towards the apron to board the aircraft.

Deplaning Process:

1. Deplane the aircraft and continue on a walkway towards the Arrivals Lounge.
2. Proceed through the Arrivals Lounge and Immigration.
3. Passengers may continue on to pick up their luggage from Baggage Claim, or stop by the restrooms along the way.
4. Passengers may visit the Airline Office or Continue through Customs to the Greeting Area, where car rental kiosks are located.
5. Exit the Greeting Area directly to the outdoors to curb-side pick-up or the parking lot.

The improvements described above will provide a workable and aesthetic solution to allow the new terminal to be constructed in the same approximate location as the existing terminal, resulting in a relatively short walk between the terminal and the aircraft and a larger area for improved passenger loading and parking (see SK-1.07 for site plan).

Option 2: Relocate Terminal (Sketches SK-2.01 through SK-2.06)

The proposed improvements under Option 2 include building a new terminal South of and adjacent to the existing terminal on the airport property. There are three phases to the work, but most of the major construction is included in one phase.

Phase 1: Demolish the existing Porte Cochere. (Refer to SK-2.01)

Phase 2: Construct a new terminal at the location of the former Porte Cochere and a portion of the existing parking lot. (Refer to SK-2.02)

Phase 3: Demolish the existing terminal. (Refer to SK-2.03)

The new floor plan is very similar to the final floor plan described in Option 1. The exception is the Arrivals wing, which has been designed in a more linear fashion to further improve passenger flow and simplify the structure. The enplaning process is the same as Option 1, but the deplaning process has been slightly modified and is as follows:

Deplaning Process:

1. Deplane the aircraft and continue on a walkway towards the Arrivals Lounge.
2. Proceed through the Arrivals Lobby and Immigration directly to Baggage Claim.
3. From the Baggage Claim Area, either continue to Customs or stop by the restrooms or Airline Manager Office.
4. Proceed through Customs to the Greeting Area, where Car Rental kiosks are located.
5. Exit the Greeting Area directly to the outdoors to curb-side pick-up or the parking lot.

The improvements described above will provide a workable and aesthetic solution similar to the final solution proposed in Option 1. However, the terminal will be located further away from the apron, resulting in a longer walk between the aircraft and the terminal, which could potentially increase safety and security risks (see SK-2.06). This location will also decrease the area available on the South side of the terminal for passenger loading and parking.

Option 3: Temporary Tented Structure (Sketches SK-3.01 through SK-3.10)

The proposed improvements under Option 3 require erecting a temporary tented structure to house the terminal while a new terminal is built in the same location as the existing terminal. There are also several phases of work required in this Option, but most of the major construction occurs during one phase.

Phase 1: Enclose the existing Porte Cochere to create a temporary Lobby, while concurrently erecting temporary tented structures to house the Arrival and Departure wings. (Refer to SK-3.01)

Phase 2: Demolish the existing terminal. During this time, the new temporary structures will be in use. (Refer to SK-3.02)

Phase 3: Construct the new terminal in the same location as the old terminal. (Refer to SK-3.03)

Phase 4: With the new terminal now in use, the temporary structures will be demolished. (Refer to SK-3.04)

The floor plan is similar to the plan in Option 2, however the shape of the Departures zone has been elongated to increase functionality and allow the secure smoking area to be located under a roof structure (see SK-3.05). The passenger flow diagram is similar to Option 2 (see SK-3.06), and the enplaning and deplaning process will be the same as described in Option 2 above.

This Option provides a less complex construction process than required in Option 1, but still allows for a terminal location that is close to the apron and a large amount of space for passenger loading and parking improvements (see SK-3.07). The downside is that less desirable tented structures would be required during the construction process, potentially resulting in increased safety and security risks during this time.

For the purpose of determining the general mass and form of the new terminal facility, conceptual elevations and perspective drawings have been developed (see SK-3.08 through SK-3.10). The Lobby and Arrivals zones are “open-air” to save on future maintenance and operational costs, while the Departures zone is fully enclosed and air-conditioned to maximize passenger comfort. The terminal features a steep pitched gable roof over the entrance and Lobby zone, reminiscent of the traditional vernacular architecture of Kosrae, with lower single slope roofs over the Arrivals and Departures zones. The result is a building form which allows for maximum functionality, while at the same time providing an aesthetic solution that is rooted in local building traditions.

ESTIMATED CONSTRUCTION COST

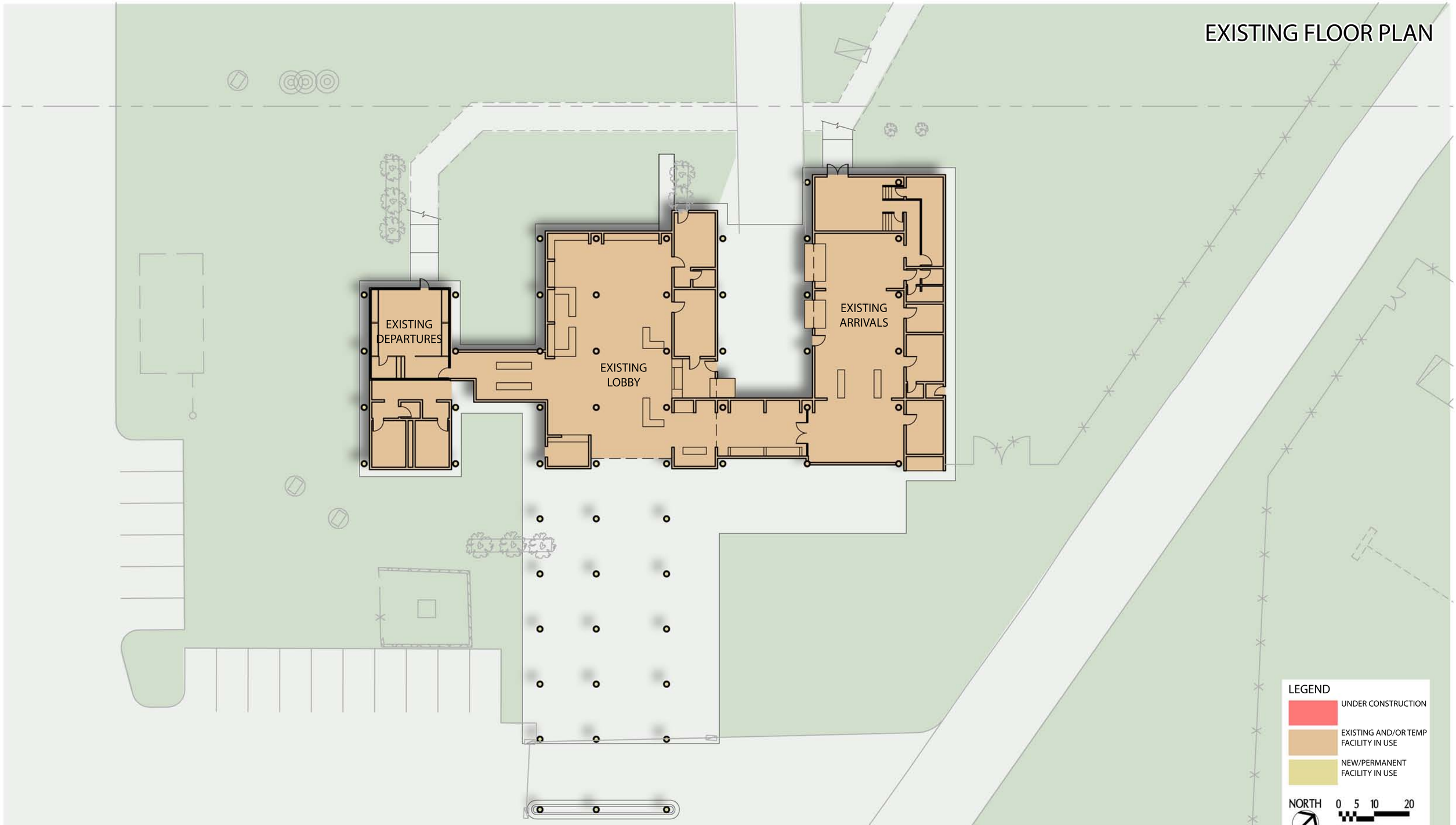
For purposes of this study, the rough order of magnitude cost for the proposed terminal and site improvements is approximately $4.0 - $4.8 million. The cost for the new terminal is approximately $3.0 - $3.2 million based on an assumed $300 per square foot for building construction. A budget/allowance for site and infrastructure improvements is estimated at $1.0 - $1.6 million. The inclusion of a grade-level loading bridge will add another $750,000.

RECOMMENDATION AND CONCLUSION

Due to problems with the existing condition, functionality, drainage, safety, and security, it is recommended that the passenger terminal facility be replaced. Of the three different options for facility replacement described in this report, Option 3 (temporary tented structure) will provide the most ideal final result while simplifying the construction process over other alternatives that may provide a similar end result.

The overall strategy advocated in this Terminal Study is to provide a solution to meet the needs of the terminal facility in a manner which provides the least possible disruption to regular airport operations. This will enable Kosrae International Airport to operate more safely, securely, and efficiently for the foreseeable future.

EXISTING FLOOR PLAN



KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

EXISTING FLOOR PLAN

SK-0.01

OPTION 1
PHASE 1

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

OPTION 1

LAD PROJECT #081-10015-017

SK-1.01

OPTION 1
PHASE 2

EXISTING DEPARTURES

DEMOLISH EXISTING LOBBY

DEMOLISH EXISTING ARRIVALS

AIRLINE OFFICE

ARRIVALS/ IMMIGRATION

BAGGAGE CLAIM

JAN.

WOMEN

MEN

IMMIGRATION OFFICE

CUSTOMS OFFICE

ELEC/UTILITY

CAR RENTAL

CAR RENTAL

CUSTOMS

GREETING AREA

TEMPORARY LOBBY

LEGEND

UNDER CONSTRUCTION

EXISTING AND/OR TEMP FACILITY IN USE

NEW/PERMANENT FACILITY IN USE

NORTH

0 5 10 20

SCALE: 1:300

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

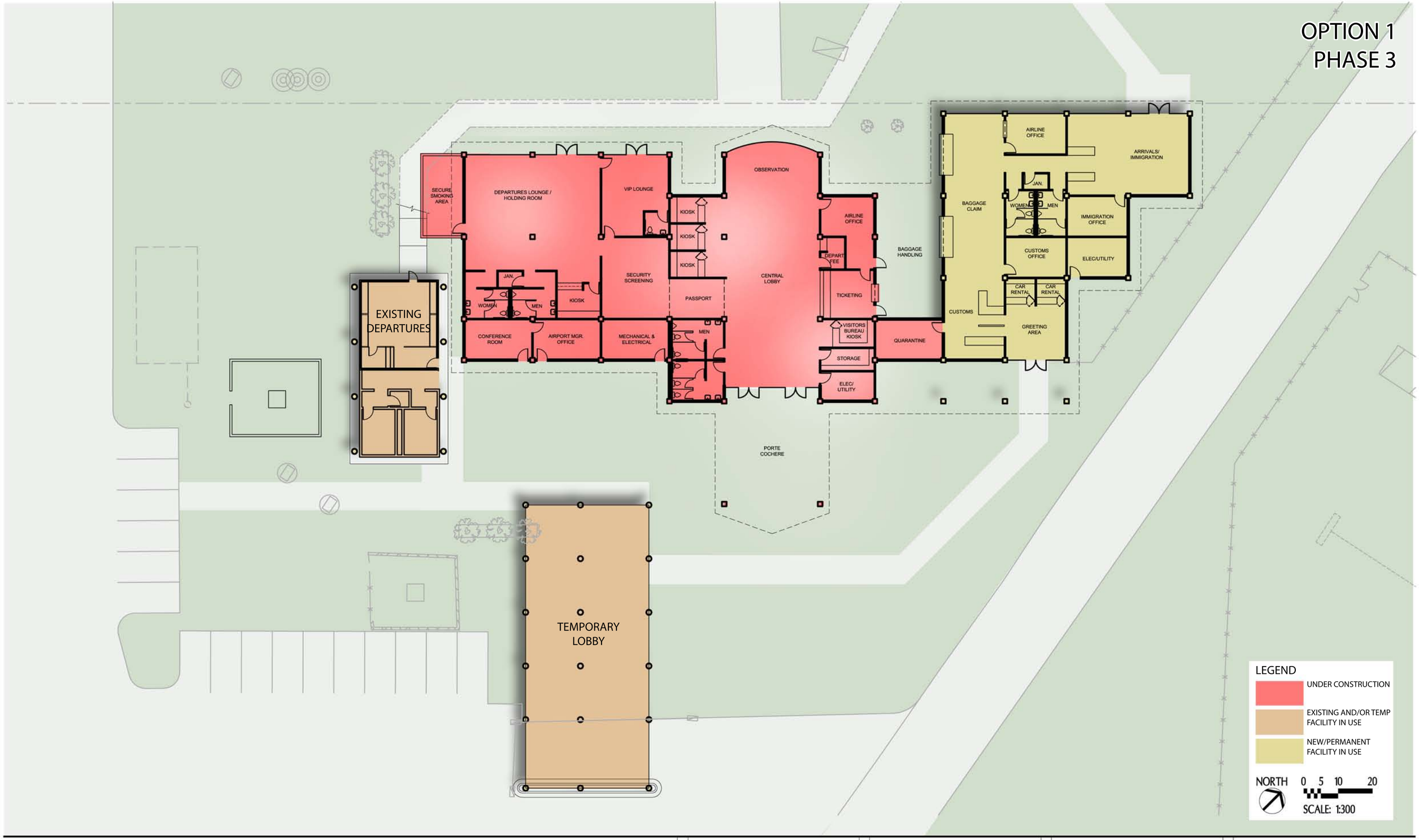
DECEMBER 2010

OPTION 1

LAD PROJECT #081-10015-017

SK-1.02

OPTION 1
PHASE 3



KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

OPTION 1

LAD PROJECT #081-10015-017

SK-1.03

OPTION 1
PHASE 4

DEMOLISH EXISTING DEPARTURES

DEMOLISH TEMPORARY STRUCTURE

DEPARTURES LOUNGE / HOLDING ROOM
VIP LOUNGE
SECURITY SCREENING
JAN.
WOMEN
MEN
KIOSK
CONFERENCE ROOM
AIRPORT MGR. OFFICE
MECHANICAL & ELECTRICAL
KIOSK
KIOSK
KIOSK
PASSPORT
MEN
OBSERVATION
CENTRAL LOBBY
PORTE COCHERE
AIRLINE OFFICE
DEPART FEE
TICKETING
VISITORS BUREAU KIOSK
STORAGE
ELEC/ UTILITY
BAGGAGE HANDLING
QUARANTINE
BAGGAGE CLAIM
CUSTOMS
AIRLINE OFFICE
JAN.
WOMEN
MEN
CUSTOMS OFFICE
CAR RENTAL
CAR RENTAL
GREETING AREA
ARRIVALS/ IMMIGRATION
IMMIGRATION OFFICE
ELEC/UTILITY

LEGEND
UNDER CONSTRUCTION
EXISTING AND/OR TEMP FACILITY IN USE
NEW/PERMANENT FACILITY IN USE

NORTH
0 5 10 20
SCALE: 1:300

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

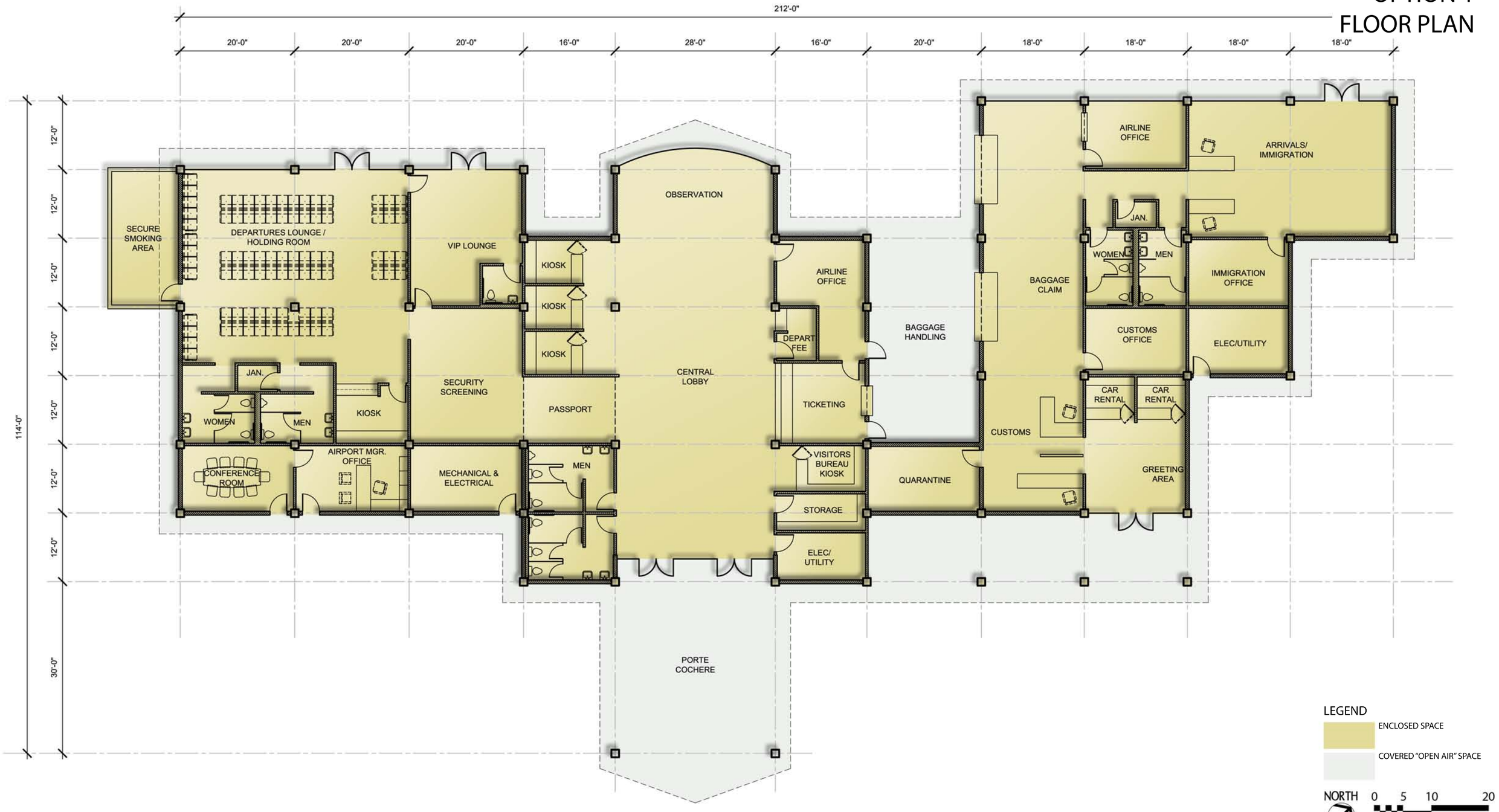
DECEMBER 2010

OPTION 1

LAD PROJECT #081-10015-017

SK-1.04

OPTION 1
FLOOR PLAN



LEGEND

ENCLOSED SPACE

COVERED "OPEN AIR" SPACE

NORTH

0 5 10 20

SCALE: 1/16"=1'-0"

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 1

SK-1.05

OPTION 1
PASSENGER FLOW DIAGRAM

LEGEND

- ENCLOSED SPACE
- COVERED "OPEN AIR" SPACE
- ARRIVALS PASSENGER FLOW
- DEPARTURES PASSENGER FLOW

NORTH

0 5 10 20

SCALE: 1/16"=1'-0"

KOSRAE INTERNATIONAL AIRPORT PASSENGER TERMINAL STUDY	FEDERATED STATES OF MICRONESIA	LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915	DECEMBER 2010 OPTION 1	LAD PROJECT #081-10015-017 SK-1.06

OPTION 1
SITE PLAN

NEW TERMINAL

NEW TERMINAL

EXISTING ARFF
STRUCTURES

SECURITY FENCE

SECURITY FENCE

SECURITY FENCE

NEW
PARKING LOT

VIP VIP VIP VIP VIP VIP H H

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

AIRPORT / HARBOR ACCESS ROAD

LEGEND

- NEW TERMINAL
- WALKWAYS
- NEW PARKING LOT

NORTH 0 10 20 40

SCALE 1:500

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF
MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 1

SK-1.07

OPTION 2
PHASE 1

EXISTING DEPARTURES

EXISTING LOBBY

EXISTING ARRIVALS

DEMOLISH EXISTING PORTE COCHERE

LEGEND

UNDER CONSTRUCTION

EXISTING AND/OR TEMP FACILITY IN USE

NEW/PERMANENT FACILITY IN USE

NORTH

0 5 10 20

SCALE: 1:300

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

OPTION 2

LAD PROJECT #081-10015-017

SK-2.01

OPTION 2
PHASE 2

EXISTING DEPARTURES
EXISTING LOBBY
EXISTING ARRIVALS

SECURE SMOKING AREA
DEPARTURES LOUNGE / HOLDING ROOM
VIP LOUNGE
KIOSK
KIOSK
KIOSK
OBSERVATION
AIRLINE OFFICE
DEPART FEE
BAGGAGE HANDLING
CENTRAL LOBBY
TICKETING
JAN.
WOMEN
MEN
KIOSK
SECURITY SCREENING
PASSPORT
MEN
VISITORS BUREAU KIOSK
QUARANTINE
STORAGE
ELEC/ UTILITY
CUSTOMS OFFICE
CONFERENCE ROOM
AIRPORT MGR. OFFICE
MECHANICAL & ELECTRICAL
PORTE COCHERE
ARRIVALS/ IMMIGRATION
IMMIGRATION OFFICE
AIRLINE MANAGER OFFICE
UNCLAIM BAGGAGE
BAGGAGE CLAIM
WOMEN
JAN.
MEN
CUSTOMS
CAR RENTAL
CAR RENTAL
GREETING AREA

LEGEND
UNDER CONSTRUCTION
EXISTING AND/OR TEMP FACILITY IN USE
NEW/PERMANENT FACILITY IN USE

NORTH
0 5 10 20
SCALE: 1:300

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY
PLANNING ARCHITECTURE ENGINEERING INTERIORS
EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 2

SK-2.02

OPTION 2
PHASE 3

DEMOLISH EXISTING TERMINAL

SECURE SMOKING AREA
DEPARTURES LOUNGE / HOLDING ROOM
VIP LOUNGE
KIOSK
KIOSK
KIOSK
OBSERVATION
AIRLINE OFFICE
DEPART FEE
TICKETING
VISITORS BUREAU KIOSK
STORAGE
ELEC/ UTILITY
BAGGAGE HANDLING
QUARANTINE
CUSTOMS OFFICE
BAGGAGE CLAIM
CUSTOMS
ARRIVALS/ IMMIGRATION
IMMIGRATION OFFICE
AIRLINE MANAGER OFFICE
UNCLAIM BAGGAGE
WOMEN
JAN.
MEN
CAR RENTAL
CAR RENTAL
GREETING AREA
JAN.
KIOSK
SECURITY SCREENING
PASSPORT
CENTRAL LOBBY
WOMEN
MEN
KIOSK
CONFERENCE ROOM
AIRPORT MGR. OFFICE
MECHANICAL & ELECTRICAL
MEN
PORTE COCHERE

LEGEND
- UNDER CONSTRUCTION
- EXISTING AND/OR TEMP FACILITY IN USE
- NEW/PERMANENT FACILITY IN USE

NORTH
0 5 10 20
SCALE: 1:300

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

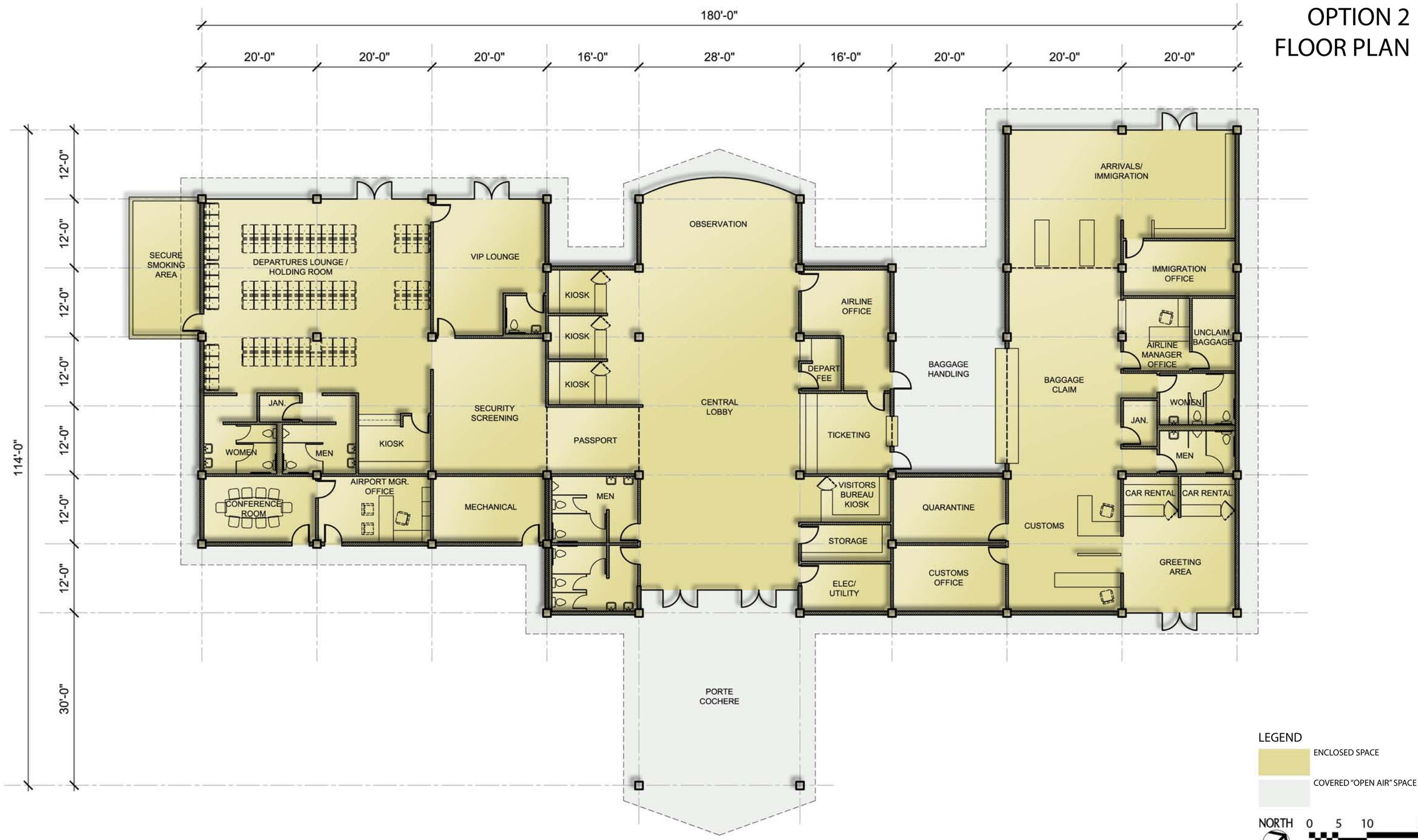
DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 2

SK-2.03

OPTION 2
FLOOR PLAN



LEGEND

ENCLOSED SPACE

COVERED "OPEN AIR" SPACE

NORTH

0 5 10 20

SCALE: 1/16"=1'-0"

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

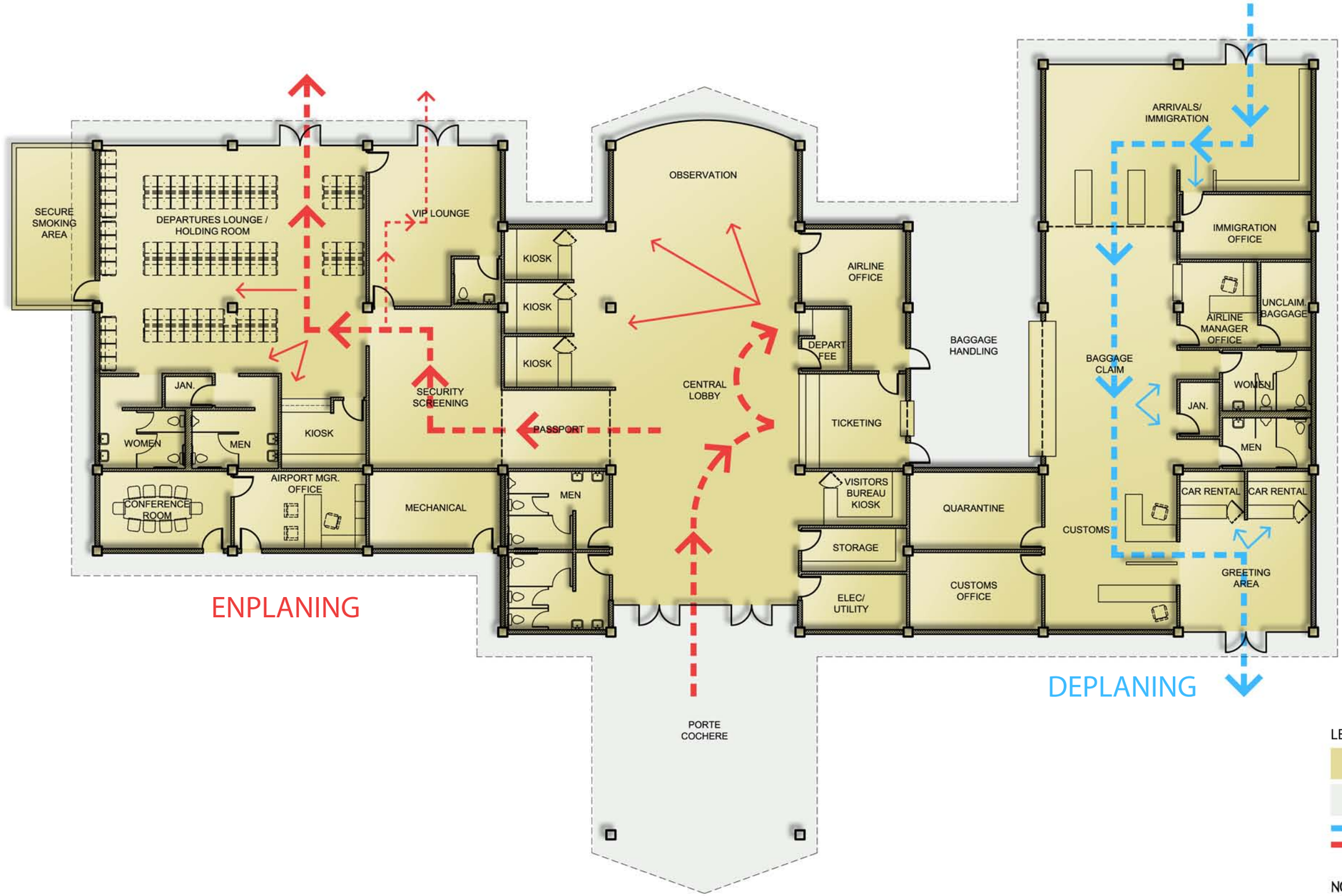
DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 2

SK-2.04

OPTION 2
PASSENGER FLOW DIAGRAM



LEGEND

- ENCLOSED SPACE
- COVERED "OPEN AIR" SPACE
- ARRIVALS PASSENGER FLOW
- DEPARTURES PASSENGER FLOW

NORTH

0 5 10 20

SCALE: 1/16"=1'-0"

KOSRAE INTERNATIONAL AIRPORT PASSENGER TERMINAL STUDY	FEDERATED STATES OF MICRONESIA	LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915	DECEMBER 2010	LAD PROJECT #081-10015-017
			OPTION 2	SK-2.05

OPTION 2
SITE PLAN

EXISTING ARFF
STRUCTURES

SECURITY FENCE

SECURITY FENCE

SECURITY FENCE

NEW TERMINAL

8 7 6 5 4 3 2 1 VIP VIP H H VIP VIP

NEW
PARKING LOT

9 10 11 12 13 14 15 16 17 18 19

AIRPORT / HARBOR ACCESS ROAD

LEGEND

NEW TERMINAL

WALKWAYS

NEW PARKING LOT

NORTH 0 10 20 40

SCALE 1:500

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF
MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 2

SK-2.06

OPTION 3
PHASE 1

EXISTING DEPARTURES

EXISTING LOBBY

EXISTING ARRIVALS

TEMPORARY STRUCTURE UNDER EXISTING PORTE COCHERE

TEMPORARY TENTED STRUCTURE

TEMPORARY TENTED STRUCTURE

LEGEND

UNDER CONSTRUCTION

EXISTING AND/OR TEMP FACILITY IN USE

NEW/PERMANENT FACILITY IN USE

NORTH

0 5 10 20

SCALE: 1:300

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 3

SK-3.01

OPTION 3
PHASE 2

DEMOLISH EXISTING
TERMINAL

TEMPORARY
DEPARTURES

TEMPORARY
LOBBY

TEMPORARY
ARRIVALS

LEGEND

UNDER CONSTRUCTION

EXISTING AND/OR TEMP
FACILITY IN USE

NEW/PERMANENT
FACILITY IN USE

NORTH

0 5 10 20

SCALE: 1:300

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF
MICRONESIA

LEO A DALY
PLANNING
ARCHITECTURE
ENGINEERING
INTERIORS
EST. 1915

DECEMBER 2010

OPTION 3

LAD PROJECT #081-10015-017

SK-3.02

OPTION 3
PHASE 3

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 3

SK-3.03

OPTION 3
PHASE 4

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 3

SK-3.04

OPTION 3
FLOOR PLAN

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

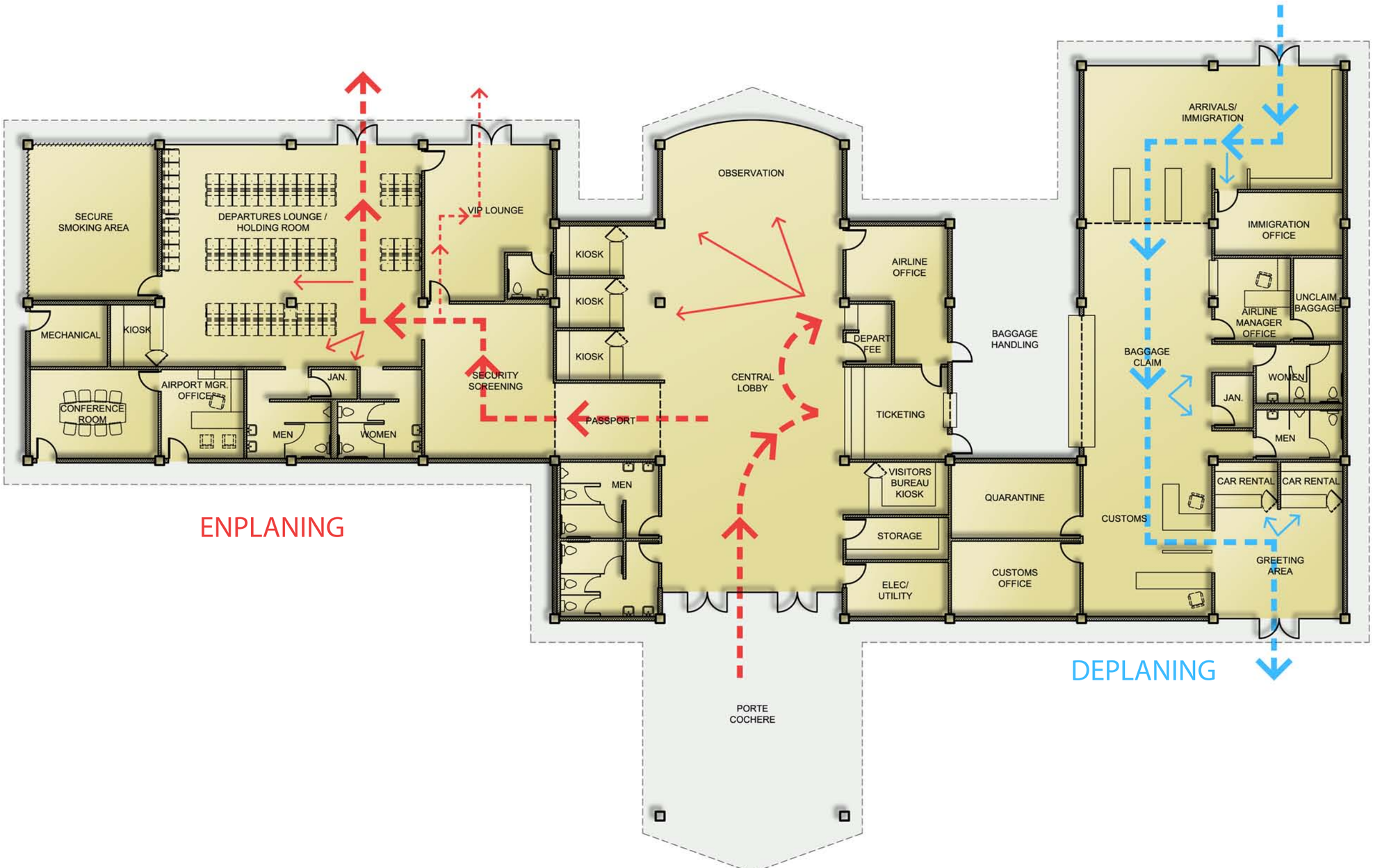
DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 3

SK-3.05

OPTION 3
PASSENGER FLOW DIAGRAM



KOSRAE INTERNATIONAL AIRPORT PASSENGER TERMINAL STUDY	FEDERATED STATES OF MICRONESIA	LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915	DECEMBER 2010	LAD PROJECT #081-10015-017
			OPTION 3	SK-3.06

OPTION 3
SITE PLAN

NEW TERMINAL

EXISTING ARFF
STRUCTURES

SECURITY FENCE

SECURITY FENCE

SECURITY FENCE

VIP VIP VIP VIP VIP VIP H H

NEW
PARKING LOT

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

AIRPORT / HARBOR ACCESS ROAD

LEGEND

- NEW TERMINAL
- WALKWAYS
- NEW PARKING LOT

NORTH 0 10 20 40

SCALE 1:500

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF
MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 3

SK-3.07

OPTION 3
ELEVATIONS

WEST ELEVATION

NORTH ELEVATION

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

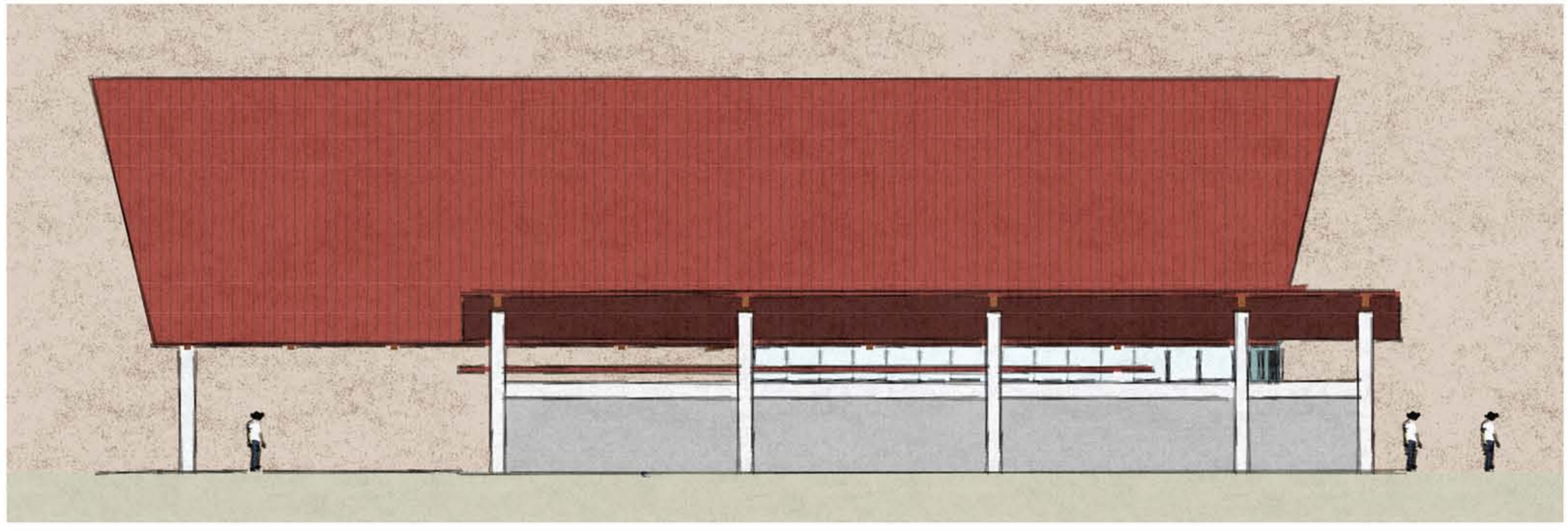
DECEMBER 2010

LAD PROJECT #081-10015-017

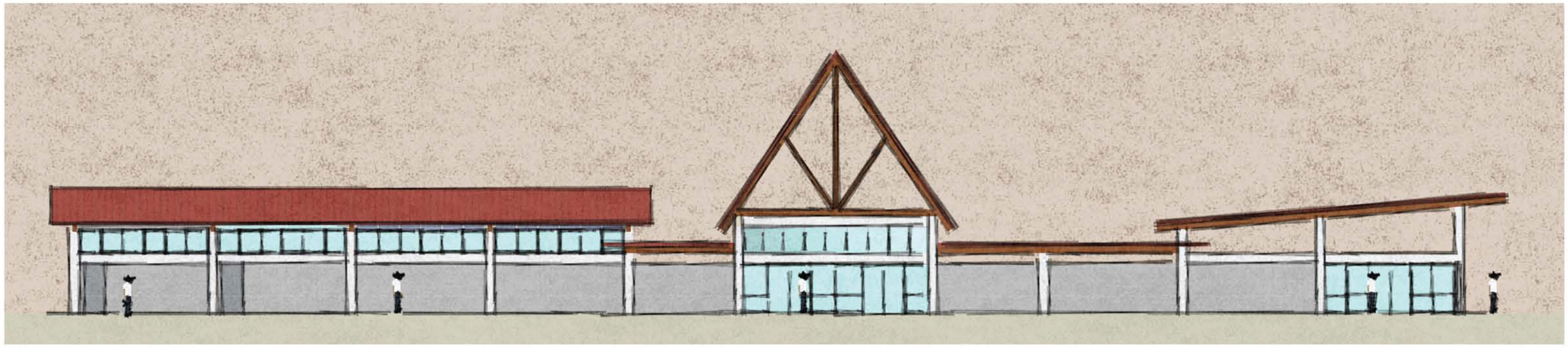
OPTION 3

SK-3.09

OPTION 3
ELEVATIONS



EAST ELEVATION



SOUTH ELEVATION

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

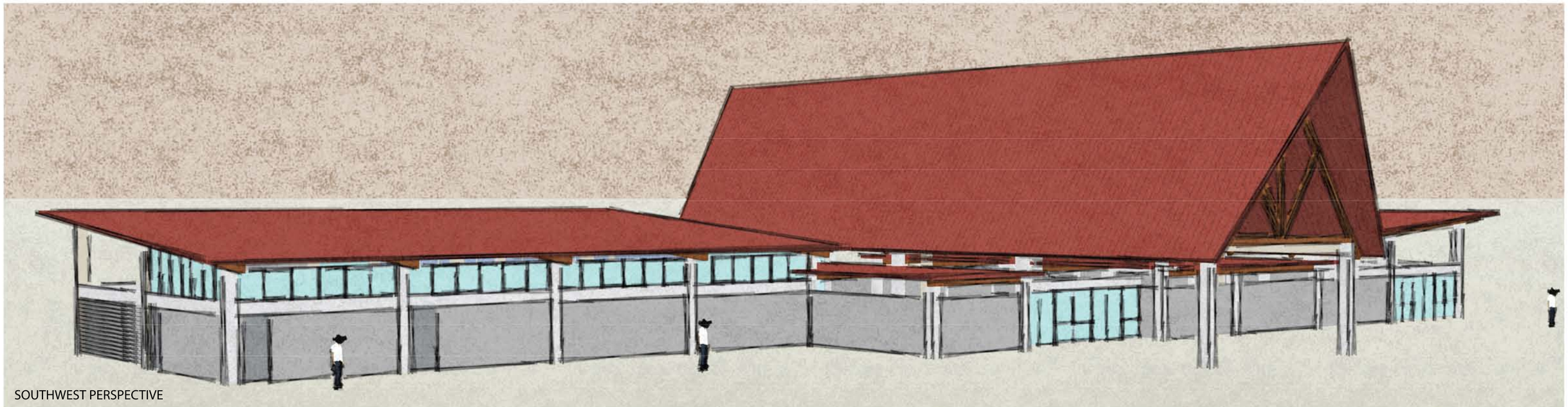
LAD PROJECT #081-10015-017

OPTION 3

SK-3.08

OPTION 3
PERSPECTIVE SKETCHES

NORTHEAST PERSPECTIVE



SOUTHWEST PERSPECTIVE

KOSRAE INTERNATIONAL AIRPORT
PASSENGER TERMINAL STUDY

FEDERATED STATES OF MICRONESIA

LEO A DALY PLANNING ARCHITECTURE ENGINEERING INTERIORS EST. 1915

DECEMBER 2010

LAD PROJECT #081-10015-017

OPTION 3

SK-3.10