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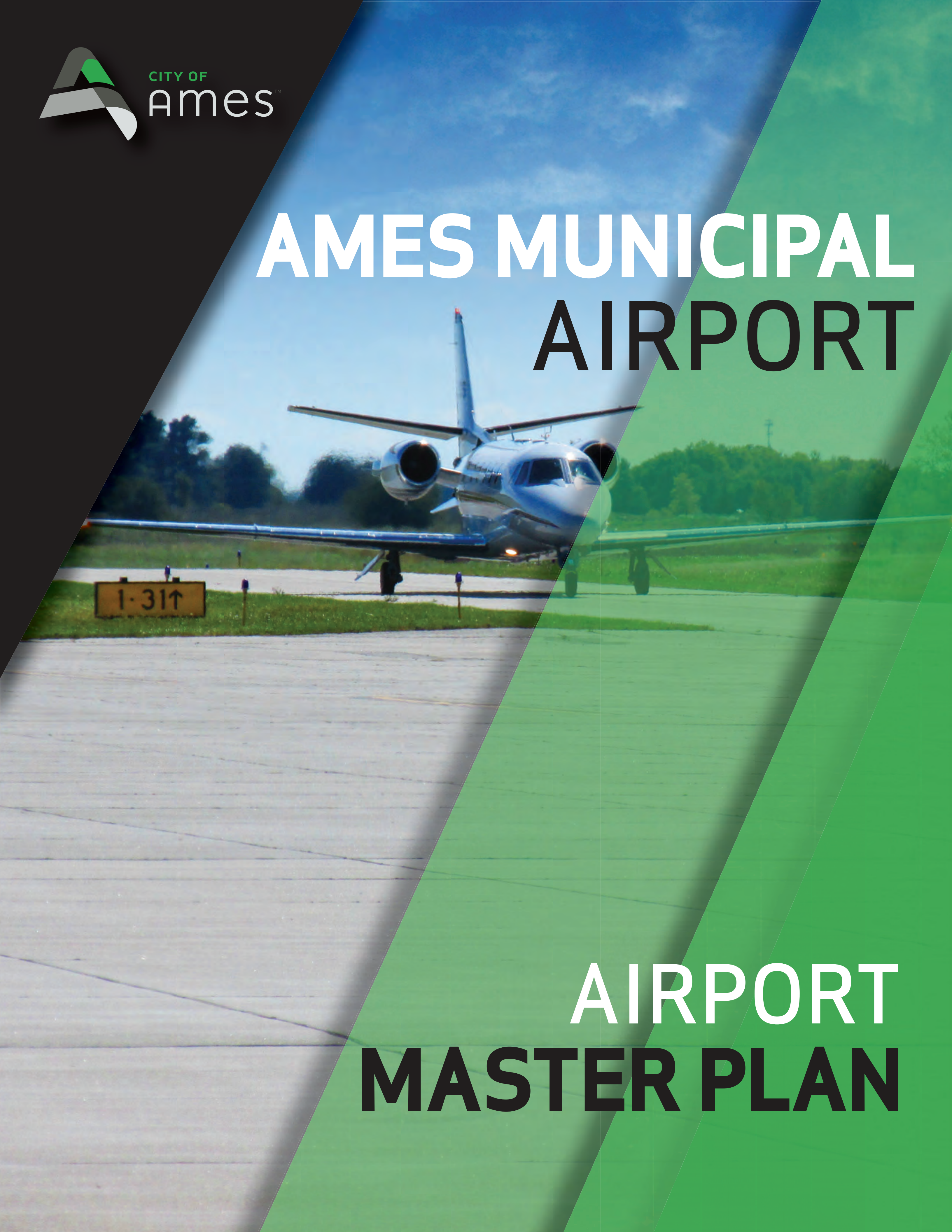

AMES MUNICIPAL AIRPORT

AIRPORT MASTER PLAN

FINAL
AIRPORT MASTER PLAN

AMES MUNICIPAL AIRPORT
City of Ames

Prepared for
City of Ames

By

Coffman Associates
Airport Consultants

October 2020

CITY OF
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AMES MUNICIPAL AIRPORT

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INTRODUCTION

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INTRODUCTION

A master plan provides an evaluation of an airport's aviation demand and an overview of the systematic development that will best meet that demand. The master plan establishes development objectives and provides for a 20-year planning period that details the rationale for various study elements, including airfield configuration, facility development, on-airport land use recommendations, and support facilities. It also serves as a strategic tool for establishing airport improvement priorities and justifying the need for federal and state funding assistance.

The Federal Aviation Administration (FAA) recommends that airports update their master plan every seven to 10 years, or as necessary, to address local changes at the airport. The last master plan for Ames Municipal Airport (AMW) was completed in 2008. The preparation of this Airport Master Plan is necessary as a timely reassessment of the development direction of AMW to meet the needs of the City of Ames metropolitan area economy and an ever-changing air transportation industry.

The Airport Master Plan has been initiated by the City of Ames to evaluate the airport's capabilities and role, to forecast future aviation demand, and to plan for the development of new or expanded facilities that may be required to meet that demand. The goal of the master plan is to provide guidelines for the airport's overall maintenance, development, and operation in an environmentally and fiscally responsible manner while adhering to appropriate FAA standards.

An important outcome of the Airport Master Plan process is a recommended development plan that reserves sufficient areas for future facility needs. Such planning will protect development areas and ensure they will be readily available when required to meet future needs. The intended outcome of this study is a detailed on-airport land use concept which outlines specific uses for all areas of airport property, including strategies for revenue enhancement.

With a sound and realistic master plan in place, AMW can take steps to achieve these goals and strategies that have been set forth. Furthermore, the airport will continue to remain an important link to the regional and national air transportation systems, as well as maintain the public and private investments in its facilities.

STUDY OVERVIEW

The City of Ames is responsible for funding capital improvements at the airport, as well as obtaining FAA and development grants. In addition, the city oversees facility enhancements and infrastructure development conducted by private entities at the airport. The master plan is intended to provide guidance for future development and justification for projects for which the airport may receive funding through an updated capital improvement program (CIP) to demonstrate the future investment required by the city, as well as the FAA.

The Airport Master Plan will follow a systematic approach outlined by the FAA to identify existing and future airport needs in advance of the actual need for improvements. This is done to ensure the City of Ames can coordinate environmental reviews, project approvals, design, financing, and construction to minimize the negative effects of maintaining and operating inadequate or insufficient facilities. The intended result is a recommended development concept which outlines the proposed uses for all areas of the airport.

The City of Ames has contracted with the airport planning firm of Coffman Associates, Inc. to undertake the Airport Master Plan. The study is prepared in accordance with FAA requirements, including Advisory Circular (AC) 150/5070-6B, *Airport Master Plans* and AC 150/5300-13A, *Airport Design*.

MASTER PLAN GOALS AND OBJECTIVES

The primary objective of the Airport Master Plan is to develop and maintain a financially feasible, long-term development program which will satisfy aviation demand of the region, while also being compatible with area development, other transportation modes, and the environment. Accomplishing this objective requires an evaluation of the existing airport to decide what actions should be taken to maintain a safe, adequate, and reliable airport facility.

This Airport Master Plan is intended to provide guidance through an updated capital improvement and financial program to demonstrate the future investments required by the City of Ames. The new planning study also provides justification for new priorities. The plan will be closely coordinated with other planning studies in the area and with aviation plans developed by the FAA. This study will also utilize historical planning efforts (2008 Master Plan) that have been undertaken at AMW.

While the master plan must be developed per FAA requirements, it can also be prepared in a manner which makes it useful in strategic planning for the airport. The FAA requires specific elements within a master plan. These elements, to be detailed in the following section, are guidelines which allow for a systematic and technical approach to reach the final recommended plan.

Specific goals and objectives to be considered in the Airport Master Plan include, but are not limited to, the following:

- Research factors likely to affect all air transportation demand segments in the City of Ames as well as the central Iowa region over the next twenty years. The analysis will include the development of forecasts of potential increased air charter activity supporting Iowa State University athletics, business jet increases due to adjacent Industrial Research Park agribusinesses, other general aviation activity, and military demand elements.

- Determine projected needs of airport users for the next twenty years, factoring in: recent revisions to FAA airfield geometrical design standards, global positioning system (GPS) Next Generation (NexGen) approaches or other new technology, the impact of general aviation fleet transitions on design standards, and on-going efforts to improve general aviation services to the community. This analysis will also include considerations of military needs and usage.

- To analyze the existing airfield system to determine the existing and ultimate runway length required to satisfy the airport's critical aircraft now and into the future. Business and ISU athletic charter jet aircraft operations at AMW could require a longer runway. This planning effort will have a primary goal of determining the optimum runway length necessary to properly facilitate air charter/air taxi operations for the next 20 years and beyond.

- Review future use and zoning of airport property, instrument approach areas, and nearby developments to ensure flight safety and land use compatibility. This will involve the development of new noise exposure contours, application of current land use compatibility guidelines, review of local land use controls and plans, and analysis of land use management techniques.

- Establish a schedule of development priorities and a program for improvements proposed in the master plan, consistent with the FAA's capital improvement program planning.

- Consider sustainability efforts, specifically waste and recycling improvements as part of FAA's updated standards.

- Produce accurate base maps of existing and proposed facilities and updated Airport Layout Plan (ALP) drawings consistent with the FAA's Standard Operating Procedures (SOP) No. 2.0 and 3.0.

- Digital Geographic Information System (GIS) data will be submitted into FAA's Airport GIS, or AGIS, system as a "New Survey." This task will conform to the Survey Requirements Matrix contained in FAA AC 150/5300-18B. The data will be submitted to the FAA AGIS system per the ALP column of Table 2-1.

- Consider passenger convenience and access.

MASTER PLAN TASKS

The master plan for AMW specifically addresses the following tasks:

- Assist the City of Ames, through a Technical Advisory Committee (TAC) and a series of Public Information Workshops, in determining a vision for the airport.

- Conduct a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis, identifying strengths, weaknesses, realistic markets, goals, resources, and strategies to move forward. This analysis will factor the strengths and weaknesses of AMW to include physical and operational features.

- Based on the realistic evaluation of the facility in terms of configuration, condition, amenities, location, competition, and forecasted aviation demand, establish goals and priorities for the airport to meet that vision.

- Identify airfield alternatives based on goals and opportunities, as well as FAA applicable design standards. The analysis will include an evaluation of the airfield geometry to address potential non-standard conditions.

- Provide a landside development plan that identifies areas for accommodating the forecasted growth of aviation and aviation-related businesses and, if appropriate, areas for non-aviation revenue-producing opportunities. Consideration will be given to the potential for new or expanded aviation facilities, including, but not limited to, terminal facilities, aircraft storage hangar capacity and apron capacity, and airport support facilities.

- Assess compatible land uses near the airport.

BASELINE ASSUMPTIONS

A study such as this typically requires some baseline assumptions that will be used throughout the analysis. The baseline assumptions for this study include:

- The airport will continue to operate as a publicly owned, regional general aviation airport through the 20-year planning period.

- AMW will continue to serve general aviation tenants and itinerant and/or local aircraft operations by air taxi, general aviation, and military operators.

- The general aviation industry will grow through the planning period as projected by the FAA. Specifics of projected growth in the national general aviation industry are contained in Chapter Two of the master plan.

- A federal airport improvement program will be in place through the planning period to assist in funding capital development needs.

MASTER PLAN ELEMENTS AND PROCESS

The Airport Master Plan is being prepared in a fashion pursuant to the scope of services that has been coordinated with the City of Ames. The study has eight specific elements that are intended to assist in the identification of future facility needs and which provide the supporting rationale for their implementation. **Exhibit iA** provides a graphical depiction of the elements and process involved with the study.

Element 1 – Initiation includes the development of the scope of services, schedule, and study website. A TAC is also formed, and study material will be assembled in a workbook format. General background information will be established that includes outlining the goals and objectives to be accomplished during the master plan.

Element 2 – Inventory is focused on collecting and assembling relevant data pertaining to the airport and the area it serves. Information is collected on existing airport facilities and operations. Local economic and demographic data is collected to define the local growth trends, and environmental information is gathered to identify potential environmental sensitivities that might affect future improvements. Planning studies which may have relevance to the master plan are also collected.

Element 3 – Aviation Demand Forecasts examines the potential aviation demand at the airport. The analysis utilizes local socioeconomic information, as well as national air transportation trends to quantify the levels of aviation activity which can reasonably be expected to occur at AMW over a 20-year period. The results of this effort are used to determine the types and sizes of facilities which will be required to meet the projected aviation demand at the airport through the planning period.

Element 4 – Demand/Capacity and Facility Requirements converts aviation demand needs into types and volumes of actual physical facilities required to meet existing and forecast demands in aviation activity. The critical design aircraft and physical planning criteria based upon AC 150/5300-13A, *Airport Design*, is also established in preparation of a needs assessment for airside and landside facilities.

Element 5 – Airport Development Alternatives considers a variety of solutions to accommodate projected airside and landside facility needs through the long-term planning period. An analysis is completed to identify the strengths and weaknesses of each proposed development alternative, with the intention of determining a single direction for development.

PROJECT WORK ELEMENTS

→ TAC #1

INVENTORY

- Airport facilities
- Airspace and air traffic control
- Area socioeconomic data
- Local planning and land use
- Airport access and parking, utilities, and aerial photography

→ WP

FORECASTS

- Based aircraft and fleet mix
- Annual operations
- Other Aviation Activity

→ WP

FACILITY REQUIREMENTS

- Taxiways
- Airfield capacity
- Hangar facilities
- Design categories
- Runway length and strength
- Support facilities
- Terminal building
- Aprons
- Navigational aids

→ WP

→ TAC #2 | PIW #1

AIRPORT ALTERNATIVES

- Evaluate development scenarios (airside, landside, support)

→ WP

→ TAC #3 | PIW #2

RECOMMENDED MASTER PLAN CONCEPT/ ENVIRONMENTAL REVIEW

- Detailed master plan facility and land use plans
- Review evaluation of NEPA environmental categories
- Noise exposure

→ WP

FINANCIAL PLAN/CAPITAL IMPROVEMENTS

- Airport Development schedule
- Cost estimates
- Funding sources

→ WP

→ TAC #4 | PIW #3

AIRPORT LAYOUT PLANS/LAND USE COMPATIBILITY

- Airport layout plan
- Landside drawing
- Recycling plan
- Airspace/approach drawings
- On-airport land use plan
- Property map
- Land use plan

FINAL DOCUMENTATION/DELIVERABLES

- Draft Master Plan Report
- Master Plan/ALP Approvals
- Final Master Plan Report
- Electronic Documentation

→ 

KEY:

TAC - Technical Advisory Committee

PIW - Public Information Workshop

WP - Working Paper

Element 6 – Recommended Master Plan Concept/Environmental Review provides both a graphic and narrative description of the recommended plan for the use, development, and operation of the airport. An environmental overview is provided to analyze potential environmental impacts of proposed airport development projects, and a waste audit and recycling plan is also conducted to identify opportunities for the airport to be more sustainable in its approach to waste management. The official ALP drawings that are produced based on the recommended development concept and used by the FAA in determining grant eligibility will also be included.

Element 7 – Financial Management and Development Program provides a proposed capital needs program which defines the schedules, costs, and funding sources for the recommended development projects.

Element 8 – Final Documentation and Deliverables provides documents which depict the findings of the study effort and present the study and its recommendations to appropriate local organizations. The final document incorporates the revisions to previous working papers prepared under earlier elements into a usable master plan document.

STUDY PARTICIPATION

The Airport Master Plan is of interest to many within the local community and region. This includes local citizens and businesses, community organizations, City of Ames officials, airport users, airport tenants, and aviation organizations. As a component of the regional, state, and national aviation systems, the master plan is of importance to both state and federal agencies responsible for overseeing the air transportation system.

To assist in the development of the Airport Master Plan, the city has identified a group of stakeholders to act in an advisory role in the development of the master plan. The TAC is comprised of airport users and stakeholders with a vested interest in the future development of AMW as well as local governmental agencies. Members of the TAC will meet four times at designated points during the planning process to review study materials and provide comments to help ensure that a realistic and viable plan is developed.

Draft materials will be prepared at various milestones in the planning process. The working paper process allows for timely input and review during each step within the master plan to ensure that all issues are fully addressed as the recommended program develops.

A series of open house Public Information Workshops are also conducted as part of the study coordination effort. These workshops are designed to allow any and all interested persons to become informed and provide input concerning the master plan process. Notices of meeting times and locations are advertised through local media outlets. Draft working papers and other information related to the master plan are available at: **www.ames.airportstudy.com**.

SWOT ANALYSIS

A SWOT analysis is a strategic business planning technique used to identify **S**trengths, **W**eaknesses, **O**pportunities, and **T**hreats associated with an action or plan. The SWOT analysis involves identifying an action, objective, or element, and then identifying the internal and external forces that are positively and negatively impacting that action, objective, or element in each environment. For this study, the SWOT analysis factors are being applied to AMW within the confines of the master plan. As a result, it provides a continuous vision and direction for the development of the master plan.

SWOT DEFINITIONS

As previously discussed, this particular SWOT analysis groups information into two categories:

- **Internal –** attributes of the airport and market area that may be considered strengths or weaknesses to the action, objective, or element.
- **External –** attributes of the aviation industry that may pose as opportunities or threats to the action, objective, or element.

The SWOT further categorizes information into one of the following:

- **Strengths –** internal attributes of the airport that are helpful to achieving the action, objective, or element.
- **Weaknesses –** internal attributes of the airport that are harmful to achieving the action, objective, or element.
- **Opportunities –** external attributes of the industry that are helpful to achieving the action, objective, or element.
- **Threats –** external attributes of the industry that are harmful to achieving the action, objective, or element.

SWOT ANALYSIS EXERCISE

The SWOT analysis for AMW is based upon information gathered, including a kick-off TAC meeting that was conducted in September 2018. As previously discussed, the TAC is a diversified group of stakeholders, community leaders, and governmental agencies that represent several interests in the airport. A SWOT analysis was conducted with this group to identify key factors that might be addressed in the master plan. A summary of the results from the SWOT analysis exercise is shown in **Table iA** on the next page. These results were used to frame the subjective or judgmental processing of the data presented in the master plan.

TABLE iA
SWOT Analysis
Ames Municipal Airport

Strengths	Weaknesses
▪ The airport presents the City of Ames in a good light ▪ The airport has great roadway access ▪ Self-sustaining ▪ Great landside development opportunity ▪ The city is experiencing large amounts of growth ▪ Competitive pricing ▪ Increasing operations from business jets ▪ High demand to base aircraft	▪ Need more fuel capacity ▪ Need stronger apron pavements ▪ Need hangars capable of storing large business jets ▪ Dated utility infrastructure ▪ Automated weather observation system (AWOS) does not transmit well to the south ▪ The airfield is not fenced ▪ Large jets need approval from the city prior to operating ▪ Runway length and strength ▪ Non-aviation land use currently generates most of the airport revenue ▪ No development-ready areas for hangars ▪ T-hangars are dated ▪ Need more auto parking ▪ Issues with lighting at night – pilot control does not always work ▪ The airfield is very unsecure
Opportunities	**Threats**
▪ Larger jets are beginning to operate at the airport ▪ There is currently a waiting list to develop hangars ▪ 18 aircraft on the T-hangar waiting list ▪ Community is growing ▪ Corporate maintenance, repair, and overhaul (MROs) could be interested in locating at AMW ▪ Marketing potential for the airport ▪ AMW is more competitive than Des Moines in terms of pricing	▪ New apartment development adjacent to the airport ▪ Lack of involvement from the county ▪ Wind farms in proximity of the airport ▪ Lack of automobile parking

CITY OF Ames

AMES MUNICIPAL AIRPORT

CHAPTER 1

INVENTORY

AMES MUNICIPAL AIRPORT

CITY OF Ames

CHAPTER ONE

INVENTORY

The inventory chapter of existing conditions is the initial step in the preparation of the Ames Municipal Airport (AMW) Master Plan. The inventory will serve as an overview of the airport's physical and operational features, including facilities, users, and activity levels, as well as specific information related to the airspace, air traffic activity, adjacent land use and zoning, and role of the airport. Finally, a summary of socioeconomic characteristics and review of existing environmental conditions on and adjacent to AMW are detailed, which will provide further input into the study process.

The information that follows serves as the baseline for the remainder of the master plan. The initial action necessary in preparing a master plan is the collection of all pertinent data that relates to the area served by the airport, as well as the airport itself. This inventory was conducted using the following sources of information:

- *City of Ames Land Use Policy Plan*, as amended January 2018
- *Ames Municipal Airport Master Plan*, 2008
- *National Plan of Integrated Airport Systems*, September 2018
- *General Aviation Airports: A National Asset*, 2012
- *Iowa Aviation System Plan 2010-2030 Technical Report,* 2010
- *Ames Mobility 2040: Ames Area MPO Long Range Transportation Plan*, approved September 2015
- Airport communication
- On-site visits
- Aerial and ground photography
- Interviews with airport staff, tenants, and users
- Federal, state, and local publications
- Project record drawings

AIRPORT CHARACTERISTICS

The purpose of this section is to summarize various studies and data collected to provide an understanding of the characteristics of the airport and the regional area. This information serves as a baseline when developing forecasts for critical airport infrastructure to support demand over the planning period.

LOCALE

Ames Municipal Airport is located within the jurisdictional boundaries of the City of Ames and Story County, Iowa. The City of Ames is located approximately 30 miles north of Des Moines, Iowa, and has a land area of approximately 22 square miles. It is situated in west-central Story County, with Boone County in close proximity to the west. **Exhibit 1A** depicts the regional setting.

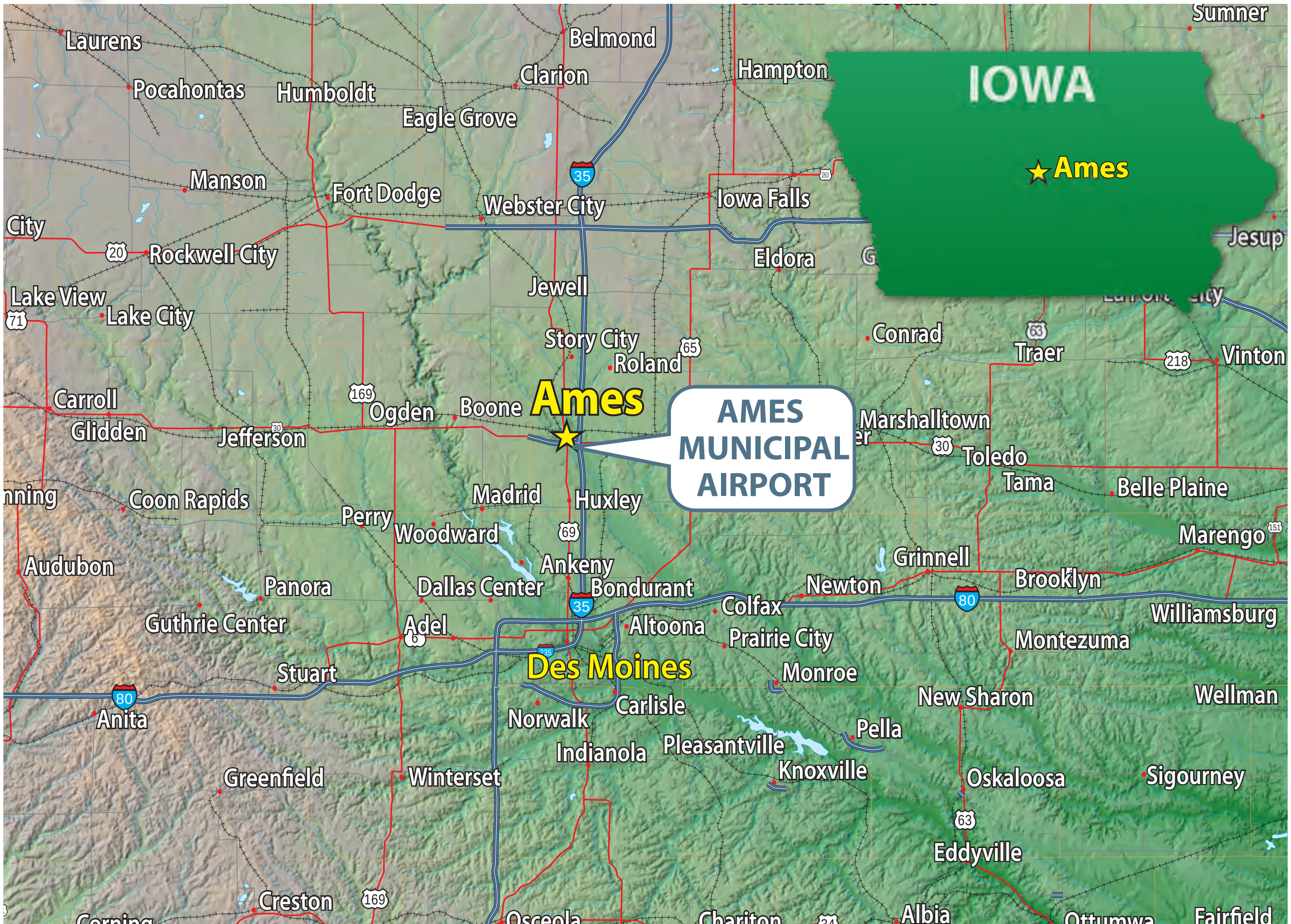
AMW is comprised of approximately 700 acres of land and is situated in the south-central portion of the city. Approximately 31 of the 700 acres of airport property are segregated from the physical airfield by Airport Road, located on the north side of the airport. The remaining 669 acres are contiguous to the aircraft operations area (AOA). Airport property is bound by Airport Road to the north, Highway 69 to the east, 256th Street to the south, and South Riverside Drive to the west.

The airport is provided excellent access to regional and interstate highway infrastructure. U.S. Highway 30 is located approximately 0.25-mile north of the airport and creates a bypass to the south of the City of Ames, providing access to the cities of Nevada and Boone, located to the east and west, respectively. U.S. Highway 30 connects with Interstate 35, located on the east side of the city, providing access to Des Moines to the south (and points beyond) and Minneapolis to the north.

It should also be noted that the City of Ames is home to Iowa State University (ISU). ISU is a National Collegiate Athletic Association (NCAA) Division I school within the Big 12 Athletics Conference and has a current enrollment of approximately 35,000 students. The university is the largest employer within the City of Ames by a factor of approximately 5,000 jobs, as addressed within the Socioeconomics section later in this chapter. In addition, the ISU Research Park is located adjacent to the northwest corner of AMW. The Research Park contains more than 400 acres and houses over 80 different businesses. The proximity of the Research Park to AMW is a large advantage for businesses and business leaders as Park tenants and visitors utilizing AMW can fly almost directly to and from their place of business.

TRANSPORTATION PLANS

Within the *Ames Mobility 2040: Ames Area MPO Long Range Transportation Plan*, approved by the City of Ames City Council in September 2015, the city has outlined general policies and strategies for maintaining and developing an adequate transportation system serving the incorporated area. The city has emphasized the development of an integrated transportation system that supports shorter trips, sustainable mode choices, a high quality of life, economic development, and the creation of high-quality



LOCATION / VICINITY

Exhibit 1A
LOCATION AND VICINITY MAP

jobs related to the overall transportation network. As such, the city has set out to achieve the following goals:

- Provide a connected transportation system that offers efficient and reliable mobility options for all modes of travel.
- Provide a safe transportation system.
- Consider and mitigate the impacts of the transportation system on the natural and built environment.
- Provide an accessible transportation system that fits within the context of its surroundings and preserves community character.
- Provide a transportation system that supports the regional economy and efficiently moves goods.
- Maintain transportation infrastructure in a state of good repair.

The plan goes on to identify aviation as an important means of accessing the greater Ames area. The aviation element of the city's transportation plan gives an overview of AMW as well as Des Moines International Airport, which provides scheduled passenger airline commercial service to the region.

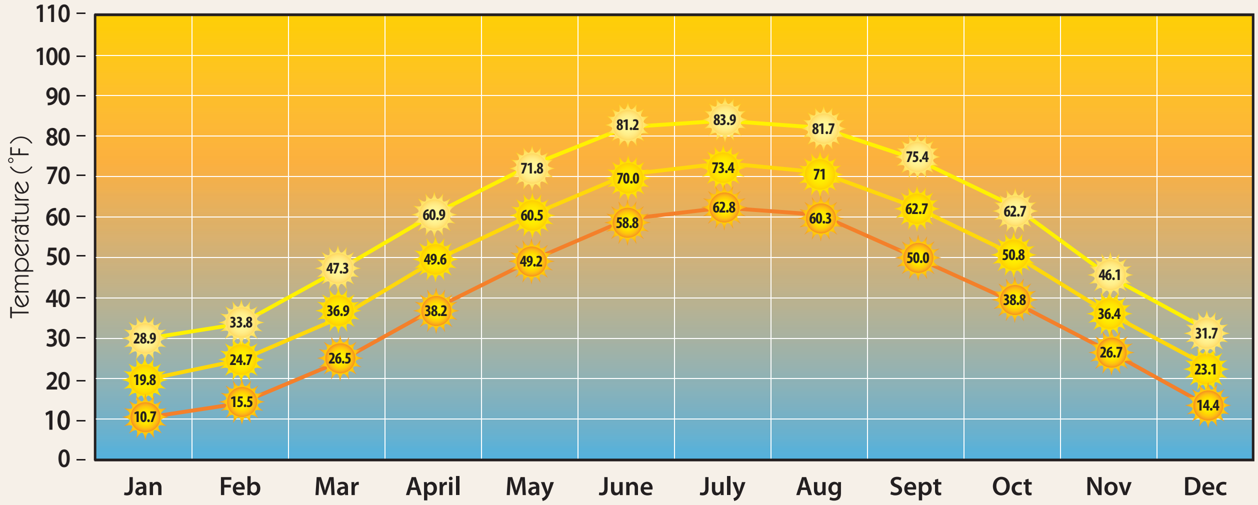
CLIMATE AND WEATHER CONDITIONS

Knowledge of climate and typical regional weather conditions greatly enhances a pilot's flying capabilities. Likewise, the ability to prepare for these conditions enhances the use of an airport. High surface temperatures and high humidity increase runway length requirements. Runway orientation is dependent on predominant wind patterns for the area. Cloud cover percentages and frequency of other climatic conditions also determine the need for navigational aids and lighting.

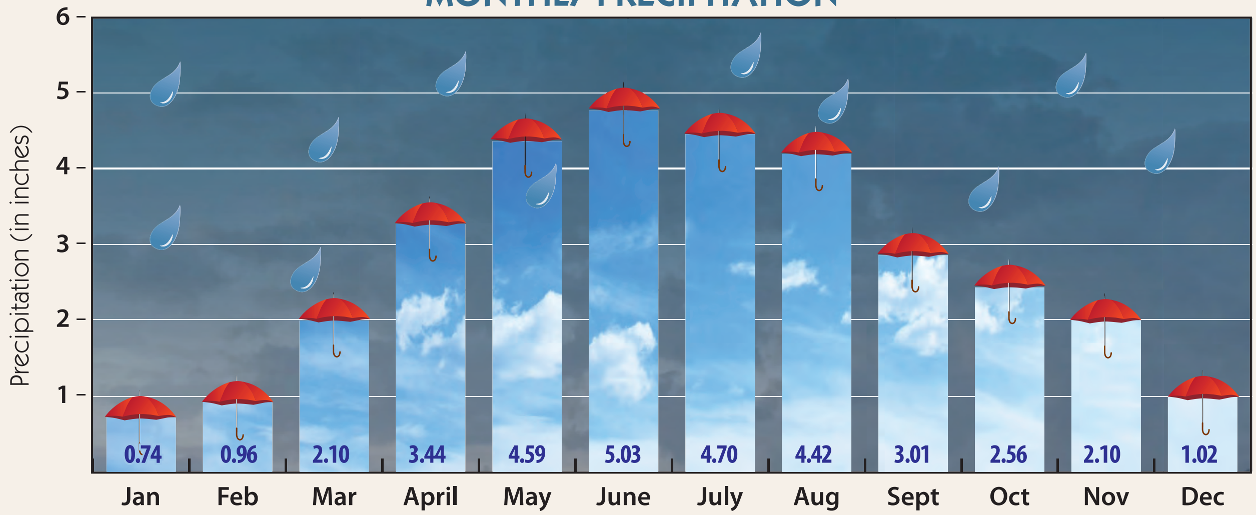
In general, the overall climate in Ames varies widely based on season. The City of Ames lies in the humid continental zone and generally experiences hot summers, cold winters, and wet springs. Weather data in **Exhibit 1B** is provided by the National Oceanic and Atmospheric Administration (NOAA) via the automated surface observation system (ASOS) currently located at the airport. This data shows an average annual high temperature of 73.4 degrees and an average annual low temperature of 19.8 degrees. July is the hottest month of the year with average highs reaching nearly 83.9 degrees, and January is the coolest month of the year with average lows down to 10.7 degrees. Precipitation is most plentiful during the spring and summer months, with June having the highest annual average at 5.03 inches of precipitation. Predominant wind patterns for the airport are most commonly out of the northwest, and wind speeds reach their peak in the springtime. April averages the highest wind speeds at 9.91 knots.

Table 1A indicates that visual meteorological conditions (VMC) occur 90.75 percent of the time. Under VMC conditions, pilots can operate using visual flight rules (VFR) and are responsible for maintaining proper separation from objects and other aircraft. Instrument meteorological conditions (IMC) account for all weather conditions less than VMC conditions that still allow for aircraft to safely operate under instrument flight rules (IFR). Under IFR, pilots rely on instruments in the aircraft to accomplish navigation. Less than IMC, or poor visibility conditions (PVC), are weather conditions that are lower than

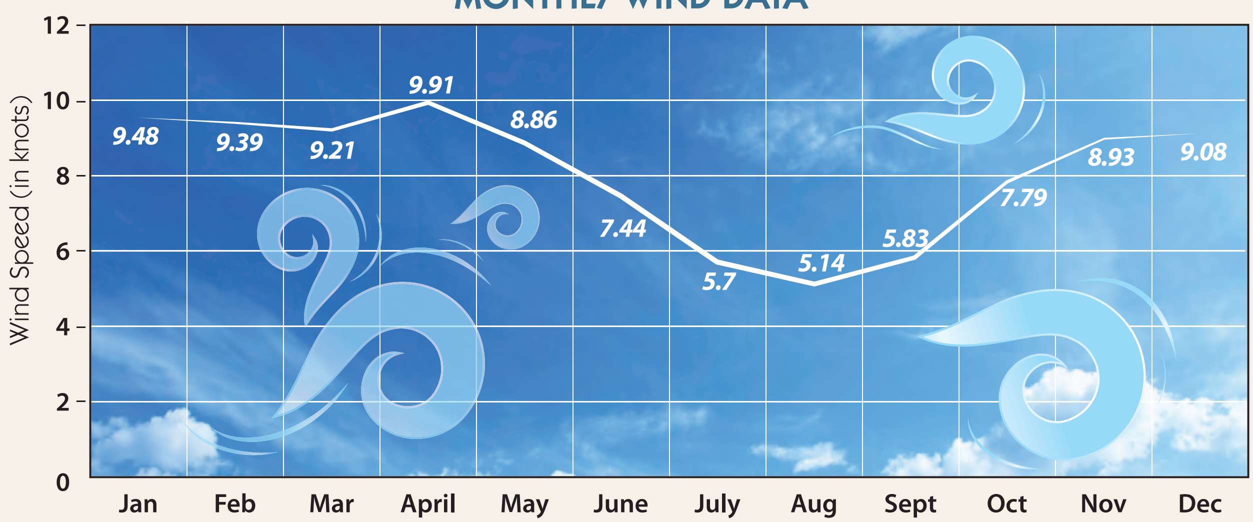
MONTHLY TEMPERATURES



MONTHLY PRECIPITATION



MONTHLY WIND DATA



Source: NOAA temperature and precipitation climate normal, Station ID: Ames Municipal Airport, IA US; GHCND:USW00094989 instrument approach minimums, making the airport inaccessible to most air traffic. IMC conditions occur 5.77 percent of the time, while PVC conditions occur 3.48 percent of the time annually at the airport.

TABLE 1A
Weather Conditions
Ames Municipal Airport

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	> 1,000' AGL	> 3 statute miles	90.75%
IMC	≥ 500' AGL and ≤ 1,000' AGL	1-3 statute miles	5.77%
PVC	< 500' AGL	< 1 statute mile	3.48%

VMC - Visual Meteorological Conditions
IMC - Instrument Meteorological Conditions
PVC - Poor Visibility Conditions
AGL - Above Ground Level

Source: National Oceanic and Atmospheric Administration (NOAA) - National Climatic Data Center. Airport observations from January 2008 – December 2017.

AIRPORT HISTORY

Interest in aviation within the City of Ames can be dated back to 1918, when the World War I armistice was declared, and aviation became widespread across the United States. However, organized aviation in Ames did not begin until 1926, when two brothers, Wilford and Joe Gerbracht, decided to rent a 40-acre field, located east of the Skunk River and south of Lincoln Way, for use as an airport. Airfield facilities were soon developed, and in 1928, the airport was moved near its current location. In the fall of 1929, responsibility for operation of the airport was transferred to the American Legion Post. The American Legion Post maintained the airport until 1932, when operation of the airport was turned over to private ownership.

In 1943, citizens of Ames voted to establish a municipal airport and developed two turf runways, which pioneered the development of AMW as it is known today. Since 1943, AMW has experienced significant improvements including two paved runways, multiple hangar facilities housing based aircraft, a modern terminal facility, and improved navigational and weather aids serving the airport, among other improvements.

The present-day airport has evolved into a vital general aviation airport accommodating a significant number of based aircraft and annual aircraft operations. The City of Ames is dedicated to continuing to enhance the airfield to meet the demands of general aviation operators that utilize the facility.

CAPITAL IMPROVEMENT PROGRAM

To assist in funding capital improvements, the Federal Aviation Administration (FAA) has provided funding assistance to AMW through the Airport Improvement Program (AIP). The AIP is funded through the Aviation Trust Fund, established in 1970 to provide funding for aviation capital investments, such as facilities and equipment, as well as research and development. The Iowa Department of Transportation—Aviation Bureau (IDOT) also offers funding assistance to the airport by providing matches to FAA grants and in some instances, funding a project through a state grant only.

Table 1B summarizes the capital improvement projects undertaken at the airport since the year 1999. Over this period, AMW has received nearly $9.4 million in FAA grants. The grants have funded engineering and construction work, environmental studies, and airfield enhancements.

For projects that are grant-eligible, airport staff must coordinate with other City of Ames departments as well as the FAA and IDOT on funding and construction schedules. In addition, airport staff coordinates with businesses and tenants to minimize operational impacts associated with construction schedules.

TABLE 1B
AIP Grant History FY1999-2018
Ames Municipal Airport

Fiscal Year	Sequence Number	Project Description	AIP Grant Total
1999	11	Rehabilitate taxiway and apron	$501,057
2000	12	Rehabilitate runway and taxiways	$850,000
2002	13	Install taxiway lighting and airfield guidance signs	$147,281
2004	14	Rehabilitate Runway 1-19	$1,277,630
2005	15	Rehabilitate taxiways serving Runway 1-19	$355,288
2006	16	Update airport master plan study	$72,385
2009	17	Rehabilitate Runway (Part A) 13-31	$1,433,770
2009	18	Rehabilitate Runway (Part B) 13-31	$1,241,200
2010	19	Rehabilitate Taxiways A-1 and A	$1,231,560
2011	20	Rehabilitate apron	$119,026
2012	21	Rehabilitate apron	$1,302,281
2015	22	Construct terminal building	$450,000
2016	23	Construct terminal building	$150,000
2018	24	Update airport master plan study	$231,048
Total			**$9,362,526**

Source: FAA AIP Grant History Lookup Tool

AIRPORT ADMINISTRATION

The airport is owned and operated by the City of Ames. AMW is overseen by the city's Public Works Department, which serves in an advisory capacity to the Assistant City Manager in matters pertaining to the airport and making recommendations on topics such as capital improvements, business relationships, and system and planning studies. It should be noted that in 2017, the city leased day-to-day management of AMW to Central Iowa Air Service, the current fixed base operator (FBO) located on the airfield.

ECONOMIC IMPACT

In 2009, the Iowa Department of Transportation – Aviation Bureau published the commissioned report, *Iowa Economic Impact of Aviation*. The report identifies 115 public-use airports in the state, of which eight provide commercial service and the remaining 107 are general aviation airports. In 2009, the base year for the study, the aviation system supported approximately 47,223 jobs, generated $2.7 billion in annual payroll, and produced $5.4 billion in economic activity. A summary of AMW's economic impact is provided in **Table 1C**.

TABLE 1C
Economic Impact
Ames Municipal Airport

Description	Impacts
General Aviation Activities	
Total Employment	98.5
Total Payroll	$2,888,000
Total Output	$7,789,400

Source: *Iowa Economic Impact of Aviation: Uses and Benefits of Aviation in Iowa, April 2009.*

AIRPORT SYSTEM ROLE

Airport planning exists on many levels: national, state, regional, and local. Each level has a different emphasis and purpose. On the national level, AMW is included in the *National Plan of Integrated Airport Systems* (NPIAS). At the state level, the airport is included in the *Iowa State Aviation System Plan 2010-2030 Technical Report*. The local planning document is primarily the Airport Master Plan, which was last updated in 2008.

FEDERAL AIRPORT PLANNING

The role of the federal government in the development of airports cannot be overstated. Many of the nation's existing airports were either initially constructed by the federal government, or their development and maintenance was partially funded through various federal grant-in-aid programs to local communities. In large measure, the system of airports existing today is due, in part, to the existence of federal policy that promotes the development of civil aviation. As part of a continuing effort to develop a national airport system to meet the needs of civil aviation and promote air commerce, the United States Congress has continually maintained a national plan for the development and maintenance of airports.

The FAA maintains a database of public-use airports that are eligible for AIP funding called the NPIAS. Overall, the current NPIAS includes 3,328 existing and proposed airports which are considered significant to the national air transportation system. The NPIAS is published and used by the FAA in administering the AIP, which is the source of federal funds for airport improvement projects across the country. The AIP program is funded exclusively by user fees and user taxes, such as those on fuel and airline tickets. The 2019-2023 NPIAS estimates that $35.1 billion worth of needed airport improvements are eligible for AIP funding across the country over the next five years. An airport must be included in the NPIAS to be eligible for federal funding assistance through the AIP.

The NPIAS categorizes these facilities by the type of activities that take place, including commercial service, cargo service, reliever operations, and general aviation (as seen in **Table 1D**).

TABLE 1D
Airport Classifications

Airport Classifications		Hub Type: Percentage of Annual Passenger Boardings (enplanement)	Common Name
Commercial Service: Publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service	**Primary:** Have more than 10,000 passenger boardings each year	**Large:** 1% or more	**Large Hub**
		Medium: At least 0.25%, but less than 1%	**Medium Hub**
		Small: At least 0.05%, but less than 0.25%	**Small Hub**
		Nonhub: More than 10,000, but less than 0.05%	**Nonhub Primary**
	Nonprimary	**Nonhub:** At least 2,500 and no more than 10,000	**Nonprimary Commercial Service**
Nonprimary (Except Commercial Service)		Not Applicable	**Reliever General Aviation**

Source: https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/

Due to different operating requirements between small general aviation aircraft and large commercial aircraft, general aviation pilots often find it difficult to use a congested commercial service airport. In recognition of this, the FAA has encouraged the development of high-capacity general aviation airports in major metropolitan areas. These specialized airports, called relievers, provide pilots with attractive alternatives to using congested primary hub airports. They also provide general aviation access to the surrounding area. The following represents reliever airport eligibility requirements:

- The airport must be open to the public;
- The airport must maintain 100 or more based aircraft; or,
- The airport must have at least 25,000 annual itinerant operations.

Aside from relievers, nonprimary airports are divided into five categories based on existing activity, geographic factors, and public interest functions. These categories include national, regional, local, basic, and unclassified. In 2012 and 2014, the FAA published documents titled, *General Aviation Airports: A National Asset (ASSET 1)* and *ASSET 2: In-Depth Review of 497 Unclassified Airports*. The ASSET 1 study categorizes airports within four groups (national, regional, local, and basic) and identifies general functions associated with each category. These classifications generally correspond to the recommended role the airport will be assigned in forthcoming editions of the NPIAS. Of the 2,952 general aviation airports included in the ASSET 1 study, 497 were not specifically classified due to types of activity and characteristics that did not provide for clear classification within one of the four groups. These 497 airports were later studied and assigned a classification as part of the ASSET 2 study.

With the ASSET 1 and ASSET 2 studies, which have been integrated into the NPIAS, the FAA promotes the important contribution that general aviation airports provide to the national aviation system and economy. Nationwide, general aviation contributed $38.8 billion in economic output in 2009. When factoring in manufacturing and visitor expenditures, general aviation accounted for an economic contribution of $76.5 billion. The study recognizes that categorizing all general aviation airports the same does not properly identify the important role of each airport within a community and the benefits of a large and diverse aviation system.

Table 1E further defines the various roles that general aviation facilities provide for their service areas. Currently, AMW is classified as a regional general aviation airport within the NPIAS. Regional general aviation airports are in metropolitan areas and serve relatively large populations. These airports support regional economies with interstate and some long-distance flying and have high levels of activity, including some jets and multiengine propeller aircraft. On average, regional airports have about 92 total based aircraft, including approximately three jets.

TABLE 1E
General Aviation Airport Descriptions

Role	Description
National	Supports the national and state system by providing communities with access to national and international markets in multiple states and throughout the United States.
Regional	Supports regional economies by connecting communities to statewide and interstate markets.
Local	Supplements communities by providing access to primarily intrastate and some interstate markets.
Basic	Links the community with the national airport system and supports general aviation activities (e.g., emergency services, charter or critical passenger service, cargo operations, flight training and personal flying).
Unclassified	Provides access to the aviation system.

Source: https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/categories/

The NPIAS includes six factors to indicate the performance of the airport system: safety, cost-effective capacity, environmental performance, pavement condition, surface transportation accessibility, and financial performance. The factors generally align with the Department of Transportation's strategic goals outlined in the Draft Strategic Plan, "Transportation for a New Generation." The NPIAS identifies airport improvements that will help meet these strategic goals. The current issue of the NPIAS identifies approximately $3.27 million in development needs at AMW for the years 2019-2023. It should be noted that this figure is not a guarantee of federal funding; rather, it represents development needs as presented to the FAA by the AMW airport administration in the annual airport capital improvement program.

A primary purpose of the NPIAS is to identify the airports that are important to national transportation, which includes all commercial service airports, all reliever airports, and selected general aviation airports. The NPIAS identifies 3,328 public-use airports (3,321 existing and seven proposed) which are eligible to receive development grants under the FAA AIP. The plan estimates that approximately $35.1 billion in AIP-eligible airport projects will require financial assistance between 2019 and 2023. **Table 1F** identifies the type of airports included in the NPIAS.

In summary, AMW is classified as a general aviation regional airport that serves the needs of corporate, military, public safety, recreational, and instructional aviation uses in the greater Ames metropolitan area.

TABLE 1F Activity and Development at NPIAS Airports					
Number of Airports	**Airport Category**	**Percentage of NPIAS Airports**	**Percentage of 2016 Total Enplanements[1]**	**Percentage of All Based Aircraft[2]**	**Percentage of NPIAS Cost[3]**
30	Large Hub	1%	72.48	0%	23.50%
31	Medium Hub	1%	15.87	1.70%	10.50%
72	Small Hub	2%	8.21	4.80%	11.90%
247	Nonhub	7%	3.26	10.20%	15.20%
380	**Primary Subtotal**	**11%**	**99.83%**	**16.70%**	**61.10%**
88	National	3%	n/a	10.20%	5.30%
492	Regional	14%	n/a	22.30%	12.10%
1,278	Local	40%	n/a	21.30%	14.50%
840	Basic	25%	n/a	3.40%	6.20%
243	Unclassified	7%	n/a	1.10%	0.03%
2,941	**Nonprimary Subtotal**	**89%**	**0.13**	**58.60%**	**38.10%**
3,321	**Total NPIAS Airports**	**100%**	**99.96%**	**75.30%**	**99.20%**

[1] The 126 nonprimary commercial service airports account for 0.07 percent of enplanements. The 2,815 nonprimary airports account for 0.06 percent of enplanements. The remaining 0.04 percent occurred at non-NPIAS airports.
[2] Based on an active general aviation fleet of 211,793 aircraft in 2016. The remaining aircraft are based at non-NPIAS airports.
[3] These costs are rounded and do not include the cost for new airports (one percent)
Source: 2019 – 2023 *National Plan of Integrated Airport Systems* (NPIAS)

STATE AIRPORT PLANNING

The primary aviation planning document for the State of Iowa is the *Iowa Aviation System Plan* (2010-2030) (IASP). The plan provides IDOT – Aviation Bureau staff with a tool to assess the needs of the state's airports; help justify funding for airport improvements; and provide information to airport sponsors and others concerning the value, use, and needs of the state's public-use airports.

The IASP identified five roles for Iowa airports which are defined as follows:

Commercial Service Airports: These airports support some level of scheduled major/national or regional/commuter commercial air service. They also have the infrastructure and services available to support the full range of general aviation activity.

Enhanced Service Airports: These airports have runways 5,000 feet or greater with facilities and services to accommodate the full range of general aviation activity. These airports serve business aviation and are regional transportation centers and economic catalysts. A total of 15 airports in the state are classified as enhanced service airports, including AMW.

General Service Airports: These airports have a runway length of at least 4,000 feet and facilities and services to support most general aviation activity, including small- to medium-sized business jets.

Basic Service Airports: These airports have a minimum runway length of 3,000 feet and facilities and services customized to meet local demand. These airports may have an FBO or some on-call availability of services and fuel.

Local Service Airports: These airports support local aviation activity with little or no airport services. These airports typically have turf runways.

AMW is listed as an Enhanced Service airport in the IASP. The minimum facility and service requirements are listed in **Table 1G**.

TABLE 1G
Facility and Service Target
IASP - Commercial/Enhanced Service Airports

Airport Criteria	Minimum Objectives
AIRSIDE	
Airport Reference Code	C-II minimum
Runway Length	5,000 feet minimum
Runway Width	100 feet minimum
Taxiway	Full parallel
Instrument Approach	Vertical guidance
Runway Lighting	Medium Intensity Runway Lights (MIRL)
Taxiway Lighting	Medium Intensity Taxiway Lights (MITL)
Visual Guidance Slope Indicator	Both runway ends (or Instrument Landing System [ILS])
Runway End Identification Lights	Both runway ends (or ILS)
Rotating Beacon	Yes
Wind Indicator	Yes (lighted) and supplemental as needed
RCO Facilities	ATCT or RCO as needed
Weather Reporting Aids	Yes (e.g., AWOS, ASOS)
Wind Coverage	95% combined coverage
LANDSIDE	
Covered Storage	100% of based aircraft
Overnight Transient Storage	Yes - Based on demand
Aircraft Apron	100% of daily average transients
Terminal/Admin Building	Yes
Paved Entry/Parking Lot	Yes
SERVICES	
Fuel Availability	100LL & Jet A (24-hour)
Attendance	Standard business hours. After hours on-call.
Ground Transportation	Courtesy car/rental car
Food & Beverage	Vending
Fixed Base Operator (FBO) Facility	Pilot lounge, flight planning, flight training, rental aircraft, aircraft maintenance, charter aircraft
Snow Removal	Yes
PLANNING	
Height Zoning	Yes
Comp Plan Define Land Uses	Yes
Emergency Plan	Yes
Airport Layout Plan	Updated within last eight years

ATCT: Air Traffic Control Tower
AWOS/ASOS: Automated Weather Observation System/Automated Surface Observation System
FBO: Fixed Base Operator
RCO: Remote Communications Outlet

Source: IASP - Iowa Aviation System Plan 2010-2030

LOCAL AIRPORT PLANNING

The most common local airport planning document is an Airport Master Plan, which the FAA recommends an airport update every 7 to 10 years. In addition to a master plan, entities often provide additional local planning through a variety of studies including strategic plans, sub-area plans, etc.

Airport Master Plan

The Airport Master Plan is the primary planning document at the local level. The master plan is intended to provide a 20-year vision for airport development based on aviation demand forecasts. Over time, the forecast element of the master plan typically becomes less reliable due to changes in aviation activity and/or the economy. The most recent update to the Ames Municipal Airport Master Plan was done in 2008. Therefore, this is an appropriate time to update the master plan and revisit development assumptions from the previous planning study.

One component of the master plan is a set of Airport Layout Plan (ALP) drawings that are used to depict existing and future development on the airport. It should be noted that the airport has updated its ALP drawings as needed, with the most recent version completed in August 2010.

AVIATION ACTIVITY

Records of airport operational activity are essential for determining required facilities (types and sizes), as well as eligibility for federal funding. Airport staff and the FAA record key operational statistics including aircraft operations and based aircraft. Analysis of historical activity levels aid in projecting future trends which will enhance the airport's ability to plan for facility demands in a timely manner. The following sections detail specific operational activities.

OPERATIONS

As previously mentioned, records of airport operational activities play a significant role in determining airport facilities (types and sizes), as well as providing justification for federal funding. An account of aircraft operations (takeoffs and landings) is available from the FAA's *Terminal Area Forecast* (TAF), published January 2018. Typically, TAF reports for airports without an airport traffic control tower (ATCT) are based upon historic operations reported in the Airport Master Record Form 5010. This data is based strictly upon estimates and generally held constant for forecast projections unless specified by a local or regional FAA official. Furthermore, it should be noted that TAF operational statistics are reviewed for comparison purposes only and may not be an accurate portrayal of airport operational statistics.

Analysis within the next chapter will apply an equation developed for non-towered general aviation airports as recommended by the FAA to more accurately estimate the current level of operational activity at AMW.

According to the historic TAF data presented in **Table 1H**, AMW had its peak operational levels in 1990 at 53,000 annual operations. Total operations declined to 23,750 in 1996 and were held constant through the year 2000. Operations further declined to 23,290 in 2001 and were held constant through 2007. In 2008, AMW experienced an increase to 33,834 operations. Beginning in 2009, 33,751 operations have been reported through 2018 and are flatlined at 33,751 operations through the long-term forecast year 2038.

Business Jet

TABLE 1H
FAA TAF Aircraft Operational History
Ames Municipal Airport

Year	Itinerant Operations					Local Operations			Total Ops
	Air Carrier	Air Taxi	GA	Military	Subtotal	GA	Military	Subtotal	
1990	0	3,000	29,000	1,000	33,000	20,000	0	20,000	53,000
1991	0	2,500	29,000	500	32,000	18,000	0	18,000	50,000
1992	0	2,500	29,000	500	32,000	18,000	0	18,000	50,000
1993	0	2,500	29,000	500	32,000	18,000	0	18,000	50,000
1994	0	2,000	26,000	500	28,500	15,000	0	15,000	43,500
1995	0	2,000	26,000	500	28,500	15,000	0	15,000	43,500
1996	0	750	13,800	0	14,550	9,200	0	9,200	23,750
1997	0	750	13,800	0	14,550	9,200	0	9,200	23,750
1998	0	750	13,800	0	14,550	9,200	0	9,200	23,750
1999	0	750	13,800	0	14,550	9,200	0	9,200	23,750
2000	0	750	13,800	0	14,550	9,200	0	9,200	23,750
2001	0	750	13,524	0	14,274	9,016	0	9,016	23,290
2002	0	750	13,524	0	14,274	9,016	0	9,016	23,290
2003	0	750	13,524	0	14,274	9,016	0	9,016	23,290
2004	0	750	13,524	0	14,274	9,016	0	9,016	23,290
2005	0	750	13,524	0	14,274	9,016	0	9,016	23,290
2006	0	750	13,524	0	14,274	9,016	0	9,016	23,290
2007	0	750	13,524	0	14,274	9,016	0	9,016	23,290
2008	0	1,660	19,004	500	21,164	12,670	0	12,670	33,834
2009	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751
2010	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751
2011	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751
2012	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751
2013	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751
2014	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751
2015	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751
2016	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751
2017	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751
2018	0	1,656	18,957	499	21,112	12,639	0	12,639	33,751

FAA *Terminal Area Forecast*, January 2018.

Operations are generally sub-categorized as either itinerant or local. Itinerant operations are those made by aircraft which arrive from or depart to destinations outside the local operating area. Local operations are associated primarily with touch-and-go or pilot training activity. Since 2009, itinerant annual operations have been estimated at 21,112 (approximately 63 percent), with local annual operations estimated at 12,639 (approximately 37 percent) according to the TAF.

In 2018, military and air taxi activity were estimated at 499 and 1,656 annual itinerant aircraft operations, respectively. The remaining 18,957 annual itinerant aircraft operations were estimated as conducted by general aviation aircraft. The 12,639 local annual operations estimate was comprised entirely of general aviation operations. This activity can include fixed-wing aircraft, as well as helicopter activity. The largest percentage of aircraft activity estimated for the airport falls within the general aviation category and can range from small aircraft conducting recreational flights, up to large corporate jets for business or charter purposes. At present, flight instruction services are available on-airport, ultimately contributing to annual local operations.

BASED AIRCRAFT

Identifying the current number of based aircraft is important to the master planning analysis as this number helps determine existing demand for several different facilities, including aircraft storage hangar space, parking aprons, pilot and passenger services, and various other aircraft support facilities.

Historic data for based aircraft was retrieved from several sources, including the FAA's TAF and from the airport's current based aircraft records. TAF data from 1990 to 2016 shows based aircraft was at a high of 134 in 1991, then decreased to a low of 54 in 2011. After 2011, based aircraft increased to 92 by 2014, then decreased to 71 in 2015. Years 2016-2018 showed an increase to 86 based aircraft, to which a flat line forecast has been applied throughout the long-term planning horizon, which is typical of general aviation airports.

The most recent based aircraft count within the FAA's National Based Aircraft Program totals 62 based aircraft and was last approved in May of 2015.

Data from the airport's current FBO, retrieved January 2019, identifies a based aircraft count of 78 aircraft. Single-engine piston aircraft make up approximately 82 percent (64 aircraft) of based aircraft and include representative aircraft such as the Cessna 182 and Piper 140. AMW also has three based multi-engine piston aircraft, one turboprop, four jets, and six gliders. **For planning purposes, the master plan is utilizing the actual airport record for total based aircraft (78), as this number is the most current and accurate based aircraft count for AMW.**

AIRSIDE FACILITIES

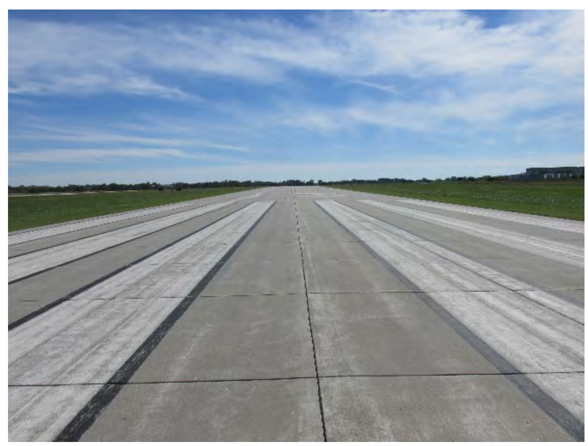
Airport facilities can be functionally classified into two broad categories: airside and landside. The airside category includes those facilities directly associated with aircraft operations. The landside category includes those facilities necessary to provide a safe transition from surface to air transportation and support aircraft parking, servicing, storage, maintenance, and operational safety. This section describes the airfield facilities, including runways, taxiways, lighting, marking, navigational aids, and weather reporting. Airside facilities are depicted and detailed on **Exhibit 1C**.

RUNWAYS

AMW is served by a crosswind runway system comprised of two runways. Runway 1-19 is designated as the primary runway and measures 5,701 feet long and 100 feet wide. Runway 13-31 serves as the crosswind runway and is 3,491 feet long and 75 feet wide. Runway 1-19 is constructed of asphalt, while Runway 13-31 is constructed of concrete.

Runway 19 (southwesterly view)

Runway gradient describes the average slope of a runway and is determined by dividing the runway's high and low points by its length. Runway 1-19 slopes up from the Runway 19 end toward the Runway 1 end by 36.7 feet, resulting in a 0.64 percent gradient. It should be noted, however, that the FAA published gradient for Runway 1-19 is 0.3 percent. Runway 13-31 contains a gradient of 0.15 percent, sloping upward from Runway 31. The FAA published gradient for Runway 13-31 is also 0.3 percent.



Runway 13 (southeasterly view)

Runway load bearing strength for Runway 1-19 is 30,000 pounds for single wheel loading (SWL) and 38,000 pounds for dual wheel loading (DWL). SWL refers to design aircraft landing gear with a single wheel on each main landing gear strut. Similarly, DWL refers to design aircraft landing gear with two wheels on each main landing gear strut. The current runway load bearing strength serving Runway 13-31 is published as 30,000 pounds SWL.

TAXIWAYS

The taxiway system, shown on **Exhibit 1C** and summarized in **Table 1J**, consists of parallel and entrance/exit taxiways. Taxiway pavement is constructed of both asphalt and concrete and is 35 feet in width. For reference, runway to taxiway separation distances shown on **Exhibit 1C** are measured from centerline to centerline. Full-length parallel Taxiway A is located 400 feet from Runway 1-19 centerline, while quasi-parallel Taxiway B is located at a distance ranging from 250 feet to 540 feet from Runway 13-31 centerline. Two hold aprons are located on Taxiway A, serving Runway 1-19. One hold apron is

Exhibit 1C
AIRSIDE AND LANDSIDE FACILITIES

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located at the threshold of Runway 1, and the other is located near Taxiway A3, approximately 1,300 feet from the Runway 1 threshold. Hold aprons allow pilots to perform flight checks and engine run-ups near the departure runway yet remain clear of the parallel taxiway.

TABLE 1J
Taxiway Data
Ames Municipal Airport

Designation	Width	Length	Description
A	35'	5,700'	Full-length parallel taxiway serving Runway 1-19.
A1	35'	1,140'	Entrance/exit taxiway serving the Runway 19 threshold. Also leads to the aircraft apron area and connects with Taxiway B.
A2	35'	330'	Exit taxiway serving Runway 1-19. Connects Runway 1-19 and parallel Taxiway A.
A3	35'	330'	Exit taxiway serving Runway 1-19. Connects Runway 1-19 and parallel Taxiway A.
A4	35'	330'	Entrance taxiway serving the Runway 1 threshold. Connects Runway 1-19 and parallel Taxiway A.
B	35'	3,360'	Full-length quasi parallel taxiway serving Runway 13-31. Also leads to the aircraft apron area.
B1	35'	500'	Entrance/exit taxiway serving the Runway 13 threshold and connects to the aircraft apron area.
B2	35'	400'	Exit taxiway serving Runway 13-31. Connects Runway 13-31 to parallel Taxiway B as well as the aircraft apron area.
B3	35'	190'	Entrance taxiway serving the Runway 31 threshold. Connects Runway 13-31 and parallel Taxiway B.

Source: Coffman Associates analysis.

AIRFIELD PAVEMENT CONDITION

The airport's pavements were last inspected in October 2015. Pavements are assessed using the pavement condition index (PCI) methodology for visually assessing pavement conditions. PCI provides a numerical indication of overall pavement condition. Types and amounts of deterioration are used to calculate the PCI value of the section. The PCI ranges from 0 to 100, with 100 representing a pavement in excellent condition. In general terms, pavements with relatively high PCIs that are not exhibiting significant load-related distress will benefit form preventative maintenance actions, such as crack sealing and surface treatments. As the PCI drops, the pavements may require major rehabilitation, such as an overlay. In some situations where the PCI has dropped low enough, reconstruction may be the only viable alternative due to the substantial damage to the pavement structure. Each PCI range and associated pavement repair type are shown in **Table 1K**.

TABLE 1K
PCI Ratings and Repair Types

PCI Range	Repair Type
86-100	Preventative Maintenance
71-85	Preventative Maintenance
56-70	Preventative Maintenance / Major Rehabilitation
41-55	Major Rehabilitation
26-40	Reconstruction
11-25	Reconstruction
0-10	Reconstruction

Source: Iowa Department of Transportation – Aviation Bureau 2017 Pavement Management System Update

The PCI ratings, surface types, and surface areas reported for each pavement section on the airport are depicted on **Exhibit 1D**. Runway 1-19 was found to have a PCI rating of 66, and Runway 13-31 had a PCI of 95. The main taxiways serving the airfield system were found to possess PCIs of 64 to 77 on average. The main aircraft parking apron ranged from 49 to 100, with the southern portion of the apron having a PCI rating of 49 and the northern portion having a PCI rating of 100. At the time of the inspection, there were five areas of pavement on the airport, including the southern portion of the aircraft apron, that contained PCIs below 55. There were also several areas of pavement that exhibited PCIs above 84, to include the majority of Taxiway A, Runway 13-31, and the northern portion of the aircraft apron. The overall airfield pavement condition is evidence that the airport and City of Ames, in conjunction with the FAA and IDOT, continue to invest in the well-being of the facility.

AIRFIELD LIGHTING

Airfield lighting systems extend an airport's usefulness into periods of darkness and/or poor visibility. A variety of lighting systems are installed at the airport for this purpose. They are categorized by function as follows:

Airport Identification Lighting: The location of the airport at night or during low-visibility weather is universally identified by a rotating beacon. A rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The beacon is centrally located in the landside development area, immediately north of the automobile parking area.


Airport Beacon

Runway Pavement and Edge Lighting: Pavement edge lighting utilizes light fixtures placed near the edge of the pavement to define the lateral limits of the pavement. This lighting is essential for safe operations during night and/or times of low visibility in order to maintain safe and efficient access to and from the runway and aircraft parking areas. Runways 1-19 and 13-31 are equipped with a medium intensity runway lighting (MIRL) system.

Approach Lighting System (ALS): An ALS is a configuration of signal lights placed symmetrically about the extended runway centerline, starting at the landing threshold and extending outward into the approach zone. This system provides visual information such as runway alignment, height perception, roll guidance, and horizon references. Currently, Runway 1 is served by a medium intensity approach lighting system with runway alignment indicator lights (MALSR), which consists of a threshold light bar and seven five-light bars located at 200-foot intervals on the extended runway centerline out to 1,400 feet from the runway threshold. Two additional five-light bars are located, one on each side of the centerline bar, 1,000 feet from the runway threshold forming a crossbar that is 66 feet long. In addition, the runway alignment indicator light (RAIL) portion of the facility consists of five sequenced flashers located on the extended runway centerline at 200-foot intervals out to 2,400 feet from the runway threshold.

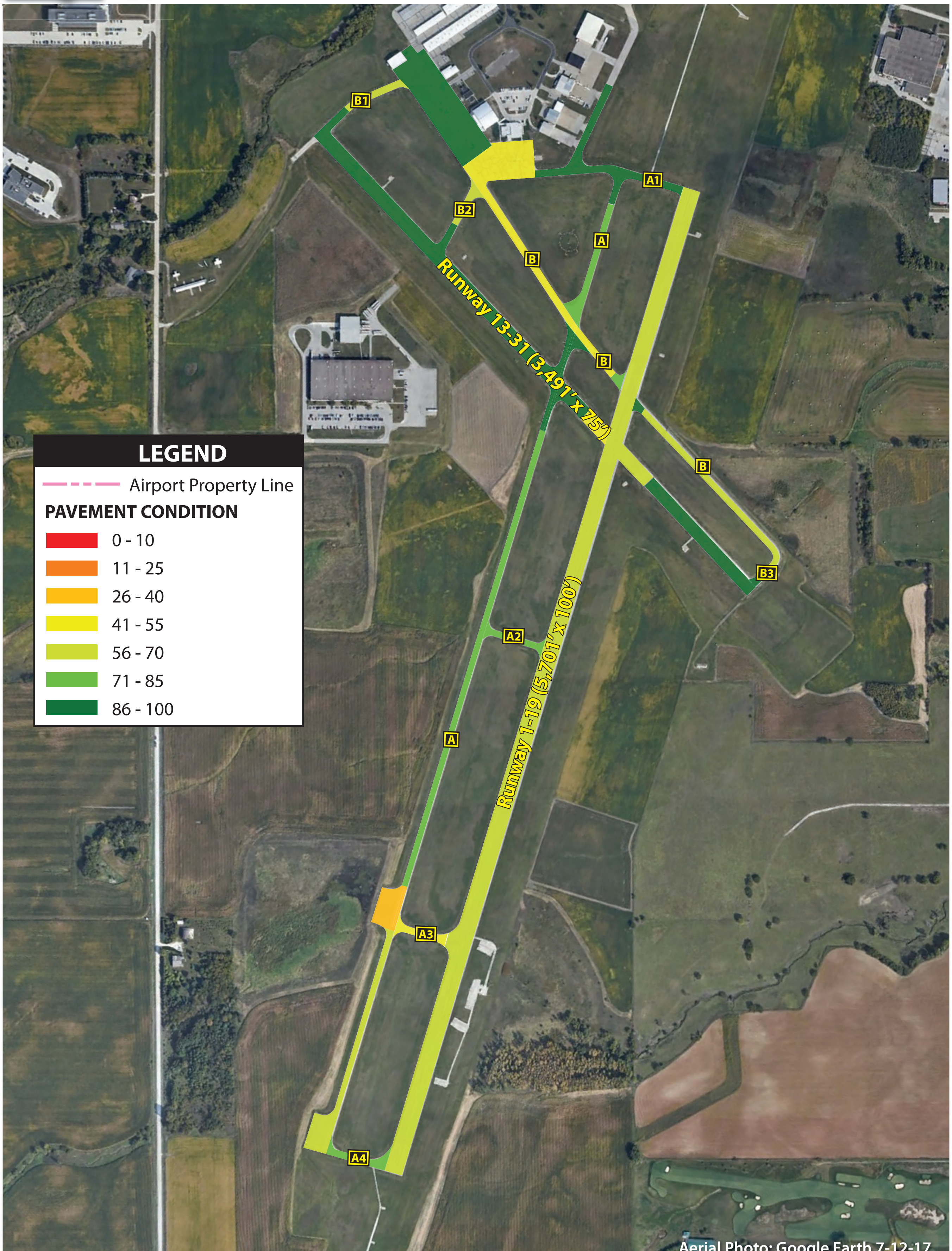


Exhibit 1D
2015 PAVEMENT CONDITION

Visual Approach Lighting: Visual approach aids have been installed at the airport to assist pilots in determining the correct descent path to the runway end during an approach to the airport. A four-box visual approach slope indicator (VASI-4) is available on approach to Runway 19 and on approach to each end of Runway 13-31. When the system of red and white lights is interpreted by the pilot, they are given an indication of being above, below, or on the designated descent path to the runway threshold. A VASI system has a range of five miles during the day and up to 20 miles at night. The VASI serving Runway 19 provides a 4.00-degree glide path which is greater than normal to ensure obstruction clearances, while the VASI systems serving Runway 13-31 each provide the standard 3.00-degree glide path.

Visual Approach Slope Indicator

Runway End Identifier Lights (REILs): REILs provide a visual identification of the runway end for landing aircraft. The REILs consists of two synchronized flashing lights, located laterally on each side of the runway end, facing the approaching aircraft. These flashing lights can be seen day or night for a distance of up to 20 miles depending on visibility conditions. At present, AMW is not equipped with REILs.

Taxiway Light

Taxiway Lighting: All airfield taxiways serving the runway system are equipped with blue medium intensity taxiway lights (MITL).

Pilot-Controlled Lighting: During nighttime hours, pilots can utilize the pilot-controlled lighting system (PCL) to activate certain airfield lights from their aircraft through a series of clicks of their radio transmitter utilizing frequency 126.0 MHz. This system can be utilized to activate the MIRL serving Runways 1-19 and 13-31, the MALSR serving Runway 1, and the 2-bar VASIs serving Runways 19, 13, and 31.

Runway/Taxiway Directional Sign

AIRFIELD SIGNAGE

The airport has a runway/taxiway signage system that assists pilots in identifying their location on the airfield and directing them to their desired location. The presence of runway/taxiway signage is an essential component of a surface movement guidance control system necessary for the safe and efficient operation of the airport. The signage system installed at AMW includes lighted runway and taxiway designations, routing/directional, and runway exits. At present, there are no distance remaining signs serving the runway system.

AIRPORT MARKINGS

Pavement markings aid in the movement of aircraft along airport surfaces and identify closed or hazardous areas on the airport. Runway 1 has precision instrument runway markings, which include landing designation, centerline, threshold markings, aiming point, touchdown zone, and edge markings. Runways 19, 13, and 31 are marked with non-precision instrument markings that include threshold, landing designation, centerline, edge, and aiming points.

Hold Position Marking

Taxiway and taxilane centerline markings are provided to assist pilots in maintaining proper clearance from pavement edges and objects near the taxiways. Taxiway markings also include hold lines located on the entrance/exit taxiways serving Runways 1-19 and 13-31. The hold line positions function to keep holding aircraft clear of the active runway while it is in use, maintaining adequate separation between aircraft. Hold lines on the entrance/exit taxiways associated with Runway 1-19 are situated at a range of 240 to 265 feet from the runway centerline. Hold lines on those taxiways serving Runway 13-31 are located at a range of 190 to 200 feet from the runway centerline. It should be noted that Runway 13-31 also contains hold position markings for land and hold short operations (LAHSO), stopping prior to Runway 1-19. The hold position markings are located on Runway 13-31, 230 feet from the Runway 1-19 centerline. Given that AMW is not served by an ATCT, it is assumed that these markings are designated for safety purposes only and indicate where an aircraft operating on Runway 13-31 should stop if it encounters another aircraft operating on Runway 1-19.

Aircraft movement areas on various parking aprons are identified with centerline markings. Aircraft tiedown positions are identified on various apron surfaces as well.

NAVIGATIONAL AIDS

Navigational aids are electronic devices that transmit radio frequencies, which pilots of properly equipped aircraft translate into point-to-point guidance and position information. Electronic navigational aids available for aircraft flying to or from AMW include the very-high frequency omni-directional range (VOR) and global positioning system (GPS).

The VOR provides azimuth readings to pilots of properly equipped aircraft by transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility to provide distance as well as direction information to the pilot. Military tactical air navigation aids (TACANs) and civil VORs are commonly combined to form a VORTAC. The VORTAC provides distance and direction information to both civil and military pilots. The Des Moines VORTAC, located 33.3 miles south of the airport, serves the local area. Similarly, the Newton and Elmwood VOR-DMEs are located 26.1 and 32.2 miles southeast and northeast of AMW, respectively.

GPS was initially developed by the United States Department of Defense for military navigation around the world. However, GPS is now used extensively for a wide variety of civilian uses, including civil aircraft navigation.

GPS uses satellites placed in orbit around the globe to transmit electronic signals, which pilots of properly equipped aircraft use to determine altitude, speed, and navigational information. This provides more freedom in flight planning and allows for more direct routing to the destination. GPS provides for en-route navigation and precision instrument approaches to AMW.

WEATHER AND COMMUNICATION

AMW is served by an automated surface observing system (ASOS). The ASOS reports automated aviation weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur. The ASOS system reports cloud ceiling, visibility, temperature, dew point, wind direction, wind speed, altimeter setting (barometric pressure), and density altitude (airfield elevation corrected for temperature). The ASOS equipment is located approximately 850 feet south of the Runway 1-19 and 13-31 intersection. Weather information can be obtained from the ASOS by utilizing the radio frequency 132.025 MHz or by calling 515-233-2611. Broadcasts are updated hourly (at a minimum) and provide arriving and departing pilots with the current surface weather conditions, communication frequencies, and other important airport-specific information.

Automated Surface Observation System

Lighted Windcone, Segmented Circle, and Tetrahedron

AMW is equipped with a lighted wind cone, lighted wind-T, and segmented circle located approximately 1,150 feet north of the Runway 1-19 and 13-31 intersection. The wind-T indicates the wind direction, while the wind cone indicates wind direction and speed to pilots, and the segmented circle indicates aircraft traffic pattern information.

LANDSIDE FACILITIES

Landside facilities are those that support the aircraft and pilot/passenger handling functions as well as other non-aviation facilities typically providing a revenue stream to the airport. These facilities include general aviation facilities, as well as support facilities such as fuel storage, vehicle parking, roadway access, and aircraft rescue and firefighting (ARFF). The primary landside facilities at the airport are identified on previously presented **Exhibit 1C**.

AMES MUNICIPAL AIRPORT TERMINAL

The recently completed state-of-the-art terminal building at the airport was opened in October 2017. The terminal facility was designed and constructed for use by pilots, passengers, the general public, and Central Iowa Air Service FBO, who manages day-to-day operations at the airport. In total, the terminal project cost approximately $3.4 million and was funded through a private-public partnership that included investments from the City of Ames, Iowa State University, the Ames Economic Development Commission, and the Ames business community. The project also received federal and state aviation grants. The 7,000 square-foot single-story building includes the following:

Airport Terminal Building

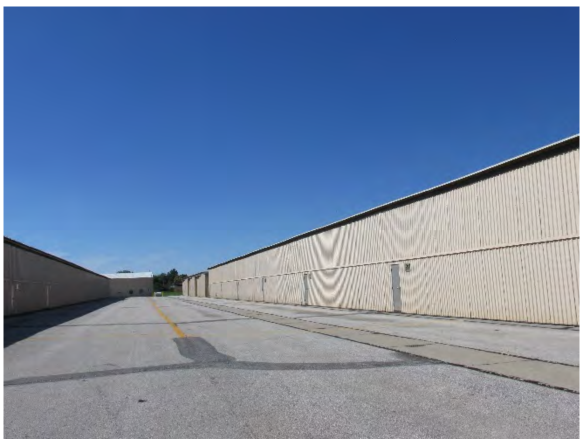
- Lobby and public waiting area
- Refreshments and vending machines
- 24-hour pilot snooze room and shower
- Weather briefing/flight planning kiosk
- Pilot supplies
- Conference room
- Restrooms

Published hours of operation for the terminal building are from 6:00 a.m. to 7:00 p.m. Monday through Friday and 7:00 a.m. to 7:00 p.m. on Saturday and Sunday.

AIRCRAFT HANGAR FACILITIES

Hangar facilities at AMW are comprised of conventional hangars, executive hangars, T-hangars, and port-a-ports. Conventional hangars provide a large open space, free from roof support structures, and have the capability to store several aircraft simultaneously. Conventional hangars are often utilized by airport businesses, such as FBOs and large aircraft maintenance providers. Conventional hangars are typically 10,000 square feet or larger.

Conventional Hangar



T-Hangar

Executive hangars provide the same type of aircraft storage as conventional hangars but are typically smaller than 10,000 square feet. These hangars are normally utilized by individual owners to store several aircraft or by smaller airport businesses. This type of hangar is becoming more popular at general aviation airports and often is included in a larger contiguous facility that contains several separate hangar facilities.

T-hangars provide for separate aircraft storage facilities within a larger hangar complex. Port-a-port hangars also provide separate aircraft storage but are stand-alone facilities. Both T-hangars and port-a-port hangars typically provide space for only one aircraft and are used for private storage only.

As shown on **Exhibit 1C**, there are 17 separate hangar facilities at the airport providing approximately 136,450 square feet of hangar, maintenance, and office spaces. Conventional hangar space at the airport totals approximately 26,700 square feet in two separate hangar facilities. There are eight separate executive hangar facilities totaling approximately 38,800 square feet. T-hangars comprise the largest amount of hangar space at the airport, totaling approximately 69,400 square feet in five separate building complexes. Nearly 60 individual storage units are contained within the T-hangar buildings. Finally, two port-a-port facilities are located on the airport, comprising approximately 1,550 square feet.

AIRCRAFT PARKING APRONS

There are several designated aircraft parking apron areas at the airport. The primary apron area on the south and west side of the landside development area extends approximately 300 feet west from the Taxiway A1 connector and approximately 700 feet along the eastern side of Taxiway B. The primary apron area has approximately 22,800 square yards of pavement for aircraft and circulation taxilanes. It contains 16 marked tiedowns for smaller general aviation aircraft and three marked tiedowns for larger aircraft adjacent to the terminal building and Central Iowa Air Service FBO.

There are several other dedicated parking aprons adjacent to private hangar owners located on the eastern side of the existing landside development area. Combined, these areas consist of approximately 8,450 square yards of additional parking and circulation.

All totaled, there are approximately 31,250 square yards of aircraft parking apron offered at the airport. Within these areas, approximately 19 marked tiedown positions are offered for general aviation aircraft. Additional unmarked areas can be configured to meet the demands of general aviation and larger business jet aircraft as well.


Aircraft Apron Area

AVIATION SERVICES

Those businesses that choose to locate on an airport or adjacent to an airport provide a significant impact not only to the airport, but also to the region. Encouraging businesses to locate in the vicinity of an airport is a good practice for several reasons. First, the business will benefit from being near a commerce and transportation hub. Second, the community will benefit because the airport will develop a buffer of industry and manufacturing that will restrict incompatible land uses, such as residential housing, from locating too close to the airport. Third, business development on and around airports can generate a direct revenue stream to the airport. Some airports have done this successfully, leading to airport self-sufficiency.

An array of general aviation services is available at AMW. This includes aircraft rental, flight training, aircraft maintenance, aircraft charter, aircraft management, aircraft fueling, aircraft sales, aircraft detailing, hangar rental, pilot supplies, rental cars, and many other services.

There are currently two businesses offering aviation services located on the airfield: Central Iowa Air Service and Hap's Air Service.

Central Iowa Air Service: Central Iowa Air Service is a full-service FBO which is responsible for the day-to-day operation of the airport and provides a variety of general aviation services. It operates its FBO activities from the airport terminal building as well as a large conventional hangar facility and provides aircraft maintenance, hangar space, de-icing services, flight planning, a pilot's lounge, pilot snooze room, shower, and other amenities. Full-service Jet A and 100LL fuel are offered.

Hap's Air Service: Hap's Air Service is a specialty aviation service operator (SASO) located on the eastern side of the landside development area, adjacent to one of the private aircraft parking aprons. Hap's Air Service provides a wide range of general aviation services including aircraft charter, aircraft rental, maintenance, and flight instruction.

VEHICLE PARKING

There are several parking lots available for vehicle use at the airport. A designated parking area for vehicles adjacent to the northern side of the new terminal building is accessible from Airport Drive. There is a total of 58 parking spaces in this area, including three handicap spaces. It should be noted that a dirt/gravel parking lot also serves this area which is approximately 12,700 square feet and capable of accommodating approximately 40 automobiles. Adjacent to the west side of Airport Drive and north of the previous airport terminal building is a parking lot which provides 11 marked parking spaces. Hap's Air Service, the other aviation service provider on the airfield, offers approximately 30 marked parking spaces. In addition, airport tenants are also permitted to park in leased areas. All totaled, there are approximately 100 marked automobile parking spaces and approximately 40 unmarked automobile parking spaces serving a variety of activities at AMW.

FUEL FACILITIES

There are currently four fuel farms located on the airport. Central Iowa Air Service operates one fuel farm that consists of underground tanks providing for 10,000 gallons of Jet A fuel storage and 10,000 gallons of 100LL storage. There are three other fuel farms on the airfield that are designated for private use only. Of the three private fuel farms, two are operational. One is an aboveground Jet-A fuel tank with a capacity of approximately 5,000 gallons. The other private fuel farm is an aboveground fuel tank with an approximate capacity of 700 gallons for 100LL.

Fuel Trucks

It should be noted that additional fuel storage capacity for 100LL and Jet A is available in FBO fuel service trucks. For planning purposes, only permanent fuel storage facilities available to the public will be considered in the facility requirement analysis to be presented in Chapter Three.

AIRCRAFT RESCUE AND FIREFIGHTING (ARFF)

There is no dedicated aircraft rescue and firefighting (ARFF) facility at AMW. As a general aviation facility, the airport is not required to have on-site firefighting capability. Fire support is provided by the Ames Fire Department Station Three, which is located approximately one mile east of the airport.

AIRPORT MAINTENANCE FACILITY

Currently, AMW does not have a building dedicated to airport maintenance or storage located on the airfield. However, city-owned maintenance equipment is stored at the airport on a cyclical basis for its use on the airfield and includes:

- 1 snow loader: on-site December 1st – April 1st
- 1 snow plow: on-site December 1st – April 1st
- 1 pick-up truck with a snow plow blade: on-site January 15th – April 1st

- 1 farm tractor with pull-behind mower: on-site April – October
- 1 zero-turn mower: on-site April – October

VEHICLE AIRFIELD ACCESS AND PERIMETER FENCING

Typically, ground vehicles authorized by the airport to operate on movement and safety areas are limited to those vehicles necessary for airport operations. These include airport maintenance vehicles, police patrols, fire and rescue vehicles, aircraft fuel and service vehicles, and others authorized by the airport such as FBO vehicles, construction vehicles, FAA, and airport staff. At present, the localizer antenna, glide slope antenna, and the MALSR are served by paved access roads.

Airfield Access Gate

Currently, the landside development area is surrounded by chain-link fencing to prevent inadvertent access onto the airfield by vehicles and/or pedestrians. However, there is no perimeter fencing in place surrounding the airfield. Signs prohibiting unauthorized entry are displayed on existing gates, fences, buildings, and other prominent locations to control inadvertent entry to the airfield. A series of controlled-access gates and manual access gates are installed in various locations to provide access for tenants on the airfield.

UTILITIES

Utility availability and capacity are critical elements when considering future expansion for both airside and landside components at an airport. The airport is presently supplied by electricity, natural gas, water, and sanitary sewer. Gas utility services are provided by Alliant Energy, while electricity, water, and sewer are all provided by the City of Ames.

AREA AIRSPACE AND AIR TRAFFIC CONTROL

The *Federal Aviation Administration (FAA) Act of 1958* established the FAA as the responsible agency for the control and use of navigable airspace within the United States. The FAA has established the National Airspace System (NAS) to protect persons and property on the ground and to establish a safe and efficient airspace environment for civil, commercial, and military aviation. The NAS covers the common network of U.S. airspace, including air navigation facilities; airports and landing areas; aeronautical charts; associated rules, regulations, and procedures; technical information; and personnel and material. The system also includes components shared jointly with the military.

AIRSPACE STRUCTURE

Airspace within the United States is broadly classified as either "controlled" or "uncontrolled." The difference between controlled and uncontrolled airspace relates primarily to requirements for pilot qualifications, ground-to-air communications, navigation and air traffic services, and weather conditions. Six classes of airspace have been designated in the United States, as shown on **Exhibit 1E**. Airspace designated as Class A, B, C, D, or E is considered controlled airspace. Aircraft operating within controlled airspace are subject to varying requirements for positive air traffic control. Airspace in the vicinity of AMW is also depicted on **Exhibit 1F**.

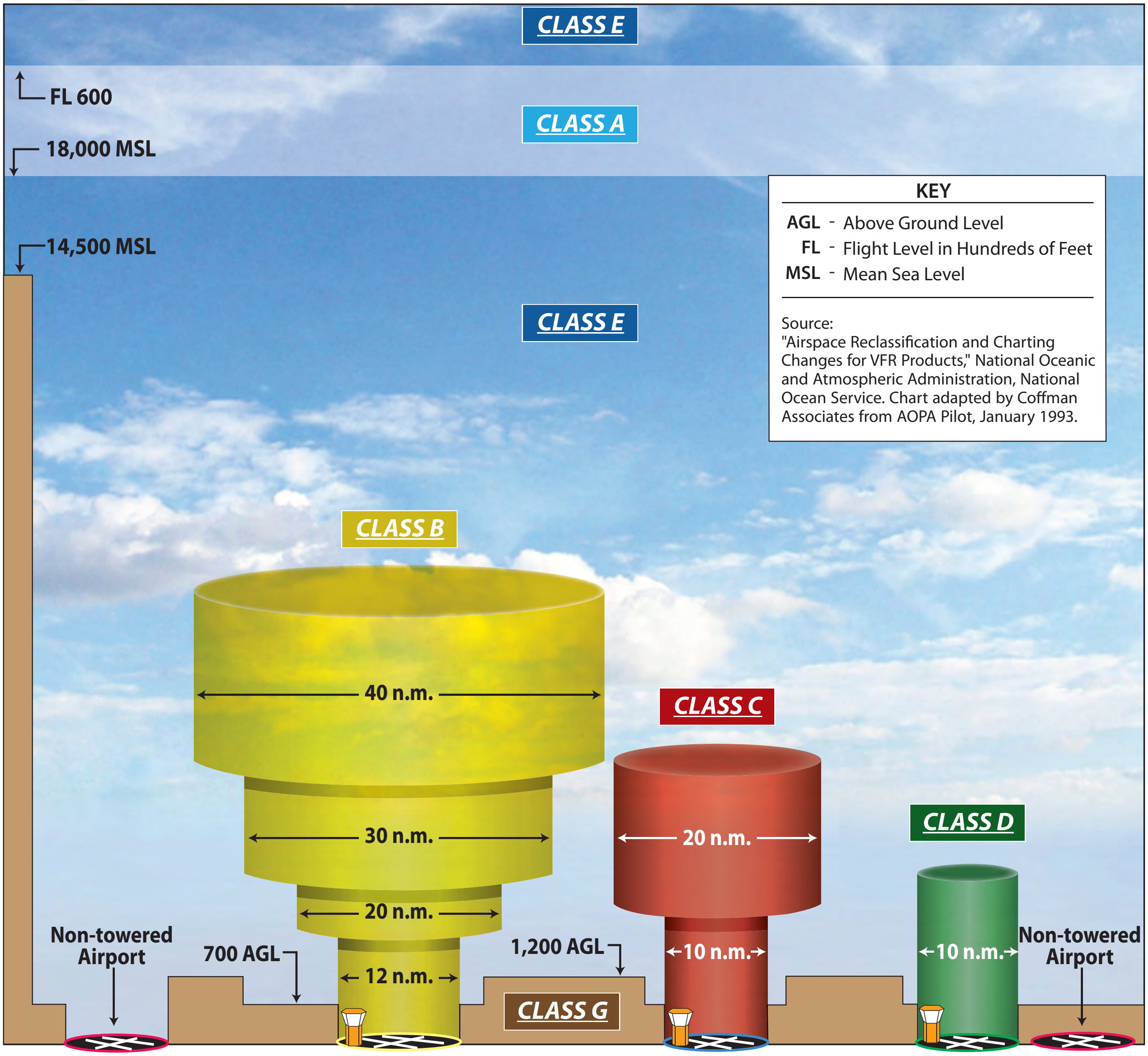
Class A Airspace: Class A airspace includes all airspace from 18,000 feet mean sea level (MSL) to flight level (FL) 600 (approximately 60,000 feet MSL) over the contiguous 48 states and Alaska. This airspace is designated in Federal Aviation Regulation (F.A.R.) Part 71.33 for positive control of aircraft. All aircraft must be on an IFR clearance to operate within Class A airspace.

Class B Airspace: Class B airspace has been designated around some of the country's major airports, such as Minneapolis-St. Paul and Kansas City International Airports, to separate all aircraft within a specified radius of the primary airport. Each Class B airspace is specifically tailored for its primary airport. All aircraft operating within Class B airspace must have an air traffic control (ATC) clearance. Certain minimum aircraft equipment and pilot certification requirements must also be met. This airspace is the most restrictive controlled airspace routinely encountered by pilots operating under visual flight rules (VFR) in an uncontrolled environment. The nearest Class B airspace is centered on Minneapolis-St. Paul International Airport, approximately 200 miles to the north.

Class C Airspace: The FAA has established Class C airspace at approximately 120 airports around the country that have significant levels of IFR traffic. Class C airspace is designed to regulate the flow of uncontrolled traffic above, around, and below the arrival and departure airspace required for high-performance, passenger-carrying aircraft at major airports. In order to fly inside Class C airspace, an aircraft must have a two-way radio, an encoding transponder, and have established communication with the ATC facility. Aircraft may fly below the floor of the Class C airspace or above the Class C airspace ceiling without establishing communication with ATC. The nearest Class C airspace to the airport surrounds Des Moines International Airport, approximately 30 miles south of AMW.

Class D Airspace: Class D airspace is controlled airspace surrounding airports with an ATCT and not classified under B or C airspace designations. The Class D airspace typically constitutes a cylinder with a horizontal radius of four or five nautical miles (nm) from an airport, extending from the surface up to a designated vertical limit, typically set at approximately 2,500 feet above the airport elevation. Pilots operating within Class D airspace are required to contact ATCT personnel prior to entering or departing the airport's airspace and must maintain contact while within the controlled airspace to land at the airport or to transverse the area.

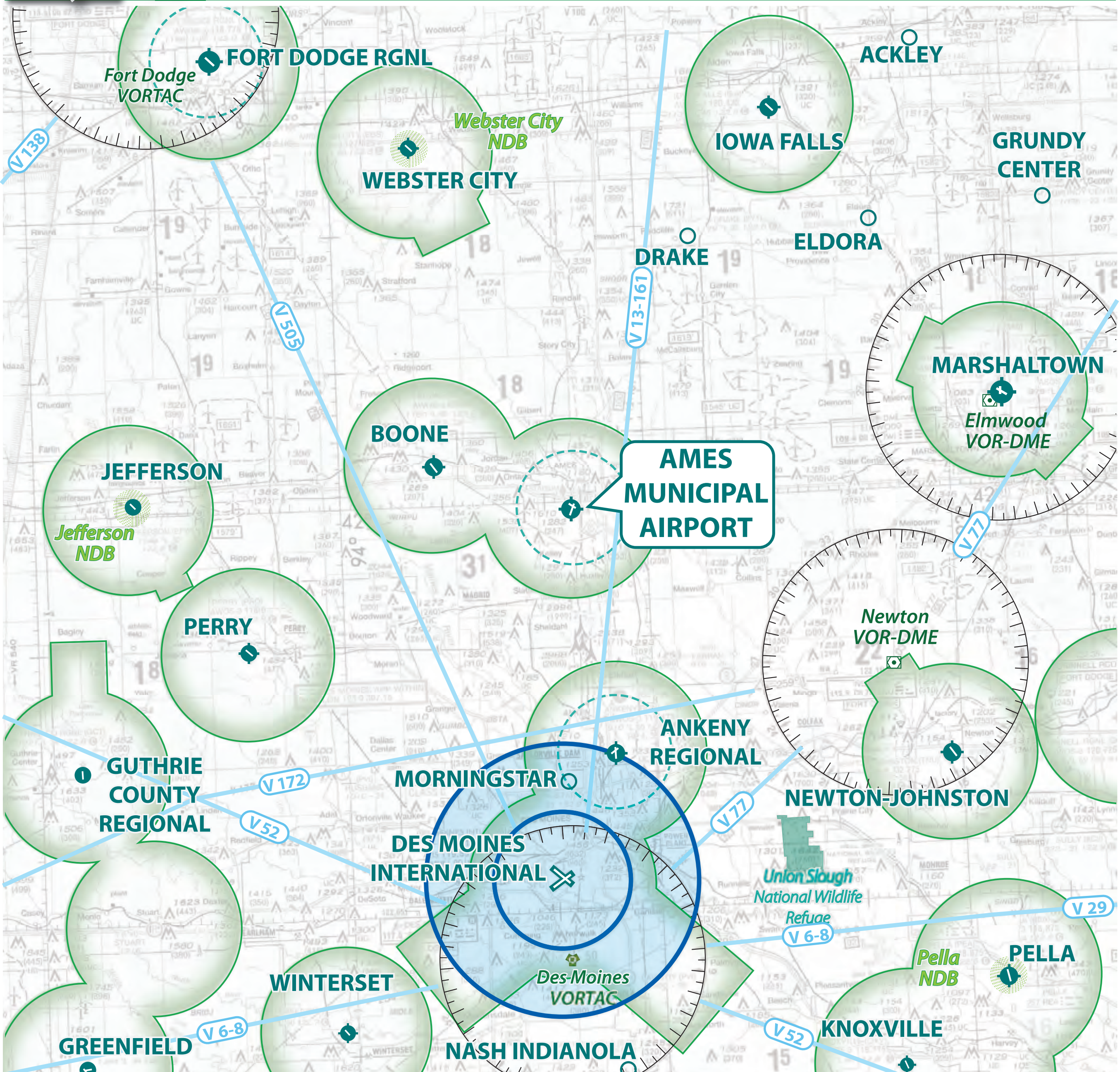
Class E Airspace: Class E airspace consists of controlled airspace designed to contain IFR operations near an airport and while aircraft are transitioning between the airport and enroute environments. Unless otherwise specified, Class E airspace terminates at the base of the overlying airspace. Only aircraft



DEFINITION OF AIRSPACE CLASSIFICATIONS

CLASS A	Generally airspace above 18,000 feet MSL up to and including FL 600.
CLASS B	Generally multi-layered airspace from the surface up to 10,000 feet MSL surrounding the nation's busiest airports.
CLASS C	Generally airspace from the surface to 4,000 feet AGL surrounding towered airports with service by radar approach control.
CLASS D	Generally airspace from the surface to 2,500 feet AGL surrounding towered airports.
CLASS E	Generally controlled airspace that is not Class A, Class B, Class C, or Class D.
CLASS G	Generally uncontrolled airspace that is not Class A, Class B, Class C, Class D, or Class E.

Exhibit 1E
AIRSPACE CLASSIFICATION



LEGEND

- Airport with other than hard-surfaced runway
- Airport with hard-surfaced runways 1,500' to 8,069' in length
- Airports with hard-surfaced runways greater than 8,069' or some multiple runways less than 8,069'
- Compass Rose
- Non-directional Radio Beacon (NDB)
- VORTAC
- VOR-DME
- Victor Airways
- Class C Airspace
- Class E Airspace
- Class E (sfc) Airspace with floor 700 ft. above surface that laterally abuts 1200 ft. or higher Class E airspace
- Wildlife Refuge

NORTH

NOT TO SCALE

Source:
Omaha and Chicago Sectional Charts, US Department of Commerce, National Oceanic and Atmospheric Administration, July 19, 2018

operating under IFR are required to be in contact with air traffic control when operating in Class E airspace. While aircraft conducting visual flights in Class E airspace are not required to be in radio communications with air traffic control facilities, visual flight can only be conducted if minimum visibility and cloud ceilings exist. AMW is currently positioned in Class E airspace, which extends down to the surface immediately surrounding the airport.

Class G Airspace: Airspace not designated as Class A, B, C, D, or E is considered uncontrolled, or Class G, airspace. Air traffic control does not have the authority or responsibility to exercise control over air traffic within this airspace. Class G airspace lies between the surface and the overlaying Class E airspace (700 to 1,200 feet above ground level).

While aircraft may technically operate within this Class G airspace without any contact with ATC, it is unlikely that many aircraft will operate this low to the ground. Furthermore, federal regulations specify minimum altitudes for flight. F.A.R. Part 91.119*, Minimum Safe Altitudes*, generally states that except when necessary for takeoff or landing, pilots must not operate an aircraft over any congested area of a city, town, or settlement, or over any open-air assembly of persons, at an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft.

Over less congested areas, pilots must maintain an altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure. Helicopters may be operated at less than the minimums prescribed above if the operation is conducted without hazard to persons or property on the surface. In addition, each person operating a helicopter shall comply with any routes or altitudes specifically prescribed for helicopters by the FAA.

Special Use Airspace

Special use airspace is defined as airspace where activities must be confined because of their nature or where limitations are imposed on aircraft not taking part in those activities. The designation of special use airspace identifies for other users the areas where military activity occurs, provides for segregation of that activity from other fliers, and allows charting to keep airspace users informed. These areas are depicted on **Exhibit 1F**.

Victor Airways: For aircraft arriving or departing the regional area using very high frequency omnidirectional range (VOR) facilities, a system of Federal Airways, referred to as Victor Airways, has been established. Victor Airways are corridors of airspace eight miles wide that extend upward from 1,200 feet above ground level (AGL) to 18,000 feet MSL and extend between VOR navigational facilities. Victor Airways are shown with blue lines on **Exhibit 1F**.

For aircraft enroute or departing AMW, there are several Victor Airways available converging at the Des Moines VORTAC adjacent to Des Moines International Airport as well as those linking to the Fort Dodge VORTAC and Newton VOR/DME.

Military Operations Areas: A military operations area (MOA) is an area of airspace designated for military training use. This is not restricted airspace; however, pilots who use the airspace should be on alert for the possibility of military traffic. A pilot may need to be aware that military aircraft can be found in high concentrations, conducting aerobatic maneuvers and possibly operating at high speeds at lower altitudes. The activity status of an MOA is advertised by a Notice to Airmen (NOTAM) and noted on sectional charts. The nearest MOAs are the Crypt North, Crypt Central, and Crypt South, located approximately 50 miles west of the airport (beyond scale limits of **Exhibit 1F**).

Restricted Airspace: Restricted areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute Title 14 CFR Part 73, *Special Use Airspace*. There is no restricted airspace in the vicinity of AMW.

Military Training Routes: Military training routes (MTRs) are designated airspace that has been generally established for use by high performance military aircraft to train below 10,000 feet AGL and in excess of 250 knots. There are VR (visual) and IR (instrument) designated MTRs. MTRs with no segment above 1,500 feet AGL will be designated with the “VR” or “IR,” followed by a four-digit number (e.g., VR1520, IR1521). MTRs with one or more segments above 1,500 feet AGL are identified by the route designation, followed by a three-digit number (e.g., VR531). The arrows on the route show the direction of travel. At present, no MTRs have been established near AMW.

Wilderness Areas: When operating near designated wilderness areas, aircraft are requested to maintain a minimum altitude of 2,000 feet above the surface of designated National Park areas, which includes wilderness areas and designated breeding grounds. FAA Advisory Circular (AC) 91-36C defines the “surface” as the highest terrain within 2,000 feet laterally of the route of flight or the uppermost rim of a canyon or valley. The airport is located approximately 30 miles northwest of the Union Slough National Wildlife Refuge.

AIRSPACE CONTROL

The FAA has established 21 Air Route Traffic Control Centers (ARTCCs) throughout the continental United States to control aircraft operating under IFR within controlled airspace and while enroute. An ARTCC assigns specific routes and altitudes along Federal Airways to maintain separation and orderly traffic flow. The Minneapolis Center ARTCC controls IFR airspace enroute to and from AMW.

Flight service stations (FSS) are air traffic facilities which provide pilot briefings, flight plan processing, inflight radio communications, search and rescue (SAR) services, and assistance to lost aircraft and aircraft in emergency situations. FSSs also relay air traffic control clearances, process NOTAMs, broadcast aviation meteorological and aeronautical information, and notify Customs and Border Protection of trans-border flights. The Fort Dodge FSS is the nearest FSS Facility to the airport.

Des Moines International Airport approach and departure service handles aircraft conducting instrument approach and departure procedures to and from AMW via Des Moines International Airport approach/departure frequency 123.9 MHz. Clearance delivery is provided via frequency 126.0 MHz.

FLIGHT PROCEDURES

Flight procedures are a set of predetermined maneuvers established by the FAA, using electronic or visual navigational aids that assist pilots in locating and landing or departing from an airport. For AMW, there are instrument approach procedures with specific characteristics presented in **Table 1L**.

Instrument Approach Procedures


Localizer Antenna

Instrument approach procedures are a series of predetermined maneuvers established by the FAA, using electronic navigational aids that assist pilots in locating and landing at an airport, especially during instrument flight conditions. There are currently six published instrument approach procedures at the airport. Precision instrument approaches provide vertical descent information and course guidance information to the pilot. Non-precision approaches only provide course guidance to the pilot; however, the relatively new area navigation (RNAV) GPS localizer performance with vertical guidance (LPV) approaches are currently categorized by the FAA as a non-precision approach even though it provides vertical guidance. AMW currently has one precision instrument approach serving Runway 1. The remaining five instrument approaches serving Runways 1-19 and 13-31 are classified as non-precision instrument approaches.

The capability of an instrument approach procedure is defined by the visibility and cloud ceiling minimums associated with the approach. Visibility minimums define the horizontal distance the pilot must be able to see in order to complete the approach. Cloud ceilings define the lowest level a cloud layer (defined in feet above the ground) can be situated for the pilot to complete the approach. If the observed visibility or cloud ceilings are below the minimums prescribed for the approach, the pilot cannot complete the instrument approach. **Table 1L** summarizes FAA approved and published instrument approach procedures, including associated weather minimums for the airport.

Instrument approaches based on GPS technology have become very common across the country. GPS is inexpensive, as it does not require a significant investment in ground-based systems by the airport or FAA. In addition to the instrument landing system (ILS) and localizer (LOC) precision instrument approaches serving Runway 1 and the non-precision VOR instrument approach serving Runway 31, Runways 1-19 and 13-31 are served by RNAV GPS approaches with associated minima, as presented on **Table 1L**. The other published approach provides circling minimums which allow pilots the flexibility to land on the runway most closely aligned with the prevailing wind at that time. This flexibility generally requires circling approaches to have higher visibility and cloud ceiling minimums than the straight-in approaches. This is done to provide pilots with sufficient visibility and ground clearance to navigate visually from the approach to the desired runway end for landing. The circling instrument approach procedure is non-precision in nature, meaning they only provide horizontal guidance to the pilot.

TABLE 1L
Instrument Approach Procedures
Ames Municipal Airport

	WEATHER MINIMUMS BY AIRCRAFT TYPE							
	Category A		Category B		Category C		Category D	
	CH	VIS	CH	VIS	CH	VIS	CH	VIS
Runway 1								
S-ILS	250	.5	250	.5	250	.5	250	.5
S-LOC	624	.5	624	.5	624	1.375	624	1.375
LPV DA	305	.75	305	.75	305	.75	NA	NA
LNAV/VNAV DA	408	1	408	1	408	1	NA	NA
LNAV MDA	484	.75	484	.75	484	.75	NA	NA
Circling (ILS/LOC)	624	1	624	1	624	1.75	1004	3
Circling (GPS)	484	1	484	1	504	1.5	NA	NA
Runway 19								
LPV DA	250	1	250	1	250	1	NA	NA
LNAV/VNAV DA	415	1.5	415	1.5	415	1.5	NA	NA
LNAV MDA	483	1	483	1	483	1.25	NA	NA
Circling	484	1	484	1	504	1.5	NA	NA
Runway 13								
LPV DA	294	1	294	1	294	1	NA	NA
LNAV/VNAV DA	548	2	548	2	548	2	NA	NA
LNAV MDA	490	1	490	1	490	1.25	NA	NA
Circling	484	1	484	1	504	1.5	NA	NA
Runway 31								
LPV DA	275	1	275	1	275	1	NA	NA
LNAV/VNAV DA	506	1.75	506	1.75	506	1.75	NA	NA
LNAV MDA	390	1	390	1	390	1	NA	NA
Circling	484	1	484	1	504	1.5	NA	NA

Aircraft categories are based on the approach speed of aircraft, which is determined as 1.3 times the stall speed in landing configuration. The approach categories are as follows:
Category A: 0-90 knots (i.e., Cessna 172)
Category B: 91-120 knots (i.e., Beechcraft King Air)
Category C: 121-140 knots (i.e., Citation X, Challenger 604)
Category D: 141-165 knots (i.e., Gulfstream IV)

Abbreviations:
CH - Cloud Height (feet above ground level)
VIS - Visibility (statute miles)
RNAV - Area Navigation
GPS - Global Positioning System
LP - Localizer Performance
MDA - Minimum Descent Altitude (used for non-precision approaches)
LNAV - Lateral Navigation
N/A - Not Authorized

It should be noted that all instrument approach procedures allow for aircraft with approach speeds up to and including 140 knots. Aircraft with approach speeds between 141-166 knots (Category D) are only authorized to conduct instrument approach procedures utilizing the ILS or LOC instrument approach to Runway 1.

LOCAL OPERATING PROCEDURES

The traffic pattern at the airport is maintained to provide the safest and most efficient use of the airspace. A standard left-hand traffic pattern is utilized for Runways 19 and 31, and a right-hand traffic pattern is utilized for Runways 1 and 13. Runway 1 is the preferred runway during calm wind conditions. The typical traffic pattern altitude for rotorcraft is 500 feet AGL, propeller aircraft is between 800 and 1,000 feet AGL, and 1,500 feet AGL for turbine aircraft.

AMW does not have aircraft restrictions, curfews, or a mandatory noise abatement program, as these programs would violate the federal *Airport Noise and Capacity Act (ANCA) of 1990*. Federal law requires the airport to remain open 24 hours a day, 7 days a week, and to accept all civilian and military aircraft that can be safely accommodated.

VICINITY AIRPORTS

There are several other airports of various sizes, capacities, and functions within the vicinity of AMW. It is important to consider the capabilities and limitations of these airports when planning for future changes and improvements at Ames Municipal Airport. In an urban setting, airports within 30 nm of each other can have some influence on the activity of the other airport. The following public-use airports are within 30 nm of AMW.

- Boone Municipal Airport
- Ankeny Regional Airport
- Morningstar Field Airport
- Drake Airport
- Perry Municipal Airport
- Des Moines International Airport
- Webster City Municipal Airport

Exhibit 1G provides information on the roles, facilities, services, and operational levels these airports experience. Information pertaining to each airport was obtained from FAA Form 5010-1, *Airport Master Record*.

From this analysis of public-use airports in the region, it is evident that there are several facilities serving the needs of all types of aviation activity. Des Moines International Airport primarily caters to scheduled commercial airline activity and corporate jets. Ankeny Regional Airport serves as a general aviation reliever for Des Moines International Airport. Except for Morningstar Field Airport and Drake Airport (which are privately owned airports with turf runways), the other airports provide an array of services that cater to general aviation needs, including some business jets and turbine powered aircraft. The primary runway lengths at certain airports, such as Boone, Perry, and Webster City Municipal Airports, can somewhat limit the use of larger aircraft from being able to fully operate at these facilities.

Even with the existence of several aviation facilities nearby, AMW is positioned well due to the full range of services it has to offer. The vicinity airports each have unique qualities that may serve a specific segment of aviation. These factors must be considered carefully in determining the service area for AMW, which will be discussed in the next chapter.

LAND USE

Not unlike many airports in the United States, area land use surrounding AMW can have a significant impact on airport operations and growth. Understanding the land use issues surrounding AMW will assist in making appropriate recommendations for the future sustainability of the airport in the way of both environmental compatibility and economic development.

SURROUNDING LAND USE

The airport is in the southern part of the City of Ames, Iowa, approximately half a mile south of Highway 30 and 2.5 miles west of Interstate 35. The airport is surrounded by a variety of land uses, including industrial, agriculture, commercial, and residential developments. To the east, south, and west there are primarily agricultural uses with pockets of commercial and low-density residential land uses. The property immediately north of the airport consists largely of commercial, public or quasi-public, and industrial land, with manufactured housing existing north of Highway 30. Future land uses are illustrated on the front side of **Exhibit 1H**, while zoning (to be discussed) is located on the backside.

Furthermore, the Land Use Framework Map is depicted on **Exhibit 1J**, which has been derived from the Ames Urban Fringe Plan. The fringe area is defined as the area within two miles of the municipal boundaries of the City of Ames. This area has historically been one of the major rural growth areas located within Story County. The Ames Urban Fringe Plan is a shared land use plan cooperatively developed by Boone County, Story County, the City of Ames, and the City of Gilbert. The plan provides guidelines for understanding and predicting future land use planning for the area. As shown on the exhibit, AMW is largely surrounded by agriculture and farm service land uses within the fringe area.

ZONING

The intent of the zoning map and ordinance in the City of Ames are to direct the development of the city in accordance with the Land Use Policy Plan, as well as promote public health, safety and welfare. Proper zoning encourages development patterns that preserve agricultural land, protect soil from erosion, encourage efficient development patterns, lessen congestion in the streets, provide adequate light and air, prevent overcrowding of land, avoid undue population concentration, conserve energy resources, and promote reasonable access to solar energy resources. Moreover, the zoning ordinance facilitates access

BOONE MUNICIPAL AIRPORT (BNW)

NPIAS Classification	GA
FAA Asset Study Classification	Local
Location from AMW	10.6 nm WNW
Elevation	1,160 ft
Weather Reporting	AWOS
ATCT	None
Annual Operations	20,800
Based Aircraft	43
Enplaned Passengers	None

Runways	15-33	2-20
Length	4808'	3248'
Width	75'	146'
Pavement Strength		
SWL	30,000	Turf
DWL	NA	NA
Lighting	MIRL	None
Marking	NPI	None
Approach Aids	PAPI-2	None
	REILs	
Instrument Approach Procedures	GPS	None

Services Provided: Aircraft hangars and tiedowns, 100LL, Jet A fuel and MOGAS, and minor airframe and powerplant maintenance.

ANKENY REGIONAL AIRPORT (IKV)

NPIAS Classification	Regional
FAA Asset Study Classification	Reliever
Location from AMW	18 nm S
Elevation	910 ft
Weather Reporting	AWOS
ATCT	None
Annual Operations	48,500
Based Aircraft	96
Enplaned Passengers	None

Runways	18-36	4-22
Length	5,500'	4,200'
Width	100'	75'
Pavement Strength		
SWL	30,000	30,000
DWL	40,000	40,000
Lighting	MIRL	MIRL
Marking	NPI/PI	NPI
Approach Aids	PAPI-2	PAPI-2
	REILs	REILs
Instrument Approach Procedures	ILS (36)/GPS	GPS (22)

Services Provided: Aircraft hangars and tiedowns, 100LL and Jet A fuel, major airframe and powerplant maintenance, and oxygen.

DRAKE AIRPORT (2Y1)

NPIAS Classification	NA
FAA Asset Study Classification	NA
Location from AMW	22 nm NNE
Elevation	1,179 ft
Weather Reporting	None
ATCT	None
Annual Operations	200
Based Aircraft	3
Enplaned Passengers	None

Runways	9-27
Length	2,480'
Width	90'
Pavement Strength	
SWL	Turf
DWL	NA
Lighting	LIRL
Marking	None
Approach Aids	None
Instrument Approach Procedures	None

Services Provided: Aircraft tiedowns.

PERRY MUNICIPAL AIRPORT (PRO)

NPIAS Classification	GA
FAA Asset Study Classification	Local
Location from AMW	26 nm WSW
Elevation	1,013 ft
Weather Reporting	AWOS
ATCT	None
Annual Operations	4,700
Based Aircraft	28
Enplaned Passengers	None

Runways	14-32	4-22
Length	4,001	2,322'
Width	75'	237'
Pavement Strength		
SWL	28,000	Turf
DWL	48,000	NA
Lighting	MIRL	None
Marking	NPI	None
Approach Aids	PAPI-2	None
	REILs	
Instrument Approach Procedures	GPS	None

Services Provided: Aircraft tiedowns, 100LL and Jet A fuel, major airframe and powerplant maintenance.

DES MOINES INTERNATIONAL AIRPORT (DSM)

NPIAS Classification	Primary Small Hub
FAA Asset Study Classification	NA
Location from AMW	28 nm S
Elevation	958 ft
Weather Reporting	ASOS
ATCT	Yes
Annual Operations	70,100
Based Aircraft	111
Enplaned Passengers	1,216,357

Runways	5-23	13-31
Length	9,003'	9,002'
Width	150'	150'
Pavement Strength		
SWL	133,000	133,000
DWL	180,000	180,000
Lighting	HIRL	HIRL
Marking	PI/NPI	PI
Approach Aids	MALSR (5), PAPI-4	MALSR/ALSF2
	REILs (23)	PAPI-4
Instrument Approach Procedures	ILS/GPS/VOR	ILS/GPS

Services Provided: Aircraft hangars and tiedowns, 100LL and Jet A fuel, major airframe and powerplant maintenance, and oxygen.

WEBSTER CITY MUNICIPAL AIRPORT (EBS)

Airport NPIAS Classification	GA
FAA Asset Study Classification	Local
Location from AMW	29 nm NNW
Elevation	1,122 ft
Weather Reporting	AWOS
ATCT	None
Annual Operations	11,300
Based Aircraft	14
Enplaned Passengers	None

Runways	14-32	5-23
Length	3,851'	2,663'
Width	75'	90'
Pavement Strength		
SWL	15,000	Turf
DWL	NA	NA
Lighting	MIRL	None
Marking	NPI	None
Approach Aids	PAPI-2	None
	REILs	
Instrument Approach Procedures	GPS/VOR/NDB	None

Services Provided: Aircraft hangars and tiedowns, 100LL and Jet A fuel, major airframe and powerplant maintenance.

KEY

- ASOS | Automated Surface Observation System
- ATCT | Airport Traffic Control Tower
- AWOS | Automated Weather Observation System
- DWL | Dual Wheel Loading
- FAA | Federal Aviation Administration
- GPS | Global Positioning System
- HIRL | High Intensity Runway Lights
- ILS | Instrument Landing System
- LIRL | Low Intensity Runway Lights
- MALSR | Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
- MIRL | Medium Intensity Runway Lights
- N/A | Not Applicable
- nm | Nautical Mile
- NPIAS | National Plan of Integrated Airport Systems
- PAPI | Precision Approach Path Indicator
- REIL | RunwayEnd Identification Lights
- SWL | Single Wheel Loading
- VASI | Visual Approach Slope Indicator
- VOR | Very High Frequency Omni-Directional Range

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Legend

Government Land
(The government land overlay prevails over the underlying land use designation so long as the property is owned by a government agency.)

Land Use Policy Plan Designations

Residential
- Low-Density Residential
- One- & Two-Family Medium-Density Residential
- Medium-Density Residential
- High-Density Residential
- Village/Suburban Residential
- South Lincoln Sub-Area Mixed Use District

Commercial
- Highway-Oriented Commercial
- Downtown Services Center
- Regional Commercial
- Community Commercial Node
- Convenience Commercial Node
- See CVCN Node restrictions in Resolution 08-196

Industrial
- General Industrial
- Planned Industrial

Other Designations
- Government/Airport
- University/Affiliated
- Medical
- Parks and Open Space
- Future Park Zone
- Agricultural/Farmstead

Unique Development Area Classifications
- Urban Core Land
- University-Impacted Land
- New Lands-All Other
- Near Term Lands
- New Lands-Existing Residential

Ames City Boundary

Ames Urban Fringe
(Refer to Ames Urban Fringe Plan Land Use Framework Map for land use designations.)

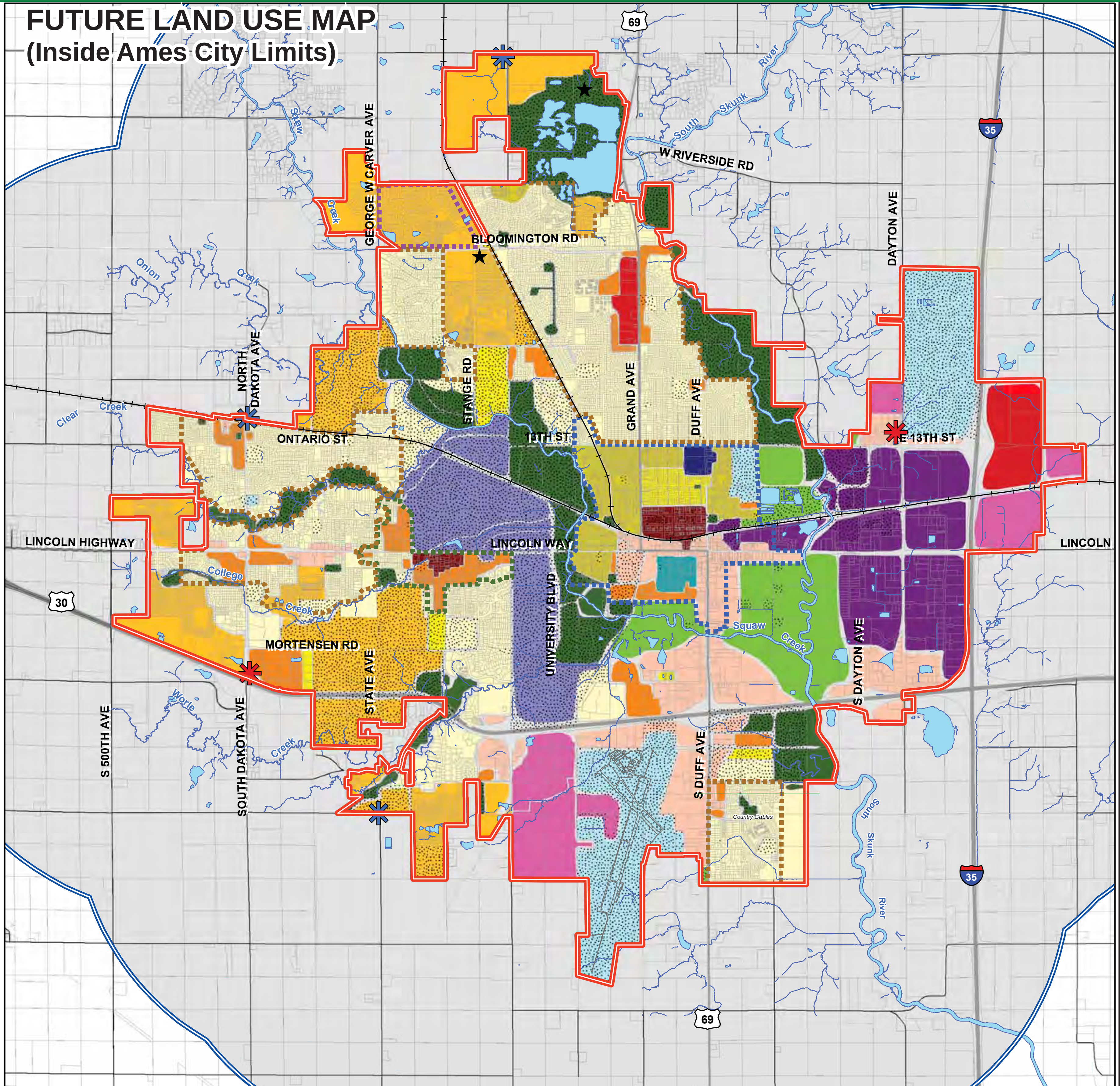
Miles
0 0.2 0.4 0.6 0.8

Map up to date through Council Resolution 15-752, adopted December 22, 2015.

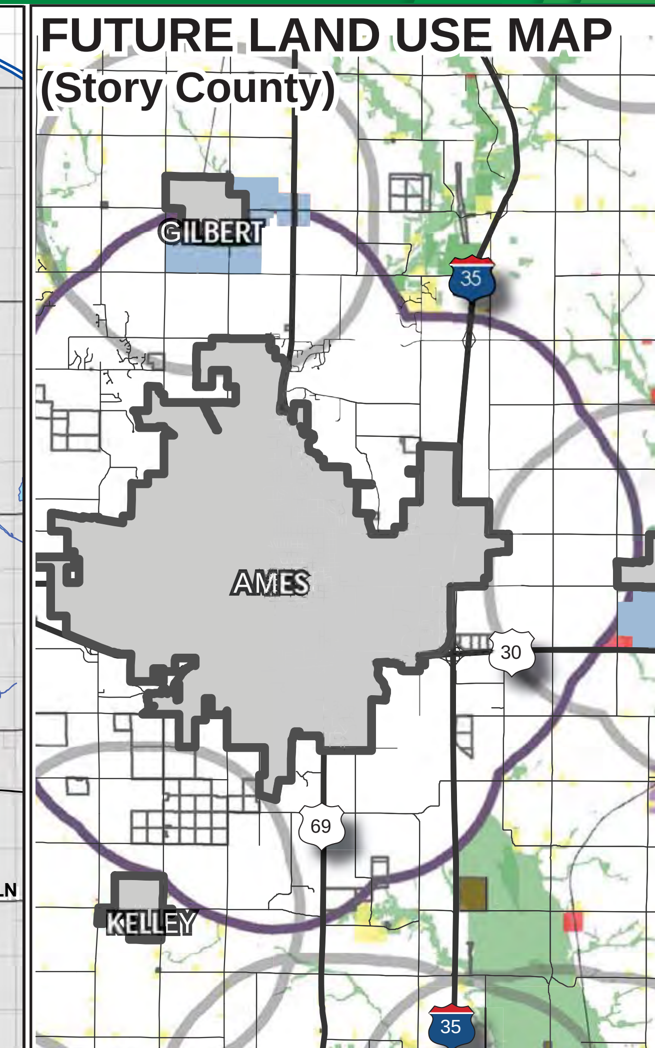
A component of the Land Use Policy Plan

Map prepared by
Department of Planning and Housing
City of Ames, Iowa
December 29, 2015

FUTURE LAND USE MAP (Inside Ames City Limits)



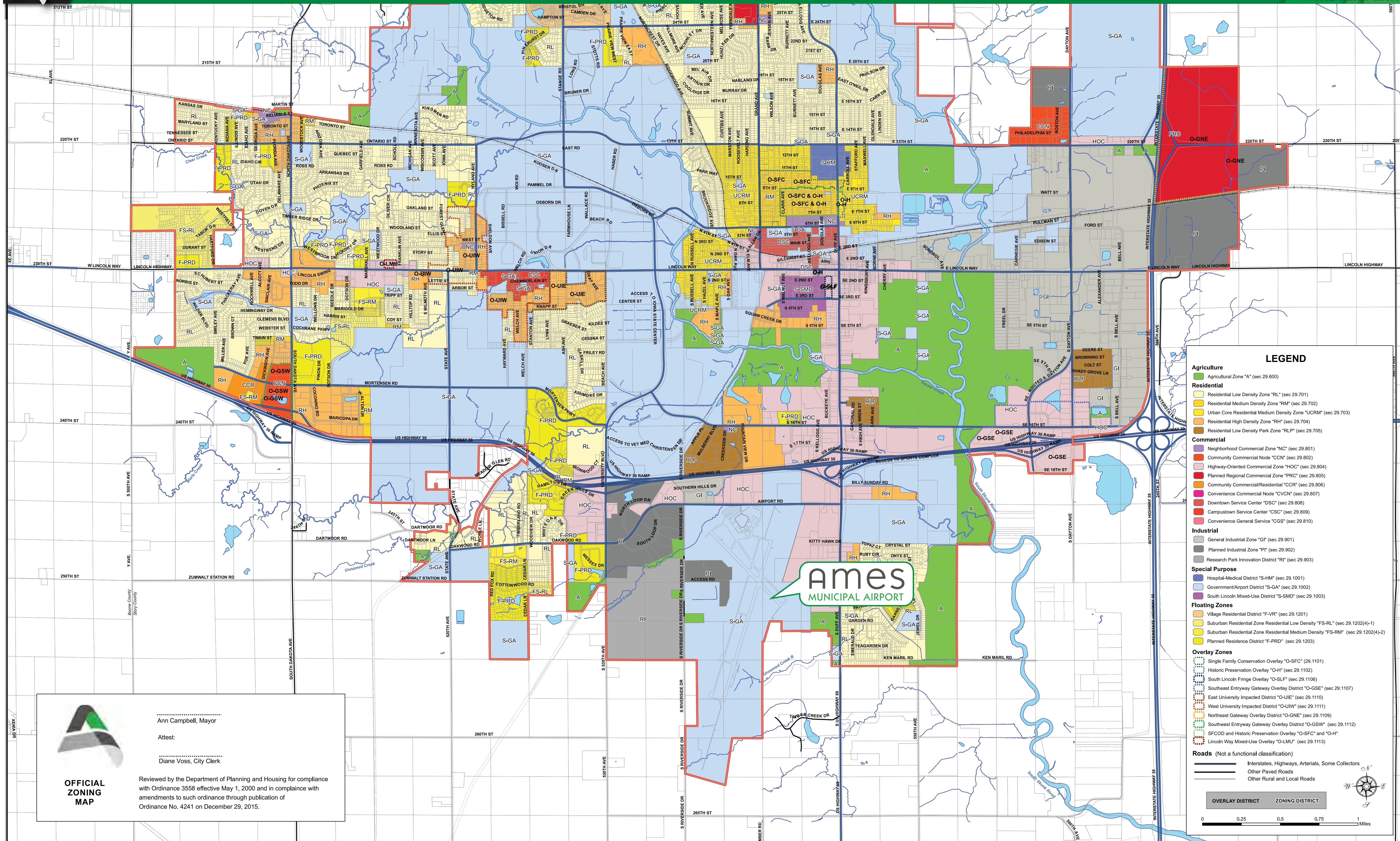
FUTURE LAND USE MAP (Story County)

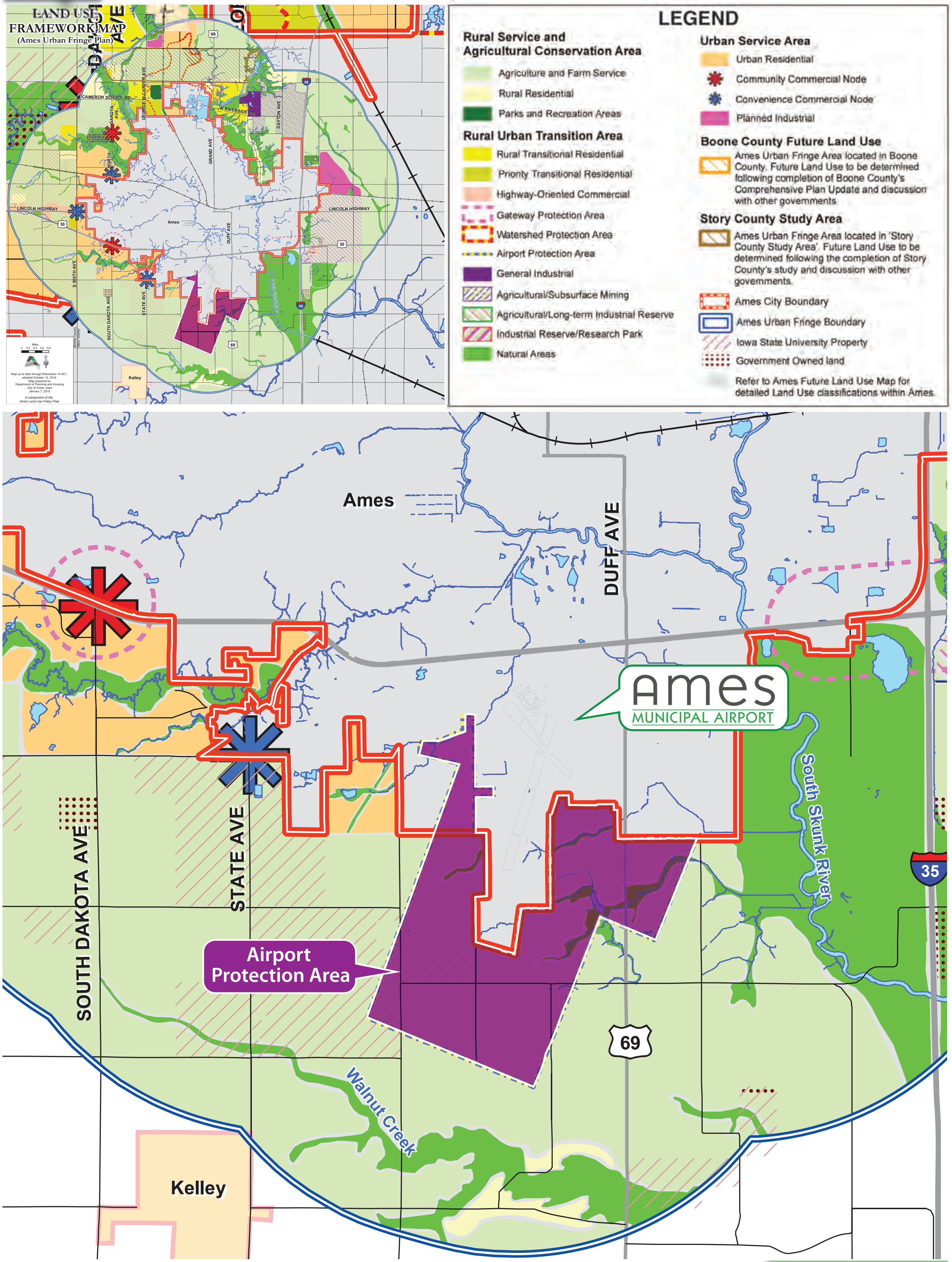


LEGEND
- City Boundaries
- 2 Mile Buffer
- Ames Urban Fringe Area
- Roadways
- Government Owned

Future Land Use Designations
- Natural Resource Area
- Agricultural Conservation Area
- Rural Residential Area
- Rural Village Area
- Commercial-Industrial Area
- Urban Expansion Area

GIS Data Sources:
Story County GIS Department
Iowa Department of Natural Resources GIS Library (NRGIS)


LEGEND
Agriculture
Agricultural Zone "A" (sec 29.600)
Residential
Residential Low Density Zone "RL" (sec 29.701)
Residential Medium Density Zone "RM" (sec 29.702)
Urban Core Residential Medium Density Zone "UCRM" (sec 29.703)
Residential High Density Zone "RH" (sec 29.704)
Residential Low Density Park Zone "RLP" (sec 29.705)
Commercial
Neighborhood Commercial Zone "NC" (sec 29.801)
Community Commercial Node "CCN" (sec 29.802)
Highway-Oriented Commercial Zone "HOC" (sec 29.804)
Planned Regional Commercial Zone "PRC" (sec 29.805)
Community Commercial/Residential "CCR" (sec 29.806)
Convenience Commercial Node "CVCN" (sec 29.807)
Downtown Service Center "DSC" (sec 29.808)
Campustown Service Center "CSC" (sec 29.809)
Convenience General Service "CGS" (sec 29.810)
Industrial
General Industrial Zone "GI" (sec 29.901)
Planned Industrial Zone "PI" (sec 29.902)
Research Park Innovation District "RI" (sec 29.903)
Special Purpose
Hospital-Medical District "S-HM" (sec 29.1001)
Government/Airport District "S-GA" (sec 29.1002)
South Lincoln Mixed-Use District "S-SMD" (sec 29.1003)
Floating Zones
Village Residential District "F-VR" (sec 29.1201)
Suburban Residential Zone Residential Low Density "FS-RL" (sec 29.1202(4)-1)
Suburban Residential Zone Residential Medium Density "FS-RM" (sec 29.1202(4)-2)
Planned Residence District "F-PRD" (sec 29.1203)
Overlay Zones
Single Family Conservation Overlay "O-SFC" (29.1101)
Historic Preservation Overlay "O-H" (sec 29.1102)
South Lincoln Fringe Overlay "O-SLF" (sec 29.1106)
Southeast Entryway Gateway Overlay District "O-GSE" (sec 29.1107)
East University Impacted District "O-UIE" (sec 29.1110)
West University Impacted District "O-UIW" (sec 29.1111)
Northeast Gateway Overlay District "O-GNE" (sec 29.1109)
Southwest Entryway Gateway Overlay District "O-GSW" (sec 29.1112)
SFCOD and Historic Preservation Overlay "O-SFC" and "O-H"
Lincoln Way Mixed-Use Overlay "O-LMU" (sec 29.1113)
Roads (Not a functional classification)
Interstates, Highways, Arterials, Some Collectors
Other Paved Roads
Other Rural and Local Roads
OVERLAY DISTRICT
ZONING DISTRICT
0
0.25
0.5
0.75
1
Miles
Ames MUNICIPAL AIRPORT
OFFICIAL ZONING MAP
Ann Campbell, Mayor
Attest:
Diane Voss, City Clerk
Reviewed by the Department of Planning and Housing for compliance with Ordinance 3558 effective May 1, 2000 and in compliance with amendments to such ordinance through publication of Ordinance No. 4241 on December 29, 2015.


LAND USE
FRAMEWORK MAP
(Ames Urban Fringe Plan)
LEGEND
Rural Service and Agricultural Conservation Area
Agriculture and Farm Service
Rural Residential
Parks and Recreation Areas
Rural Urban Transition Area
Rural Transitional Residential
Priority Transitional Residential
Highway-Oriented Commercial
Gateway Protection Area
Watershed Protection Area
Airport Protection Area
General Industrial
Agricultural/Subsurface Mining
Agricultural/Long-term Industrial Reserve
Industrial Reserve/Research Park
Natural Areas
Urban Service Area
Urban Residential
Community Commercial Node
Convenience Commercial Node
Planned Industrial
Boone County Future Land Use
Ames Urban Fringe Area located in Boone County. Future Land Use to be determined following completion of Boone County's Comprehensive Plan Update and discussion with other governments
Story County Study Area
Ames Urban Fringe Area located in 'Story County Study Area'. Future Land Use to be determined following the completion of Story County's study and discussion with other governments.
Ames City Boundary
Ames Urban Fringe Boundary
Iowa State University Property
Government Owned land
Refer to Ames Future Land Use Map for detailed Land Use classifications within Ames.
Ames
DUFF AVE
ames
MUNICIPAL AIRPORT
South Skunk River
35
SOUTH DAKOTA AVE
STATE AVE
Airport
Protection Area
69
Walnut Creek
Kelley

to transportation, water, sewerage, schools, parks, and other public requirements as well as preserves historically significant areas of the city.[1] The zoning ordinance also regulates the use, size, and height of structures to ensure compatible development.

Existing zoning on and around the airport is shown on the backside of **Exhibit 1H**. The airport is primarily zoned as Government/Airport District (S-GA); however, one portion of airport property, located on the west side of the airfield, is currently zoned as Planned Industrial (PI). It should be noted that this parcel is currently slated for land release from airport property. Land immediately east of AMW is zoned primarily as Agricultural (A) and Highway Oriented Commercial (HOC). Zoning adjacent to the north and west sides of the airport includes HOC, General Industrial (GI), Planned Industrial (PI), and limited "A" zoning. Property beyond the city boundary adjacent to the southeast, south, and southwest sides of AMW are zoned largely as agricultural uses, with some single family residential, corresponding with the existing land use map described in the previous section.

SOCIOECONOMICS

Socioeconomic characteristics are collected and examined to derive an understanding of the dynamics of growth near an airport. This information is crucial in determining aviation demand level requirements, as most general aviation demand is directly related to the socioeconomic condition of the surrounding region. Statistical analysis of population, employment, and income trends provide a picture of the economic strength of the region, as well as the ability of the area to sustain a strong economic base into the future. Additional socioeconomic data will be provided in the Chapter Two – Forecasts; however, the information in this chapter will introduce the socioeconomic trends in the study area.

Whenever possible, local or regional data is used for analysis. For this study, socioeconomic data was gathered from various sources, including the U.S. Census Bureau; the Ames Economic Development Commission; and Woods and Poole Economics, *The Complete Economic and Demographic Data Source*, 2018.

POPULATION

Population is a key socioeconomic factor to consider when planning for future airport needs. Historical and forecast trends in population provide an indication of the potential of the region to sustain growth in aviation activity. Population data for the City of Ames, as well as surrounding jurisdictions, Story County[2], the Des Moines-Ames-West Des Moines Combined Statistical Area (CSA), the State of Iowa, and the United States are discussed to provide the past and present population metrics of the region within which the airport operates.

Historic population trends for the City of Ames, Story County, the State of Iowa, and the United States is detailed in **Table 1M**. In 2018, the State of Iowa had over 3.1 million residents. According to this data,

[1] *Ames Municipal Planning Code*: Zoning Ordinance for the City of Ames, Iowa, June 2002.
[2] Story County consists of the entirety of the Ames MSA.

the state has grown over the past 18-year period by 229,653 residents for a compound annual growth rate (CAGR) of 0.42 percent. Over the same period, the United States experienced population growth at 0.86 percent CAGR. Between 2000 and 2018, Story County experienced a CAGR of 1.14 percent, adding over 18,000 new residents. Similarly, the Des Moines-Ames-West Des Moines CSA experienced a CAGR of 1.43 percent and grew by more than 182,000 residents. In 2000, the City of Ames reported 50,960 residents. Between 2000 and 2018, the city experienced an increase of 16,578 residents, resulting in a CAGR of 1.58 percent, outpacing the historic growth of the Des Moines-Ames-West Des Moines CSA.

TABLE 1M
Population Statistics

Location	2000	2005	2010	2015	2018	CAGR (2000-2018)
City of Ames	50,960	53,512	58,965	65,474	67,547[1]	1.58%
Story County[2]	80,152	82,884	89,634	96,346	98,336	1.14%
Des Moines-Ames-West Des Moines CSA	626,898	668,444	724,725	782,226	809,124	1.43%
State of Iowa	2,929,067	2,964,454	3,050,738	3,121,997	3,158,720	0.42%
United States	282,162,385	295,516,553	309,348,139	320,898,756	328,910,940	0.86%

[1] The 2018 population estimate for the City of Ames has been interpolated from the 2017 Census estimate based upon the historical CAGR of 1.58%.
[2] The Ames MSA consists of the entirety of Story County.
CAGR: Compound Average Growth Rate
MSA: Metropolitan Statistical Area
CSA: Combined Statistical Area
Source: U.S. Census Bureau, 2000 and 2010 Census; Woods and Poole, *The Complete Economic and Demographic Data Source*, 2018.

EMPLOYMENT

Analysis of a region's employment base can be valuable in determining the overall well-being of the general area. In most cases, the area's makeup and health is significantly impacted by the availability of jobs, variety of employment opportunities, and types of wages provided by local employers. **Table 1N** provides historical employment characteristics from 2000 to 2018 in four analysis categories, including Story County, the Des Moines-Ames-West Des Moines CSA, the State of Iowa, and the United States. Total employment in Story County has grown at a CAGR of 1.17 percent over the 18-year period, while the Des Moines-Ames-West Des Moines CSA grew at a CAGR of 1.43. Employment growth rates within Story County and the CSA have historically outpaced the state and national CAGRs of 0.68 and 1.14 percent, respectively.

TABLE 1N
Employment Statistics

Location	2000	2005	2010	2015	2018	CAGR (2000-2018)
Story County[1]	53,547	58,190	59,042	63,526	66,004	1.17%
Des Moines-Ames-West Des Moines CSA	445,650	472,239	490,152	536,569	575,403	1.43%
State of Iowa	1,914,664	1,936,255	1,951,933	2,060,350	2,163,161	0.68%
United States	165,371,963	172,557,438	173,034,709	190,422,800	202,637,900	1.14%

[1]The Ames MSA consists of the entirety of Story County.
CAGR: Compound Average Growth Rate
MSA: Metropolitan Statistical Area
CSA: Combined Statistical Area
Source: Woods and Poole, *The Complete Economic and Demographic Data Source*, 2018.

Although the recent downturn in the economy has affected the employment base, the greater area of Ames continues to sustain an economy that provides a variety of employment options serving multiple industries. Locally, the City of Ames is a center of commerce for the region outside the greater Des Moines metropolitan area. The Ames community provides education, retail shopping, medical facilities, industry, government, art, and much more. The major employers for the City of Ames are presented in **Table 1P**, while employment by labor sector for Story County is presented in **Figure 1A**. Understanding the types of employment opportunities will aid in identifying demand for aviation services in the immediate area.

TABLE 1P
Top 15 Employers
City of Ames

#	Employer	Employees (#)
1	Iowa State University	10,000+
2	Iowa Department of Transportation	2,000-5,000
3	Mary Greeley Medical Center	1,000-2,000
4	McFarland Clinic PC	1,000-2,000
5	Danfoss	1,000-2,000
6	Ames Community School	500-1,000
7	City of Ames	500-1,000
8	National Centers for Animal Health	500-1,000
9	3M	250-500
10	Ag Leader Technology	250-500
11	Ames Laboratory	250-500
12	Hach Companies	250-500
13	Hy-Vee Food Store, Lincoln Center	250-500
14	Hy-Vee Food Store, West	250-500
15	Workiva	250-500

Source: Ames Economic Development Commission.

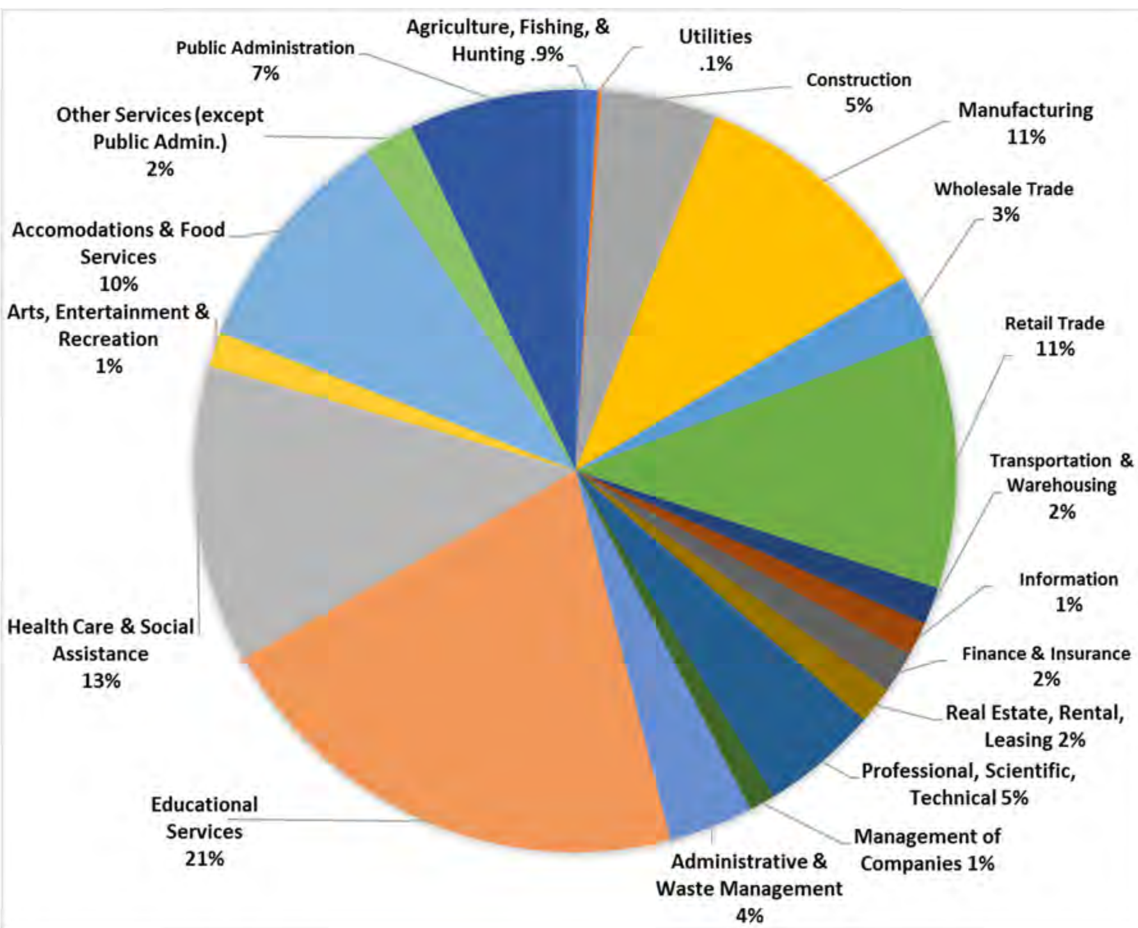


Figure 1A
Labor Market by Sector, Story County (Ames MSA)
Source: Ames Economic Development Commission

INCOME

Table 1Q presents the per capita personal income (PCPI) for Story County, Des Moines-Ames-West Des Moines CSA, State of Iowa, and United States since 2000. PCPI is determined by dividing the total income by population. For PCPI to grow, income growth must outpace population growth significantly. As shown in the table, Story County has experienced growth in PCPI from 2000 to 2018. The continued PCPI growth can be attributed to the economic strength of the region. However, the 0.98 percent CAGR experienced by Story County is exceeded by the Des Moines-Ames-West Des Moines CSA and the State of Iowa's 1.18 and 1.50 percent CAGR, respectively. Over the same period, a CAGR of 1.26 percent was experienced nationwide.

TABLE 1Q
Historical Per Capita Personal Income (Adjusted to 2009 Dollars)

Location	2000	2005	2010	2015	2018	CAGR (2000-2018)
Story County[1]	$31,571	$33,119	$31,709	$35,001	$37,612	0.98%
Des Moines-Ames-West Des Moines CSA	$37,255	$39,980	$39,778	$43,545	$46,023	1.18%
State of Iowa	$33,095	$35,344	$37,329	$41,786	$43,282	1.50%
United States	$36,812	$38,916	$39,622	$44,255	$46,097	1.26%

[1]The Ames MSA consists of the entirety of Story County.
CAGR: Compound Average Growth Rate
MSA: Metropolitan Statistical Area
CSA: Combined Statistical Area
Source: Woods and Poole, *The Complete Economic and Demographic Data Source*, 2018.

ENVIRONMENTAL INVENTORY

This environmental inventory identifies potential environmental sensitivities, based on the 14 environmental impact categories outlined in FAA's Order 1050.1F *Environmental Impacts: Policies and Procedures*, that should be considered when planning future improvements at the airport.

- Air Quality
- Biological Resources (including fish, wildlife, and plants)
- Climate
- Coastal Resources
- Department of Transportation Act, Section 4(f)
- Farmlands
- Hazardous Materials, Solid waste, and Pollution Prevention
- Historical, Architectural, Archeological, and Cultural Resources
- Land Use
- Natural Resources and Energy Supply
- Noise and Compatible Land Use
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks
- Visual Effects (including light emissions)
- Water Resources (including wetlands, floodplains, surface waters, groundwater, and wild and scenic rivers)

It was determined that the following resources are not present within the airport environs or cannot be inventoried because they are evaluated as part of project implementation:

- Resources Not Present
  - Coastal Resources (Coastal Barriers and Coastal Zones) – the airport is inland and not subject to any coastal restrictions.
  - Wild and Scenic Rivers – There are no designated Wild and Scenic Rivers within the State of Iowa. The closest designated Wild and Scenic River is a portion of the Missouri River located 155 miles northwest of the airport and outside the state of Iowa.
- Resources Not Inventoried, But Discussed in the Environmental Overview
  - Visual effects (including light emissions)
  - Natural resources and energy supply

AIR QUALITY

The concentration of various pollutants in the atmosphere describes the local air quality. The significance of a pollution concentration is determined by comparing it to the state and federal air quality standards. In 1971, the U.S. Environmental Protection Agency (EPA) established standards that specify the maximum permissible short-term and long-term concentrations of various air contaminants. The National Ambient Air Quality Standards (NAAQS) consist of primary and secondary standards for six criteria pollutants, which include: Ozone (O_3), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Nitrogen Oxide (NO_x), Particulate matter (PM_{10} and $PM_{2.5}$), and Lead (Pb).

Based on federal air quality standards, a specific geographic area can be classified as either an "attainment," "maintenance," or "non-attainment" area for each pollutant. The threshold for non-attainment designation varies by pollutant. The airport is in Story County, Iowa, and the county has been designated as an attainment area for all federal criteria pollutants.[3]

BIOLOGICAL RESOURCES

Biotic resources include the various types of plants and animals that are present in an area. The term also applies to rivers, lakes, wetlands, forests, and other habitat types that support plants and animals.

The U.S. Fish and Wildlife Service (USFWS) is charged with overseeing the requirements contained within Section 7 of the *Endangered Species Act* (ESA). This Act was put into place to protect animal or plant species whose populations are threatened by human activities. Along with the FAA, the USFWS reviews projects to determine if a significant impact to these protected species will result with implementation of a proposed project. Significant impacts occur when the proposed action could jeopardize the continued existence of a protected species or would result in the destruction or adverse modification of federally designated critical habitat in the area.

[3] https://www3.epa.gov/airquality/greenbook/anayo_ia.html

According to the USFWS Information for Planning and Consultation (IPaC), there are four federally listed threatened or endangered species which have the potential to occur in the vicinity of the airport: Indiana bat (endangered, mammal), northern long-eared bat (threatened, mammal), prairie bush-clover (threatened, flowering plant), and western prairied fringed orchid (threatened, flowering plant). Habitat for these species are not found on airport property.

The Indiana bat hibernates during the winter in caves and occasionally in abandoned mines. In the summer, the Indiana bat roosts under the peeling bark of dead and dying trees. Summer habitat includes small to medium river and stream corridors with mature riparian woods, and wood lots within one to three miles of small to medium streams and rivers. The range of this bat includes the Midwest, Ohio River Valley, and does not extend east of the Appalachian Mountain range.[4] The northern long-eared bat hibernates in areas of consistent temperature and high humidity with little air movement, typically caves and mines. During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. The range of the northern long-eared bat is eastern and north central United States, including Canada.[5]

IPaC also identified two threatened flowering plant species within the vicinity of the airport, the prairie bush-clover and western prairie fringed orchid. The prairie bush-clover is native to the tallgrass prairie region in four midwestern states of the upper Mississippi River Valley, Iowa included.[6] The western prairie fringed orchid occurs most often in mesic to wet unplowed tallgrass prairies and meadows.[7]

Critical habitat for the Topeka shiner, not recognized as an endangered or threatened species by the USFWS, was identified within the vicinity of the airport. While the habitat is not located on airport property, critical habitat has been identified within five miles of the facility.

In addition to the ESA, the *Migratory Bird Treaty Act* (MBTA) is also applicable at the airport, as much of the study area constitutes habitat for birds protected under this Act. The IPaC report lists eight bird species that may be present at the airport which are listed in **Table 1R**.

Birds protected under the MBTA may nest, winter, or migrate throughout the area, including those protected by the ESA. Under the requirements of the MBTA, all project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project.

TABLE R
Birds Protected Under the *Migratory Bird Treaty Act*
Story County

Bald eagle	Franklin's gull
Black-billed cuckoo	Lesser yellowlegs
Black tern	Long-eared owl
Bobolink	Red-headed woodpecker

Source: U.S. Fish and Wildlife Service, Information for Planning and Consultation, https://ecos.fws.gov/ipac/

[4] https://www.fws.gov/midwest/Endangered/mammals/inba/index.html
[5] https://www.fws.gov/midwest/endangered/mammals/nleb/nlebFactSheet.html
[6] https://www.fws.gov/midwest/Endangered/plants/prairieb.html
[7] https://www.fws.gov/midwest/Endangered/plants/prairief.html

CLIMATE

The EPA's *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2016*, found that the transportation sector, which includes aviation, accounted for 27 percent of U.S. greenhouse gas (GHG) emissions in 2016. Of this, aviation contributed 168.0 million metric tons (MMT) of carbon dioxide equivalent (CO_2e), or nearly nine percent of all transportation emissions.[8, 9] Transportation sources include cars, trucks, ships, trains, and planes. Most of the GHG emissions from transportation are CO_2 emissions resulting from the combustion of petroleum-based products in internal combustion engines. Relatively insignificant amounts of methane (CH_4), hydrofluorocarbon (HFC), and nitrous oxide (N_2O) are emitted during fuel combustion.

From 1990 to 2016, total transportation emissions increased. The upward trend is largely due to increased demand for travel; however, much of this travel was done in passenger cars and light-duty trucks. In addition to transportation-related emissions, **Figure 1B** shows all GHG emissions sources in the U.S. in 2016.

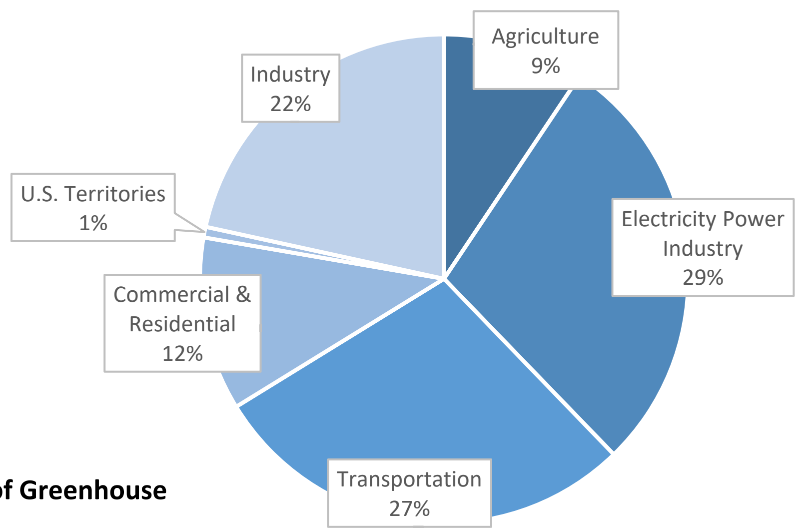


Figure 1B: 2016 Sources of Greenhouse Gas Emissions in the U.S.
Source: U.S. EPA (2018)

Increasing concentrations of GHGs can affect global climate by trapping heat in the Earth's atmosphere. Scientific measurements have shown that Earth's climate is warming with concurrent impacts, including warmer air temperatures, rising sea levels, increased storm activity, and greater intensity in precipitation events. This climate change is a global phenomenon that can also have local impacts (Intergovernmental Panel on Climate Change, 2014). GHGs, such as water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3), are both naturally occurring and anthropogenic (man-made).

[8] Aviation activity consists of emissions from jet fuel and aviation gasoline consumed by commercial aircraft, general aviation, and military aircraft.
[9] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016, Table 2-13 (available: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2016)

Research has established a direct correlation between fuel combustion and GHG emissions. GHGs from anthropogenic sources include CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). CO_2 is the most important anthropogenic GHG because it is a long-lived gas that remains in the atmosphere for up to 100 years.

Information regarding the climate in Ames, including wind, temperature, and precipitation, are found earlier in this chapter.

DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

Section 4(f) of the DOT Act, which was recodified and renumbered as Section 303(c) of 49 USC, provides that the Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a historic site, public parks, recreation areas, or waterfowl and wildlife refuges of national, state, regional, or local importance unless there is no feasible and prudent alternative to the use of such land, and the project includes all possible planning to minimize harm resulting from the use.

The following list summarizes the nearest properties to the airport of each type that may be protected under Section 4(f) of the DOT Act:

- National Register of Historic Places
  - Gilmour B. MacDonald and Edith Craig House, 1.3 miles northwest
  - Skunk River Bridge, 1.4 miles east
  - Bandshell Park Historic District, 1.7 miles north
- Recreation Area – Mississippi National River and Recreation Area, 188.5 miles northeast
- Wilderness Area – Paddy Creek Wilderness, 315 miles southeast
- Wildlife Refuge – Neal Smith National Wildlife Refuge, 30.7 miles southeast
- City Owned Parks
  - Ames Dog Park, 0.6 miles northeast
  - Squaw Creek Park, 1 mile north
  - Stuart Smith Park, 1.2 miles north
  - Greenbriar Park, 2.5 miles north
- County Owned Parks
  - Teagarden Park, 0.2 miles east
  - Greenbriar Park, 0.5 miles north
  - Country Gables Park, 0.5 miles east
  - Hans Peter Christofferson Park, 0.7 miles west
  - Moore Park, 0.9 miles northwest
  - Gateway Park, 1.1 miles northwest

FARMLANDS

Under the *Farmland Protection Policy Act* (FPPA), federal agencies are directed to identify and consider the adverse effects of federal programs on the preservation of farmland, evaluate appropriate alternative actions which could lessen adverse effects, and to assure that such federal programs are, to the extent practicable, compatible with state or local government programs and policies to protect farmland. The FPPA guidelines, developed by the U.S. Department of Agriculture (USDA), apply to farmland classified as prime or unique, or of state or local importance as determined by the appropriate government agency, with concurrence by the Secretary of Agriculture.

Information obtained from the Natural Resource Conservation Service's (NRCS) Web Soil Survey (WSS) indicates much of the airport property and land adjacent to the airport is classified as being prime farmland, prime farmland if drained, or farmland of statewide importance. These soil classifications are shown on **Exhibit 1K**.

HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

Federal, state, and local laws regulate hazardous materials use, storage, transport, and disposal. These laws may extend to past and future landowners of properties containing these materials. In addition, disrupting sites containing hazardous materials or contaminates may cause significant impacts to soil, surface water, groundwater, air quality, and the organisms using these resources. According to the EPA's *EJSCREEN*, no Superfund or brownfields sites are located within five miles of the airport.[10]

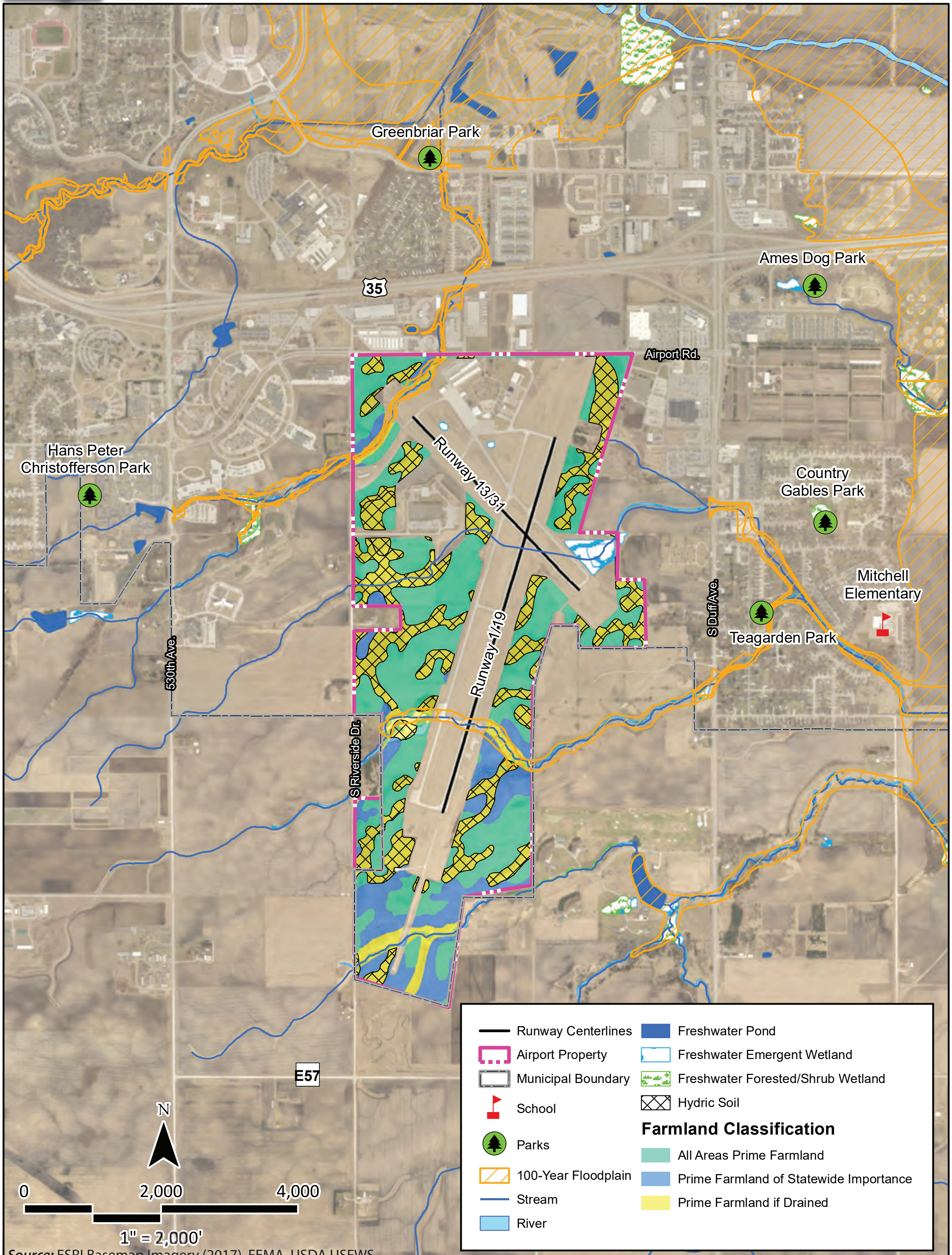
HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Determination of a project's environmental impact to historic and cultural resources is made under the guidance of the *National Historic Preservation Act* (NHPA) *of 1966*, as amended, the *Archaeological and Historic Preservation Act* (AHPA) *of 1974*, the *Archaeological Resources Protection Act* (ARPA), and the *Native American Graves Protection and Repatriation Act* (NAGPRA) *of 1990*. In addition, the *Antiquities Act of 1906*, the *Historic Sites Act of 1935*, and the *American Indian Religious Freedom Act of 1978* also protect historical, architectural, archaeological, and cultural resources. Impacts may occur when the proposed project causes an adverse effect on a property which has been identified (or is unearthed during construction) as having historical, architectural, archaeological, or cultural significance.

There are three places listed on the National Register of Historic Places located within five miles of the airport. These locations are:

- Gilmour B. MacDonald and Edith Craig House, located approximately 1.3 miles northwest
- Bandshell Park Historic District, located 1.7 miles north
- Skunk River Bridge, located 1.4 miles east.

[10] https://ejscreen.epa.gov/mapper/



Source: ESRI Basemap Imagery (2017), FEMA, USDA,USFWS

LAND USE

Land uses around the airport are described earlier in Chapter One and are displayed on **Exhibits 1H and 1J**.

NOISE AND COMPATIBLE LAND USE

Federal land use compatibility guidelines are established under 14 CFR Part 150 (Part 150), *Airport Noise Compatibility Planning*. According to 14 CFR 150, residential land uses and schools are noise-sensitive land uses that are not considered compatible with a 65 decibel (dB) Day-Night Average Sound Level (DNL). Other noise-sensitive land uses (such as religious facilities, hospitals, or nursing homes), if located within a 65 dB DNL contour, are generally compatible when an interior noise level reduction of 25 dB is incorporated into the design and construction of the structure. Special consideration should also be given to noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in 14 CFR 150 do not account for the value, significance, and enjoyment of the area in question (FAA 2015).

Noise-sensitive land uses near the airport consist primarily of residential uses to the east, north, and west. Other nearby noise-sensitive uses include an elementary school located east of the airport and a continuing care retirement community (including skilled nursing and memory care) to the west. A Part 150 study was prepared for the airport in 2009. At that time, there were noise-sensitive land uses within the 65 DNL noise contours for the airport.

Neither the City of Ames nor Story County has an established Airport Overlay zone restricting uses, density, or height around the airport. However, in 2006, the City of Ames, in a joint planning effort with the City of Gilbert and Story and Boone Counties, approved the Ames Urban Fringe Plan addressing future land use within a two-mile boundary of unincorporated county lands outside Ames city limits. Intended to provide guidelines for understanding and predicting future land use in the urban fringe, the plan includes an Airport Protection Area (APA) land use designation. The APA designation is intended to reduce risk, increase safety, and promote land use compatibility between the airport and adjacent land uses. The Urban Fringe Plan adopted three policies regarding the APA:

1. APA Policy 1: Land in this designation is adjacent to or in close proximity of the airport.
2. APA Policy 2: Limit or restrict intensity and density of land uses in order to protect life and maintain the integrity of aviation operations.
3. APA Policy 3: Analyze land uses within this designation in terms of aviation risk, noise attenuation, height, and by local, state, and federal regulations.

The Urban Fringe Land Use Framework Map designates the APA as Agriculture/Farm Service land use. Any proposed changes to land use, use such as high-density residential or commercial uses, would most likely require amending the framework map. **Exhibit 1J** represents the Airport Protection Area within the urban fringe zone.

SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

General socioeconomic information, such as population and economic trends, are addressed earlier in the chapter. However, FAA Order 1050.1F specifically requires that a federal action causing disproportionate impacts to an environmental justice population (i.e., a low-income or minority population), be considered, as well as an evaluation of environmental health and safety risks to children. The EPA's *EJSCREEN* online tool was consulted regarding the presence of environmental justice areas within the airport environs. Within five miles of the airport, 45 percent of the population is considered low-income and 19 percent is considered a minority population. Likewise, according to *EJSCREEN*, four percent of the population is under the age of five within a five-mile radius of the airport.

WATER RESOURCES

Wetlands

The U.S. Army Corps of Engineers regulates the discharge of dredged and/or fill material into waters of the United States, including adjacent wetlands, under Section 404 of the *Clean Water Act*. Wetlands are defined in Executive Order (EO) 11990, *Protection of Wetlands*, as "those areas that are inundated by surface or groundwater with a frequency sufficient to support and under normal circumstances does or would support a prevalence of vegetation or aquatic life that requires saturated or seasonably saturated soil conditions for growth and reproduction." Wetlands can include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, estuarine areas, tidal overflows, and shallow lakes and ponds with emergent vegetation. Wetlands exhibit three characteristics: the soil is inundated or saturated to the surface at some time during the growing season (hydrology), has a population of plants able to tolerate various degrees of flooding or frequent saturation (hydrophytes), and soils that are saturated enough to develop anaerobic conditions during the growing season (hydric).

According to USFWS, which manages the National Wetlands Inventory on behalf of all federal agencies, there are freshwater emergent wetlands identified on airport property adjacent to a drainage way and an unnamed stream. It is important to note that these areas were identified as wetlands based on a review of aerial photography dated 1985 and may no longer be present. The location of these wetlands is identified on **Exhibit 1K**.

The NRCS WSS identified hydric soils on airport property. The location of the most hydric soils on airport property have been identified on **Exhibit 1K**.

Floodplains

EO 11988 directs federal agencies to take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve the natural and beneficial values served by the floodplains. Based on a review of Federal Emergency Management Agency (FEMA) Flood

Insurance Rate Map (FIRM) panels 19169C0276E (dated February 20, 2008) and 19169C0257F (dated October 16, 2014), two areas have been identified as a Special Flood Hazard Area – Zone A subject to flooding by a 100-year flood event; however, no Base Food Elevations have been determined. The first identified floodplain is a small area on either side of Runway 1-19; the second is located at the northwest corner of airport property. The 100-year flood plain is identified on **Exhibit 1K**.

Surface Waters

The *Clean Water Act* provides the authority to establish water quality standards, control discharges, develop waste treatment management plans and practices, prevent or minimize the loss of wetlands, and regulate other issues concerning water quality. Water quality concerns related to airport development most often relate to the potential for surface runoff and soil erosion, as well as the storage and handling of fuel, petroleum products, solvents, etc. Additionally, Congress has mandated (under the *Clean Water Act*) the National Pollutant Discharge Elimination System (NPDES). Using NPDES permits, certain procedures are required to prevent contamination of water bodies from storm water runoff.

Examples of direct impacts to surface waters include any in-water work resulting from expansion of an existing FAA facility adjacent to surface waters, or a withdrawal of water from a surface water for construction or operations. The South Skunk River, located approximately 1.2 miles east of the airport, is classified as an impaired waterway under section 303(d) of the *Clean Water Act* within a five-mile radius of the study area. Total Maximum Daily Load (TMDL) describes the maximum amount of a pollutant allowed in a waterbody and serves as the starting point or planning tool for restoring water quality.

A review of the National Hydrography Dataset, published by the United States Geological Survey, indicates drainage channels are present on airport property.

Groundwater

Groundwater is subsurface water that occupies the space between sand, clay, and rock formations. The term aquifer is used to describe the geologic layers that store or transmit groundwater, such as to wells, springs, and other water sources. Examples of direct impacts to groundwater could include withdrawal of groundwater for operational purposes, or reduction of infiltration or recharge area due to new impervious surfaces. The airport covers the Mississippian aquifer, a sandstone and carbonate-rock aquifer.[11]

SUMMARY

The information presented in this chapter is intended to establish a baseline of understanding about the current capabilities of the airport and the environment in which it operates. The chapter began with a discussion of the history, regional setting, administration, and operational characteristics of the airport. The airport is a regional general aviation facility providing a direct aviation link to the national network

[11] https://water.usgs.gov/ogw/aquifer/101514-wall-map.pdf

of airports and a full range of services for operators from small piston-powered aircraft to large business jets.

The Ames Municipal Airport Master Plan is intended to provide the city with a long-term (20-year) visioning document to aid decision-making, particularly as related to capital improvements, in the coming years. Development of the airport master plan follows an FAA-prescribed process. While the FAA will not provide approval of the overall airport master plan, they will review and approve two specific elements: the aviation demand forecasts and the airport layout plan (ALP).

In the next chapter, the baseline information presented here will be used in the development of aviation demand forecasts.

CITY OF Ames

AMES MUNICIPAL AIRPORT

CHAPTER 2

FORECASTS

AMES MUNICIPAL AIRPORT

CITY OF Ames

CHAPTER TWO

FORECASTS

The definition of demand that may reasonably be expected to occur during the useful life of an airport's key components (e.g., runways, taxiways, terminal buildings, storage hangars, etc.) is an important factor in facility planning. In airport master planning, this involves projecting potential aviation activity for at least a 20-year timeframe. Aviation demand forecasting for Ames Municipal Airport (AMW) will focus on demand indicators, such as based aircraft, based aircraft fleet mix, annual aircraft operations, operational peaking periods, and the critical design aircraft.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. In addition, aviation activity forecasts may be an important input to future benefit-cost analyses associated with airport development, and the FAA reviews these analyses when federal funding requests are submitted.

The FAA will review individual airport forecasts with the objective of comparing them to its *Terminal Area Forecast* (TAF) and the *National Plan of Integrated Airport Systems* (NPIAS). Even though the TAF is updated annually, in the past there has almost always been a disparity between the TAF and master planning forecasts. This was primarily because the TAF forecasts did not consider local conditions or recent trends. In recent years, however, the FAA has improved its forecast model to be a demand-driven forecast for aviation services based upon local and national economic conditions, as well as conditions within the aviation industry.

As stated in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, forecasts should be:

- Realistic;
- Based on the latest available data;
- Reflective of current conditions at the airport (as a baseline);
- Supported by information in the study; and
- Able to provide adequate justification for airport planning and development.

The forecast process for an airport master plan consists of a series of basic steps that vary in complexity depending upon the issues to be addressed and the level of effort required. The steps include a review of previous forecasts, determination of data needs, identification of data sources, collection of data, selection of forecast methods, preparation of the forecasts, and evaluation and documentation of the results. FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, outlines seven standard steps involved in the forecast process, including:

1) **Identify Aviation Activity Measures**: The level and type of aviation activities likely to impact facility needs. For general aviation, this typically includes based aircraft and operations.
2) **Review Previous Airport Forecasts**: May include the FAA *Terminal Area Forecast*, state or regional system plans, and previous master plans.
3) **Gather Data**: Determine what data are required to prepare the forecasts, identify data sources, and collect historical and forecast data.
4) **Select Forecast Methods**: There are several appropriate methodologies and techniques available, including regression analysis, trend analysis, market share or ratio analysis, exponential smoothing, econometric modeling, comparison with other airports, survey techniques, cohort analysis, choice and distribution models, range projections, and professional judgment.
5) **Apply Forecast Methods and Evaluate Results**: Prepare the actual forecasts and evaluate for reasonableness.
6) **Summarize and Document Results**: Provide supporting text and tables as necessary.
7) **Compare Forecast Results with FAA's TAF**: Follow guidance in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*. In part, the Order indicates that forecasts should not vary significantly (more than 10 percent) from the TAF. When there is a greater than 10 percent variance, supporting documentation should be supplied to the FAA. (The FAA has provided additional guidance indicating forecasts are consistent with the TAF when they differ by less than 10 percent in the first five years and less than 15 percent in the 10-year period.)

Aviation activity can be affected by many influences on the local, regional, and national levels, making it virtually impossible to predict year-to-year fluctuations of activity over 20 years with any certainty. Therefore, it is important to remember that forecasts are to serve only as guidelines, and planning must remain flexible enough to respond to a range of unforeseen developments.

The COVID-19 pandemic struck late in the preparation of this planning document. Day-to-day aviation activity as a whole was significantly impacted during the health crisis. It is recognized the suggested implementation timeframes for the long-term development this report outlines may be affected by the economic downturn associated with the pandemic. However, based upon the types of aircraft using this airport throughout its long history, the proposed existing and ultimate design aircraft are still considered reasonable and valid for planning purposes.

The following forecast analysis for AMW was produced following the basic guidelines mentioned above. Existing forecasts are examined and compared against current and historic activity. The historical aviation activity is then examined, along with other factors and trends that can affect demand. The intent is to provide an updated set of aviation demand projections for the airport that will permit airport management to make planning adjustments as necessary to maintain a viable, efficient, and cost-effective facility.

NATIONAL AVIATION TRENDS AND FORECASTS

The forecasts developed for the airport must consider national, regional, and local aviation trends. The following section describes trends in aviation. This information is utilized both in statistical analysis and to aid the forecast preparer in making any manual adjustments to the forecasts as necessary.

NATIONAL TRENDS

Each year, the FAA updates and publishes a national aviation forecast. Included in this publication are forecasts for the large air carriers, regional/commuter air carriers, general aviation, and FAA workload measures. The forecasts are prepared to meet budget and planning needs of the FAA and to provide information that can be used by state and local authorities, the aviation industry, and the general public. The current edition when this chapter was prepared was FAA *Aerospace Forecasts – Fiscal Years 2018-2038*, published in March 2018. The FAA primarily used the economic performance of the United States as an indicator of future aviation industry growth. Similar economic analyses are applied to the outlook for aviation growth in international markets. The following discussion is summarized from the FAA Aerospace Forecasts.

Since its deregulation in 1978, the U.S. commercial air carrier industry has been characterized by boom-to-bust cycles. The volatility that was associated with these cycles was thought by many to be a structural feature of an industry that was capital-intensive but cash-poor. However, the great recession of 2007-09 marked a fundamental change in the operations and finances of U.S. airlines. Air carriers fine-tuned their business models to minimize losses by lowering operating costs, eliminating unprofitable routes, and grounding older, less fuel-efficient aircraft. To increase operating revenues, carriers initiated new services that customers were willing to purchase and started charging separately for services that were historically bundled in the price of a ticket. The industry experienced an unprecedented period of consolidation with four major mergers in five years. These changes, along with capacity discipline exhibited by carriers, resulted in a seventh consecutive year of profitability for the industry in 2016. Looking ahead, there is optimism that the industry has been transformed from that of a boom-to-bust cycle to one of sustainable profits.

Fundamentally, over the medium- and long-terms, demand for aviation is driven by economic activity, and a growing U.S. and world economy provides the basis for aviation to grow over the long-term. The 2018 FAA forecast calls for U.S. carrier passenger growth over the next 20 years to average 1.9 percent per year, slightly slower than last year's forecast. The sharp decline in the price of oil in 2016-17 will continue into 2018, spurred on by favorable economic conditions in the U.S. and the world. Oil prices averaged $48 per barrel in 2017, rising to $51 in 2018, and the forecast assumes they will increase thereafter to exceed $100 by 2030 and approach $119 by the end of the forecast period.

FAA GENERAL AVIATION FORECASTS

The FAA forecasts the fleet mix and hours flown for single engine piston aircraft, multi-engine piston aircraft, turboprops, business jets, piston and turbine helicopters, light sport, experimental, and others (gliders and balloons). The FAA forecasts "active aircraft," not total aircraft. An active aircraft is one that is flown at least one hour during the year. From 2010 through 2013, the FAA undertook an effort to have all aircraft owners re-register their aircraft. This effort resulted in a 10.5 percent decrease in the number of active general aviation aircraft, mostly in the piston category.

The long-term outlook for general aviation is favorable, led by gains in turbine aircraft activity. The active general aviation fleet is not forecast to grow significantly in the next 20 years, adding just 1,040 new aircraft to the fleet by 2038. While steady growth in both gross domestic product (GDP) and corporate profits results in continued growth of the turbine and rotorcraft fleets, the largest segment of the fleet – fixed-wing piston aircraft – continues to shrink over the FAA's forecast.

In 2017, the FAA estimated there were 146,670 piston-powered aircraft in the national fleet. The total number of piston-powered aircraft in the fleet is forecast to decline by 0.8 percent from 2018-2038, resulting in 124,320 by 2038. This includes -1.0 percent annually for single engine pistons and -0.4 percent for multi-engine pistons.

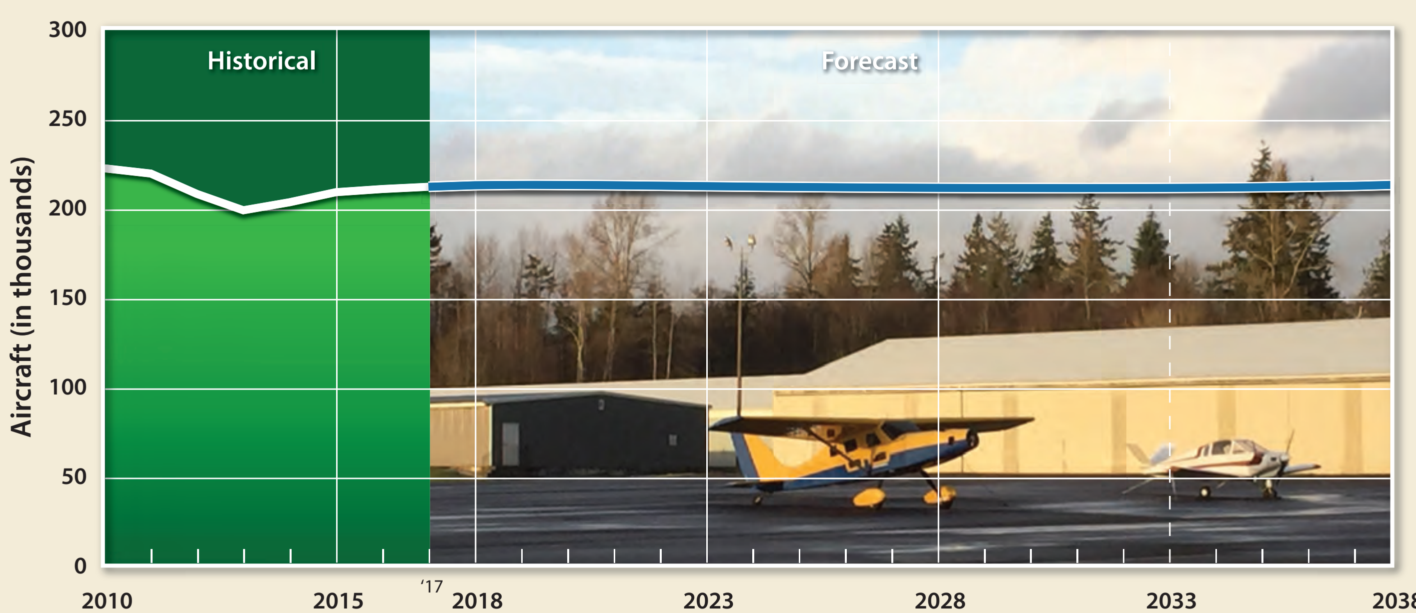
Total turbine aircraft are forecast to grow at an annual growth rate of 2.0 percent through 2038. The FAA estimates there were 30,905 turbine-powered aircraft in the national fleet in 2017, and there will be 46,160 by 2038. This includes annual growth rates of 1.7 percent for turboprops, 2.2 percent for business jets, and 1.9 percent for turbine helicopters.

While comprising a much smaller portion of the general aviation fleet, experimental aircraft, typically identified as home-built aircraft, are projected to grow annually by 0.8 percent through 2038. The FAA estimates there were 27,865 experimental aircraft in 2017, and these are projected to grow to 33,105 by 2038. Sport aircraft are forecast to grow 3.6 percent annually through the long-term, growing from 2,585 in 2017 to 5,440 by 2038. **Exhibit 2A** presents the historical and forecast U.S. active general aviation aircraft.

The FAA also forecasts total operations based upon activity at control towers across the U.S. Operations are categorized as air carrier, air taxi/commuter, general aviation, and military.

U.S. ACTIVE GENERAL AVIATION AIRCRAFT

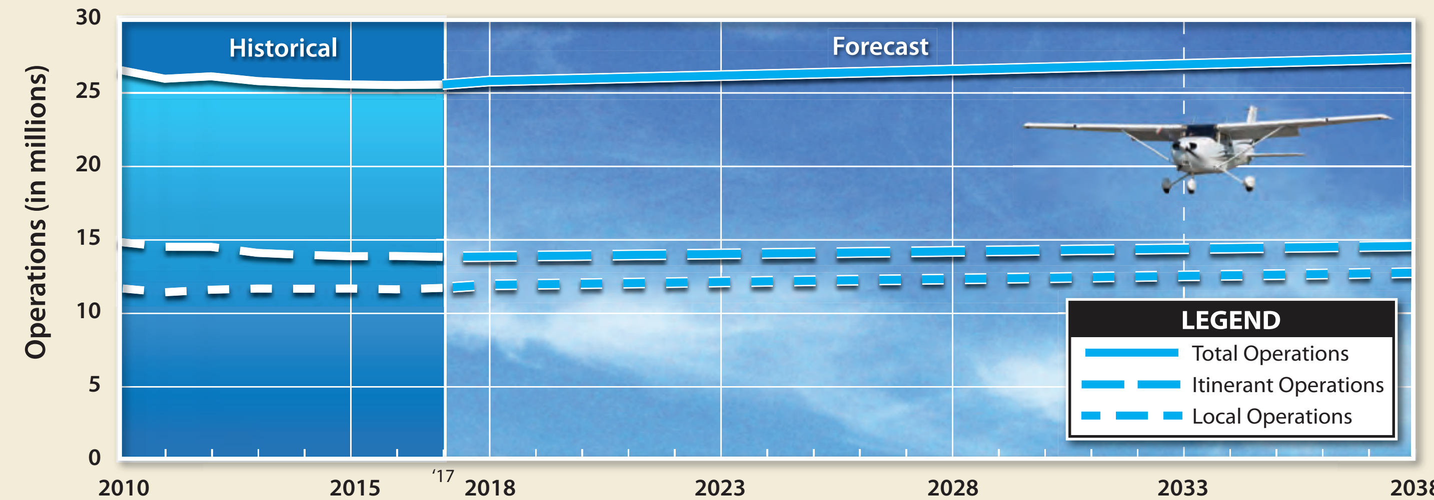
	2017E	2023	2028	2038	AAGR 2018-2038
Fixed Wing					
Piston					
Single Engine	130,330	125,330	118,740	107,800	-1.0%
Multi-Engine	12,935	12,720	12,465	11,845	-0.4%
Turbine					
Turboprop	9,430	9,025	9,870	12,855	1.7%
Turbojet	14,075	16,220	18,120	22,195	2.2%
Rotorcraft					
Piston	3,405	3,750	4,035	4,675	1.5%
Turbine	7,400	8,375	9,200	11,110	1.9%
Experimental					
	27,865	29,595	30,980	33,105	0.8%
Sport Aircraft					
	2,585	3,330	3,995	5,440	3.6%
Other					
	5,025	5,045	5,060	5,065	0.0%
Total Pistons	**146,670**	**141,800**	**135,240**	**124,320**	**-0.8%**
Total Turbines	**30,905**	**33,620**	**37,190**	**46,160**	**2.0%**
Total Fleet	**213,050**	**213,390**	**212,465**	**214,090**	**0.0%**



Notes: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.
Source: FAA Aerospace Forecast - Fiscal Years 2018-2038

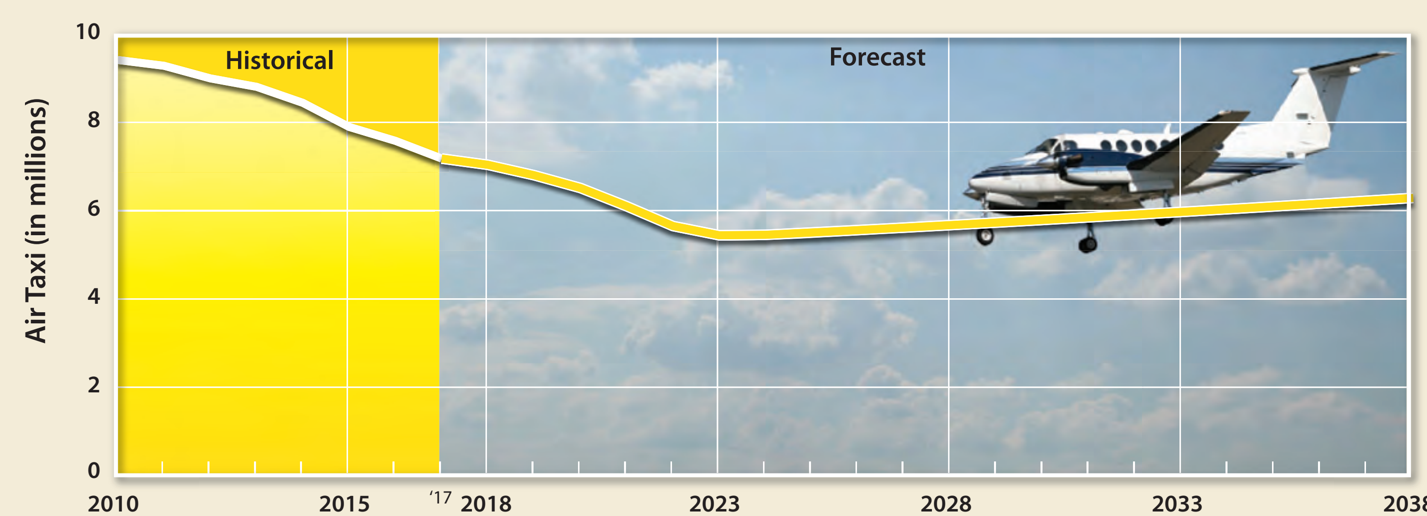
U.S. GENERAL AVIATION OPERATIONS

	2017E	2023	2028	2038	AAGR 2018-2038
Itinerant					
	13,838,029	14,039,925	14,217,031	14,587,442	0.3%
Local					
	11,731,596	12,135,595	12,338,286	12,763,556	0.3%
Total GA Operations	**25,569,625**	**26,175,520**	**26,555,317**	**27,350,998**	**0.3%**



U.S. AIR TAXI

	2017E	2023	2028	2038	AAGR 2018-2038
Air Taxi/Commuter Operations					
Itinerant	7,179,301	5,442,448	5,671,740	6,287,749	-0.6%



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General aviation operations, both local and itinerant, declined significantly with the 2008-2009 recession and subsequent slow recovery. Through 2038, total general aviation operations are forecast to grow 0.3 percent annually. Air taxi/commuter operations are forecast to decline by 2.1 percent through 2028, and then increase slightly through the remainder of the forecast period. Overall, air taxi/commuter operations are forecast to decline by 0.6 percent annually from 2018 through 2038.

GENERAL AVIATION AIRCRAFT SHIPMENTS AND REVENUE

The 2008-2009 economic recession has had a negative impact on general aviation aircraft production, and the industry has been slow to recover. Aircraft manufacturing declined for three straight years from 2008 through 2010. According to the General Aviation Manufacturers Association (GAMA), there is optimism that aircraft manufacturing will stabilize and return to growth, which has been evidenced since 2011. **Table 2A** presents currently available historical data related to general aviation aircraft shipments.

TABLE 2A
Annual General Aviation Airplane Shipments
Manufactured Worldwide and Factory Net Billings

Year	Total	SEP	MEP	TP	J	Net Billings ($millions)
1994	1,132	544	77	233	278	3,749
1995	1,251	605	61	285	300	4,294
1996	1,437	731	70	320	316	4,936
1997	1,840	1,043	80	279	438	7,170
1998	2,457	1,508	98	336	515	8,604
1999	2,808	1,689	112	340	667	11,560
2000	3,147	1,877	103	415	752	13,496
2001	2,998	1,645	147	422	784	13,868
2002	2,677	1,591	130	280	676	11,778
2003	2,686	1,825	71	272	518	9,998
2004	2,962	1,999	52	319	592	12,093
2005	3,590	2,326	139	375	750	15,156
2006	4,054	2,513	242	412	887	18,815
2007	4,277	2,417	258	465	1,137	21,837
2008	3,974	1,943	176	538	1,317	24,846
2009	2,283	893	70	446	874	19,474
2010	2,024	781	108	368	767	19,715
2011	2,120	761	137	526	696	19,042
2012	2,164	817	91	584	672	18,895
2013	2,353	908	122	645	678	23,450
2014	2,454	986	143	603	722	24,499
2015	2,331	946	110	557	718	24,129
2016	2,268	890	129	582	667	21,092
2017	2,324	936	149	563	676	20,197

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet
Source: General Aviation Manufacturers Association, *2017 Annual Report*

Worldwide shipments of general aviation airplanes increased in 2017, with a total of 2,324 units delivered around the globe, compared to 2,268 units in 2016. However, worldwide general aviation billings were lower than the previous year. In 2017, $20.2 billion in new general aviation aircraft were shipped, but year-end results were mixed across the market segments. North America is the largest market for general aviation aircraft. The Asian-Pacific region is the second largest market for piston-powered aircraft, Latin America is the second largest market for turboprops, and Europe is the second largest market for business jets.

Business Jets: General aviation manufacturers' business jet deliveries grew from 667 units in 2016 to 676 units in 2017. The North American market accounted for 63.8 percent of business jet deliveries, which is a 1.8 percent increase in market share compared to 2016.

Turboprops: Turboprop shipments were down from 582 in 2016 to 563 in 2017. North America's market share of turboprop aircraft dropped by 3.6 percent in the last year, while the European, Asian-Pacific, and Latin American markets increased their market share.

Pistons: In 2017, piston airplane shipments grew to 1,085 units over last year's shipment of 1,019 units for a 6.5 percent increase. However, North America's market share of piston aircraft deliveries dropped from 69.6 percent in 2016 to 65.6 percent in 2017. The Asian-Pacific market saw the largest increase in market share at 3.2 percent growth.

RISKS TO THE FORECASTS

While the FAA is confident that its forecasts for aviation demand and activity can be achieved, this hinges on a number of factors, including the strength of the global economy, security (including the threat of international terrorism), and the level of oil prices. Higher oil prices could lead to further shifts in consumer spending away from aviation, dampening a recovery in air transport demand. In the long-term, the FAA foresees a competitive and profitable industry characterized by increasing demand for air travel and airfares growing more slowly than inflation.

AIRPORT SERVICE AREA

The initial step in determining the aviation demand for an airport is to define its generalized service area for various segments of aviation. The service area is determined primarily by evaluating the location of competing airports, their capabilities, their services, and their relative attraction and convenience. In determining the aviation demand for an airport, it is necessary to identify the role of the airport, as well as the specific areas of aviation demand the airport is intended to serve.

The primary role for AMW is to accommodate general aviation demand in the region. The airport is classified as a regional general aviation facility within the NPIAS and within the FAA's study *General Aviation, A National Asset I and II*. A regional classification denotes that one of the airport's main purposes is to support regional economies via interstate and some long-distance flying. Regional general aviation airports have high levels of activity, including some jets and multi-engine propeller aircraft. On average, regional airports have 92 total based aircraft including approximately three jets.

The service area for an airport is a geographic region from which an airport can be expected to attract the largest share of its activity. The definition of the service area can then be used to identify other factors, such as socioeconomic and demographic trends, which influence aviation demand at an airport. Aviation demand will be impacted by the proximity of competing airports, the strength of aviation services provided by the airport versus its regional airports, and the surface transportation network serving the region.

As in any business enterprise, the more attractive the facility is in terms of services and capabilities, the more competitive it will be in the market. If an airport's attractiveness increases in relation to nearby airports, so will the size of its primary service area. If facilities and services are adequate and/or competitive, some level of aviation activity might be attracted to an airport from more distant locales which serve as a secondary service area.

As a general rule, an airport's primary service area extends upwards of 30 miles as defined by FAA guidance. This should be viewed only as a guide with the FAA goal of serving a populace within a 20 to 30-minute drive time. Many factors can influence a drive time beyond simple distance. As such, the 30-mile radius is used for forecasting purposes.

There are six public-use airports within 30 nautical miles of AMW as discussed in Chapter One and summarized on Exhibit 1G. Of the six public-use airports identified, all but one (Drake Airport) are FAA supported being included in the NPIAS. Des Moines International Airport's (DSM) primary function is to serve scheduled commercial passenger and cargo airline services; however, the airport also caters to general aviation operators including a wide array of corporate aviation activity. The four other NPIAS airports in the region provide various levels of general aviation services. Of these four, Ankeny Regional Airport is classified by the FAA as a general aviation reliever airport, serving to relieve general aviation traffic at DSM. **Table 2B** presents comparative summary information related to AMW and the six airports in proximity. Each airport's level of services and facilities available will play a role in limiting AMW's service area.

TABLE 2B
Regional Airports

Airport	Distance from AMW (nm)	NPIAS Service Level	Based Aircraft	Annual Operations	Longest Runway (feet)	Lowest Visibility Minimums
Ames Municipal (AMW)	0	GA	78	33,751	5,701	½-Mile
Boone Municipal (BNW)	11 WNW	GA	43	20,800	4,808	1-Mile
Ankeny Regional (IKV)	18 S	R-R	96	48,500	5,500	¾-Mile
Drake Airport (2Y1)	22 NNE	N/A	3	200	2,480	N/A
Perry Municipal (PRO)	26 WSW	GA	28	4,700	4,001	¾-Mile
Des Moines International (DSM)	28 S	PCS	111	70,100	9,003	CAT-III
Webster City Municipal (EBS)	29 NNW	GA	14	11,300	3,851	1-Mile

R-R: Regional Reliever; GA: General Aviation; PCS: Primary Commercial Service; nm: nautical mile
Source: FAA Form 5010-1, *Airport Master Record*; www.airnav.com

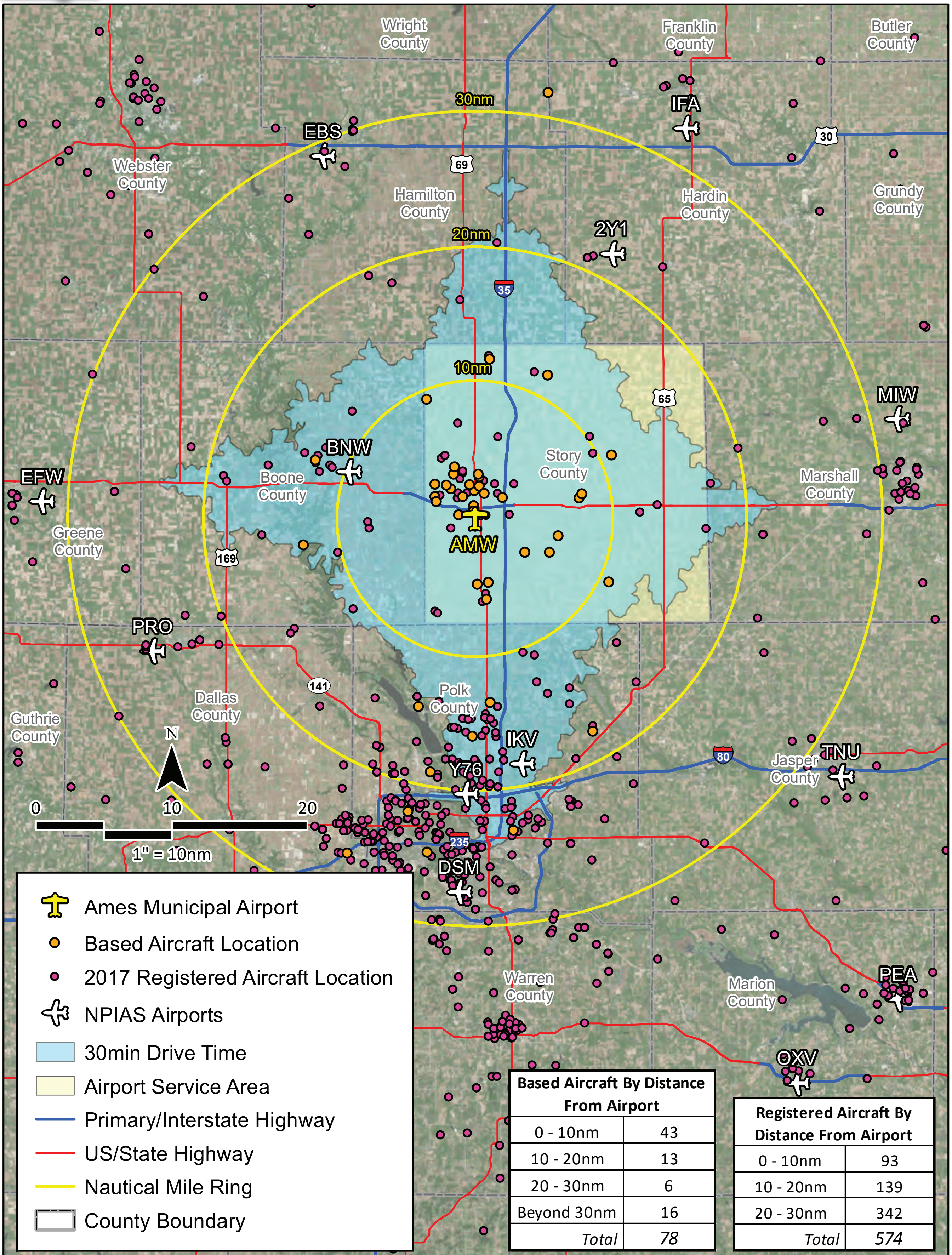
The service area for AMW is fundamentally limited by Des Moines International Airport and Ankeny Regional Airport to the south. Each of these facilities offers an array of corporate and general aviation services, including aircraft fuel, aircraft maintenance, hangar storage, etc. As previously mentioned, Des Moines International Airport also caters to commercial airline services. Additionally, Boone Municipal Airport is located approximately 11 nautical miles (nm) west-northwest of AMW and houses approximately 43 based aircraft; however, it is somewhat limited in the types of larger business aircraft it can accommodate given its primary runway length of 4,808 feet. Combined, it is estimated that 250 aircraft are based at Des Moines International, Ankeny Regional, and Boone Municipal Airports.

The remaining airports situated between 20 nm and 30 nm from AMW are Drake, Perry Municipal, and Webster City Municipal Airports. These airports also provide an array of general aviation services and have runway lengths of 2,480, 4,001, and 3,851 feet, respectively. These airports also somewhat limit the AMW service area, however, are not as competitive as Ankeny Regional and Des Moines International Airports.

AMW has remained a very important facility, meeting the needs of general aviation operators in the region. The airport is a hub for business and recreational aircraft activity. In addition, the airport is a designated regional general aviation airport. In this capacity, it should continue to fare well in its ability to compete for general aviation activity, considering the services and amenities it has to offer. It should be noted, aside from Des Moines International Airport, AMW currently offers the longest primary runway length as well as the lowest instrument approach visibility minimums within the 30 nm primary service area.

With the City of Ames being home to Iowa State University (ISU), AMW is frequently utilized to accommodate charter aircraft from ISU personnel, athletic teams, competing athletic teams, visitors, alumni, and business leaders in the community. As described in Chapter One, AMW is adjacent to the ISU Research Park, which is a 400+ acre facility with approximately 703,000 square feet of current building space and over 80 business tenants. The proximity of the research park to AMW is a large advantage for businesses and business leaders as the research park tenants and visitors utilizing AMW have the ability to fly almost directly to and from their place of business. Moreover, with the recent terminal and corporate hangar projects completed, the facilities and fixed base operator (FBO) services available at AMW are increasingly accommodating to itinerant general aviation aircraft and operators of business jets.

As a regional general aviation airport, AMW's service area is also driven by aircraft owners/operators and where they choose to base their aircraft. The primary consideration of aircraft owners/operators when choosing where to base their aircraft is convenience (i.e., easy access and proximity to the airport). However, some aircraft owners have other priorities, such as runway length, specific services, hangar availability, airport congestion, etc. The most effective method of defining an airport's service area is by examining the based aircraft by their registered address. **Exhibit 2B** presents the number of AMW-based aircraft located within the region according to airport records. Current registered aircraft that are based at AMW are presented as the larger orange dots. As depicted, approximately 72 percent of based aircraft owners reside or work within 20 miles of the airport. It should be noted that 16 based aircraft (approximately 21 percent) are registered to addresses outside the regional area, many of which are registered out-of-state. It is not uncommon for an aircraft based in one location to be registered in another,



Based Aircraft By Distance From Airport	
0 - 10nm	43
10 - 20nm	13
20 - 30nm	6
Beyond 30nm	16
Total	*78*

Registered Aircraft By Distance From Airport	
0 - 10nm	93
10 - 20nm	139
20 - 30nm	342
Total	*574*

especially for corporate aircraft which typically are registered by the controlling ownership entity, such as a bank. By far the most concentrated areas of based aircraft ownership are located within the City of Ames; however, based aircraft are also spread throughout several communities in the greater Des Moines metropolitan area as well as rural Story County. As presented on the exhibit, many of the based aircraft owners located outside Story County are positioned within or near the 30-minute drivetime contour.

The total registered aircraft within the region are also presented on **Exhibit 2B**. The regional registered aircraft are depicted as the smaller purple dots and total 574 registered aircraft within 30 miles of AMW. The majority of these aircraft are located south of AMW within the 10-20 and 20-30 nautical mile rings and likely base at Ankeny Regional (Y76) or DSM. However, there are a total of 93 registered aircraft within 10 miles of AMW. At present, AMW has 43 of these aircraft based at the airport, leaving a difference of 50 aircraft that have registered owners within 10 miles of the airport.

This data shows that a high percentage of based aircraft owners reside or do business near the airport. The remainder of the based aircraft owners are rurally located surrounding the Ames and Des Moines metropolitan areas. Considering all previous factors associated with competing airports, available aviation services, and based aircraft ownership, the airport's primary service area is generally comprised of the City of Ames, with a secondary service area extending to the entirety of Story County, which is the primary driver of based aircraft at AMW.

SOCIOECONOMIC TRENDS AND PROJECTIONS

Socioeconomic conditions also provide an important baseline for preparing aviation demand forecasts. Local socioeconomic variables, such as population and employment, are indicators for understanding the dynamics of the community and can relate to local trends in aviation activity. Analysis of the demographics of the airport service area will give a more comprehensive understanding of the socioeconomic situations influencing the region which supports AMW. The following is a summary of the demographic and socioeconomic data presented in Chapter One, as well as forecasts of those socioeconomic characteristics.

Table 2C summarizes historical and forecast population, employment, and income estimates for Story County, which includes the entirety of the Ames Metropolitan Statistical Area (MSA). The Des Moines-Ames-West Des Moines Combined Statistical Area (CSA) is also included, which is comprised of Boone, Dallas, Guthrie, Jasper, Madison, Polk, Story, and Warren counties. As a point of comparison, historical and forecast figures for the State of Iowa are also depicted in the table. By 2038, the population of Story County is projected to reach over 110,000 people. The Des Moines-Ames-West Des Moines CSA is projected to reach over 955,000 residents by 2038, which will make up approximately 28 percent of the state's population. Employment growth is projected to outpace population growth in each jurisdiction, forecast at 0.92 percent CAGR for Story County, 1.30 percent CAGR for the CSA, and 0.91 percent CAGR for the state. Per capita personal income is projected to grow most quickly in the CSA at 1.08 percent CAGR, compared to 0.83 and 1.07 percent CAGR for the county and state, respectively. Gross regional product (GRP) for the county and CSA are projected to grow at CAGRs of 1.29 and 1.88 percent, respectively, while the GRP for the state is projected to grow at 1.44 percent.

TABLE 2C
Socioeconomic History and Projections

	HISTORICAL				PROJECTIONS			
	2000	2010	2018	CAGR (2000-2018)	2023	2028	2038	CAGR (2018-2038)
Story County								
Population	80,152	89,634	98,336	1.14%	101,636	104,872	110,289	0.58%
Employment	53,547	59,042	66,004	1.17%	69,575	72,987	79,221	0.92%
Income (PCPI)	31,571	31,709	37,612	0.98%	39,574	41,405	44,363	0.83%
GRP (millions)	2,949	3,652	5,111	3.10%	5,488	5,863	6,606	1.29%
Des Moines-Ames-West Des Moines Combined Statistical Area (CSA)								
Population	626,898	724,725	809,124	1.43%	846,573	884,611	955,176	0.83%
Employment	445,650	490,152	575,403	1.43%	621,640	666,674	744,631	1.30%
Income (PCPI)	37,255	39,778	46,023	1.18%	49,223	52,228	57,041	1.08%
GRP (millions)	32,660	40,869	57,049	3.15%	63,391	69,899	82,724	1.88%
State of Iowa								
Population	2,929,067	3,050,738	3,158,720	0.42%	3,224,906	3,289,412	3,388,097	0.35%
Employment	1,914,664	1,951,933	2,163,161	0.68%	2,286,283	2,401,507	2,590,857	0.91%
Income (PCPI)	33,095	37,329	43,282	1.50%	46,263	49,072	53,523	1.07%
GRP (millions)	114,027	139,393	175,700	2.43%	190,354	205,173	233,636	1.44%

CAGR – Compound Annual Growth Rate
GRP – Gross Regional Product (adjusted to 2009 dollars)
PCPI – Per Capita Personal Income (adjusted to 2009 dollars)
Story County includes Ames MSA
Des Moines-Ames-West Des Moines CSA includes Boone County

Source: U.S. Census Bureau; Woods & Poole Complete Economic and Demographic Data Source (CEDDS) 2018

AVIATION FORECAST METHODOLOGY

The development of aviation forecasts proceeds through both analytical and judgmental processes. A series of mathematical relationships is tested to establish statistical logic and rationale for projected growth. However, the judgment of the forecast analyst, based upon professional experience, knowledge of the aviation industry, and assessment of the local situation is important in the final determination of the preferred forecast.

By developing several projections for each aviation demand indicator, a reasonable planning envelope, or range of forecasts, will emerge. The selected forecast may be one of the individual projections, or a combination of several projections, based on local conditions. The selected forecast will almost always fall within the planning envelope. Some combination of the following forecasting techniques is utilized to develop the planning envelope for each demand indicator.

Trend line projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical demand data and then extending them into the future, a basic trend line projection is produced. A basic assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections.

Market share analysis involves a historical review of aviation activity as a percentage, or share, of a larger regional, state, or national aviation market. A historical market share trend is determined, providing an expected market share for the future. These shares are then multiplied by the forecasts of the larger geographical area to produce a market share projection. This method has the same limitations as trend line projections but can provide a useful check on the validity of other forecasting techniques.

Historical growth analysis is a simple forecasting method in which the historical annual growth rate is identified and then extended out to forecast years. This analysis method assumes factors that impacted growth in the past will continue into the future.

Correlation analysis provides a measure of the direct relationship between two separate sets of historic data. If there is a reasonable correlation between the data, further evaluation using regression analysis may be employed.

Regression analysis is a statistical technique used to measure the relationship between variables. This technique yields an r-squared (r^2) value which shows the level of correlation between the variables. If the r^2 value is greater than 0.95, it indicates a strong predictive reliability.

Beyond five years, the predictive reliability of the forecasts will diminish due to many factors, including unforeseen events such as 9/11 and the 2008 Great Recession. Therefore, it is prudent for the airport to update the forecasts, reassess the assumptions originally made, and revise the forecasts based on the current airport and industry conditions. Facility and financial planning usually require at least a 10-year outlook since it often takes several years to complete a major facility development program.

Another consideration is that technological advances in aviation have historically altered, and will continue to change, the growth rates in aviation demand over time. The most obvious example is the impact of jet aircraft on the aviation industry, which resulted in a growth rate that far exceeded expectations. Such changes are difficult, if not impossible, to predict, and there is no mathematical way to estimate their impacts. It is important to use forecasts which do not overestimate revenue-generating capabilities or understate demand for facilities needed to meet public (user) needs.

Forecasts of aviation demand for AMW have been developed employing preferred statistical methods, examining available existing forecasts, and utilizing analyst expertise and judgement. The following section presents the aviation demand forecasts and includes activity in two broad categories: based aircraft and annual operations.

AVIATION FORECASTS

The following forecast analysis examines each of the aviation demand categories expected at AMW over the next 20 years. Each segment will be examined individually, and then collectively, to provide an understanding of the overall aviation activity at the airport through 2038.

The need for airport facilities at the airport can best be determined by accounting for forecasts of future aviation demand. Forecasts for airport activities include the following:

- Registered Aircraft
- Based Aircraft
- Based Aircraft Fleet Mix
- Annual Aircraft Operations
- Peaking Characteristics
- Annual Instrument Approaches

For a regional general aviation facility such as AMW, based aircraft, annual aircraft operations, and peak activity levels are the relevant aviation demand indicator segments that need to be forecast. The remainder of this chapter will examine historical trends about these areas of general aviation and project future demand for these segments of general aviation activity at the airport. Once approved by the FAA, these forecasts will become the basis for planning future facilities, both airside and landside, at the airport.

REVIEW OF HISTORICAL MASTER PLAN, STATE AVIATION, AND FAA FORECASTS

As part of the previous master plan update conducted at Ames Municipal Airport, forecasts of aviation demand were formulated for a 20-year planning period with a base year of 2007. Forecasts for total based aircraft and annual operations, which have been divided into itinerant and local operations, are presented in **Table 2D**. In 2007, AMW had a total based aircraft count of 63. Total based aircraft were forecast to grow to 83 by 2026, which represents a CAGR of 1.39 percent. Annual aircraft operations were estimated at 23,863 in 2007 and were forecast to grow to 34,577 by 2026 at a CAGR of 1.87 percent. Itinerant aircraft operations were estimated at 60 percent of total operations, while local operations were estimated at 40 percent. Ultimately, the itinerant/local percentage of total operations was maintained throughout the long-term planning year 2026.

TABLE 2D
2008 Airport Master Plan Aviation Forecasts
Ames Municipal Airport

	2007	2011	2016	2026
BASED AIRCRAFT				
Total Based Aircraft	63	70	75	83
ANNUAL AIRCRAFT OPERATIONS				
Total Operations	23,863	27,759	30,681	34,577
Itinerant Operations	14,318	16,655	18,409	20,746
Local Operations	9,545	11,104	12,272	13,831

Source: *Ames Municipal Airport Plan 2008*, completed by Snyder and Associates, Inc.

The Iowa Department of Transportation (IDOT) prepared the *Iowa Aviation System Plan (2010-2030)* (IASP) in 2010, which included an updated set of based aircraft and aircraft operation projections for each airport included in the state system. These forecasts were developed utilizing a base year of 2010 and are presented in **Table 2E**. The most current IASP forecasts are presented below.

As reported in the IASP, AMW had 65 based aircraft in 2010. The based aircraft count was expected to grow by 18, resulting in a CAGR of 1.23 percent over the 20-year planning period. During the same period, annual operations were estimated at 22,750 and were expected to grow at a CAGR of 1.23 percent to 29,050 operations by 2030.

TABLE 2E IASP Aviation Forecasts Ames Municipal Airport	2010	2015	2020	2025	2030
BASED AIRCRAFT					
Total Based Aircraft	65	69	74	78	83
ANNUAL AIRCRAFT OPERATIONS					
Total Operations	22,750	24,150	25,900	27,300	29,050
Source: *Iowa Aviation System Plan 2010-2030.*					

The FAA TAF offers a much more recent projection, having been prepared in January 2018. The TAF estimates 86 based aircraft at AMW with a flatline projection of 86 based aircraft over the entire 20-year planning period. Similarly, the TAF applies a flat aircraft operation forecast for the planning period at 33,751 annual aircraft operations. It should be noted that differences in operational levels between forecasts could be primarily due to a lack of actual operational counts. Given that the airport is not served by an airport traffic control tower (ATCT), current operational counts must be estimated.

REGISTERED AIRCRAFT

The number of based aircraft is the most basic indicator of general aviation demand. By first developing a forecast of based aircraft for the airport, other general aviation activity and demand can be projected. The process of developing forecasts of based aircraft begins with an analysis of aircraft ownership in the primary general aviation service area through a review of historical aircraft registrations.

Table 2F presents historical data regarding aircraft registered in Story County since 1998. These figures are derived from the FAA aircraft registration database that categorized registered aircraft by county based on the zip code of the registered aircraft. Although this information generally provides a correlation to based aircraft, it is not uncommon for some aircraft to be registered in the county but based at an airport outside the county or vice versa.

Between 2008 and 2014, two factors contributed to the decline in registered aircraft nationally: 1) the 2008-2009 national recession and subsequent slow recovery; and 2) FAA required all aircraft to be re-registered from 2010-2013, which removed nearly 30 percent of previously registered active general aviation aircraft. The FAA's database of registered aircraft was inaccurate due to a lack of proper data maintenance as well as faulty registration reporting by aircraft owners. As presented in the table, Story County experienced a decline in registered aircraft during this timeframe that was likely attributed to a combination of the factors mentioned. With these two major factors now in the past, it is reasonable to anticipate a return to more normal growth trends.

As presented in the table, Story County registered aircraft ranged between a low of 80 in 2014 to a high of 98 in 2017, a registered aircraft count not experienced since the year 2000. After 2017, registered aircraft experienced a decline to 94 in 2018. The table also includes the type of aircraft registered in Story County. As is typical for nearly all areas in the United States, single engine piston aircraft dominate the total aircraft registrations. In 2018, for example, of the 94 registered aircraft in the county, 78 were single engine piston aircraft. Aircraft registrations in 2018 also included three multi-engine piston aircraft, two turboprop aircraft, three jets, and one helicopter. There were also seven aircraft included in the “other” category, which can include gliders, ultralights, and electric-powered aircraft.

TABLE 2F
Historical Aircraft Registration by Type
Story County

Year	SEP	MEP	Turboprop	Jet	Helicopter	Other[1]	Total
1998	64	8	2	0	1	15	90
1999	64	7	2	0	1	17	91
2000	70	7	2	0	1	18	98
2001	67	7	3	0	1	17	95
2002	68	6	3	0	1	16	94
2003	67	3	7	0	1	15	93
2004	66	4	5	0	1	14	90
2005	64	5	4	0	1	17	91
2006	67	5	1	0	1	16	90
2007	71	4	1	1	1	13	91
2008	72	4	1	1	1	14	93
2009	75	5	1	1	1	13	96
2010	72	6	1	1	1	11	92
2011	70	6	1	1	1	11	90
2012	69	5	2	1	1	9	87
2013	62	5	2	1	1	10	81
2014	63	5	1	1	1	9	80
2015	70	5	1	2	1	8	87
2016	71	4	1	2	1	8	87
2017	78	5	2	2	1	10	98
2018	78	3	2	3	1	7	94

[1] "Other" category consists of gliders, ultralights, electric-powered aircraft, etc.
SEP - Single Engine Piston
MEP - Multi-Engine Piston

Source: FAA Aircraft Registration Database

Table 2G presents four different projections of registered aircraft for Story County, two market share forecasts, and two ratio projections. The first market share forecast considers the relationship between registered aircraft located within Story County and active aircraft within the United States. In 2018, Story County held 0.044 percent of the U.S. active aircraft. By keeping this market share constant, a forecast emerges that shows no growth, with 94 registered aircraft maintained over the next 20 years at a CAGR of 0.01 percent.

The second forecast considers an increasing market share percentage of local registered aircraft to the number of national active aircraft. As evidenced in the table, since 1998, the county’s market share has fluctuated from a high of 0.046 percent to a low of 0.039 percent. The county has generally gained market share of the U.S. active fleet since 2014. A continued increasing forecast model having the county market share of U.S. active aircraft rising to 0.052 percent in 2038 generates 111 registered aircraft at a CAGR of 0.85 percent.

TABLE 2G
Registered Aircraft Projections
Story County

Year	County Registrations[1]	U.S. Active Aircraft[2]	Market Share of U.S. Aircraft	Story County Population[3]	Aircraft per 1,000 Residents
1998	90	204,710	0.044%	78221	1.15
1999	91	219,464	0.041%	79,372	1.15
2000	98	217,533	0.045%	80,152	1.22
2001	95	211,446	0.045%	80,260	1.18
2002	94	211,244	0.044%	81,885	1.15
2003	93	209,606	0.044%	82,068	1.13
2004	90	219,319	0.041%	82,754	1.09
2005	91	224,257	0.041%	82,884	1.10
2006	90	221,942	0.041%	84,739	1.06
2007	91	231,606	0.039%	86,540	1.05
2008	93	228,664	0.041%	87,831	1.06
2009	96	223,876	0.043%	89,285	1.08
2010	92	223,370	0.041%	89,634	1.03
2011	90	220,453	0.041%	90,864	0.99
2012	87	209,034	0.042%	91,799	0.95
2013	81	199,927	0.041%	93,569	0.87
2014	80	204,408	0.039%	95,366	0.84
2015	87	210,031	0.041%	96,346	0.90
2016	87	211,794	0.041%	97,090	0.90
2017	98	213,050	0.046%	97,677	1.00
2018	94	213,905	0.044%	98,336	0.96
Constant Market Share of U.S. Active Aircraft (CAGR 0.01%)					
2023	94	213,390	0.044%	101,636	0.92
2028	93	212,465	0.044%	104,872	0.89
2038	94	214,090	0.044%	110,289	0.85
Increasing Market Share of U.S. Active Aircraft (CAGR 0.85%					
2023	96	213,390	0.045%	101,636	0.94
2028	100	212,465	0.047%	104,872	0.95
2038	111	214,090	0.052%	110,289	1.01
Constant Ratio Projection per 1,000 County Residents (CAGR 0.60%) – *Selected Forecast*					
2023	98	213,390	0.046%	101,636	0.96
2028	101	212,465	0.047%	104,872	0.96
2038	106	214,090	0.049%	110,289	0.96
Increasing Ratio Projection per 1,000 County Residents (CAGR 1.00%)					
2023	100	213,390	0.047%	101,636	0.98
2028	105	212,465	0.049%	104,872	1.00
2038	115	214,090	0.054%	110,289	1.04

Source:
[1] FAA Aircraft Registration Database
[2] *FAA Aerospace Forecast - Fiscal Years 2018-2038*
[3] U.S. Census Bureau; *Woods and Poole CEDDS 2018*

In addition to the market share forecasts, two ratio projection forecasts were generated. In 2018, the county had 0.96 registered aircraft per 1,000 Story County residents. The first ratio projection holds this ratio constant while it is applied to the population forecast of Story County. The constant ratio forecast results in 106 registered aircraft by 2038 and a CAGR of 0.60 percent. A second ratio projection considers an increase in the number of aircraft per 1,000 residents in Story County. For this forecast, the historical average ratio projection of registered aircraft per 1,000 county residents was examined and has averaged 1.04 since 1998. When increasing the ratio projection up to 1.04 over the planning period, the forecast results in 115 registered aircraft at a CAGR of 1.00 percent.

It should be noted that regression and time-series analyses were conducted. Because of the overall stagnant or declining trends in certain variables, such as registered aircraft and U.S. active aircraft not being consistent with increasing trends in population growth, regression and time-series analyses did not result in reliable forecasts. As such, these analytical methods were not considered further.

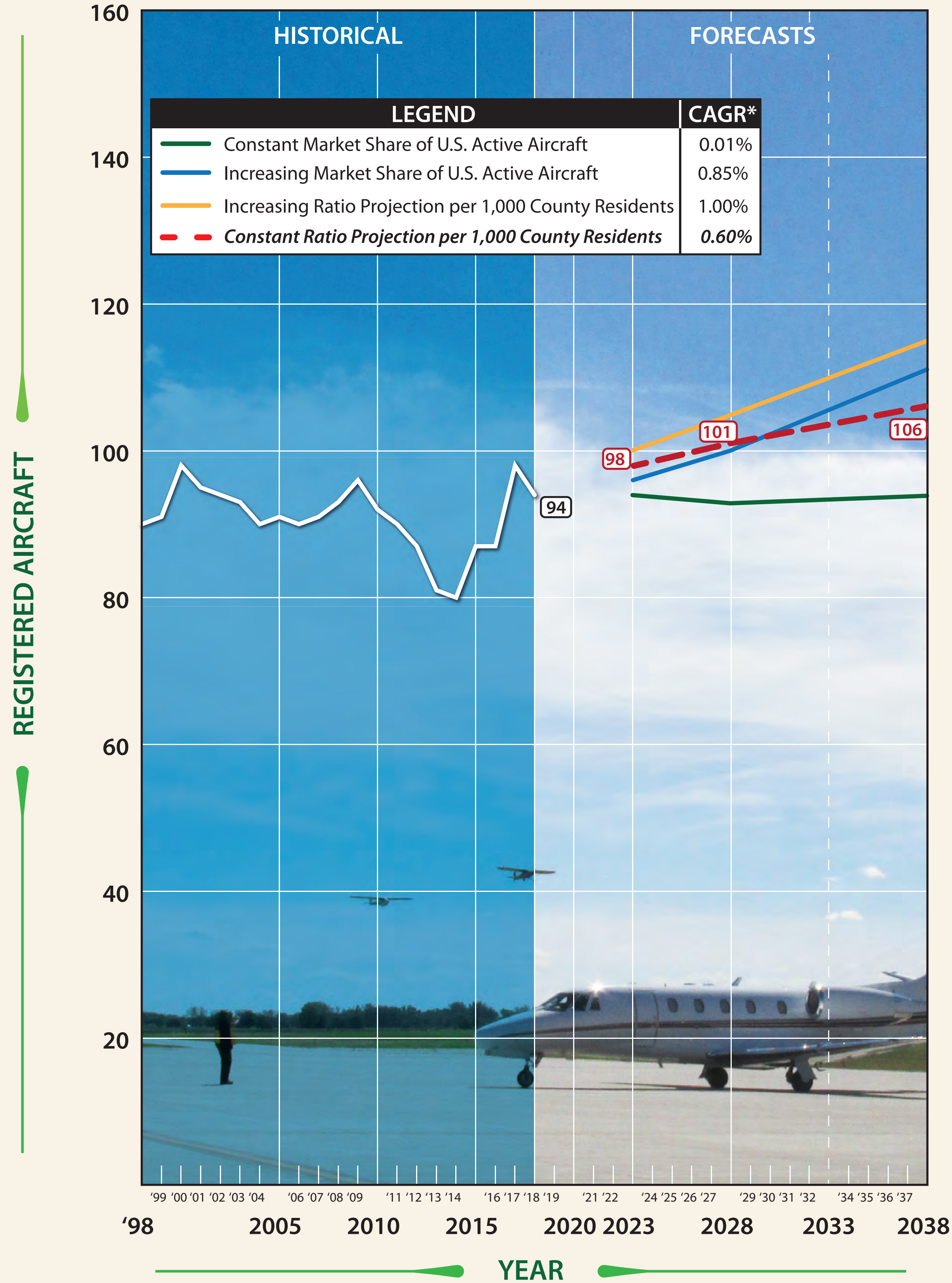
Exhibit 2C summarizes the registered aircraft forecasts for Story County. The registered aircraft forecasts produced a high range of 115 registered aircraft and a low range of 94 registered aircraft. Recent declines in registered aircraft and U.S. active aircraft following the 2008-2009 recession have slowly leveled off and are projected to return to growth over time, although at a lower rate than what has been projected in the past. Ultimately, the constant ratio projection of aircraft per 1,000 county residents is considered the most reasonable forecast as it maintains historic trends that have remained relatively constant over the past 10 years, while accounting for growth in population projected in Story County during the forecast period. In 2023, registered aircraft are forecast to increase to 98. By 2038, registered aircraft for the county are forecast to reach 106. Over the next 20 years, registered aircraft within the county are forecast to grow at a CAGR of 0.60 percent annually.

The registered aircraft projection is one variable to be used in the development of a based aircraft forecast. The following section will present several potential based aircraft forecasts, as well as the selected based aircraft forecast, to be utilized in this study.

BASED AIRCRAFT

Determining the number of historical, and sometimes existing, based aircraft at an airport can be a challenging task. Aircraft storage can be somewhat transient in nature, meaning aircraft owners can and do move their aircraft. Some aircraft owners may store their aircraft at an airport for only part of the year. For many years, the FAA did not require maintaining official detailed based aircraft records; therefore, historical records are often incomplete or non-existent.

Historic and current based aircraft counts at AMW were compiled using the FAA TAF, FAA Form 5010 – Airport Master Record, and records as reported by the Central Iowa Air Service FBO. FAA TAF figures were generally estimates obtained via annual site visits. Although the 2018 FAA TAF identifies 86 based aircraft at AMW, the current based aircraft count provided by the FBO will be utilized as it has been specifically verified at the airport. Based on these records, including specified aircraft registration numbers in 2018, there were 78 based aircraft at AMW.



* Compound Annual Growth Rate

Table 2H presents several based aircraft forecasts for AMW. The first method used to project based aircraft examined the airport's share of registered aircraft in Story County. As shown, the airport captured 83.0 percent of aircraft registered in the county in 2018. The first forecast assumes a constant market share of 83.0 percent. This projection yields 88 aircraft by 2038, equating to a 0.60 percent CAGR. The second projection assumes the airport's market share will increase throughout the planning period, like what has occurred during certain timeframes over previous years, including the most recent market share high of 98.9 percent in 2016. This projection would yield 105 based aircraft by the year 2038, resulting in a growth rate of 1.49 percent annually. It should be noted that historic based aircraft (retrieved from the FAA TAF) at AMW have, at times in the recent past, exceeded the number of registered aircraft in Story County. This is likely due to multiple factors including AMW's draw of based aircraft from outside Story County as well as based aircraft that are registered out of state.

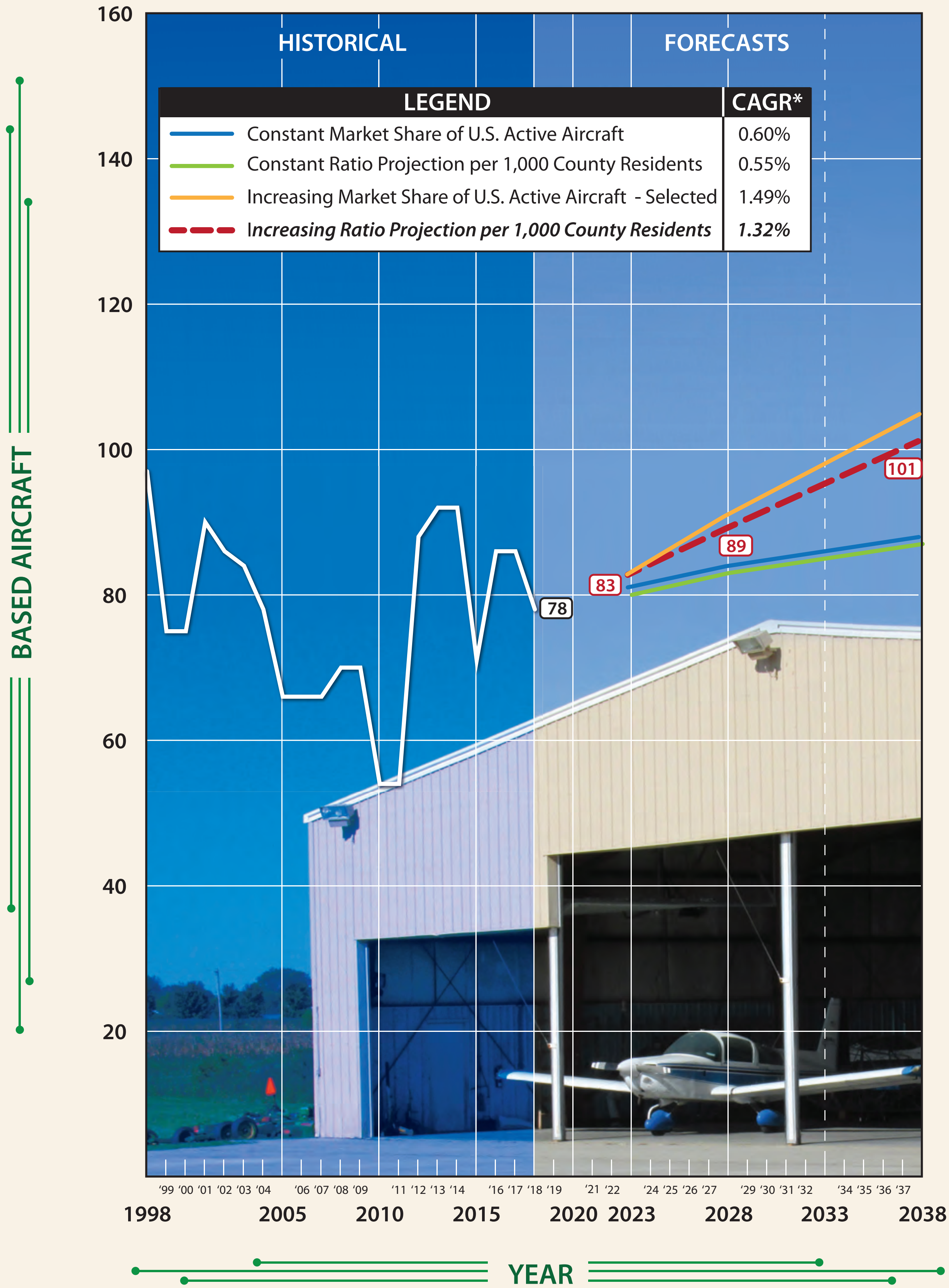
Trends comparing the number of based aircraft with the airport's service area population were also analyzed. A constant ratio of based aircraft per 1,000 people results in based aircraft growing at the same rate as the service area population. This yields 87 based aircraft by 2038, which is an annual growth rate of 0.55 percent. Additionally, an increasing ratio projection up to 0.92, which represents incremental growth to slightly above the 20-year average of 0.88, was analyzed. This forecast results in 101 based aircraft by 2038 and a CAGR of 1.32 percent.

The FAA TAF is a generalized annual forecast of activity produced by the FAA for airports across the country. As detailed earlier in this chapter, the TAF estimates that in 2018, there were 86 based aircraft at AMW, which is not believed to be an accurate count. Furthermore, the TAF has utilized a flatlined forecasting approach, holding the based aircraft count constant throughout the 20-year planning period. As such, the current TAF has not been considered further as a forecasting measure for this master plan.

Like the registered aircraft projections, based aircraft forecasts considered regression and time-series analyses techniques. Due to contradicting trends in based aircraft and other variables, these techniques did not result in reliable forecasts.

The forecasts previously discussed in **Table 2H** and further depicted on **Exhibit 2D** represent a reasonable planning envelope. The selected forecast considers increasing the existing ratio projection of based aircraft per 1,000 residents within the service area. As such, it projects the airport experiencing an increase in based aircraft per 1,000 residents through the planning period to 0.92, as well as an increase in market share of service area registered aircraft to 95.7 percent. These trends have been realized at the airport in the recent past. In the next five years, 83 aircraft are projected. In 10 years, 89 aircraft are projected, and by 2038, 101 based aircraft are projected. This forecast results in a 1.32 percent CAGR through the 20-year planning period.

Future aircraft basing at the airport will depend on several factors, including the state of the economy, fuel costs, available facilities, competing airports, and hangar development potential. Forecasts assume a reasonably stable and growing economy, as well as reasonable development of airport facilities necessary to accommodate aviation demand. Competing airports will play a role in deciding demand; however, AMW should fare well in this competition as it is served by a runway system capable of handling most general aviation aircraft and additional demand for based aircraft hangars.



* Compound Annual Growth Rate

Exhibit 2D
BASED AIRCRAFT FORECASTS

TABLE 2H
Based Aircraft Forecast
Ames Municipal Airport

Year	AMW Based Aircraft[1]	County Registrations[2]	Market Share of Registered Aircraft	Story County Population[3]	Aircraft per 1,000 Residents
1998	97	90	107.8%	78,221	1.24
1999	75	91	82.4%	79,372	0.94
2000	75	98	76.5%	80,152	0.94
2001	90	95	94.7%	80,260	1.12
2002	86	94	91.5%	81,885	1.05
2003	84	93	90.3%	82,068	1.02
2004	78	90	86.7%	82,754	0.94
2005	66	91	72.5%	82,884	0.80
2006	66	90	73.3%	84,739	0.78
2007	66	91	72.5%	86,540	0.76
2008	70	93	75.3%	87,831	0.80
2009	70	96	72.9%	89,285	0.78
2010	54	92	58.7%	89,634	0.60
2011	54	90	60.0%	90,864	0.59
2012	88	87	101.1%	91,799	0.96
2013	92	81	113.6%	93,569	0.98
2014	92	80	115.0%	95,366	0.96
2015	71	87	81.6%	96,346	0.74
2016	86	87	98.9%	97,090	0.89
2017	86	98	87.8%	97,677	0.88
2018	78	94	83.0%	98,336	0.79
Constant Market Share of Registered Aircraft (CAGR 0.60%)					
2023	81	98	83.0%	101,636	0.80
2028	84	101	83.0%	104,872	0.80
2038	88	106	83.0%	110,289	0.80
Increasing Market Share of Registered Aircraft (CAGR 1.49%)					
2023	83	98	85.0%	101,636	0.82
2028	91	101	90.0%	104,872	0.87
2038	105	106	98.9%	110,289	0.95
Constant Ratio Projection per 1,000 County Residents (CAGR 0.55%)					
2023	80	98	81.9%	101,636	0.79
2028	83	101	82.0%	104,872	0.79
2038	87	106	82.2%	110,289	0.79
Increasing Ratio Projection per 1,000 County Residents (CAGR 1.32%) - *Selected Forecast*					
2023	83	98	85.0%	101,636	0.82
2028	89	101	88.3%	104,872	0.85
2038	101	106	95.7%	110,289	0.92

Source:
[1] FAA Aircraft Registration Database
[2] *FAA Aerospace Forecast - Fiscal Years 2018-2038*
[3] U.S. Census Bureau; *Woods and Poole CEDDS 2018*

Consideration must also be given to the current and future aviation conditions at the airport. AMW provides an array of aviation services and will continue to be favored by aviation operators due to its location and available facilities. It is important to note that the airport also maintains a hangar waiting list comprised of nearly 20 aircraft, further pointing to existing demand potential. Furthermore, the City of Ames has given every indication that it plans to continue support of the airport. Significant investments are currently being made to the facility, and the airport should continue to meet the needs of aircraft in the regional general aviation system.

BASED AIRCRAFT FLEET MIX

The fleet mix of based aircraft is oftentimes more important to airport planning and design than the total number of aircraft. For example, the presence of one, or a few business jets, can impact the design standards more than a large number of smaller, single engine piston-powered aircraft.

Knowing the aircraft fleet mix expected to utilize AMW is necessary to properly plan for facilities that will best serve the level of activity and the type of activities occurring at the airport. The existing fleet mix of aircraft based at the airport is comprised of 64 single engine piston aircraft, three multi-engine piston aircraft, one turboprop, four jets, and six gliders which are classified in the "other" aircraft category. The "other" aircraft category consists of ultralights, electric-powered aircraft, gliders, hot air balloons, etc.

The based aircraft fleet mix, as presented on **Table 2J**, was compared to the existing and forecast U.S. general aviation fleet mix trends as presented in *FAA Aerospace Forecast – Fiscal Years 2018-2038*, as well as to trends occurring at the airport. The national trend in general aviation continues to be toward a greater percentage of larger, more sophisticated aircraft. While single engine piston-powered aircraft will continue to account for the largest share of based aircraft at the airport, these aircraft are forecast to drop as a percentage of the fleet mix. Multi-engine piston-powered aircraft are expected to decrease in number and decrease as a percentage of the fleet mix during the planning period of the master plan.

TABLE 2J
Based Aircraft Fleet Mix
Ames Municipal Airport

	Existing		Forecast					
Aircraft Type	**2018**	**Percent**	**2023**	**Percent**	**2028**	**Percent**	**2038**	**Percent**
Single Engine Piston	64	82.05%	67	80.50%	71	80.00%	80	79.00%
Multi-Engine Piston	3	3.85%	2	2.50%	1	1.00%	0	0.00%
Turboprop	1	1.28%	2	2.50%	3	3.50%	5	5.00%
Jet	4	5.13%	5	6.00%	6	7.00%	8	8.00%
Helicopter	0	0.00%	1	1.50%	2	2.00%	2	2.00%
Other	6	7.69%	6	7.00%	6	6.50%	6	6.00%
Totals	**78**	**100.00%**	**83**	**100.00%**	**89**	**100.00%**	**101**	**100.00%**

Source: Airport Records: Coffman Associates analysis

Consistent with national aviation trends, growth is anticipated to occur within the more sophisticated categories, including turboprop and jet categories. The turboprop and jet categories are projected to increase by four based aircraft each over the next 20 years. Helicopters are also considered a significant growth category, growing to two based helicopters through 2038.

GENERAL AVIATION ANNUAL OPERATIONS

General aviation operations are classified as either local or itinerant. A local operation is a take-off or landing performed by an aircraft that operates within sight of the airport, or which executes simulated approaches or touch-and-go operations at the airport. Generally, local operations are characterized by training operations. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Typically, itinerant operations increase with business and commercial use, since business aircraft are not typically used for large scale training activities.

The FAA TAF estimated operational levels for AMW in the current TAF is 33,751 total operations, and the forecast is a flat-line forecast through the planning horizon. The FAA recommends applying an approved forecast model specifically developed for small non-towered general aviation airports. The report entitled, *Model for Estimating General Aviation Operations at Non-Towered Airports Using Towered and Non-Towered Airport Data* (GRA, Inc. 2001), presents the methodology and formula for the model. Independent variables used in the model include airport characteristics, demographics, and geographic features. The model was derived using a combined data set for small towered and non-towered general aviation airports and incorporates a dummy variable to distinguish the two airport types. Specifically, the model utilizes the following variables:

TABLE 2K
Model for Estimating Operations at Non-Towered Airports
Ames Municipal Airport

Function	Category	2018
	775	775
+	241 x BA	18,798
-	0.14 x BA^2	852
+	31,478 x %100mi	2,737
+	5,577 x VITFSnum	11,114
+	.001 x Pop100	1,673
-	3,736 x WACAORAK	0
+	12,121 x Pop25/100	1,909
=	**Total**	**36,154**

Function Definitions:
BA - Based Aircraft: 78
BA^2 - Based Aircraft Squared: 6,084
%100mi - % Based aircraft among based GA aircraft within 100 miles: 8.70%
VITFSnum - # of FAR 141 flight schools on airport: 2
Pop100 - Population within 100 miles: 1,673,147
WACAORAK - 1 if WA, CA, OR, AK; 0 otherwise: 0
Pop20/100 - Ratio of Pop 25 to Pop 100 (proportion between 1 and 0): 0.157498415

Source: 2018 Estimate of operations – Derived from *Model for Estimating General Aviation Operations at Non-Towered Airports*, Equation #15, FAA Statistics and Forecast Branch (July 2001).

- Based aircraft;
- Percent of aircraft based at the airport among general aviation airports within 100 miles;
- Number of FAR 141 flight training schools at the airport;
- Population within 100 miles;
- Ratio of population within 25 miles and within 100 miles.

The model factors each of these variables so that both local and national factors are considered when estimating operations. The results of the model show an annual general aviation operation estimate of 36,154. **Table 2K** presents the calculations of operations for the airport.

General Aviation Operations Forecast

Utilizing the operations estimate derived from the model described above, five forecasts of general aviation operations have been developed and are presented in **Table 2L**. The forecasts presented examine and/or manipulate variables, such as AMW's operations per based aircraft and forecast growth rates in the FAA's *Aerospace Forecast 2018-2038*. As shown in the table, the estimated 36,154 annual general aviation operations equate to 464 operations per based aircraft. Typically, general aviation airports will experience between 250 and 500 operations per based aircraft. The FAA TAF estimates that the current general aviation operational split is 63 percent itinerant and 37 percent local and will continue to remain so through the forecast period. It should be noted that all operations forecasts have been rounded to the nearest hundred for planning purposes.

TABLE 2L
General Aviation Operations Forecast
Ames Municipal Airport

Year	AMW GA Operations	Itinerant GA Operations	Local GA Operations	AMW Based Aircraft	GA Operations per Based Aircraft
2018	36,154	22,777	13,377	78	464
Constant Operations per Based Aircraft (CAGR 1.31%)					
2023	38,500	24,300	14,200	83	464
2028	41,300	26,000	15,300	89	464
2038	46,900	29,500	17,400	101	464
Increasing Operations per Based Aircraft—Low Growth (CAGR 1.37%) - *Selected Forecast*					
2023	38,600	24,300	14,300	83	465
2028	41,600	26,200	15,400	89	467
2038	47,500	29,900	17,600	101	470
Increasing Operations per Based Aircraft—Medium Growth (CAGR 1.68%)					
2023	39,000	24,600	14,400	83	470
2028	42,700	26,900	15,800	89	480
2038	50,500	31,800	18,700	101	500
Increasing Operations per Based Aircraft—High Growth (CAGR 3.41%)					
2023	41,500	26,100	15,400	83	500
2028	57,900	36,500	21,400	89	650
2038	70,700	44,500	26,200	101	700
FAA TAF National Forecast Growth Rate (CAGR 0.64%)					
2023	37,300	23,500	13,800	83	449
2028	38,500	24,300	14,200	89	433
2038	41,100	25,900	15,200	101	407

Sources: FAA *Aerospace Forecast 2018-2038*; FAA Form 5010; FAA *Terminal Area Forecast*; FAA National Based Aircraft Inventory Program

The first projection maintains the existing general aviation operations per based aircraft of 464 through the long-term planning period, resulting in 46,900 operations by year 2038 and a CAGR of 1.31 percent. Applying low, medium, and high growth rates of 470, 500, and 700 operations per based aircraft by year 2038 results in annual operations forecasts of 47,500, 50,500, and 70,700 with respective CAGRs of 1.37, 1.68, and 3.41 percent. It should be noted that Central Iowa Air Service is currently planning a pilot training program accredited through ISU. As such, operations could increase in a very short period. These operations, however, will likely be primarily local (training) by small aircraft.

The national general aviation operations forecasts presented in the FAA's 2018 TAF were also examined. Using the base year of 2018, the TAF's national forecasted growth rate of 0.64 percent was carried forward throughout the planning horizon. This projection yields 41,100 annual general aviation operations by 2038.

Ultimately, the increasing operations per based aircraft—low growth projection has been selected. The potential for additional based aircraft at AMW could drive local as well as itinerant demand. The selected forecast maintains a reasonable and modestly increasing level of operations per based aircraft, while increasing local and itinerant general aviation annual operations slightly above the FAA TAF national projection. It is believed that the moderate and higher growth models represent the top end of the planning envelope without evidence of reasonable expectation.

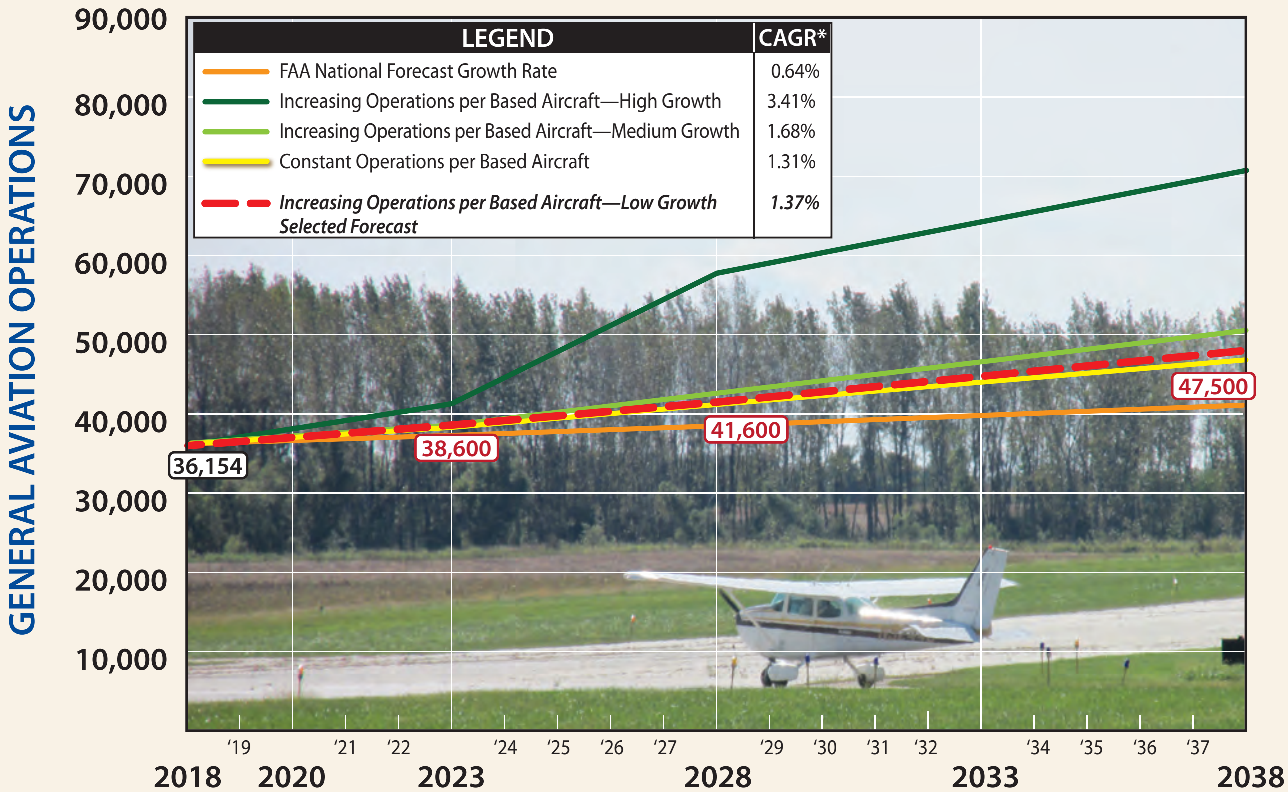
Exhibit 2E graphically illustrates the forecasts for total general aviation operations along with the air taxi operations forecasts (to be discussed). As can be seen, the forecasts developed create a planning envelope of high and low growth curves, with a selected forecast within the envelope.

AIR TAXI OPERATIONS FORECAST

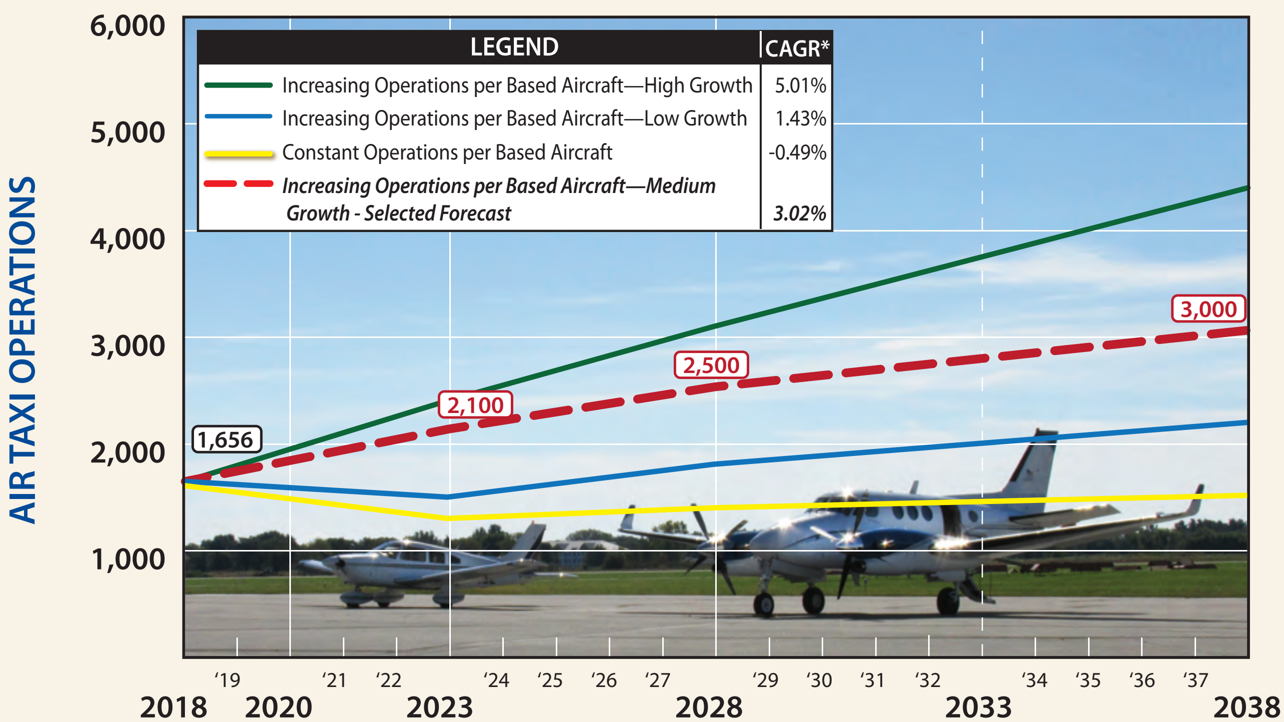
The air taxi category can be classified as a sub-set of the itinerant operations category and includes aircraft involved in on-demand passenger charter, fractional ownership aircraft operations, small parcel transport, and air ambulance activity. While not typically a large percentage of total airport operations, air taxi operations can be conducted via more sophisticated aircraft, ranging from multi-engine piston aircraft up to large business jet aircraft. As a result, it is important to factor these types of operations at airports that experience air taxi operations.

The FAA national air taxi forecast projects a 2.1 percent decrease in air taxi operations through 2028, followed by modest increases thereafter. The primary reason for this decrease is the transition by commuter airlines to larger aircraft with more than 60 passenger seats, which are then counted as air carrier operations. While air taxi operations that are represented by commuter airlines using aircraft with fewer than 60 seats are decreasing, the business jet segment of the air taxi category is expected to continue to grow nationally. As previously discussed, with the City of Ames being home to ISU, AMW is a large draw for itinerant aircraft including business jets. AMW is regularly utilized for purposes including, but certainly not limited to, transportation of ISU personnel, athletic teams, competing athletic teams, visitors, alumni, as well as business leaders in the community. Moreover, AMW is located directly adjacent to the ISU Research Park, which is also believed to be a key driver of current and future air taxi operations. Therefore, it is reasonable to expect the business jet component of air taxi activity to increase moderately over time at AMW.

GENERAL AVIATION OPERATIONS FORECAST



AIR TAXI OPERATIONS FORECAST



* Compound Annual Growth Rate

Based upon historical air taxi operations reported in the FAA TAF and an examination of flight plans filed and closed on the ground from years 2017-2018, it was determined that AMW experienced 1,656 annual air taxi operations, totaling approximately four percent of annual airport operations.

Table 2M and **Exhibit 2E** present four forecasts for air taxi operations at AMW. Similar to the general aviation operations forecast above, the air taxi forecast has been rounded to the nearest hundred for planning purposes. To generate a reliable air taxi forecast, two different forecasting techniques were utilized, generating a total of four forecasts. The first method examines a constant market share of national air taxi operations. Carrying the existing 0.024 percent market share of national air taxi operations forward through the long-term planning horizon, a forecast emerges of 1,500 air taxi operations and a CAGR of -0.49 percent by year 2038.

TABLE 2M
Air Taxi Operations Forecast
Ames Municipal Airport

Year	AMW Air Taxi Operations	U.S. Air Taxi Operations	AMW Market Share
2018	1,656	7,037,000	0.024%
Constant Market Share of U.S. Air Taxi Operations (CAGR -0.49%)			
2023	1,300	5,442,000	0.024%
2028	1,400	5,672,000	0.024%
2038	1,500	6,288,000	0.024%
Increasing Market Share of U.S. Air Taxi Operations —Low Growth (CAGR 1.43%)			
2023	1,500	5,442,000	0.028%
2028	1,800	5,672,000	0.032%
2038	2,200	6,288,000	0.035%
Increasing Market Share of U.S. Air Taxi Operations —Medium Growth (CAGR 3.02%) - *Selected Forecast*			
2023	2,100	5,442,000	0.040%
2028	2,500	5,672,000	0.044%
2038	3,000	6,288,000	0.048%
Increasing Market Share of U.S. Air Taxi Operations —High Growth (CAGR 5.01%)			
2023	2,400	5,442,000	0.045%
2028	3,100	5,672,000	0.055%
2038	4,400	6,288,000	0.070%

Sources: FAA *Aerospace Forecast 2018-2038*; FAA Form 5010; FAA *Terminal Area Forecast*; FAA National Based Aircraft Inventory Program

The second forecast method applies an increasing market share of national air taxi operations throughout the planning period, generating three forecasts at low, medium, and high growth rates. The low, medium, and high growth rates yield totals of 2,200, 3,000, and 4,400 air taxi operations by year 2038 and CAGRs of 1.43, 3.02, and 5.01 percent, respectively.

The increasing operations per based aircraft—medium growth projection has been selected as the most reasonable forecast. As was discussed, with regular turbine aircraft traffic at AMW associated with ISU, the ISU Research Park, and local businesses, AMW could reasonably expect air taxi operations to grow. Furthermore, with long-term growth projected for this market segment nationally, AMW could experience moderate growth in this category.

Military Operations Forecast

Military aircraft can and do utilize civilian airports across the country. Current operational data reported in the FAA TAF identifies 499 annual military operations occurring at AMW. Forecasting of military activity is inherently difficult because of the national security nature of their operations and the fact that missions can change often. Thus, it is typical for the FAA to utilize a flat-line forecast number for military operations. At AMW, the FAA TAF reflects virtually no change in military operations at the airport through the long-term planning horizon. For planning purposes, annual military operations are forecast to remain at 500 through the 20-year planning period.

PEAKING CHARACTERISTICS

Peaking characteristics are an important aspect in generating airport capacity and facility requirements. It should be noted that because AMW does not have a control tower, the generalized peaking characteristics of other non-towered general aviation airports have been used for the purposes of this study. The peaking periods used to develop the capacity analysis and facility requirements are described below.

- Peak Month – The calendar month in which traffic activity is highest.
- Design Day – The average day in the peak month. This indicator is derived by dividing the peak month by the number of days in the month.
- Busy Day – The busy day of a typical week in the peak month.
- Design Hour – The peak hour within the design day.

For the purposes of this study, the peak month was estimated at ten percent of the annual operations. By 2038, the estimated peak month is projected to reach 5,100 operations. The design day is estimated by dividing the peak month by its number of days, and the busy day is calculated at 1.25 times the design day. The design hour is then calculated at 15 percent of the design day. These projections can be viewed in **Table 2N**.

TABLE 2N
Peak Operations Forecast
Ames Municipal Airport

	2018	2023	2028	2038
Annual Operations	38,309	41,200	44,600	51,000
Peak Month	3,831	4,120	4,460	5,100
Busy Day	154	133	144	165
Design Day	124	166	180	206
Design Hour	19	20	22	25

Source: Coffman Associates analysis.

ANNUAL INSTRUMENT APPROACHES

An instrument approach, as defined by the FAA, is "an approach to an airport with the intent to land by an aircraft in accordance with an Instrument Flight Rule (IFR) flight plan, when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude." To qualify as an instrument approach, aircraft must land at the airport after following one of the published instrument approach procedures in less than visual conditions. Forecasts of annual instrument approaches (AIAs) provide guidance in determining an airport's requirements for navigational aid facilities, such as an instrument landing system. It should be noted that practice or training approaches do not count as annual AIAs, nor do instrument approaches conducted in visual conditions.

During poor weather conditions, pilots are less likely to fly and rarely would perform training operations. As a result, an estimate of the total number of AIAs can be made based on a percentage of itinerant operations regardless of the frequency of poor weather conditions. An estimate of three percent of total itinerant (general aviation, air taxi, and military) operations is utilized to forecast AIAs at AMW, as presented in **Table 2P**.

TABLE 2P
Annual Instrument Approaches
Ames Municipal Airport

Year	Annual Instrument Approaches	Itinerant Operations	Ratio
2018	748	24,932	3.00%
2023	807	26,900	3.00%
2028	876	29,200	3.00%
2038	1,002	33,400	3.00%

Source: Coffman Associates analysis

FORECAST COMPARISON TO THE FAA TAF

The FAA will review the forecasts presented in this master plan for consistency with the *Terminal Area Forecast*. Typically, the local FAA Airport District Office (ADO) or Regional Airports Division (RO) are responsible for forecasting. When reviewing a sponsor's forecast, FAA must ensure that the forecast is based on reasonable planning assumptions, uses current data, and is developed using appropriate forecast methods. Forecasts of operations and based aircraft are considered consistent with the TAF if they differ by less than 10 percent in the five-year period and 15 percent in the 10-year forecast period. If the forecast is not consistent with the TAF, differences must be resolved if the forecast is to be used for FAA decision-making. **Table 2Q** presents the direct comparison of the master planning forecasts with the TAF published in January 2018.

The reason the FAA allows this differential is because the TAF forecasts are not meant to replace forecasts developed locally (i.e., in this Master Plan). While the TAF can provide a point of reference or comparison, their purpose is much broader in defining FAA national workload measures.

In examining the master plan and FAA TAF projections of itinerant operations, the master plan forecast differs from the TAF by 15.45 percent in the five-year forecast and 20.34 percent in the 10-year forecast. Thus, the master plan forecast of itinerant operations is not considered to be consistent with the FAA TAF; however, the master plan base year itinerant operations are estimated at a 10.76 percent difference from the TAF. The same is also true for the local and total operations forecasts selected for the master plan. For based aircraft, the TAF identifies a total of 86 based aircraft in 2018; however, the master planning effort identified 78 based aircraft at AMW from current based aircraft records obtained from the airport. As a result, the master plan base year count has a 6.61 percent difference from the TAF. Ultimately, the master plan based aircraft forecast decreases to 2.27 percent difference from the TAF in the 10-year forecast period and climbs to 10.42 percent difference in the 20-year forecast.

TABLE 2Q
Forecast Comparison to the *Terminal Area Forecast*
Ames Municipal Airport

	BASE YEAR	FORECAST			
	2018	**2023**	**2028**	**2038**	**CAGR 2018-2038**
Itinerant Operations					
Master Plan Forecast	24,932	26,900	29,200	33,400	1.47%
2018 FAA TAF	21,112	21,112	21,112	21,112	0.00%
% Difference	10.76%	15.45%	20.34%	27.96%	
Local Operations					
Master Plan Forecast	13,377	14,300	15,400	17,600	1.38%
2018 FAA TAF	12,639	12,639	12,639	12,639	0.00%
% Difference	3.75%	8.06%	12.71%	20.74%	
Total Operations					
Master Plan Forecast	38,309	41,200	44,600	51,000	1.44%
2018 FAA TAF	33,751	33,751	33,751	33,751	0.00%
% Difference	8.26%	12.83%	17.65%	25.41%	
Based Aircraft					
Master Plan Forecast	78	83	89	101	1.30%
2018 FAA TAF	86	86	86	86	0.00%
% Difference	6.61%	2.38%	2.27%	10.42%	

CAGR - Compound annual growth rate
Source: Coffman Associates analysis

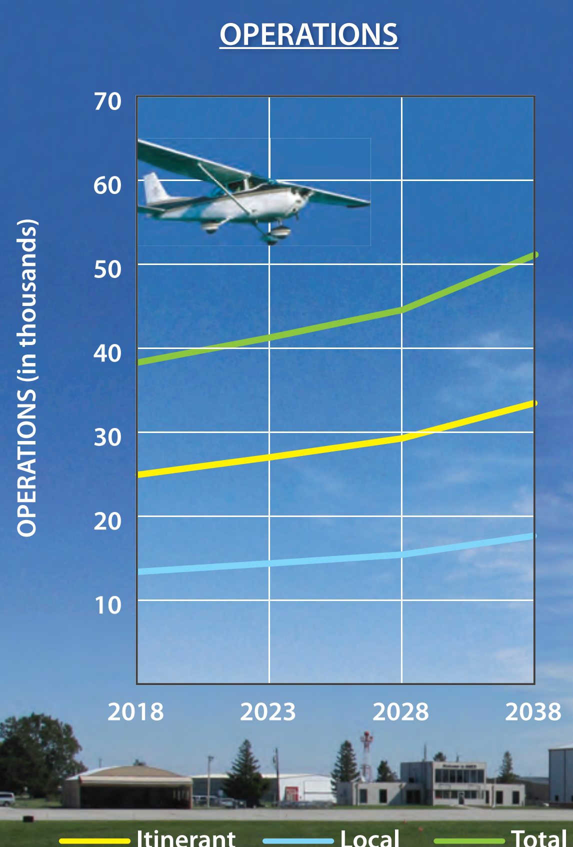
FORECAST SUMMARY

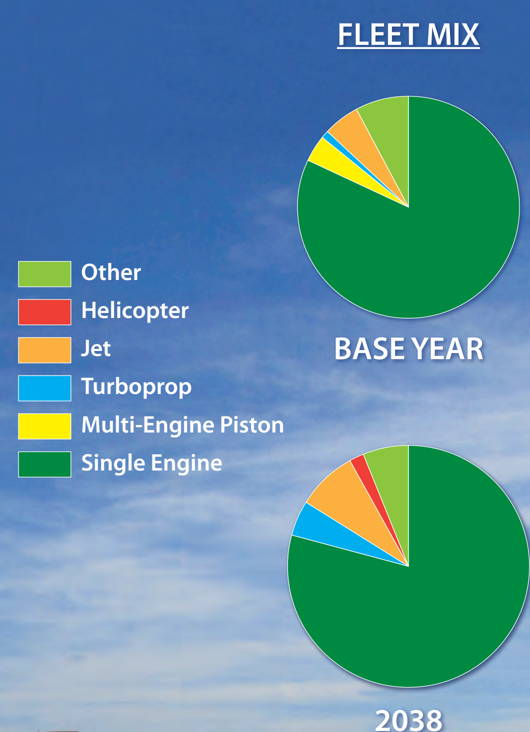
This section has provided demand-based forecasts of aviation activity at AMW over the next 20 years. An attempt has been made to define the projections in terms of short (1-5 years), intermediate (6-10 years), and long (11-20 years) term planning horizons. **Exhibit 2F** presents a 20-year forecast summary as previously detailed in this chapter. Elements such as local socioeconomic indicators, anticipated regional development, historical aviation data, and national aviation trends were all considered when determining future conditions.

AIRCRAFT/AIRPORT/RUNWAY CLASSIFICATION

The FAA has established several aircraft classification systems that group aircraft types based on their performance (approach speed in landing configuration) and design characteristics (wingspan and landing gear configuration). These classification systems are used to determine the appropriate airport design standards for specific airport elements, such as runways, taxiways, taxilanes, and aprons.

	BASE YEAR	2023	2028	2038
ANNUAL OPERATIONS				
Itinerant				
Air Carrier	-	-	-	-
Air Taxi	1,656	2,100	2,500	3,000
General Aviation	22,777	24,300	26,200	29,900
Military	499	500	500	500
Total Itinerant	*24,932*	*26,900*	*29,200*	*33,400*
Local				
General Aviation	13,377	14,300	15,400	17,600
Military	-	-	-	-
Total Local	*13,377*	*14,300*	*15,400*	*17,600*
TOTAL ANNUAL OPERATIONS	*38,309*	*41,200*	*44,600*	*51,000*
BASED AIRCRAFT				
Single Engine	64	67	71	80
Multi-Engine Piston	3	2	1	0
Turboprop	1	2	3	5
Jet	4	5	6	8
Helicopter	0	1	2	2
Other	6	6	6	6
BASED AIRCRAFT TOTAL	*78*	*83*	*89*	*101*
ANNUAL INSTRUMENT APPROACHES	*748*	*807*	*876*	*1,002*





AIRCRAFT CLASSIFICATION

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use, an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft type or, more commonly, is a composite aircraft representing a collection of aircraft with similar characteristics. The critical design aircraft is defined by three parameters: Aircraft Approach Category (AAC), Airplane Design Group (ADG), and Taxiway Design Group (TDG). FAA AC 150/5300-13A, *Airport Design*, describes the following airplane classification systems, the parameters of which are presented on **Exhibit 2G**.

Aircraft Approach Category (AAC): A grouping of aircraft based on a reference landing speed (V_{REF}), if specified, or if V_{REF} is not specified, 1.3 times stall speed (V_{SO}) at the maximum certificated landing weight. V_{REF}, V_{SO}, and the maximum certificated landing weight are those values as established for the aircraft by the certification authority of the country of registry.

The AAC generally refers to the approach speed of an aircraft in landing configuration. The higher the approach speed, the more restrictive the applicable design standards. The AAC, depicted by a letter A through E, is the aircraft approach category and relates to aircraft approach speed (operational characteristic). The AAC generally applies to runways and runway-related facilities, such as runway width, runway safety area (RSA), runway object free area (ROFA), runway protection zone (RPZ), and separation standards.

Airplane Design Group (ADG): The ADG, depicted by a Roman numeral I through VI, is a classification of aircraft which relates to aircraft wingspan or tail height (physical characteristic). When the aircraft wingspan and tail height fall in different groups, the higher group is used. The ADG influences design standards for taxiway safety area (TSA), taxiway object free area (TOFA), apron wingtip clearance, and various separation distances.

Taxiway Design Group (TDG): A classification of airplanes based on outer-to-outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance. The TDG relates to the undercarriage dimensions of the design aircraft. The taxiway design elements determined by the application of the TDG include the taxiway width, taxiway edge safety margin, taxiway shoulder width, taxiway fillet dimensions, and, in some cases, the separation distance between parallel taxiways/taxilanes. Other taxiway elements, such as the TSA, TOFA, taxiway/taxilane separation to parallel taxiway/taxilanes or fixed or movable objects, and taxiway/taxilane wingtip clearances, are determined solely based on the wingspan (ADG) of the design aircraft utilizing those surfaces. It is appropriate for taxiways to be planned and built to different TDG standards based on expected use.

Exhibit 2H presents the aircraft classification of the most common aircraft in operation today.

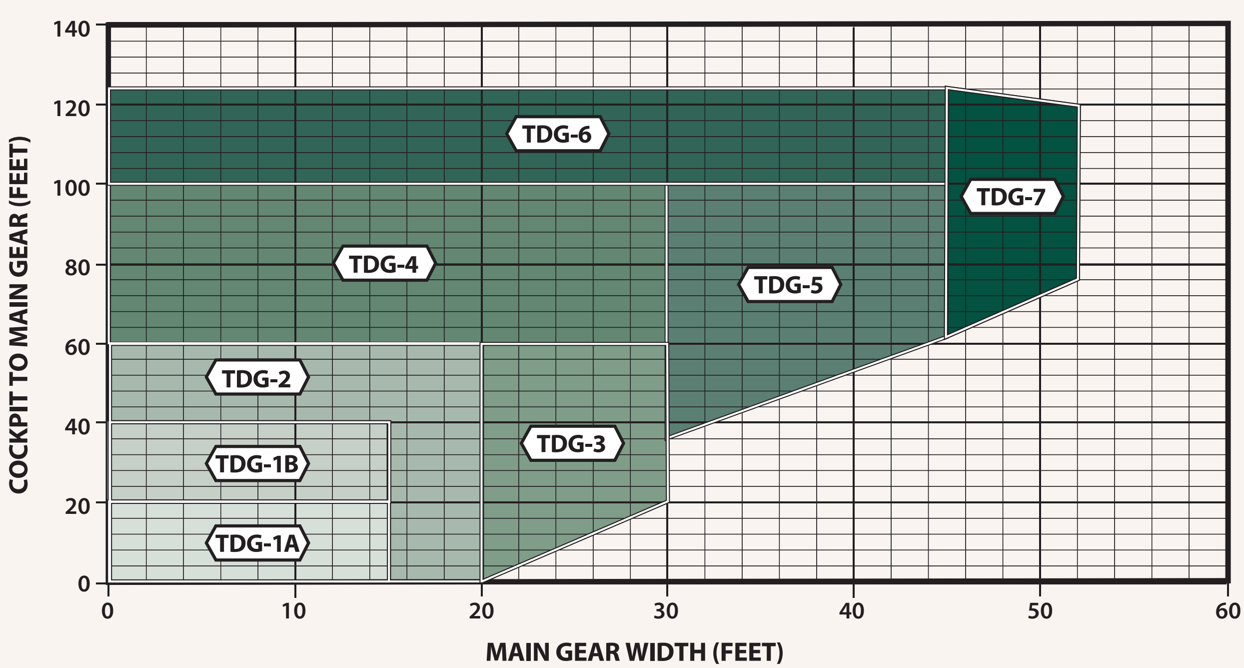
AIRCRAFT APPROACH CATEGORY (AAC)	
Category	**Approach Speed**
A	less than 91 knots
B	91 knots or more but less than 121 knots
C	121 knots or more but less than 141 knots
D	141 knots or more but less than 166 knots
E	166 knots or more

AIRPLANE DESIGN GROUP (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

VISIBILITY MINIMUMS	
RVR* (ft)	**Flight Visibility Category (statute miles)**
VIS	3-mile or greater visibility minimums
5,000	Not lower than 1-mile
4,000	Lower than 1-mile but not lower than ¾-mile
2,400	Lower than ¾-mile but not lower than ½-mile
1,600	Lower than ½-mile but not lower than ¼-mile
1,200	Lower than ¼-mile

***RVR**: Runway Visual Range

TAXIWAY DESIGN GROUP (TDG)



Source: FAA AC 150/5300-13A, Airport Design

A-I

- Beech Baron 55
- **Beech Bonanza**
- Cessna 150
- Cessna 172
- Cessna Citation Mustang
- Eclipse 500/550
- Piper Archer
- Piper Seneca

C-II, D-II

- **Cessna Citation X (750)**
- Gulfstream 100, 200,300
- Challenger 300/600
- ERJ-135, 140, 145
- CRJ-200/700
- Embraer Regional Jet
- Lockheed JetStar
- Hawker 800

B-I

- Beech Baron 58
- Beech King Air A90/100
- Cessna 402
- **Cessna 421**
- Piper Navajo
- Piper Cheyenne
- Swearingen Metroliner
- Cessna Citation I (525)

less than 100,000 lbs. C-III, D-III

- ERJ-170
- CRJ 705, 900
- Falcon 7X
- **Gulfstream 500**, 550, 650
- Global Express, Global 5000
- Q-400

B-II

- Super King Air 200
- Cessna 441
- DHC Twin Otter
- Super King Air 350
- **Cessna Caravan**
- Citation Excel (560), Sovereign (680)
- Falcon 50, 900, 2000
- **Citation Bravo (550)**
- Embraer 120

over 100,000 lbs. C-III, D-III

- ERJ-90
- Boeing Business Jet
- B-727
- **B-737**-300, **700,** 800
- MD-80, DC-9
- A319, A320

A-III, B-III

- DHC Dash 7
- **DHC Dash 8**
- DC-3
- Convair 580
- Fairchild F-27
- ATR 72
- ATP

C-IV, D-IV

- **B-757**
- B-767
- C-130 Hercules
- DC-8-70
- MD-11

C-I, D-I

- Beech 400
- **Lear** 31, **35,** 45, 60
- Israeli Westwind

D-V

- **B-747-400**
- B-777
- B-787
- A-330, A-340

Exhibit 2H
AIRCRAFT REFERENCE CODES

Note: Aircraft pictured is identified in bold type.

AIRPORT AND RUNWAY CLASSIFICATION

These classifications, along with the aircraft classifications defined previously, are used to determine the appropriate FAA design standards to which the airfield facilities are to be designed and built.

***Airport Reference Code (ARC)*:** An airport designation that signifies the airport's highest Runway Design Code (RDC), minus the third (visibility) component of the RDC. The ARC is used for planning and design only and does not limit the aircraft that may be able to operate safely on the airport. The current Airport Layout Plan (ALP) for AMW, which will be updated as part of this master planning effort, identifies an existing and future ARC of C-II.

Runway Design Code (RDC): A code signifying the design standards to which the runway is to be built. The RDC is based upon planned development and has no operational component.

The AAC, ADG, and runway visual range (RVR) are combined to form the RDC of a particular runway. The RDC provides the information needed to determine certain design standards that apply. The first component, depicted by a letter, is the AAC and relates to aircraft approach speed (operational characteristics). The second component, depicted by a Roman numeral, is the ADG and relates to either the aircraft wingspan or tail height (physical characteristics), whichever is most restrictive. The third component relates to the visibility minimums expressed by RVR values in feet of 1,200 (⅛-mile), 1,600 (¼-mile), 2,400 (½-mile), 4,000 (¾-mile), and 5,000 (1-mile). The RVR values approximate standard visibility minimums for instrument approaches to the runways. The third component should read "VIS" for runways designed for visual approach use only.

Approach Reference Code (APRC): A code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to landing operations. Like the RDC, the APRC is composed of the same three components: the AAC, ADG, and RVR. The APRC describes the current operational capabilities of a runway under particular meteorological conditions where no special operating procedures are necessary, as opposed to the RDC, which is based upon planned development with no operational component. The APRC for a runway is established based upon the minimum runway to taxiway centerline separation.

Currently, the runway to taxiway centerline separation for Runway 1-19 is 400 feet. Given that Runway 1 is served by precision instrument approach procedures with minimums not lower than ½-mile, Runway 1 meets standards for APRC D/IV/2400 and D/V/2400. Similarly, Runway 19 is served by non-precision instrument approaches with visibility minimums not lower than 1-mile. As such, Runway 19 meets standards for ARPC D/IV/5000 and D/V/5000.

The runway to taxiway centerline separation for Runway 13-31 is currently 250 feet and is served by non-precision instrument approaches with visibility minimums not lower than 1-mile to each end of the runway. Given these conditions, Runway 13-31 meets standards for APRC B/II/5000.

Departure Reference Code (DPRC): A code signifying the current operational capabilities of a runway and associated parallel taxiway with regard to takeoff operations. The DPRC represents those aircraft that can takeoff from a runway while any aircraft are present on adjacent taxiways, under particular meteorological conditions with no special operating conditions. The DPRC is similar to the APRC but is composed of two components: ACC and ADG. A runway may have more than one DPRC depending on the parallel taxiway separation distance.

The runway to taxiway centerline separation for Runway 1-19 is currently 400 feet which meets FAA design standards for DPRC D/IV and D/V, while the 250-foot taxiway centerline separation for Runway 13-31 meets FAA design standards for DPRC B/II.

CRITICAL DESIGN AIRCRAFT

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or are expected to use, an airport. The critical design aircraft is used to define the design parameters for an airport. The design aircraft may be a single aircraft or a composite aircraft representing a collection of aircraft classified by the three parameters: AAC, ADG, and TDG. In the case of an airport with multiple runways, a design aircraft is selected for each runway.

The first consideration is the safe operation of aircraft likely to use an airport. Any operation of an aircraft that exceeds design criteria of an airport may result in either an unsafe operation or a lesser safety margin; however, it is not the usual practice to base the airport design on an aircraft that uses the airport infrequently.

The design aircraft is defined as the most demanding aircraft type, in grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is 500 annual operations, excluding touch-and-go operations. Planning for future aircraft use is of high importance since the design standards are used to plan separation distances between facilities. These future standards must be considered now to ensure that short-term development does not preclude the reasonable long-range potential needs of the airport. Thus, if the critical design aircraft is anticipated to change within the near future, that aircraft (or family of aircraft) should be used as the current critical design aircraft.

According to FAA AC 150/5300-13A, *Airport Design*, "Airport designs based only on existing aircraft can severely limit the ability to expand the airport to meet future requirements for larger, more demanding aircraft. Airport designs that are based on large aircraft never likely to be served by the airport are not economical." Selection of the current and future critical design aircraft must be realistic in nature and supported by current data and realistic projections.

AIRPORT CRITICAL DESIGN AIRCRAFT

It is imperative to have an accurate understanding of what type of aircraft operate at the airport both now and in the future. The type of aircraft utilizing airport facilities can have a significant impact on numerous design criteria. Thus, an aircraft activity study by type and aircraft category can be beneficial in determining future airport standards that must be met in order to accommodate certain aircraft.

The FAA maintains the Traffic Flow Management System Count (TFMSC) database, which documents certain aircraft operations at airports. Information is added to the TFMSC database when pilots file flight plans and/or when flights are detected by the National Airspace System, usually via radar. It includes documentation of commercial traffic (air carrier and air taxi), general aviation, and military aircraft. Due to factors such as incomplete flight plans and limited radar coverage, TFMSC data does not account for all aircraft activity at an airport by a given aircraft type. Some VFR and non-enroute IFR traffic can be excluded. Therefore, it is likely that there are more operations at the airport than are captured by this methodology. TFMSC data is available for activity at AMW and was utilized in this analysis.

Exhibit 2J presents the TFMSC operational mix at the airport for turbine aircraft operations for the last 10 years. It should be noted, however, that the 2018 operational counts are through November of 2018. As can be seen, the airport experiences activity by a full range of business jets, including some of the largest in the national fleet.

In 2018, the greatest number of operations in any single design family was 976 in B-II. These accounted for approximately 50 percent of logged turbine aircraft activity. Over the 10-year period, the B-II design category has averaged approximately 730 annual operations. Representative aircraft in the category include several makes/models in the Cessna Citation and Falcon families. Furthermore, turbine aircraft in the B-I design category constituted approximately 27 percent of logged aircraft activity during 2018.

Overall, the most demanding aircraft to utilize the airport in terms of AAC were the Learjet 35/36 and larger business jets to include the Gulfstream 450 and 500/600 series. These aircraft fall within AAC D. The most demanding aircraft in terms of ADG to operate at the airport were the Gulfstream 500/600 series, Bombardier Global Express and Global 5000, and Falcon 7X/8X series, which fall in ADG III. Over the past 10 years, the airport has averaged 196 annual operations by aircraft in AAC C and D combined. **Exhibit 2J** further details the more demanding jet operations in AAC C and D and ADG III. It should be noted that the TFMSC database has identified limited operations by the Boeing 757-200, which has an ARC of C-IV, occurring at AMW. Given AMW's proximity to Des Moines International Airport, it is likely that these operations have been misidentified within the TFMSC database.

The 2010 ALP designates the existing ARC as C-II, which is based strictly upon the C-II category, or family of similar aircraft, as opposed to identifying a specific critical aircraft. Based upon the TFMSC analysis, as well as based aircraft records, category C-II is not currently the most demanding ARC/RDC designation for AMW per FAA regular use operational threshold standard. It should be noted that B-II category aircraft are currently based at AMW, including a Beechcraft King Air 300 and multiple variants of the Cessna Citation. According to operational data captured by the TFMSC, the most frequent B-II aircraft operating at AMW include the King Air 200/300/350 and the Citation XLS. Combined, these aircraft conducted 536 operations in 2017 and 478 operations through November 2018. The King Air 200, 300, and 350 are all classified within TDG 2 due to the dimensions of the undercarriage of the aircraft. Based purely upon operational counts, the existing design aircraft is best described as B-II-2. However, larger business jets such as the Hawker 800 and the Challenger 600 as well as regional transport aircraft including the

Canadair CRJ 100 / 200 / 700 and Embraer ERJ 120 / 135 / 145 have also been identified operating at AMW. These operations are likely associated with the ISU Research Park and ISU (or competing universities) in transporting students, athletic teams, etc. Through November 2018, aircraft larger than ARC B-II totaled 196 operations. While operations larger than ARC C-II do not currently meet the operational threshold of 500, AMW has historically been planned to an ARC of C-II as evidenced within the current approved ALP and IASP.

RUNWAY DESIGN CODE

Once the critical aircraft has been identified, a resulting RDC is assigned to each runway at an airport. The RDC relates to specific FAA design standards that should be planned in relation to each runway, regardless of whether or not the airport currently meets the appropriate design standards (to be discussed in Chapter Three).

Runway 1-19

Runway 1-19 is the primary runway at AMW and measures 5,701 feet long by 100 feet wide and has a precision instrument approach procedure providing visibility minimums as low as ½-mile for Runway 1. According to the TFMSC data, operations by aircraft in AAC B and ADG II have exceeded the 500 annual operations threshold. Based upon current activity levels, the airport is best classified as ARC B-II; however, the airport has long been planned to ARC C-II standards. Additionally, the aviation demand forecasts indicate the potential for continued growth in turbine activity at the airport. This includes eight based jets and five turboprops by the long-term planning horizon. The type and size of business jets and turboprops using the airport regularly can impact the design standards to be applied to the runway system. Therefore, it is important to understand what type of aircraft may use the airport in the future. Factors such as population and employment growth in the airport service area, the proximity and level of service of other regional airports, and development at the airport can influence future activity. Therefore, **this master plan will utilize an existing RDC of B-II-2400 and ultimate RDC of C-II-2400 for Runway 1-19**.

Runway 13-31

Runway 13-31 is the crosswind runway, which is 3,491 feet long and 75 feet wide. It is also provided with an instrument approach procedure that allows for visibility minimums as low as one mile. The runway is designed to meet minimum requirements for AAC B aircraft that utilize the airport as Runway 1-19 does not meet FAA wind coverage requirements for crosswind components up to 13 knots (to be discussed in Chapter Three). Given these characteristics, **the existing RDC for Runway 13-31 is B-II-5000**. Previous planning, including the 2008 master plan and currently approved 2010 ALP, call for an ultimate B-II designation for Runway 13-31. Given the significant number of operations at the airport that fall within the B-II category, **this planning effort will maintain the future RDC for Runway 13-31 as B-II-5000**.

ARC	Aircraft	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
A-I	Cirrus Vision Jet	0	0	0	0	0	0	0	2	0	0
	Diamond DA 20/40/Twinstar	0	2	0	0	0	0	0	0	0	0
	Eclipse 400/500	2	2	2	2	4	8	0	2	4	4
	Kodiak Quest	0	0	0	0	0	0	4	4	0	0
	Lancair 4	4	0	0	0	0	0	0	0	0	0
	Lancair Evolution/Legacy	0	0	0	0	0	2	0	0	2	0
	Piper Malibu/Meridian	14	34	6	16	22	24	16	24	22	14
	Socata TBM 7/850/900	60	64	64	56	30	50	72	68	60	80
	TOTAL	**80**	**102**	**72**	**74**	**56**	**84**	**92**	**100**	**88**	**98**
A-II	Cessna Caravan	0	0	2	0	0	2	6	0	0	0
	De Havilland Twin Otter	0	0	0	0	0	0	0	2	0	0
	Pilatus PC-12	14	32	70	36	34	38	20	6	48	90
	TOTAL	**14**	**32**	**72**	**36**	**34**	**40**	**26**	**8**	**48**	**90**
B-I	Beechjet 400	166	154	176	126	134	106	160	120	144	162
	Cessna 425 Corsair	10	14	12	6	16	12	32	26	18	20
	Citation CJ1	130	156	160	194	184	164	156	148	176	146
	Citation I/SP	16	4	20	10	16	2	10	6	2	12
	Citation M2	0	0	0	0	0	0	0	0	0	4
	Citation Mustang	20	28	8	12	8	10	10	10	154	122
	Falcon 10	12	8	0	4	0	2	4	0	0	6
	Hawker 1000	0	0	0	0	0	2	0	0	0	0
	Honda Jet	0	0	0	0	0	0	0	0	0	2
	King Air 90/100	72	134	88	108	42	86	52	46	56	38
	L-39 Albatross	0	0	0	0	0	0	0	0	6	0
	Mitsubishi MU-2	6	10	6	2	8	4	4	4	6	6
	Phenom 100	0	2	2	10	4	18	14	6	0	0
	Piaggio Avanti	6	8	0	4	4	2	2	0	0	2
	Piper Cheyenne	38	42	10	32	18	38	36	34	24	2
	Premier 1	0	4	6	2	0	10	12	12	10	4
	Rockwell Sabre 40/60	4	6	0	2	0	0	0	0	8	0
	TOTAL	**480**	**570**	**488**	**512**	**434**	**456**	**492**	**412**	**604**	**526**
B-II	Aero Commander 690	2	2	0	6	4	0	0	0	4	0
	BAe Jetstream	0	2	4	0	0	0	0	0	0	0
	Beech 1900	0	0	0	0	0	0	4	0	0	4
	Cessna Conquest	2	2	24	30	78	18	34	32	30	40
	Challenger 300	6	24	26	38	44	10	36	36	50	90
	Citation CJ2/CJ3/CJ4	10	38	58	56	26	54	78	42	52	52
	Citation II/SP/Latitude	46	22	70	34	26	44	28	34	32	70
	Citation V/Sovereign	32	34	44	50	70	68	58	46	74	56
	Citation X	20	16	16	22	16	24	36	30	42	22

ARC	Aircraft	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
B-II	Citation XLS	48	28	42	20	40	52	40	90	254	200
	Dornier 328	116	96	76	84	78	48	60	64	70	80
	Embraer EMB-110/120	0	6	14	4	0	0	6	2	10	2
	Falcon 20/50	10	18	22	8	10	20	8	8	22	6
	Falcon 2000	8	8	8	14	10	2	12	10	40	8
	Falcon 900	8	4	4	24	10	28	16	18	24	18
	Hawker 4000	2	2	2	6	0	0	2	0	0	0
	King Air 200/300/350	204	294	260	234	272	334	296	282	282	278
	King Air F90	2	0	0	0	0	4	16	4	4	4
	Phenom 300	0	0	0	10	2	6	24	18	52	38
	Saab 340	4	0	0	6	0	0	0	0	0	4
	Swearingen merlin	4	4	0	4	0	0	0	0	0	4
	TOTAL	**524**	**600**	**670**	**650**	**686**	**712**	**754**	**716**	**1042**	**976**
B-III	Bombardier Global Express	2	0	0	0	0	0	0	0	0	0
	Falcon 7X/8X	0	0	0	0	0	0	0	0	0	6
	Saab 2000	0	0	4	16	36	52	54	66	20	42
	TOTAL	**2**	**0**	**4**	**16**	**36**	**52**	**54**	**66**	**20**	**48**
C-I	BAe HS 125 Series	0	0	2	0	0	0	0	0	4	0
	Learjet 20 Series	0	0	4	0	0	0	2	0	0	0
	Learjet 31	4	10	6	4	2	12	0	0	4	8
	Learjet 40 Series	18	20	82	90	56	88	82	78	48	40
	Learjet 50 Series	10	0	4	0	0	0	0	0	0	4
	Learjet 60 Series	2	12	16	14	20	14	20	8	16	8
	Westwind II	2	6	30	0	4	6	4	0	0	0
	TOTAL	**36**	**48**	**144**	**108**	**82**	**120**	**108**	**86**	**72**	**60**
C-II	Bombardier CRJ 100/200/700	0	0	0	0	0	2	4	0	0	0
	Challenger 600/604	26	26	44	22	8	6	10	14	12	6
	Citation III/VI	6	6	0	0	8	10	2	10	0	8
	Embraer 500/450 Legacy	0	0	0	0	0	0	0	0	0	2
	Embraer ERJ-135/140/145	0	0	2	10	0	12	16	20	38	34
	Gulfstream 100/150	0	6	2	4	4	0	2	2	10	14
	Gulfstream 280	0	0	0	0	0	0	0	8	2	6
	Gulfstream G100	4	2	4	6	2	0	12	6	0	0
	Hawker 800	18	36	36	40	52	64	62	60	32	22
	Learjet 70 Series	0	0	0	0	0	0	2	10	0	8
	TOTAL	**54**	**76**	**88**	**82**	**74**	**94**	**110**	**130**	**94**	**100**
C-III	P-3 Orion	0	0	2	0	0	0	0	0	0	0
	TOTAL	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
C-IV	Boeing 757-200	4	10	12	0	0	0	0	0	0	0
	TOTAL	**4**	**10**	**12**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Exhibit 2J
OPERATIONS BY REFERENCE CODE

ARC	Aircraft	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
D-I	Learjet 35/36	14	2	16	10	4	12	8	8	2	4
	T-38 Talon	0	0	0	0	0	2	0	0	0	0
	TOTAL	0	0	0	0	0	2	0	0	0	0
D-II	Gulfstream 200	6	12	2	6	8	8	10	6	6	16
	Gulfstream 450	0	10	10	2	4	2	4	0	6	10
	TOTAL	6	22	12	8	12	10	14	6	12	26
D-III	Gulfstream 500/600	2	4	2	0	0	6	4	2	8	10
	TOTAL	2	4	2	0	0	6	4	2	8	10
E-I	F-16 Falcon/Viper	0	0	0	2	2	0	0	0	0	0
	TOTAL	0	0	0	2	2	0	0	0	0	0

AIRPORT REFERENCE CODE (ARC) SUMMARY

ARC	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
A-I	80	102	72	74	56	84	92	100	88	98
A-II	14	32	72	36	34	40	26	8	48	90
B-I	480	570	488	512	434	456	492	412	604	526
B-II	524	600	670	650	686	712	754	716	1042	976
B-III	2	0	4	16	36	52	54	66	20	48
C-I	36	48	144	108	82	120	108	86	72	60
C-II	54	76	88	82	74	94	110	130	94	100
C-III	0	0	2	0	0	0	0	0	0	0
C-IV	4	10	12	0	0	0	0	0	0	0
D-I	0	0	0	0	0	2	0	0	0	0
D-II	6	22	12	8	12	10	14	6	12	26
D-III	2	4	2	0	0	6	4	2	8	10
E-I	0	0	0	2	2	0	0	0	0	0
TOTAL	1202	1464	1566	1488	1416	1576	1654	1526	1988	1934

APPROACH CATEGORY

AC	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
A	94	134	144	110	90	124	118	108	136	188
B	1006	1170	1162	1178	1156	1220	1300	1194	1666	1550
C	94	134	246	190	156	214	218	216	166	160
D	8	26	14	8	12	18	18	8	20	36
E	0	0	0	2	2	0	0	0	0	0
TOTAL	1202	1464	1566	1488	1416	1576	1654	1526	1988	1934

DESIGN GROUP

DG	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018*
I	596	720	704	696	574	662	692	598	764	684
II	598	730	842	776	806	856	904	860	1196	1192
III	4	4	8	16	36	58	58	68	28	58
IV	4	10	12	0	0	0	0	0	0	0
TOTAL	1202	1464	1566	1488	1416	1576	1654	1526	1988	1934

AIRPORT DESIGN SUMMARY

Table 2R summarizes the design aircraft components to be applied at the airport. Besides the RDC, the APRC and DPRC are also noted for each runway.

TABLE 2R
Design Aircraft Parameters
Ames Municipal Airport

Runway Design Parameters	Runway Design Code (RDC)	Approach Reference Code (APRC)	Departure Reference Code (DPRC)
Existing			
Runway 1-19 (400' runway/taxiway separation)	B-II-2400	D/IV/2400 D/V/2400	D/IV D/V
Runway 13-31 (250' runway/taxiway separation)	B-II- 5000	B/II/5000	B/II
Ultimate			
Runway 1-19 (400' runway/taxiway separation)	C-II-2400	D/IV/2400 D/V/2400	D/IV D/V
Runway 13-31 (250' runway/taxiway separation)	B-II- 5000	B/II/5000	B/II

Source: FAA AC 150/5300-13A, Change 1, *Airport Design*

SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the next 20 years at AMW. **Exhibit 2F** presents a summary of the aviation demand forecasts. The baseline year for forecast data is 2018, and the forecasting effort extends 20 years to 2038.

Forecasts of aviation activity, including based aircraft and annual aircraft operations, are key to determining future facility requirements. There are currently 78 aircraft based at the airport, and this is forecast to grow to 101 aircraft by 2038. The airport experienced an estimated 38,309 operations in 2018, which are forecast to grow to approximately 51,000 annual operations by 2038.

The fleet mix operations, or type and frequency of aircraft use, is important in determining facility requirements and environmental impacts. While single engine piston-powered aircraft are expected to represent most based aircraft, the long-term forecast considers increasing the number of turboprop and jet aircraft, as well as helicopters, in the fleet mix.

The next step in the master plan process is to use the forecasts to determine development needs for the airport through 2038. Chapter Three will address airside elements, such as safety areas, runways, taxiways, lighting, and navigational aids, as well as landside requirements, including hangars, aircraft aprons, and support services. The remaining portions of the master plan will lay out how potential development can be accommodated in an orderly, efficient, and cost-effective manner.

CITY OF
Ames

AMES MUNICIPAL AIRPORT

CHAPTER 3

FACILITY REQUIREMENTS

AMES MUNICIPAL AIRPORT

CHAPTER THREE

FACILITY REQUIREMENTS

To properly plan for the future of Ames Municipal Airport (AMW), it is necessary to identify specific types and quantities of facilities required or desired to adequately serve the airport over the next 20 years. Facilities are broadly classified as airside (i.e., runways, taxiways, navigational aids, marking and lighting) and landside (i.e., hangars, aircraft parking apron, and support facilities). There are four primary sources from which to examine and determine facility requirements:

- *Aviation Demand Forecasts*: The forecasts of aviation demand developed in the previous chapter serve as data inputs to various models, which have been constructed following Federal Aviation Administration (FAA) guidance, to generate facility needs.
- *Design Standards Review*: Various design standards that apply to the airport are reviewed as they can change based on modifications to FAA guidance or activity changes at the airport. Design standards primarily relate to the numerous safety-related imaginary surfaces and separation distances.
- *Facility Maintenance*: Airports are required to maintain their pavement surfaces for the useful life of those pavements. The pavements require routine maintenance and occasionally must be rehabilitated or reconstructed. This category includes maintenance of airport structures and landside facilities.
- *Support Facilities*: This category includes all airport related facilities that do not naturally fall into the airside and landside categories, including elements such as fuel facilities, access and circulation, and general on-airport land use.

The objective of this effort is to identify the adequacy of existing airport facilities and outline what new facilities may be needed, and when these may be needed, to accommodate forecast demands. Having established these facility requirements, alternatives for providing these facilities will be evaluated in the next chapter.

The facility requirements at AMW were evaluated using guidance contained in several FAA publications, including the following:

- Advisory Circular (AC) 150/5300-13A, *Airport Design*
- AC 150/5060-5, *Airport Capacity and Delay*
- AC 150/5325-4B (and Draft 4C), *Runway Length Requirements for Airport Design*
- Title 14 Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace*
- FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*

PLANNING HORIZONS

An updated set of aviation demand forecasts for AMW has been established. These activity forecasts include annual operations, based aircraft, based aircraft and operational fleet mix, and operational peaking characteristics. With this information, specific components of the airfield and landside system can be evaluated to determine their capacity to accommodate future demand.

Cost-effective, efficient, and orderly development of an airport should rely more upon actual demand at an airport than on a time-based forecast figure. In order to develop a master plan that is demand-based rather than time-based, a series of planning horizon milestones has been established for the airport that takes into consideration the reasonable range of aviation demand projections. The planning horizons for the master plan are the short term (years 1-5), intermediate term (years 6-10), and long term (years 11-20).

It is important to consider that the actual activity at the airport will not follow a straight line as tends to be presented in forecast projections. More commonly, aviation activity will be higher or lower than what the annualized forecast portrays. By planning according to activity milestones, the resultant plan can accommodate unexpected shifts or changes in the area's aviation demand by allowing airport management the flexibility to make decisions and develop facilities according to need generated by actual demand levels, not based solely on dates in time. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to demand at any given time over the planning period. The resultant plan provides airport management with a financially responsible and needs-based program. **Table 3A** presents the short, intermediate, and long-term planning horizon milestones for each aircraft activity level forecasted in Chapter Two.

TABLE 3A
Planning Horizon Activity Summary
Ames Municipal Airport

	Base Year (2018)	Short Term (1-5 years)	Intermediate Term (6-10 years)	Long Term (11-20 years)
BASED AIRCRAFT				
Single Engine Piston	64	67	71	80
Multi-Engine Piston	3	2	1	0
Turboprop	1	2	3	5
Jet	4	5	6	8
Helicopter	0	1	2	2
Other	6	6	6	6
Total Based Aircraft	**78**	***83***	***89***	***101***
ANNUAL AIRCRAFT OPERATIONS*				
Itinerant	24,932	26,900	29,200	33,400
Local	13,377	14,300	15,400	17,600
Total Operations	**38,309**	**41,200**	**44,600**	**51,000**
ANNUAL INSTRUMENT APPROACHES				
Annual Estimate	748	807	876	1,002
PEAKING CHARACTERISTICS				
Peak Month	3,831	4,120	4,460	5,100
Design Day	124	133	144	165
Busy Day	154	166	180	206
Design Hour	19	20	22	25

* Rounded to the nearest 100.
Source: ATCT records; Coffman Associates analysis

AIRPORT DESIGN STANDARDS

The selection of appropriate FAA design standards for the development and location of airport facilities is based primarily upon the characteristics of the aircraft which are currently using, or expected to use, the airport. Based strictly upon Traffic Flow Management System Counts (TFMSC), the critical aircraft discussion in Chapter Two identified the existing critical aircraft family as aircraft approach category (AAC) B and airplane design group (ADG) II, creating an airport reference code (ARC) of B-II. However, AMW has historically been planned to ARC C-II standards and will be maintained as such. This is largely due to the large business jet and regional transport aircraft that currently utilize AMW. In the future, it is expected that the airport will continue to support ARC C-II as larger, more sophisticated aircraft are forecast to base and operate at AMW over the planning horizon.

Since the previous master planning effort in 2008, the FAA published FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, which replaced the previous Airport Design AC, which was in its 19th Change. The new AC presents several substantial design changes, including the introduction of the Runway Design Code (RDC) and Taxiway Design Group (TDG) (discussed in Chapter Two), in addition to changes to revised standards for taxiway design and runway protection zones (RPZs). More recently, in February 2014, the FAA published AC 150/5300-13A, Change 1, *Airport Design*, which provides additional changes and clarifications to various airport design standards. The following sections provide details on the content in AC 150/5300-13A, Change 1, *Airport Design*.

STATE OF IOWA FACILITY OBJECTIVES

As noted in Chapter One, the Iowa Department of Transportation (IDOT) – Aviation Bureau completed the *Iowa Aviation System Plan* (2010-2030) (IASP). As a part of that study, all state airports were classified into distinctive groupings based on key factors. The study classified AMW as an Enhanced Service Airport. **Table 3B** presents the system goals and performance measures, as well as generalized objectives for enhanced service airports as outlined in the state plan. The table also depicts the state plan's assessment of AMW based on the specific goals and objectives outlined in the plan.

TABLE 3B
Facility and Service Target
IASP - Commercial/Enhanced Service Airports

Airport Criteria	Minimum Objectives	Meets Objective
AIRSIDE		
Airport Reference Code	C-II minimum	Yes
Runway Length	5,000 feet minimum	Yes
Runway Width	100 feet minimum	Yes
Taxiway	Full parallel	Yes
Instrument Approach	Vertical guidance	Yes
Runway Lighting	Medium Intensity Runway Lights (MIRL)	Yes
Taxiway Lighting	Medium Intensity Taxiway Lights (MITL)	Yes
Visual Guidance Slope Indicator	Both runway ends (or Instrument Landing System [ILS])	Yes
Runway End Identification Lights	Both runway ends (or ILS)	No
Rotating Beacon	Yes	Yes
Wind Indicator	Yes (lighted) and supplemental as needed	Yes
RCO Facilities	ATCT or RCO as needed	NA
Weather Reporting Aids	Yes (e.g., AWOS, ASOS)	Yes
Wind Coverage	95% combined coverage	Yes
LANDSIDE		
Covered Storage	100% of based aircraft	No
Overnight Transient Storage	Yes - Based on demand	Yes
Aircraft Apron	100% of daily average transients	No
Terminal/Admin Building	Yes	Yes
Paved Entry/Parking Lot	Yes	Yes
SERVICES		
Fuel Availability	100LL & Jet A (24-hour)	Yes
Attendance	Standard business hours. After hours on-call.	Yes
Ground Transportation	Courtesy car/rental car	Yes
Food & Beverage	Vending	Yes
Fixed Base Operator (FBO) Facility	Pilot lounge, flight planning, flight training, rental aircraft, aircraft maintenance, charter aircraft	Yes
Snow Removal	Yes	Yes
PLANNING		
Height Zoning	Yes	Yes
Comp Plan Define Land Uses	Yes	Yes
Emergency Plan	Yes	Yes
Airport Layout Plan	Updated within last eight years	Yes

ATCT: Air Traffic Control Tower
AWOS/ASOS: Automated Weather Observation System/Automated Surface Observation System
FBO: Fixed Base Operator
RCO: Remote Communications Outlet
Source: IASP - Iowa Aviation System Plan 2010-2030

As presented in the IASP, the airport layout and available services meet the minimum recommendations in the IASP for all criteria except for runway end identification lights (REILs) serving Runway 19, availability of hangars to house 100 percent of based aircraft, and availability of apron areas to meet 100 percent of average daily transient traffic.

AIRFIELD CAPACITY AND DELAY

Airfield capacity is measured in a variety of different ways. The **hourly capacity** of a runway measures the maximum number of aircraft operations that can take place in an hour. The **annual service volume** (ASV) is an annual level of service that may be used to define airfield capacity needs and is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year without incurring significant delay factors. **Aircraft delay** is the total delay incurred by aircraft using the airfield during a given timeframe. The FAA AC 150/5060-5, *Airport Capacity and Delay*, provides a methodology for examining the operational capacity of an airfield for planning purposes.

FACTORS AFFECTING ANNUAL SERVICE VOLUME

This analysis takes into account specific factors about the airfield, such as airfield layout, weather conditions, aircraft mix, and operations in order to calculate the airport's ASV. These factors are depicted in **Exhibit 3A**. The following describes the input factors as they relate to AMW.

- **Runway Configuration –** The existing runway configuration consists of a crosswind runway system supported by a full-length parallel taxiway on each runway. Primary Runway 1-19 is 5,701 feet long and the crosswind Runway 13-31 is 3,491 feet long.

- **Runway Use –** Runway use in capacity conditions will be controlled by wind and/or airspace conditions. The direction of takeoffs and landings are generally determined by wind direction. It is generally safest for aircraft to take off and land into the wind in order to avoid crosswind (wind that is blowing perpendicular to the travel of the aircraft) or tailwind components. Based upon information from the airport's automated surface observation system (ASOS), winds favor the use of Runway 31 most often. It should be noted, however, that Runway 1 is listed as the calm wind runway.

  The availability of instrument approaches is also considered. Each end of Runways 1-19 and 13-31 are served by straight-in instrument approach procedures. While Runways 19, 13, and 31 are served by non-precision instrument approach minimums of not lower than 1-mile, Runway 1 is served by precision instrument approach minimums of not lower than ½-mile. The airport is also served by circling approaches.

- **Exit Taxiways –** Exit taxiways have a significant impact on airfield capacity since the number and location of exits directly determine the occupancy time of an aircraft on the runway. The greater the number of taxiway exits that are appropriately spaced, the lower the runway occupancy time

AIRFIELD LAYOUT

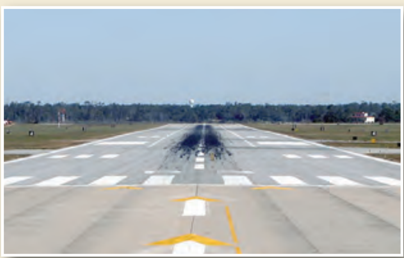
Runway Configuration

Runway Use

Number of Exits

WEATHER CONDITIONS

VMC
Visual Meteorological Conditions



IMC
Instrument Meteorological Conditions

PVC
Poor Visibility Conditions

AIRCRAFT MIX

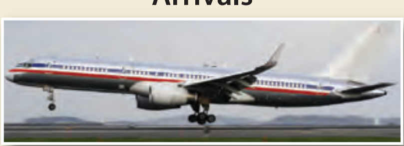
Category A & B Aircraft

Category C Aircraft

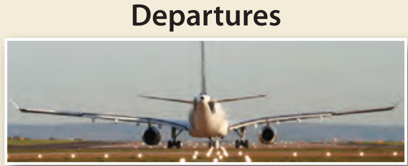
Category D Aircraft

OPERATIONS

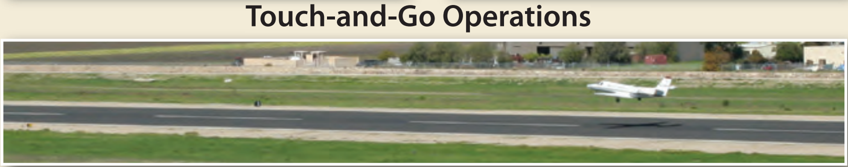
Arrivals



Departures



Touch-and-Go Operations



Total Annual Operations

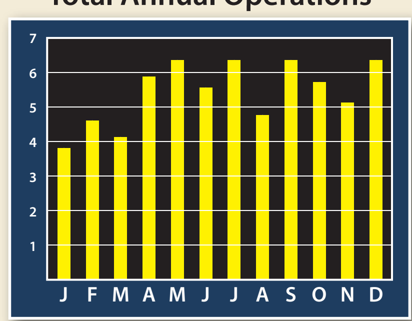


Exhibit 3A
AIRFIELD CAPACITY FACTORS

for an aircraft, which contributes to a higher overall capacity for the airfield. The airfield capacity analysis gives credit to taxiway exits located within the prescribed range from a runway's threshold. This range is based upon the mix index of the aircraft that use the runways. For AMW, exit taxiways located between 2,000 and 4,000 feet from the landing threshold count in the capacity determination. The exits must be at least 750 feet apart to count as separate exits. Under these criteria, Runway 1-19 is credited with one taxiway exit. Including the threshold taxiways, Runway 13 is credited with one taxiway exit, while Runway 31 is credited with two.

- **Weather Conditions –** Weather conditions can have a significant impact on airfield capacity. Airport capacity is usually highest in clear weather, when flight visibility is at its best. Airfield capacity is diminished as weather conditions deteriorate and cloud ceilings and visibility are reduced. As weather conditions deteriorate, the spacing of aircraft must increase to provide allowable margins of safety and air traffic vectoring. The increased distance between aircraft reduces the number of aircraft which can operate at the airport during any given period, thus reducing overall airfield capacity.

  According to meteorological data collected from the ASOS, the airport reported visual flight rule (VFR) conditions a majority of the time, with 81.18 percent of total observations. VFR conditions exist whenever the cloud ceiling is greater than or equal to 1,000 feet above ground level (AGL) and visibility is greater than three statute miles. Instrument flight rule (IFR) conditions are defined when cloud ceilings are between 500 and 1,000 feet AGL or visibility is between one and three miles. According to on-site reporting, IFR conditions accounted for 11.88 percent of total weather observations. Poor visibility conditions (PVC) apply for cloud ceilings below 500 feet and visibility minimums below one mile. PVC constituted 6.94 percent of total observations over the 10-year timeframe. **Table 3C** summarizes the weather conditions experienced at the airport over a 10-year period.

TABLE 3C
Weather Conditions
Ames Municipal Airport

Condition	Cloud Ceiling	Visibility	Percent of Total
VMC	> 1,000' AGL	> 3 statute miles	81.18%
IMC	≥ 500' AGL and ≤ 1,000' AGL	1-3 statute miles	11.88%
PVC	< 500' AGL	< 1 statute mile	6.94%

VMC - Visual Meteorological Conditions   PVC - Poor Visibility Conditions
IMC - Instrument Meteorological Conditions   AGL - Above Ground Level
Source: National Oceanic and Atmospheric Administration (NOAA) - National Climatic Data Center. Airport observations from January 2009 – December 2018.

- **Aircraft Mix –** The aircraft mix for the capacity analysis is defined in terms of four aircraft classes based upon weight. Classes A and B consist of small- and medium-sized propeller-driven aircraft and some smaller business jets, all weighing 12,500 pounds or less. These aircraft are associated primarily with general aviation activity, but do include some air taxi, air cargo, and commuter aircraft. Class C consists of aircraft weighing between 12,500 pounds and 300,000 pounds. These aircraft include most business jets and some turboprop aircraft. Class D consists of large aircraft weighing more than 300,000 pounds. These aircraft are associated with major airline and air cargo activities, and include the Boeing 747 and 777, among others. The airport does not currently nor is it expected to experience operations by Class D aircraft.

For the capacity analysis, the percentage of Class C aircraft operating at AMW is critical in determining the ASV as this class includes the larger and faster aircraft in the operational mix. Based upon an analysis of the FAA's TFMSC, operations by Class C aircraft make up approximately three percent of AMW's annual aircraft operations. The percentage of Class C aircraft operations at the airport is expected to increase through the planning period as business and corporate use of jets and turboprop aircraft increases.

- **Percent Arrivals vs. Departures –** The aircraft arrival/departure split is typically 50/50 in the design hour. At AMW, traffic information indicated no major deviation from this pattern.

- **Touch-And-Go Activity –** A touch-and-go operation involves an aircraft making a landing and then an immediate takeoff without coming to a full stop or exiting the runway. As previously discussed in Chapter Two, these operations are normally associated with general aviation training activity and classified as a local operation. A high percentage of touch-and-go traffic normally results in a higher operational capacity because one landing and one takeoff occurs within a shorter time period than individual operations. Touch-and-go operations at AMW account for approximately 35 percent of total annual operations. A similar ratio is expected in the future.

- **Peak Period Operations –** For the airfield capacity analysis, average daily operations and average peak hour operations during the peak month are utilized. Typical operations activity is important in the calculation of an airport's ASV as "peak demand" levels occur sporadically. The peak periods used in the capacity analysis are representative of normal operational activity and can be exceeded at various times throughout the year.

AIRFIELD CAPACITY SUMMARY

Given the factors outlined above, the airfield's ASV will range between 200,000 and 230,000 annual operations. The ASV does not indicate a point of absolute gridlock for the airfield; however, it does represent the point at which operational delay for each aircraft operation will increase exponentially.

It is estimated that AMW experienced approximately 38,309 annual operations in 2018. This operational level for the airport represents approximately 19 percent of the airfield's ASV, if the ASV is considered at the low end of the typical range of 200,000 annual operations. By the end of the long-term planning period, total annual operations are expected to represent approximately 26 percent of the airfield's ASV.

FAA Order 5090.3B, *Field Formulation of the National Plan of Integrated Airport Systems* (NPIAS), indicates that improvements for airfield capacity purposes should begin to be considered once operations reach 60 to 75 percent of the annual service volume. This is an approximate level to begin the detailed planning of capacity improvements. At the 80 percent level, the planned improvements should be made.

While no significant capacity improvements will be necessary, options to improve airfield efficiency will still be considered in the master plan.

AIRSIDE FACILITY REQUIREMENTS

As indicated earlier, airport facilities include both airside and landside components. Airside facilities are those related to the arrival, departure, and ground movement of aircraft. The FAA has established various dimensional design standards related to the airfield to ensure the safe operations of aircraft. The FAA design standards impact the design of each of the airside components to be analyzed. The following airside components are analyzed for compliance to FAA design standards in detail:

- Runway Elements
- Runway Design Standards
- Taxiways
- Navigational and Approach Aids
- Airfield Lighting and Signage

RUNWAY ELEMENTS

In this chapter, the adequacy of the existing runway system at AMW will be analyzed from a number of perspectives related to adherence to safety area standards. From this information, requirements for runway improvements are determined for the airport. Runway elements such as orientation, length, width, and strength are now presented.

Runway Orientation

For the operational safety and efficiency of an airport, it is desirable for the primary runway to be oriented as close as possible to the direction of the prevailing wind. This reduces the impact of wind components perpendicular to the direction of travel of an aircraft that is landing or taking off. For AMW, Runways 1-19 and 13-31 are orientated in a crosswind configuration. Primary Runway 1-19 is oriented in a north-northeast/south-southwest manner, while crosswind Runway 13-31 is oriented in a northwest/southeast manner.

FAA AC 150/5300-13A, *Airport Design,* recommends that a crosswind runway be made available when the primary runway orientation provides for less than 95 percent wind coverage for specific crosswind components. The 95 percent wind coverage is based on the crosswind component not exceeding 10.5 knots (12 mph) for Runway Design Code (RDC) A-I and B-I; 13 knots (15 mph) for RDC A-II and B-II; and 16 knots (18 mph) for RDC A-III, B-III, C-I through C-III, and D-I through D-III.

Weather data specific to the airport was obtained from the National Oceanic Atmospheric Administration (NOAA) National Climatic Data Center. This data was collected from the on-field ASOS over a continuous time period from 2009 to 2018. A total of 114,281 observations of wind direction and other data points were made.

The front side of **Exhibit 3B** presents the all-weather wind rose for the airport. A wind rose is a graphic tool that gives a succinct view of how wind speed and direction are historically distributed at a particular location. The table at the top of the exhibit indicates the percent of wind coverage for the runway and specific wind intensity. In all-weather conditions, the orientation of Runway 1-19 provides 85.25 percent coverage for the 10.5-knot component, 91.52 percent coverage for 13 knots, 96.65 percent coverage for 16 knots, and greater than 98.98 percent coverage for the 20-knot component. Runway 13-31 provides 91.47 percent coverage for the 10.5-knot crosswind component, 95.52 percent coverage for 13 knots, 98.51 percent coverage for 16 knots, and greater than 99.59 percent coverage for the 20-knot component. The combination of both runways provides for 97.74 percent coverage for the 10.5-knot crosswind component and over 99 percent coverage for 13 knots and greater. The IFR wind rose, presented on the backside of **Exhibit 3B**, shows a similar distribution of crosswind components on each respective runway. As a result of the combination of both runways providing greater than 95 percent coverage for the 10.5-knot condition, no additional runways or reorientation of existing runways is necessary for crosswind purposes.

Runway Length

AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. A draft revision of this AC is currently available (150/5325-4C), and the FAA is utilizing the draft revision in most cases when evaluating runway length needs for airports.

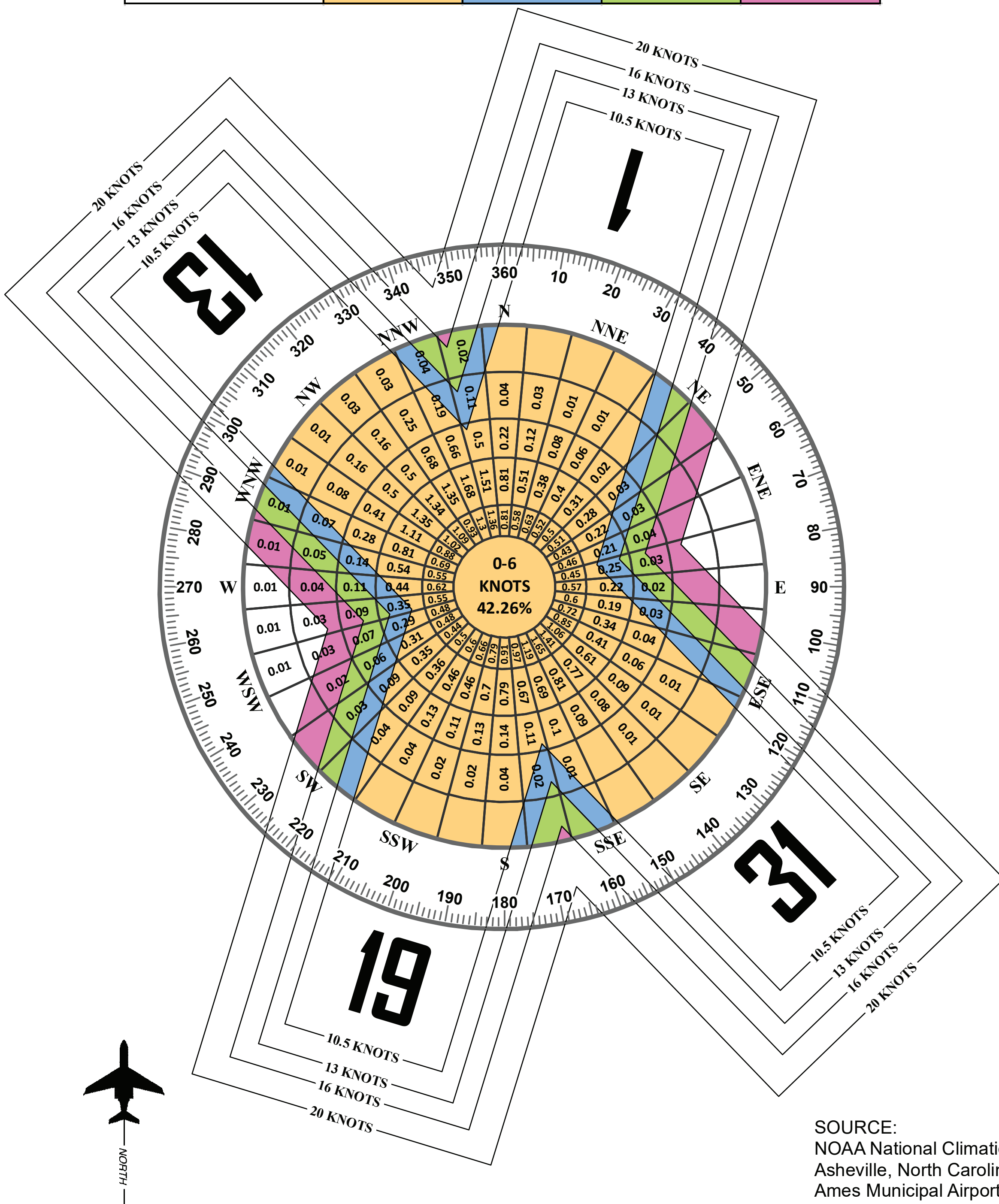
There is not a direct relationship between the classification of the design aircraft (e.g., B-I, B-II, C-II, D-II, etc.) and runway length as airplanes operate on a wide variety of available runway lengths. The suitability of the runway length is governed by many factors, including elevation, temperature, wind, aircraft weight, wing flap settings, runway condition (wet or dry), runway gradient, vicinity airspace obstructions, useful load, and any special operating procedures.

Aircraft performance declines as elevation, temperature, and runway gradient factors increase. For AMW, the mean maximum daily temperature of the hottest month is 83.9 degrees Fahrenheit (F), which occurs in July. The airport's elevation is 955.6 feet above mean sea level (MSL). The published gradient of primary Runway 1-19 is 0.3 percent, and the gradient for Runway 13-31 is 0.3 percent.

Airport sponsors can pursue policies that can maximize the suitability of the runway length. Policies such as area zoning and height and hazard restrictions can protect an airport's runway length. Airport ownership (fee simple or easement) of land leading to the runway ends can reduce the possibility of natural growth or man-made obstructions. Planning of runways should include an evaluation of aircraft types expected to use the airport now and in the future. Future plans should be realistic and supported by the FAA-approved forecasts and should be based on the critical design aircraft (or family of aircraft).

The first step in evaluating runway length is to determine general runway length requirements for the majority of aircraft operating at the airport. Most operations at AMW are conducted using smaller single engine piston-powered aircraft weighing less than 12,500 pounds. Following guidance from AC 150/5325-4B, the existing length of primary Runway 1-19 (5,701 feet) can accommodate the fleet mix of small aircraft with less than 10 passenger seats, as well as small aircraft with 10 or more passenger seats. This includes the majority of single engine and smaller multi-engine aircraft in the national fleet. The

ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 1-19	85.52%	91.52%	96.65%	98.98%
Runway 13-31	91.47%	95.52%	98.51%	99.59%
All Runways	97.74%	99.20%	99.73%	99.93%

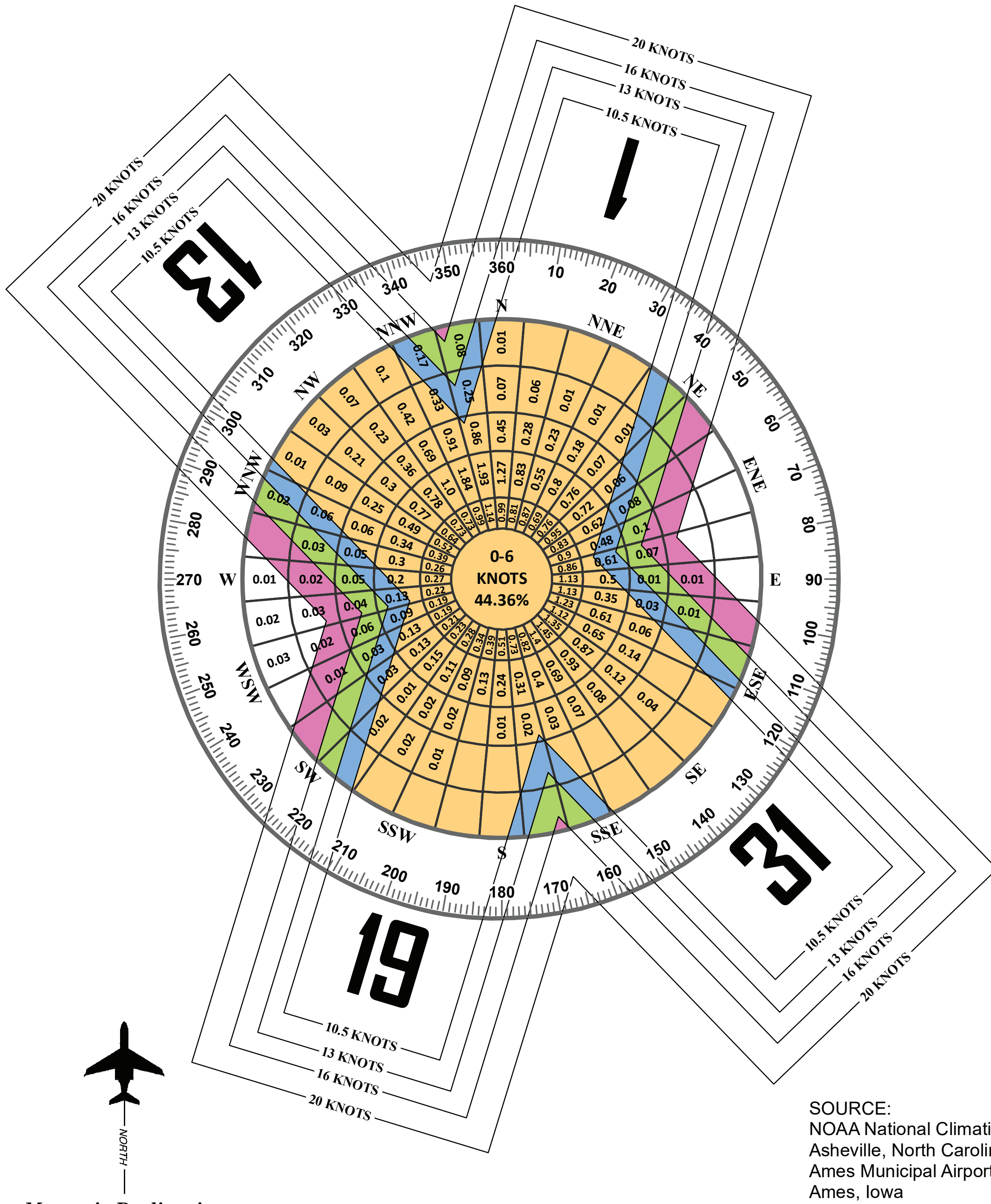


Magnetic Declination
00° 44' 00" East (Feb. 2019)
Annual Rate of Change
00° 04' 00" West (Feb. 2019)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Ames Municipal Airport
Ames, Iowa

OBSERVATIONS:
114,281 All Weather Observations
Jan. 1, 2009 - Dec, 31 2018

IFR WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 1/19	86.31%	91.92%	96.65%	98.74%
Runway 13/31	90.31%	94.77%	98.33%	99.59%
All Runways	97.28%	99.04%	99.69%	99.89%



Magnetic Declination
00° 44' 00" East (Feb. 2019)
Annual Rate of Change
00° 04' 00" West (Feb. 2019)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Ames Municipal Airport
Ames, Iowa

OBSERVATIONS:
21,504 IFR Observations
Jan. 1, 2009 - Dec, 31 2018

length of the crosswind Runway 13-31 (3,491 feet) can readily accommodate 95 percent of the small aircraft fleet. **Table 3D** outlines the runway length requirements for various classifications of aircraft that utilize AMW.

TABLE 3D
Runway Length Requirements (Small Airplanes)
Ames Municipal Airport

AIRPORT AND RUNWAY DATA	
Airport elevation	955.6 feet above MSL
Mean daily maximum temperature of the hottest month	83.9° F (July)
Maximum difference in runway elevation	36.7 feet (Runway 1-19)
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with less than 10 passenger seats:	
95 percent of small airplanes	3,300 feet
100 percent of small airplanes	3,900 feet
Small airplanes with 10 or more passenger seats	4,300 feet

Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design.*

The airport is also regularly utilized by aircraft weighing more than 12,500 pounds, including business jet and larger turboprop aircraft. The FAA runway length AC includes methods to calculate recommended runway length for large aircraft. Runway length requirements for business jets weighing less than 60,000 pounds have been calculated based on FAA AC 150/5325-4B. These calculations take into consideration the runway gradient and landing length requirements for contaminated runways (wet and slippery conditions). Business jets tend to need greater runway length when landing on a wet surface because of their increased approach speeds.

AC 150/5325-4B stipulates that runway length determinations for large aircraft consider a grouping of airplanes with similar operating characteristics. The AC provides two separate "family groupings of airplanes," each based upon their representative percentage of aircraft in the national fleet. The first grouping is those business jets that make up 75 percent of the national fleet, and the second group is those making up 100 percent of the national fleet (75-100 percent of the national fleet). **Table 3E** presents a representative list of aircraft for each aircraft grouping. A third group includes business jets weighing more than 60,000 pounds; however, runway length determination for these aircraft types must be based on the performance characteristics of the individual aircraft.

TABLE 3E
Business Jet Categories for Runway Length Determination

75 percent of the national fleet	MTOW (lbs.)	75-100 percent of the national fleet	MTOW (lbs.)	Greater than 60,000 pounds	MTOW (lbs.)
Lear 35	20,350	Lear 55	21,500	Gulfstream II	65,500
Lear 45	20,500	Lear 60	23,500	Gulfstream IV	73,200
Cessna 550	14,100	Hawker 800XP	28,000	Gulfstream V	90,500
Cessna 560XL	20,000	Hawker 1000	31,000	Global Express	98,000
Cessna 650 (VII)	22,000	Cessna 650 (III/IV)	22,000		
IAI Westwind	23,500	Cessna 750 (X)	36,100		
Beechjet 400	15,800	Challenger 604	47,600		
Falcon 50	18,500	IAI Astra	23,500		

MTOW: Maximum Take-Off Weight
Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*

Table 3F presents the results of the runway length analysis for business jets developed following the guidance provided in AC 150/5325-4B. To accommodate 75 percent of the business jet fleet at 60 percent useful load, a runway length of 5,500 feet is recommended. This length is derived from a raw length of 5,093 feet that is adjusted, as recommended, for runway gradient, then rounded up to the nearest hundred feet (when the raw number is 30 feet or more). From the analysis of jet operations conducted at AMW presented in Chapter Two, most jet operations are those in the 75 percent of the business jet fleet category. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 7,000 feet is recommended. For 100 percent of the business jet fleet at 60 and 90 percent useful load, a runway length of 5,800 and 8,500 feet are recommended, respectively. While three of these recommended lengths exceed the current length of primary Runway 1-19, aircraft within these categories are still capable of utilizing the airport; however, certain aircraft will be weight-restricted, especially during the summer months.

TABLE 3F
Business Jet Runway Length Requirements
Ames Municipal Airport

Airport Elevation	955.6 feet above MSL
Average High Monthly Temp.	83.9° F (July)
Runway Gradient	36.7 feet (Runway 1-19)

Fleet Mix Category	Raw Runway Length from FAA AC	Runway Length With Gradient Adjustment (+367')	Wet Surface Landing Length for Jets (+15%)*	Final Runway Length
75% of fleet at 60% useful load	4,726’	5,093’	5,434’	5,500’
75% of fleet at 90% useful load	6,375	6,742’	7,000’	7,000’
100% of fleet at 60% useful load	5,454’	5,821’	5,500’	5,800’
100% of fleet at 90% useful load	8,129’	8,496’	7,000’	8,500’

* Max 5,500' for 60% useful load in wet conditions and 7,000’ for 90% useful load in wet conditions.
Source: FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design.*

A more specific method to determine runway length requirements for jet and turbine-powered aircraft at AMW is to examine each aircraft’s flight planning manual under conditions specific to the airport. Several aircraft were analyzed for takeoff length required with a design temperature of 83.9 degrees Fahrenheit at a field elevation of 955.6 feet MSL.

Exhibit 3C provides a detailed runway takeoff length analysis for business jet aircraft, which have been identified as utilizing AMW. This data was obtained from Ultranav software, which computes operational parameters for specific aircraft based on its flight manual data. The analysis includes the maximum takeoff weight (MTOW) allowable and the percent useful load from 60 percent to 100 percent. The runway length data is presented in a “gradient” format, with runway length requirement values shown in increasingly darker shades of red depending upon the runway length required. Runway length values identified in bold text are longer than the primary Runway 1-19 length of 5,701 feet. Additionally, the designation “OL” refers to aircraft that are out of limits at a specific useful load for the runway. Regional transport aircraft such as the Canadair CRJ 100 / 200 / 700, Embraer ERJ 120 / 135 / 145ER / 175, and Fairchild-Dornier 328 Jet have also been analyzed as part of the runway length analysis as they have been identified operating at AMW and are likely associated with athletic charters for Iowa State University or competing schools.

Aircraft Name	MTOW lbs.	Payload lbs	60% Useful Load Takeoff Length (ft.) Dry	70% Useful Load Takeoff Length (ft.) Dry	80% Useful Load Takeoff Length (ft.) Dry	90% Useful Load Takeoff Length (ft.) Dry	100% Useful Load Takeoff Length (ft.) Dry
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**5,709**
[illegible]	[illegible]	[illegible]	No Data	No Data	No Data	No Data	**5,795**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,106**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,112**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,200**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**5,789**	**6,353**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**5,858**	**6,389**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**5,800**	**6,400**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**5,937**	**6,433**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**5,786**	**6,336**	**6,882**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,300**	**7,000**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,700**	**7,000**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**5,850**	**6,446**	**7,054**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,280**	**7,110**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,050**	**6,610**	**7,213**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,000**	**6,600**	**7,300**
[illegible]	[illegible]	[illegible]	[illegible]	**6,025**	**6,836**	**7,230**	**7,549**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,110**	**6,790**	**7,590**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,274**	**6,941**	**7,650**
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	**6,500**	**6,800**	**8,000**
[illegible]	[illegible]	[illegible]	[illegible]	**5,871**	**6,588**	**7,361**	**8,280**
[illegible]	[illegible]	[illegible]	[illegible]	**5,824**	**6,469**	**7,107**	O/L
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	**6,016**

[illegible]
[illegible]
[illegible]
Note: Bolded values are longer than the existing runway length.

Aircraft Name	MLW	Landing Lengths Required for:					
		CFR Part 25		CFR Part 91K		CFR Part 135	
		Dry	Wet	Dry (.8)	Wet (.8)	Dry (.6)	Wet (.6)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,038
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,067
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,353
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,367
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,657
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,795
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5,983	6,883
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,007	6,908
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7,105
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7,268
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5,736	[illegible]	7,648
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5,835	[illegible]	7,780
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5,930	6,877	7,907
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5,975	[illegible]	7,967
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,103	6,072	8,137
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,359	[illegible]	8,478
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,959	5,885	9,278
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6,996	6,252	9,328
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7,070	6,605	9,427
[illegible]	[illegible]	[illegible]	5,725	[illegible]	7,156	[illegible]	9,542
[illegible]	[illegible]	[illegible]	6,014	[illegible]	7,518	[illegible]	10,023
[illegible]	[illegible]	[illegible]	6,028	[illegible]	7,535	[illegible]	10,047
[illegible]	[illegible]	[illegible]	6,030	[illegible]	7,538	6,938	10,050
Average Landing Length		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7,584

[illegible]

[illegible] [illegible] [illegible]

This analysis shows that Runway 1-19 can generally accommodate several types of jets and turboprops operating at AMW; however, its current length will have difficulty accommodating larger jet aircraft at higher useful load percentages. The average takeoff length needed for all jets, within operational limits, analyzed at 100 percent useful load is 6,016 feet. This is 322 feet longer than the current length of Runway 1-19.

The crosswind runway length of 3,491 feet is also capable of accommodating some of the business jet aircraft, but most must operate with sizable restrictions to their takeoff weight due to operational limitations.

The back side of **Exhibit 3C** presents the runway length required for landing under three operational categories: Title 14 CFR Part 25, CFR Part 91k, and CFR Part 135. CFR Part 25 operations are those conducted by individuals or companies which own their aircraft. CFR Part 91k includes operations in fractional ownership programs which utilize their own aircraft under direction of pilots specifically assigned to said aircraft. CFR Part 135 applies to all for-hire charter operations, including most fractional ownership operations. If the aircraft is under the control of the fractional operator, then the 60 percent rule of Part 135 applies unless that operator uses a Destination Airport Analysis Program (DAAP). DAAP is recognition that the operator has the systems and the processes in place to assess airports and conditions that are suitable for increased regulatory landing distance. There are 22 conditions governing the use of DAAP that must be in place prior to departure to the destination airport.

Similar to the runway takeoff length requirements, the landing lengths are depicted in a gradient format with longer runway length requirements presented in increasingly darker shades of red. The bold text indicates a runway length requirement that exceeds 5,701 feet, which is the current length of Runway 1-19. The analysis for landing length shows that several business jets that utilize the airport can be accommodated under Part 25, Part 91k, and Part 135 (dry conditions). When factoring in wet conditions, the landing length often increases, and many exceed the current primary runway length. Accumulations of snow and ice will also dramatically increase landing length requirements. The landing length analysis shows an average landing length of 5,688 feet for aircraft operating under CFR Part 91k and an average landing length of 7,584 feet for aircraft operating under CFR Part 135 during wet runway conditions.

Runway Length Summary

As previously noted, the FAA will typically support runway length planning only to the 60 percent useful load factor unless it can be demonstrated that aircraft are frequently operating at higher fully loaded (90 percent). Some business aircraft are capable of taking off on Runway 1-19 at or above 90 percent useful load; however, approximately half of the aircraft analyzed at 90 percent and most aircraft analyzed at 100 percent useful load would require additional runway length. For landing situations, the majority of the aircraft analyzed require additional runway length when operating under Part 135 rules and wet runway conditions. In addition, approximately half of the aircraft analyzed require additional runway length when landing under Part 91k rules and wet runway conditions.

Many factors are considered when determining appropriate runway length for safe and efficient operations of aircraft at AMW. The airport should strive to accommodate business jets as well as regional transport aircraft utilized for charter operations as demand dictates. Runway 1-19 is currently 5,701 feet long and can accommodate a diverse mix of turbine-powered aircraft. The analysis notes that more aircraft are subject to weight restrictions at useful loads of 80 percent or greater during hot days.

Justification for any runway extension to meet the needs of business jets would require regular use on the order of 500 annual itinerant operations. This is the minimum threshold required to obtain FAA grant funding assistance. The existing length of primary Runway 1-19 does not fully provide for all jet activity, especially during hot weather (or wet runway conditions when landing) and when carrying full useful loads. When analyzing the runway landing length of the most demanding aircraft that conducted over 500 operations collectively at AMW in 2018, the wet runway length required at maximum landing weight (MLW) for aircraft operating under Part 91k is 6,359 feet and 8,478 feet under Part 135. **Table G** presents landing length requirements and number of operations of the most demanding aircraft operating at AMW in 2018.

TABLE 3G
Runway Length Landing Summary
Ames Municipal Airport

		Landing Length Required for:					
		CFR Part 25		CFR Part 91k		CFR Part 135	
Aircraft	**2018 Ops**	**Dry**	**Wet**	**Dry**	**Wet**	**Dry**	**Wet**
Challenger 300	90	2,654	5,087	3,318	**6,359**	4,423	**8,478**
Citation XLS	200	3,531	5,567	4,414	**6,959**	**5,885**	**9,278**
Beechjet 400A	162	3,751	5,597	4,689	**6,996**	**6,252**	**9,328**
Citation X	22	3,963	5,656	4,954	**7,070**	**6,605**	**9,427**
Gulfstream 450	10	3,324	**5,725**	4,155	**7,156**	5,540	**9,542**
Citation II	70	2,488	**6,014**	3,110	**7,518**	4,147	**10,023**
Gulfstream 100	14	3,218	**6,028**	4,023	**7,535**	5,363	**10,047**
Citation III	8	4,163	**6,030**	5,204	**7,538**	**6,938**	**10,050**
Total Operations	**576**						

Bolded values are longer than the existing runway length (5,701).
Source: Ultranav Planning Software

It should be noted that wet runway length requirements for Part 91k and Part 135 increase to 6,959 and 9,278 feet, respectively, when considering the seven most demanding aircraft operating at AMW in 2018. Combined, these aircraft conducted a total of 486 operations. Given the current level of business jet activity occurring at AMW, the airport should consider additional runway length up to a minimum of 7,000 feet. Furthermore, with projected increases in based business jets and air taxi operations, runway length beyond 7,000 feet could be justified with additional information on FAR Part 135 operators at AMW. This is further supported by use of AMW for Iowa State University (ISU) athletic charter operations and jet operations associated with the ISU Research Park. **As such, analysis in the next chapter will examine potential runway alternatives that could be achieved at AMW to better accommodate the needs of larger aircraft during the 20-year planning period of this Airport Master Plan.**

Runway Width

Runway width design standards are primarily based on the critical aircraft but can also be influenced by the visibility minimums of published instrument approach procedures. For Runway 1-19, ultimate RDC C-II-2400 design criteria stipulate a runway width of 100 feet. Its current runway width of 100 feet meets this standard and should be maintained in the future.

Runway 13-31 is 75 feet wide, which meets the existing and ultimate design standard width for RDC B-II-5000. As such, the existing width of 75 feet should be maintained.

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The FAA reports the pavement strength for Runway 1-19 at 30,000 pounds single wheel loading (SWL) and 38,000 pounds dual wheel loading (DWL). Runway 13-31 provides a strength rating of 30,000 pounds SWL. These strength ratings refer to the configuration of the aircraft landing gear. For example, SWL indicates an aircraft with a single wheel on each landing gear.

The strength rating of a runway does not preclude aircraft weighing more than the published strength rating from using the runway. The strength is based on design parameters which support a high volume of aircraft at or below the published weight, allowing the pavement to survive its intended useful life. Aircraft weighing more than the published weight could damage the runway in severe conditions, but more likely will simply reduce the life cycle of the pavement.

All federally obligated airports must remain open to the public, and it is typically up to the pilot of the aircraft to determine if a runway can support their aircraft safely. An airport sponsor cannot restrict an aircraft from using the runway simply because its weight exceeds the published strength rating. On the other hand, an airport sponsor has an obligation to properly maintain the runway and protect the useful life of the runway, typically for 20 years.

According to the FAA publication, *Chart Supplement*, "Runway strength rating is not intended as a maximum allowable weight or as an operating limitation. Many airport pavements are capable of supporting limited operations with gross weights in excess of the published figures." The supplement directory goes on to say that those aircraft exceeding the pavement strength should contact the airport sponsor for permission to operate at the airport.

The strength rating of a runway can change over time. Regular usage by heavier aircraft can decrease the strength rating, while periodic runway resurfacing or other maintenance methods can increase the strength rating. The current strength on Runway 1-19 is adequate to accommodate a large majority of aircraft that operate at the airport. However, given the number of jet aircraft currently operating and forecast to operate at AMW, future planning should maintain the existing SWL pavement strength at 30,000 pounds and consider increasing the DWL pavement strength to 60,000 pounds on Runway 1-19.

The strength rating on Runway 13-31 is adequate to serve a majority of general aviation aircraft. The airport should maintain the runway strength rating at 30,000 pounds SWL.

Runway Markings

Runway markings are typically designed to the type of instrument approach available on the runway. FAA AC 150/5340-1L, *Standards for Airport Markings*, provides guidance necessary to design airport markings.

Runway 1 is served by precision instrument markings, while Runway 19 is served by non-precision instrument markings. These markings should be maintained through the long-term planning period to accommodate the precision instrument approach serving Runway 1 and the non-precision instrument approach serving Runway 19. Runway 13-31 is currently served by non-precision instrument approaches and has non-precision instrument markings, which should be maintained throughout the planning horizon.

RUNWAY DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions. These include the runway safety area (RSA), runway object free area (ROFA), runway obstacle free zone (ROFZ), precision obstacle free zone (POFZ), and runway protection zone (RPZ).

The entire RSA, ROFA, and ROFZ (which includes the POFZ when applicable) must be under the direct ownership of the airport sponsor to ensure these areas remain free of obstacles and can be readily accessed by maintenance and emergency personnel. RPZs should also be under airport ownership. An alternative to outright ownership of the RPZ is the purchase of avigation easements (acquiring control of designated airspace within the RPZ) or having sufficient land use control measures in places which ensure the RPZ remains free of incompatible development. The various airport safety areas are presented on **Exhibit 3D**.

Dimensional standards for the various safety areas associated with the runway are a function of the type of aircraft using or expected to use the runway as well as the instrument approach capability. **Table 3H** presents the FAA design standards as they apply to the runways at AMW both now and in the future per the detailed analysis conducted at the end of Chapter Two.

For primary Runway 1-19, the existing design standards should meet Runway Design Code (RDC) B-II-2400 and ultimate design standards should meet RDC C-II-2400. Crosswind Runway 13-31, existing and ultimate design standards should adhere to B-II-5000.


EXISTING RUNWAY DESIGN CODE
RUNWAY 1-19 RDC B-II-2400
RUNWAY 13-31 RDC B-II-5000
S Duff Ave
Kitty Hawk Dr
Airport Rd
265th St
S Riverside Dr
+/- .05 acres
+/- 1.3 acres
+/- 2.8 acres
+/- 0.7 acres
+/- 0.5 acres
Localizer Antenna
RPZ Incompatibility - Building and Road
Direct Access
High Energy Crossing
RPZ Incompatibility - Road
Runway 1-19 (5,701' x 100')
Runway 13-31 (3,491' x 75')
400'
LEGEND
Airport Property Line
Runway Safety Area
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Existing Runway Protection Zone (RPZ)
Precision Obstacle Free Zone (POFZ)
Runway Visibility Zone (RVZ)
Building Restriction Line (BRL)
Localizer Critical Area
Glideslope Critical Area
High Energy Area
RPZ Incompatibility - Roadway
Existing Easement
Vegetation to be Removed
SCALE IN FEET
0
800
N
Aerial Photo: Martinez Geospatial 9-11-18

ULTIMATE RUNWAY DESIGN CODE
RUNWAY 1-19 RDC C-II-2400
RUNWAY 13-31 RDC B-II-5000

TABLE 3H
Runway Design Standards
Ames Municipal Airport

	Runway 13-31 Existing/ Ultimate	Runway 1-19 Existing		Runway 1-19 Ultimate	
Runway Design Code	B-II-5000	B-II-2400		C-II-2400	
Visibility Minimums	≥1 mile	≥½ mile – Rwy 1 >1 mile – Rwy 19		≥½ mile – Rwy 1 >1 / >¾ mile – Rwy 19	
Runway Design					
Runway Safety Area					
Width	150	300		400	
Length Beyond Departure End	300	600		1,000	
Length Prior to Threshold	300	600		1,000	
Runway Object Free Area					
Width	500	800		800	
Length Beyond Departure End	300	600		1,000	
Length Prior to Threshold	300	600		1,000	
Runway Obstacle Free Zone					
Width	400	400		400	
Length Beyond Runway End	200	200		200	
Precision Obstacle Free Zone					
Width	NA	800 (Rwy 1)		800 (Rwy 1)	
Length Beyond Runway End	NA	200 (Rwy 1)		200 (Rwy 1)	
Approach Runway Protection Zone		**1**	**19**	**1**	**19**
Inner Width	500	1,000	500	1,000	500 / 1,000
Outer Width	700	1,750	700	1,750	1,010 / 1,510
Length	1,000	2,500	1,000	2,500	1,700
Departure Runway Protection Zone		**1**	**19**	**1**	**19**
Inner Width	500	500	500	500	500
Outer Width	700	700	700	1,010	1,010
Length	1,000	1,000	1,000	1,700	1,700
Runway Separation					
Runway Centerline to:					
Parallel Taxiway	250[1]	250		250	
Hold Line Markings	190-200[2]	300		400	
Aircraft Parking Apron	510[3]	400		500	

[1]Current dimension. Separation standard for RDC B-II-5000 is 240 feet.
[2] Current dimension. Separation standard for RDC B-II-5000 is 200 feet.
[3]Current dimension. Separation standard for RDC B-II-5000 is 250 feet.
Note: All dimensions in feet unless otherwise noted.
Source: FAA AC 150/5300-13A, *Airport Design*

Runway Safety Area

The RSA is defined in FAA AC 150/5300-13A, *Airport Design,* as a "surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of undershoot, overshoot, or excursion from the runway." The RSA is centered on the runway and dimensioned in accordance to the approach speed of the critical design aircraft using the runway. The FAA requires the RSA to be cleared and graded, drained by grading or storm sewers, capable of accommodating the design aircraft and fire and rescue vehicles, and free of obstacles not fixed by navigational purpose, such as runway edge lights or approach lights.

Under existing B-II-2400 conditions, the RSA serving Runway 1-19 is 300 feet wide and extends 600 feet beyond each end of the runway. Under ultimate conditions, the FAA calls for the RSA to be 400 feet wide and extend 1,000 feet beyond the runway ends for RDC C-II runways with approach visibility minimums lower than ¾-mile. As depicted on **Exhibit 3D**, an examination of the RSA for this runway under existing and ultimate conditions did not identify any non-standard conditions and should be maintained as such throughout the planning horizon.

For RDC B-II with not lower than one-mile approach visibility minimums, which is currently the case for Runway 13-31, the RSA is 150 feet wide and extends 300 feet beyond the runway ends. This runway currently meets this RSA standard and should be maintained throughout the planning horizon.

Runway Object Free Area

The ROFA is "a two-dimensional ground area, surrounding runways, taxiways, and taxilanes, which is clear of objects except for objects whose location is fixed by function (i.e., airfield lighting)." The ROFA does not have to be graded and level like the RSA; instead, the primary requirement for the ROFA is that no object in the ROFA penetrates the lateral elevation of the RSA. The ROFA is centered on the runway, extending out in accordance to the critical design aircraft utilizing the runway.

Under existing RDC B-II design standards with approach visibility minimums of not lower than one mile, the ROFA is 800 feet wide and extends 600 feet beyond each end of the runway. For ultimate RDC C-II design standards with approach visibility minimums lower than ¾-mile, the FAA calls for the ROFA to be 800 feet wide, extending 1,000 feet beyond each runway end. As shown on **Exhibit 3D**, vegetation and crops currently obstruct the existing and ultimate ROFA. It is recommended that the airport clear the existing ROFA of all obstructing crops and vegetation in accordance with FAA standards.

For RDC B-II with not lower than one-mile approach visibility minimums, the ROFA is 500 feet wide and extends 300 feet beyond each runway end. Under existing and ultimate conditions, the north and southeast corners as well as portions of the southwestern side of the ROFA serving Runway 13-31 are obstructed by vegetation and crops. It is recommended that the airport clear the ROFA serving Runway 13-31 of all obstructing crops and vegetation.

Runway Obstacle Free Zone

The ROFZ is an imaginary volume of airspace which precludes object penetrations, including taxiing and parked aircraft. The only allowance for ROFZ obstructions is navigational aids mounted on frangible bases which are fixed in their location by function, such as airfield signs. The ROFZ is established to ensure the safety of aircraft operations. If the ROFZ is obstructed, an airport's approaches could be removed, or approach minimums could be increased.

The FAA's criterion for runways utilized by aircraft weighing more than 12,500 pounds requires a clear ROFZ to extend 200 feet beyond the runway ends and be 400 feet wide (200 feet on either side of the runway centerline). The ROFZ standards are currently met on Runways 1-19 and 13-31 and should be maintained as such.

The POFZ is defined as "a volume of airspace above an area beginning at the runway threshold, at the threshold elevation, and centered on the extended runway centerline, 200 feet long by 800 feet wide." The POFZ is only in effect when the following operational conditions are met:

I. Vertically-guided approach
II. Reported ceiling below 250 feet and/or visibility less than ¾ of a statute mile
III. An aircraft on final approach within two miles of the runway threshold

When these conditions are met, aircraft holding for take-off must hold in such a position so that neither the fuselage nor the tail of the aircraft penetrates the POFZ. However, the wings of the aircraft can penetrate the surface. At present, Runway 1 is served by a POFZ as it is served by an instrument landing system (ILS) with approach visibility minimums down to ½-mile. As presented on **Exhibit 3D**, the POFZ serving Runway 1 is clear of obstructions under existing and ultimate conditions and should be maintained as such.

Runway Protection Zone

The RPZ is a trapezoidal area centered on the runway, beginning 200 feet beyond the runway end. The RPZ has been established by the FAA to provide an area clear of obstructions and incompatible land uses, in order to enhance the protection of people and property on the ground. The RPZ is comprised of the central portion of the RPZ and the controlled activity area. The central portion of the RPZ extends from the beginning to the end of the RPZ, is centered on the runway, and is the width of the ROFA. The controlled activity area is any remaining portions of the RPZ. The dimensions of the RPZ vary per the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway.

While the RPZ is intended to be clear of incompatible objects or land uses, some uses are permitted with conditions and other land uses are prohibited. According to AC 150/5300-13A, the following land uses are permissible within the RPZ:

- Farming that meets the minimum buffer requirements,
- Irrigation channels as long as they do not attract birds,
- Airport service roads, as long as they are not public roads and are directly controlled by the airport operator,
- Underground facilities, as long as they meet other design criteria, such as RSA requirements, as applicable, and

- Unstaffed navigational aids (NAVAIDs) and facilities, such as required for airport facilities that are fixed by function in regard to the RPZ.

Any other land uses considered within RPZ land owned by the airport sponsor must be evaluated and approved by the FAA Office of Airports. The FAA has published *Interim Guidance on Land Uses Within a Runway Protection Zone* (September 2012), which identifies several potential land uses that must be evaluated and approved prior to implementation. The specific land uses requiring FAA evaluation and approval include:

- Buildings and structures. Examples include, but are not limited to: residences, schools, churches, hospitals or other medical care facilities, commercial/industrial buildings, etc.)
- Recreational land use. Examples include, but are not limited to: golf courses, sports fields, amusement parks, other places of public assembly, etc.)
- Transportation facilities. Examples include, but are not limited to:
    - Rail facilities - light or heavy, passenger or freight
    - Public roads/highways
    - Vehicular parking facilities
- Fuel storage facilities (above and below ground)
- Hazardous material storage (above and below ground)
- Wastewater treatment facilities
- Above-ground utility infrastructure (i.e., electrical substations), including any type of solar panel installations.

The *Interim Guidance on Land within a Runway Protection Zone* states, "RPZ land use compatibility also is often complicated by ownership considerations. Airport owner control over the RPZ land is emphasized to achieve the desired protection of people and property on the ground. Although the FAA recognizes that in certain situations the airport sponsor may not fully control land within the RPZ, the FAA expects airport sponsors to take all possible measures to protect against and remove or mitigate incompatible land uses."

Currently, the RPZ review standards are applicable to any new or modified RPZ. The following actions or events could alter the size of an RPZ, potentially introducing an incompatibility:

- An airfield project (e.g., runway extension, runway shift),
- A change in the critical design aircraft that increases the RPZ dimensions,
- A new or revised instrument approach procedure that increases the size of the RPZ, and/or
- A local development proposal in the RPZ (either new or reconfigured).

Since the interim guidance only addresses a new or modified RPZ, existing incompatibilities are generally (but not always) grandfathered under certain circumstances. While it is still necessary for the airport sponsor to take all reasonable actions to meet the RPZ design standard, FAA funding priority for certain actions, such as relocating existing roads in the RPZ, will be determined on a case-by-case basis.

RPZs have been further designated as approach and departure RPZs. The approach RPZ is a function of the Aircraft Approach Category (AAC) and approach visibility minimums associated with the approach runway end. The departure RPZ is a function of the AAC and departure procedures associated with the runway. For a particular runway end, the more stringent RPZ requirements (usually associated with the approach RPZ) will govern the property interests and clearing requirements that the airport sponsor should pursue.

As presented on **Exhibit 3D**, existing RPZs and ultimate RPZs associated with Runway 1-19 and 13-31 extend off airport property and include public roadway and land use incompatibilities associated with commercial property. However, it should be noted that all property within RPZs that extend off airport property is owned by the airport in avigation easement. The existing and ultimate RPZ serving Runway 1 is 1,000 feet wide at the inner portion, 1,750 feet wide at the outer portion, and 2,500 feet long. Under these conditions, the RPZ serving Runway 1 extends beyond airport property encompassing approximately 2.8 acres of property owned in easement and includes a portion of South Riverside Drive.

Under existing conditions, the RPZ serving Runway 19 is 500 feet wide at the inner portion, 700 feet wide at the outer portion, and 1,000 feet long. Under RDC C-II conditions with approach minimums not lower than one mile, the RPZ serving Runway 19 is 500 feet wide at the inner portion, 1,510 feet wide at the outer portion, and 1,700 feet long. While the entirety of the RPZ is contained within the airport property boundary under existing B-II-5000 and ultimate C-II-5000 conditions, it is traversed by Airport Road. Ultimately, the RPZ serving Runway 19 could be expanded to meet RDC C-II with approach visibility minimums not lower than ¾-mile (to be discussed). Under these conditions, the RPZ serving Runway 19 will be 1,000 feet wide at the inner portion, 1,510 feet wide at the outer portion, and 1,700 feet long. Presented on **Exhibit 3D**, the ultimate RDC C-II RPZ associated with instrument approach minimums of not lower than ¾-mile is traversed by Airport Road and extends beyond airport property encompassing approximately 1.4 acres of property owned in easement. The segment of the RPZ owned in easement is located in the controlled activity area of the RPZ and contains a portion of a Sam's Club shopping center and its associated parking lot. Although the ultimate RPZ serving Runway 19 contains roadway and land use incompatibilities, it should be noted that an RPZ of this size and dimension (containing the same incompatibilities) is shown on the current approved ALP.

Exhibit 3D also depicts the existing and ultimate RPZs on Runway 13-31, which are 500 feet at the inner portion, 700 feet at the outer portion, and 1,000 feet long. As noted on the exhibit, the RPZ serving Runway 13 extends off airport property to the northwest encompassing approximately 1.2 acres of property (combined) owned in easement as well as portions of South Riverside Drive and Airport Road. It should be noted that the easement-owned segments of the Runway 13 RPZ also include a self-storage facility as well as a parking lot. The RPZ serving Runway 31 extends beyond airport property to the southeast encompassing approximately 1.35 acres of property combined, which is owned in easement.

As previously mentioned, since the interim guidance only addresses new or modified RPZs, existing incompatibilities are generally considered grandfathered conditions. For example, roads that are in the current RPZ are typically allowed to remain as grandfathered unless the runway environment changes. The airport sponsor should take reasonable actions to meet RPZ design standards, which could include relocating the roads from within the existing RPZs; however, roadways could be considered acceptable since they existed before the RPZ standards were published. Funding priority for certain actions, such as relocating existing roads in RPZs, will be determined on a case-by-case basis.

Whenever possible, the airport should maintain positive control over the RPZs through fee simple acquisition; however, avigation easements can be pursued if fee simple acquisition is not feasible. Currently, avigation easements are in place over the existing and ultimate RPZs serving each runway end. Further examination of the RPZs associated with each runway end will be undertaken later in this study.

Runway Visibility Zone (RVZ)

The RVZ is an area formed by imaginary lines connecting the line-of-sight points of intersecting runways. The purpose of the RVZ is to facilitate coordination among aircraft and between aircraft and vehicles that are operating on active runways. Having a clear line-of-sight allows departing aircraft and arriving aircraft to verify the location and actions of other aircraft and vehicles on the ground that could create a conflict. Within the RVZ, any point five feet above the runway centerline must be mutually visible with any other point five feet above the centerline of the crossing runway. The RVZ at AMW is depicted on **Exhibit 3D**. Currently, there are no obstructions to the RVZ serving the runway system.

Building Restriction Line (BRL)

The BRL identifies suitable building area locations on the airport. The BRL encompasses the RPZs, the ROFA, navigational aid critical areas, areas required for terminal instrument procedures, and other areas necessary for meeting airport line-of-sight criteria, such as the RVZ.

Two primary factors contribute to the determination of the BRL: type of runway (utility or other-than-utility) and the capability of the instrument approaches. Runway 1-19 is considered a "precision instrument" runway with visibility minimums lower than ½-mile. Runway 13-31 is considered a "non-precision instrument" runway with visibility minimums of not lower than 1-mile.

The BRL is the product of CFR Part 77 transitional surface clearance requirements. These requirements stipulate that no object be located in the primary surface, defined as being 1,000 feet wide for precision instrument runways, and 500 feet wide for utility runways having instrument approach minimums of not lower than 1-mile. From the primary surface, the transitional surface extends outward at a slope of one vertical foot to every seven horizontal feet. For Runway 1-19, the 35-foot BRL is set at 745 feet from the runway centerline. For Runway 13-31, the 35-foot BRL is set at 495 feet from the runway centerline. The BRL is depicted on **Exhibit 3D**, and all landside facilities are located beyond the 35-foot BRL.

Runway/Taxiway Separation

The design standard for the separation between runways and parallel taxiways is a function of the critical design aircraft and the instrument approach visibility minimum. The separation standard for existing B-

II and ultimate RDC C-II with lower than ¾-mile visibility minimums is 300 and 400 feet from the runway centerline to the parallel taxiway centerline, respectively. Parallel Taxiway A serving Runway 1-19 is 400 feet from the runway; therefore, the current location of the taxiway meets the proposed separation standards and should be maintained throughout the planning horizon.

Quasi-Parallel Taxiway B serving Runway 13-31 is currently 250 feet from the runway. This exceeds the FAA design standard of 240 feet from RDC B-II with approach visibility minimums not lower than one-mile. As such, the airport should maintain the existing runway to taxiway centerline separation through the long-term planning horizon.

Hold Line Separation

Holding position markings are placed on taxiways leading to runways. The FAA mandates that taxiway holding positions be located a certain distance from the runway. When approaching the runway, pilots are to stop short of the holding position marking line as a precautionary measure to check for traffic in the area. For RDC B-II and C-II runways with approach minimums lower than ¾-mile, the holding positions on taxiways are required to be located 250 feet from runway centerline. While most holding positions serving Runway 1-19 are located at least 250 feet from runway centerline to taxiway centerline, holding positions located on Taxiway B serving the eastern and western side of Runway 1-19 are acutely angled to the runway, causing the nearest portion of each holding position to be located 242 and 240 feet from runway centerline, respectively. **Figure 3A** presents the acutely angled holding position markings located on Taxiway B along with additional holding position marking deficiencies to be discussed. As previously mentioned in Chapter One, Runway 13-31 contains hold position markings for land and hold short operations (LAHSO), stopping prior to Runway 1-19. The hold position markings are located on Runway 13-31, 230 feet from the Runway 1-19 centerline. Given that AMW is not served by an airport traffic control tower (ATCT), it is assumed that these markings are designated for safety purposes only and indicate where an aircraft operating on Runway 13-31 should stop if it encounters another aircraft operating on Runway 1-19.

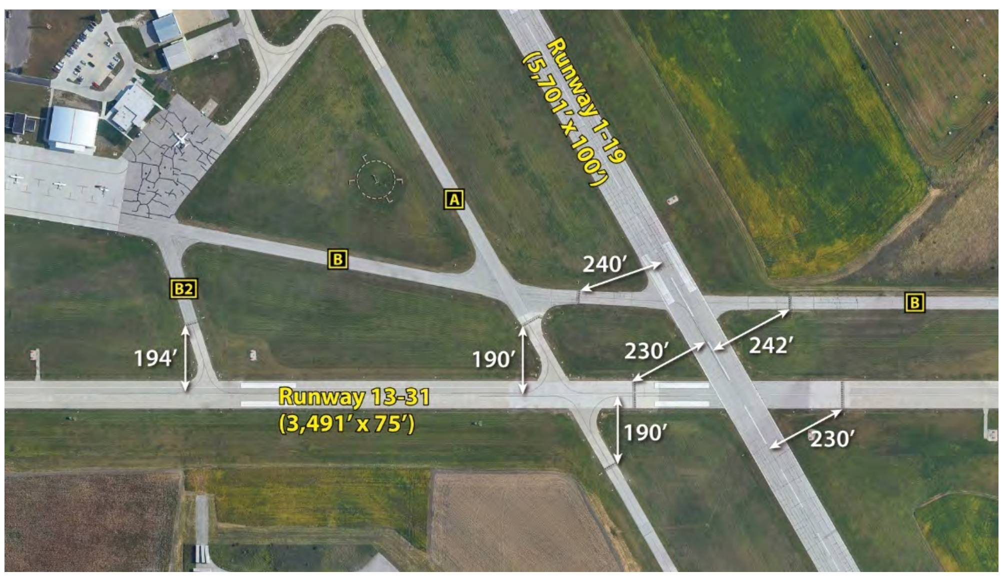


Figure 3A
Holding Position Markings

It is recommended that the airport locate all holding position and LAHSO markings serving Runway 1-19 at least 250 feet from runway centerline when measuring from the nearest point of each respective holding position. Relocating the deficient holding positions as such will bring all holding position markings serving Runway 1-19 into compliance with existing RDC B-II-2400 and ultimate RDC C-II-2400 FAA design standards.

For RDC B-II runways with approach minimums not lower than one-mile, holding position markings are required to be placed 200 feet from runway centerline. Existing holding position marking measurements serving Runway 13-31 are presented on **Figure 3A**. As presented in the figure, holding position markings located on Taxiway A serving Runway 13-31 are positioned at 190 feet from runway centerline when measuring from the nearest point of the holding position. Similarly, the holding position marking located on Taxiway B2 is 194 feet from runway centerline. It is recommended that the airport relocate the identified holding position markings to at least 200 feet from runway centerline.

Aircraft Parking Apron Separation

Under existing and ultimate conditions, aircraft parking areas should be at least 400 and 500 feet from the Runway 1-19 centerline, respectively. Currently, all aircraft parking areas exceed this standard as over 700 feet of separation exists between the runway and designated aircraft parking aprons to the west.

For Runway 13-31, aircraft parking areas should be at least 250 feet from the runway centerline under existing and ultimate conditions. Currently, the parking areas begin at least 500 feet from the runway centerline. The airport should ensure these separation standards are maintained in compliance with FAA regulations should additional apron area be considered (to be discussed).

TAXIWAYS

The design standards associated with taxiways are determined by the Taxiway Design Group (TDG) or the Airplane Design Group (ADG) of the critical design aircraft. As determined previously, the applicable ADG for Runways 1-19 and 13-31 is ADG II for both existing and ultimate conditions. **Table 3J** presents the various taxiway design standards related to ADG II.

The table also shows those taxiway design standards related to TDG. The TDG standards are based on the Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance of the critical design aircraft expected to use those taxiways. Different taxiway and taxilane pavements can and should be planned to the most appropriate TDG design standards based on usage.

The current taxiway design for Runways 1-19 and 13-31 should be TDG 2. As such, the taxiways supporting each runway should be at least 35 feet wide, which is the current taxiway width of all taxiways serving AMW. This taxiway width should be maintained throughout the planning horizon.

Taxiway Design Considerations

FAA AC 150/5300-13A, Change 1, *Airport Design*, provides guidance on recommended taxiway and taxilane layouts to enhance safety by avoiding runway incursions. A runway incursion is defined as "any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft."

The taxiway system at Ames Municipal Airport generally provides for the efficient movement of aircraft; however, AC 150/5300-13A, Change 1, *Airport Design*, provides recommendations for taxiway design. The following is a list of the taxiway design guidelines and the basic rationale behind each recommendation.

TABLE 3J
Taxiway Dimensions and Standards
Ames Municipal Airport

STANDARDS BASED ON WINGSPAN	***ADG II***
Taxiway Protection	
Taxiway Safety Area width (feet)	79
Taxiway Object Free Area width (feet)	131
Taxilane Object Free Area width (feet)	115
Taxiway Separation	
Taxiway Centerline to:	
Fixed or Movable Object (feet)	65.5
Parallel Taxiway/Taxilane (feet)	97
Taxilane Centerline to:	
Fixed or Movable Object (feet)	57.5
Parallel Taxilane (feet)	97
Wingtip Clearance	
Taxiway Wingtip Clearance (feet)	26
Taxilane Wingtip Clearance (feet)	18
STANDARDS BASED ON TDG	***TDG 2***
Taxiway Width Standard (feet)	35
Taxiway Edge Safety Margin (feet)	7.5
Taxiway Shoulder Width (feet)	15

ADG: Airplane Design Group
TDG: Taxiway Design Group
Source: FAA AC 150/5300-13A, Change 1, *Airport Design*

1. **Taxi Method**: Taxiways are designed for "cockpit over centerline" taxiing with pavement being sufficiently wide to allow a certain amount of wander. On turns, sufficient pavement should be provided to maintain the edge safety margin from the landing gear. When constructing new taxiways, upgrading existing intersections should be undertaken to eliminate "judgmental oversteering," which is where the pilot must intentionally steer the cockpit outside the marked centerline in order to assure the aircraft remains on the taxiway pavement.

2. **Steering Angle**: Taxiways should be designed such that the nose gear steering angle is no more than 50 degrees, the generally accepted value to prevent excessive tire scrubbing.

3. **Three-Node Concept**: To maintain pilot situational awareness, taxiway intersections should provide a pilot a maximum of three choices of travel. Ideally, these are right and left angle turns and a continuation straight ahead.

4. **Intersection Angles**: Turns should be designed to 90 degrees wherever possible. For acute angle intersections, standard angles of 30, 45, 60, 120, 135, and 150 degrees are preferred.

5. **Runway Incursions**: Taxiways should be designed to reduce the probability of runway incursions.
   - *Increase Pilot Situational Awareness*: A pilot who knows where he/she is on the airport is less likely to enter a runway improperly. Complexity leads to confusion. Keep taxiway systems simple using the "three node" concept.
   - *Avoid Wide Expanses of Pavement*: Wide pavements require placement of signs far from a pilot's eye. This is especially critical at runway entrance points. Where a wide expanse of pavement is necessary, avoid direct access to a runway.
   - *Limit Runway Crossings*: The taxiway layout can reduce the opportunity for human error. The benefits are twofold – through simple reduction in the number of occurrences, and through a reduction in air traffic controller workload.
   - *Avoid "High Energy" Intersections*: These are intersections in the middle third of runways. By limiting runway crossings to the first and last thirds of the runway, the portion of the runway where a pilot can least maneuver to avoid a collision is kept clear.
   - *Increase Visibility*: Right-angle intersections, both between taxiways and runways, provide the best visibility. Acute angle runway exits provide for greater efficiency in runway usage but should not be used as runway entrance or crossing points. A right-angle turn at the end of a parallel taxiway is a clear indication of approaching a runway.
   - *Avoid "Dual Purpose" Pavements*: Runways used as taxiways and taxiways used as runways can lead to confusion. A runway should always be clearly identified as a runway and only a runway.
   - *Indirect Access*: Do not design taxiways to lead directly from an apron to a runway. Such configurations can lead to confusion when a pilot typically expects to encounter a parallel taxiway.
   - *Hot Spots*: Confusing intersections near runways are more likely to contribute to runway incursions. These intersections must be redesigned when the associated runway is subject to reconstruction or rehabilitation. Other Hot Spots should be corrected as soon as practicable.

6. **Runway/Taxiway Intersections**:
   - *Right-Angle*: Right-angle intersections are the standard for all runway/taxiway intersections, except where there is a need for a high-speed exit. Right-angle taxiways provide the best visual perspective to a pilot approaching an intersection with the runway to observe aircraft in both the left and right directions. They also provide optimal orientation of the runway holding position signs so they are visible to pilots.
   - *Acute Angle*: Acute angles should not be larger than 45 degrees from the runway centerline. A 30-degree taxiway layout should be reserved for high-speed exits. The use of multiple intersecting taxiways with acute angles creates pilot confusion and improper positioning of taxiway signage.
   - *Large Expanses of Pavement*: Taxiways must never coincide with the intersection of two runways. Taxiway configurations with multiple taxiway and runway intersections in a single area create large expanses of pavement, making it difficult to provide proper signage, marking, and lighting.

7. **Taxiway/Runway/Apron Incursion Prevention**: Apron locations that allow direct access into a runway should be avoided. Increase pilot situational awareness by designing taxiways in such a manner that forces pilots to consciously make turns. Taxiways originating from aprons and forming a straight line across runways at mid-span should be avoided.

- *Wide Throat Taxiways*: Wide throat taxiway entrances should be avoided. Such large expanses of pavement may cause pilot confusion and make lighting and marking more difficult.
- *Direct Access from Apron to a Runway*: Avoid taxiway connectors that cross over a parallel taxiway and directly onto a runway. Consider a staggered taxiway layout that forces pilots to make a conscious decision to turn.
- *Apron to Parallel Taxiway End*: Avoid direct connection from an apron to a parallel taxiway at the end of a runway.

FAA AC 150/5300-13A, Change 1, *Airport Design*, states that "existing taxiway geometry should be improved whenever feasible, with emphasis on designated 'hot spots.'" Currently, there are no hot spots published by the FAA at AMW.

Primarily, the taxiway system at AMW meets the recommended design and geometry standards set forth by the FAA. However, there are certain non-standard conditions that include:

- Taxiway A1 could be considered to provide direct access from the aircraft parking apron to Runway 1-19.
- Taxiway B provides direct access from the aircraft parking apron to Runway 1-19.
- Taxiways B1 and B2 provide direct access from the aircraft parking apron to Runway 13-31.
- Taxiway A crosses within the high energy area associated with Runway 13-31.

Exhibit 3D identifies these areas of interest. In the alternatives chapter, potential solutions to these non-standard conditions will be presented. Analysis in the next chapter will also consider improvements which could be implemented on the airfield to minimize runway incursion potential, improve efficiency, and better conform to FAA standards for taxiway design.

Taxilane Design Considerations

Taxilanes are distinguished from taxiways in that they do not provide access to or from the runway system directly. Taxilanes typically provide access to hangar areas. As a result, taxilanes can be planned to varying design standards depending on the type of aircraft utilizing the taxilane. For example, a taxilane leading to a T-hangar area only needs to be designed to accommodate those aircraft typically accessing the T-hangar.

NAVIGATIONAL AND APPROACH AIDS

Navigational aids are devices that provide pilots with guidance and position information when utilizing the runway system. Electronic and visual guidance to arriving aircraft enhance the safety and capacity of the airfield. Such facilities are vital to the success of an airport and provide additional safety to passengers using the air transportation system. While instrument approach aids are especially helpful during poor weather, they are often used by pilots conducting flight training and operating larger aircraft when visibility is good. AMW employs the following navigational and approach aids.

Instrument Approach Aids

Instrument approaches are categorized as either precision or non-precision. Precision instrument approach aids provide an exact course alignment and vertical descent path for an aircraft on final approach to a runway, while non-precision instrument approach aids provide only course alignment information. In the past, most existing precision instrument approaches in the United States have been the instrument landing system (ILS); however, with advances in global positioning system (GPS) technology, it can now be used to provide both vertical and lateral navigation for pilots under certain conditions.

AMW has straight-in instrument approach capabilities to Runways 1-19 and 13-31. Runway 1 is served by precision instrument approach procedures down to ½-mile, while Runways 19 and 13-31 are served by a non-precision area navigation (RNAV) GPS approaches not lower than one-mile. The precision instrument approach serving Runway 1 and the RNAV GPS approach to Runway 19 provide for 250-foot cloud ceilings. The RNAV GPS approaches to Runway 13-31 provides for one-mile approach visibility minimums and cloud ceilings at 294 and 275 feet, respectively. Except for the ILS or localizer (LOC) instrument approach to Runway 1, it is important to note that aircraft with approach speeds between 141 and 166 knots (Category D) are not authorized to conduct a straight-in instrument approach at the airport.

As a regional general aviation airport, the lowest possible visibility minimums should be considered when possible. Visibility minimums as low as ¾-mile or ½-mile are common at these airports. As such, improved instrument approach visibility minimums not lower than ¾-mile should be considered on Runway 19. Given that Runway 13-31 is designated as the crosswind runway, instrument approach visibility minimums of not lower than one mile should be maintained throughout the planning horizon.

Visual Approach Aids

In most instances, the landing phase of any flight must be conducted in visual conditions. To provide pilots with visual guidance information during landings to the runway, electronic visual approach aids are commonly provided at airports. The most common visual approach aids at airports include the visual approach slope indicator (VASI) and precision approach path indicator (PAPI). Currently, Runways 19, 13, and 31 are served by four-box VASIs. However, VASI lighting systems have begun to be phased-out by FAA and are being replaced by PAPI systems. As such, the airport should consider replacing the VASI approach aids serving Runway 13-31 with four-box PAPIs. If Runway 19 is to be served by instrument approach visibility minimums not lower than ¾-mile, consideration should be given to an economy approach lighting system (ALS) such as a medium intensity approach lighting system (MALS).

Given that Runway 1 is served by a precision instrument approach with visual approach minimums down to ½-mile, the runway end is served by a medium intensity approach lighting system with runway alignment indicator lights (MALSR), which should be maintained throughout the planning horizon.

Runway end identification lights (REILs) are flashing lights located at the runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and distinguish the runway end lighting from other lighting on the airport and in the approach areas. The FAA indicates that REILs should be considered for all lighted runway ends not planned for a more sophisticated approach lighting system. There are currently no REILs serving AMW. Consideration should be given to REILs serving Runway 13-31.

Weather Reporting Aids

Ames Municipal Airport has a lighted wind cone and segmented circle, as well as a lighted wind-T on the airfield. The wind cone and wind-T provide information to pilots regarding wind speed and direction. The segmented circle consists of a system of visual indicators designed to provide traffic pattern information to pilots. These should be maintained throughout the planning period.

An automated surface observation system (ASOS) is also located on the airfield, which provides weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur. This information is then transmitted at regular intervals (usually once per hour). Aircraft in the vicinity can receive this information if they have their radio tuned to the correct frequency (132.025 MHz). It should be noted that numerous reports have been made by local and transient pilots that the existing ASOS broadcast is difficult to tune into and is often sporadic. Many times, pilots will call the FBO for current weather reports due to inconsistency of the ASOS broadcast system.

AIRFIELD LIGHTING AND SIGNAGE

There are several lighting and signage aids serving pilots using AMW. These aids assist pilots in locating the airport and runway at night or in poor visibility conditions. They also assist in the ground movement of aircraft.

Airport Identification Lighting

The location of the airport at night is universally indicated by a rotating beacon. For civil airports, a rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The existing beacon is centrally located in the landside development area, immediately north of the automobile parking area and should be maintained throughout the planning period.

Runway and Taxiway Lighting

Runway lighting provides the pilot with positive identification of the runway and its alignment. Runways 1-19 and 13-31 are served by medium intensity runway lighting (MIRL). This system should be maintained through the planning period as it complements the runway's instrument approach capabilities during poor visibility conditions.

Medium intensity taxiway lighting (MITL) is provided on parallel Taxiways A and B and all associated entrance/exit, access, and connecting taxiways serving the airfield system. This system is vital for safe and efficient ground movements and should be maintained in the future. Future planning should also consider MITL on future taxiways that directly support the runway system at the airport. At a minimum, planning should also consider edge reflectors on more remote taxiways and taxilanes serving landside development areas.

As airfield lighting is replaced, the airport should consider upgrading the airfield lighting system with light emitting diode (LED) technology. LEDs have many advantages, including lower energy consumption, longer lifetime, tougher construction, reduced size, greater reliability, and faster switching. While a substantial initial investment is required upfront, the energy savings and reduced maintenance costs will outweigh any additional costs in the long run.

Airfield Signs

Airfield identification signs assist pilots in identifying their location on the airfield and directing them to their desired location. Lighted signs are installed on the runway and taxiway system on the airfield. The signage system includes runway and taxiway designations, holding positions, routing/directional, and runway exits. All existing signs should be maintained throughout the planning period. At present, there are no distance remaining signs serving AMW. As such, consideration should be given to the addition of distance remaining signage on Runway 1-19 at minimum.

A summary of the airside facilities previously discussed at AMW is presented on **Exhibit 3E**.

LANDSIDE FACILITY REQUIREMENTS

Landside facilities are those necessary for the handling of aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacity of the various components of each area was examined in relation to projected demand to identify future landside facility needs. At AMW, this includes components for general aviation needs such as:

- General Aviation Terminal Facilities
- Aircraft Hangars
- Aircraft Parking Aprons
- Airport Support Facilities

GENERAL AVIATION TERMINAL FACILITIES

The terminal facilities at an airport are often the first impression of the community that corporate officials and other visitors will encounter. General aviation terminal facilities at an airport provide space for passenger waiting, pilots' lounge, pilot flight planning, concessions, management, storage, and other



CATEGORY	EXISTING		FUTURE	
RUNWAYS	**1-19**	**13-31**	**1-19**	**13-31**
Runway Design Code (RDC)	C-II-2400	B-II-5000	Maintain	Maintain
Dimensions	5,701' x 100'	3,491' x 75'	Consider additional runway length	Consider additional runway length
Pavement Strength	30,000 lbs SWL 38,000 lbs DWL	30,000 lbs SWL	Maintain SWL Consider 60,000 lbs DWL	Maintain SWL
TAXIWAYS				
Parallel Taxiway	Yes	Yes	Maintain full length parallel taxiway	Maintain full length parallel taxiway
Parallel Taxiway Separation from Runway	400'	250'-540'	Maintain	Maintain at least 250'
Widths	35'	35'	Maintain	Maintain
Holding Position Locations from Runway	240' - 265'	190'-200'	Relocate to at least 250'	Relocate to at least 200'
Taxiway Geometry	Direct Access (B)	Direct Access (B1, B2), High Energy Crossing (A)	Consider mitigating High Energy Crossing (A)deficiencies	



CATEGORY	EXISTING		FUTURE	
NAVIGATIONAL AND WEATHER AIDS				
Instrument Approaches	≥ ½-mile ILS (1)/ ≥ 1-mile GPS (19)	≥ 1-mile GPS	Consider ≥ ¾-mile GPS (19)	Maintain
	ASOS, Lighted Wind Cone, Tetrahedron, and Beacon		Maintain	
LIGHTING AND MARKING				
Runway Lighting	MIRL	MIRL	Maintain	Same
Runway Marking	PI (1)/ NPI (19)	NPI	Maintain	Same
Taxiway Lighting	MITL	MITL	Maintain	Same
Approach Aids	MALSR (1)/VASI-4 (19)	VASI-4	PAPI-4, MALS (19)	Consider PAPI-4, REILs

KEY

- DWL - Dual Wheel Loading
- GPS - Global Positioning System
- ILS - Instrument Landing System
- MALS - Medium Intensity Approach Lighting System
- MALSR - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
- MIRL - Medium Intensity Runway Lighting
- MITL - Medium Intensity Taxiway Lighting
- PAPI - Precision Approach Path Indicator
- REIL - Runway End Identification Lights
- SWL - Single Wheel Loading

Exhibit 3E
AIRSIDE FACILITY REQUIREMENTS

various needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by FBOs and other specialty operators for these functions and services. At AMW, aviation terminal facilities are provided by the Central Iowa Air Service FBO. The amount of general aviation terminal building space currently provided by the FBO terminal building is estimated at 7,000 square feet. Other specialty aviation operators also provide secondary terminal support facilities.

The methodology used in estimating general aviation terminal facility needs was based upon the number of airport users expected to utilize general aviation facilities during the design hour. Space requirements for terminal facilities were based on providing 125 square feet per design hour itinerant passenger. A multiplier of 2.7 in the short term, increasing to 3.0 in the long term, was also applied to terminal facility needs in order to better determine the number of passengers associated with each itinerant aircraft operation. This increasing multiplier indicates an expected increase in business and charter operations through the long term. Business and charter operations typically support larger turboprop and jet aircraft which accommodate an increasing passenger load factor. Such is the case at AMW, as the facility is expected to experience an increase in these activities through the planning period of this study.

Table 3K outlines the space requirements for general aviation terminal services at AMW through the long-term planning period. As shown in the table, up to 6,000 square feet of space could be needed in the long term for general aviation passengers. As previously mentioned, the amount of space currently offered in the existing terminal building is approximately 7,000 square feet, which should be adequate through the long-term planning horizon. Other specialty aviation operators on the airfield also provide space for pilots and passengers. It can be assumed that adequate services and space is provided to accommodate their customers.

TABLE 3K
General Aviation Terminal Area and Automobile Parking
Ames Municipal Airport

	Currently Available	Short Term Need	Intermediate Term Need	Long Term Need
Design Hour Itinerant Operations	12	13	14	16
Passenger Multiplier	2.5	2.7	2.8	3.0
Design Hour Itinerant Passengers	30	35	40	48
Terminal Facility Area (s.f.)	7,000	4,400	5,000	6,000
Vehicle Parking Spaces	99[1]	77	85	99
Total Automobile Parking Area (s.f.)	29,600	27,000	29,800	34,700

[1]Accounts only for marked automobile parking spaces at the airport.
Source: Coffman Associates analysis

General aviation vehicular parking demands have also been determined for AMW. Space determinations for itinerant passengers were based on an evaluation of existing airport use, as well as standards set forth to help calculate projected terminal facility needs.

The parking requirements of based aircraft owners should also be considered. Although some owners prefer to park their vehicles in their hangar, safety can be compromised when automobile and aircraft movements are intermixed. For this reason, separate parking requirements, which consider one-half of based aircraft at the airport, were applied to general aviation automobile parking space requirements. Utilizing this methodology, parking requirements for general aviation activity call for approximately 77 spaces in the short term, increasing to approximately 99 spaces in the long-term planning horizon. It is estimated that there are 99 marked vehicle parking spaces at AMW currently serving various airport activities. It should be noted that differences in long-term parking square footage needs versus existing marked parking square footage are due to the planning standard of 350 square feet per parking space, which is being applied for future planning purposes. Ultimately, local demands will dictate the future parking area sizes and marked parking spaces allotted. Future consideration in the master plan will be given to providing vehicle parking to support additional development potential.

AIRCRAFT HANGARS

Utilization of hangar space varies as a function of local climate, security, and owner preferences. The trend in general aviation aircraft, whether single or multi-engine, is toward more sophisticated aircraft (and consequently, more expensive aircraft); therefore, many aircraft owners prefer enclosed hangar space to outside tiedowns.

The demand for aircraft storage hangars is dependent upon the number and type of aircraft expected to be based at the airport in the future. For planning purposes, it is necessary to estimate hangar requirements based upon forecast operational activity. However, actual hangar construction should be based upon actual demand trends and financial investment conditions.

While the majority of aircraft owners prefer enclosed aircraft storage, a number of based aircraft will still use outdoor tiedown spaces (due to lack of hangar availability, hangar rental rates, and/or operational needs). Therefore, enclosed hangar facilities do not necessarily need to be planned for each based aircraft. At AMW, approximately eight percent of based aircraft are gliders. Oftentimes, gliders are stored in portable trailers with the wings removed or with multiple other glider aircraft within a single hangar facility. Given the unique storage options for glider aircraft, hangar storage requirements have been calculated for powered aircraft only.

There are a variety of aircraft storage options typically available at an airport, including Port-A-Port hangars, T-hangars, linear box hangars, executive hangars, and bulk storage conventional hangars. Covered tiedowns are the most basic form of aircraft protection and are common in warmer climates. These structures provide a roof covering, but no walls or doors. There are no covered tiedowns at AMW, and for purposes of planning, any future covered tiedowns would be included in the T-hangar need forecast.

T-hangars are intended to accommodate one small single engine piston aircraft or, in some cases, one multi-engine piston aircraft. T-hangars are so named because they are in the shape of a “T,” providing a space for the aircraft nose and wings, but no space for turning the aircraft within the hangar. Basically, the aircraft can be parked in only one position. A Port-A-Port hangar is essentially a stand-alone T-hangar facility. As such, any future Port-A-Port facilities will be included in the T-hangar need forecast.

T-hangars are commonly "nested" with several individual storage units to maximize hangar space. In these cases, taxiway access is needed on both sides of the nested T-hangar facility. T-hangars are popular with aircraft owners with tighter budgets as they tend to be the least expensive enclosed hangar space to build and lease. T-hangar and Port-A-Port positions at the airport total approximately 70,950 square feet of aircraft storage capacity.

Similar to the T-hangar style is the linear box hangar. Linear box hangars typically provide storage for a single aircraft and can be nested with multiple individual linear box hangars. Unlike the T-hangar, linear box hangars enable the user to store aircraft in more ways than one. Ultimately, this will allow the user to maximize aircraft storage space. At this time, there are no linear box hangars located at AMW; however, this hangar type will be included within the T-hangar space requirements as linear box hangar types are similar in nature and could be built should demand dictate.

The next type of aircraft hangar common for storage of general aviation aircraft is the executive hangar. Executive hangars typically provide a larger space, generally with an area between 2,500 and 10,000 square feet. This type of hangar can provide for maneuverability within the hangar, can accommodate more than one aircraft, and may have a small office and utilities. Executive hangars may be connected in a row of units with doors facing a taxilane. Executive hangars may also be stand-alone hangars. These hangars are typically utilized by a corporate/business entity or to support an on-airport business. AMW currently has approximately 38,800 square feet of executive hangar aircraft storage capacity.

Conventional hangars are the large, clear span hangars typically located facing the main aircraft apron at airports. These hangars provide for bulk aircraft storage and are often utilized by airport businesses, such as an FBO and/or aircraft maintenance business. Conventional hangars are generally larger than executive/box hangars and can range in size from 10,000 square feet to more than 20,000 square feet. Often, a portion of a conventional hangar is utilized for non-aircraft storage needs, such as maintenance or office space. There is an estimated 26,700 square feet of conventional hangar space at AMW.

Planning for future aircraft storage needs is based on typical owner preferences and standard sizes for hangar space. For determining future aircraft storage needs in T-hangars and linear box hangars, planning standards of 1,200 square feet and 1,500 square feet are utilized for single engine piston aircraft and multi-engine piston aircraft, respectively. For executive and conventional hangars, a planning standard of 3,000 square feet is utilized for turboprop aircraft, 6,000 square feet is utilized for business jet aircraft, and 1,500 square feet is utilized for helicopter storage needs.

At AMW, with a total of 78 based aircraft, there are currently six gliders based at the airport. As previously mentioned, gliders have not been included in the hangar storage analysis due to their unique storage options. As such, it is estimated that 72 based aircraft at AMW are currently hangered. With the trend toward aircraft owners preferring enclosed aircraft storage space, minimal growth is projected for aircraft that utilize outside tiedowns. Providing a mix of aircraft storage options is preferred when planning storage needs, in order to meet the varied needs of aircraft owners. **Table 3L** provides a summary of the aircraft storage needs through the long-term planning horizon.

TABLE 3L
Aircraft Hangar Requirements
Ames Municipal Airport

	Currently Available	Short Term Need	Intermediate Term Need	Long Term Need
Total Based Aircraft	78	83	89	101
Aircraft to be Hangared	72	77	83	95
Hangar Area Requirements				
T-Hangar/Linear Box Hangar Area (s.f.)	70,950	73,100	76,400	85,700
Executive Hangar Area (s.f.)	38,800	41,800	44,800	50,800
Conventional Hangar Area (s.f.)	26,700	34,200	41,700	53,700
Office/Maintenance Area (s.f.)	-	9,600	20,000	31,900
Total Hangar Area (s.f.)	**136,450***	**158,700**	**182,900**	**222,100**

*Includes total hangar and maintenance area currently at the airport.
Source: Coffman Associates analysis

The analysis shows that future hangar requirements indicate there is a potential need for over 222,100 square feet of hangar storage space to be offered through the long-term planning period. This includes a mixture of hangar and maintenance areas. Due to the projected increase in based aircraft, annual aircraft operations, and hangar storage needs, facility planning will consider additional hangars at the airport. It is expected that the aircraft storage hangar requirements will continue to be met through a combination of hangar types. The largest need could involve the construction of conventional-style hangars that are better suited to accommodate larger turboprop and jet aircraft.

It should be noted that hangar requirements are general in nature and based on the aviation demand forecasts. The actual need for hangar space will further depend on the actual usage within hangars. For example, some hangars may be utilized entirely for non-aircraft storage, such as maintenance; yet from a planning standpoint, they have an aircraft storage capacity. Therefore, the needs of an individual user may differ from the calculated space necessary.

AIRCRAFT PARKING APRONS

The aircraft parking apron is an expanse of paved area intended for aircraft parking and circulation. Typically, a main apron is centrally located near the airside entry point, such as the terminal building or FBO facility. Ideally, the main apron is large enough to accommodate transient airport users as well as a portion of locally based aircraft. Often, smaller aprons are available adjacent to FBO or specialty aviation service operator (SASO) hangars and at other locations around the airport. The apron layout at AMW generally follows this typical pattern.

The combined aircraft parking and movement areas at AMW total approximately 22,800 square yards. Aircraft apron area strictly designated for aircraft parking is approximately 10,600 square yards and includes those spaces outlined in Chapter One. A planning criterion of 800 square yards was used for single and multi-engine itinerant aircraft, while a planning criterion of 1,600 square yards was used to determine the area for transient turboprop and jet aircraft.

A parking apron should also provide space for locally based aircraft that require temporary tiedown storage. Locally based tiedowns typically will be utilized by smaller single engine aircraft; thus, a planning standard of 650 square yards per position is utilized. For local tiedown needs, five spaces are identified for maintenance activities. Maintenance activities would include the movement of aircraft into and out of hangar facilities and temporary storage of aircraft on the apron.

The total apron parking requirements are presented in **Table 3M**. Currently, there are 19 marked positions available for based and itinerant aircraft at AMW. As shown in the table, approximately 10 marked tiedown positions could be needed through the planning period of this study. Additionally, there is a projected need for approximately 15,700 square yards of aircraft parking apron space.

TABLE 3M
Aircraft Parking Apron Requirements
Ames Municipal Airport

	Currently Available	Short Term Need	Intermediate Term Need	Long Term Need
Based GA Aircraft Positions	-	2	3	5
Transient Single/Multi-Engine Aircraft Positions	-	16	18	20
Transient Business Jet Positions	-	2	3	4
Total Positions	19*	20	24	29
Total Apron Area (s.y.)	**10,600**	**17,900**	**20,700**	**26,300**

*Available parking only includes marked positions.
Source: Coffman Associates analysis

AIRPORT SUPPORT FACILITIES

Various other landside facilities that play a supporting role in overall airport operations have also been identified. These support functions include facilities related to fuel storage, aircraft rescue and firefighting (ARFF), maintenance, utilities, and security.

Fuel Storage

At present, there are four fuel farms located on the airport. Central Iowa Air Service operates one fuel farm that consists of underground tanks providing for 10,000 gallons of Jet A fuel storage and 10,000 gallons of 100LL storage. There are three other fuel farms on the airfield that are designated for private-use only. Of the three private fuel farms, two are operational. One is an aboveground Jet-A fuel tank with a capacity of approximately 5,000 gallons; the other is an aboveground fuel tank with an approximate capacity of 700 gallons for 100LL. It should be noted that additional fuel storage capacity for 100LL and Jet A is available in FBO fuel service trucks. For planning purposes, only permanent fuel storage facilities available to the public will be considered.

Based upon historic fuel flowage records provided by airport management, in calendar year 2018, the airport pumped approximately 179,775 gallons of Jet A and 47,104 gallons of 100LL. This works out to approximately 4.69 gallons per turbine operation and 1.23 per piston operation. Based upon projected operational growth, maintaining the gallons per operation ratios constant through the forecast period results in total flowage increasing to 281,100 of Jet A and 73,000 gallons of 100LL.

Maintaining a 14-day fuel supply would allow the airport to limit the impact of a disruption of fuel delivery. Future aircraft demand experienced by the FBO will determine the need for additional fuel storage capacity. In the future, based on these usage assumptions, additional fuel storage capacity could be needed to meet demand for Jet A fueling operations. One option to address this storage capacity issue is to increase the frequency of fuel deliveries. The forecasted fuel storage requirements are summarized in **Table 3N**. At this time, all fuel is dispensed through full-service fuel trucks. The airport could consider implementing self-service fueling for 100LL. It is important that the airport work with the FBO to plan for adequate levels of fuel storage capacity through the long-term planning period of this study.

TABLE 3N
Fuel Storage Requirements
Ames Municipal Airport

			Planning Horizon		
	Available	Current	Short Term Need	Intermediate Term Need	Long Term Need
Jet A					
Daily Usage (gal.)		490	620	680	770
14-Day Supply (gal.)	10,000[1]	8,100	8,700	9,500	10,800
Annual Usage (gal.)		179,775	226,300	248,200	281,100
100LL					
Daily Usage (gal.)		129	160	180	200
14-Day Supply (gal.)	10,000[1]	2,100	2,300	2,500	2,800
Annual Usage (gal.)		47,104	58,400	65,700	73,000

[1]Total fuel storage capacity on airport available to the public.
Source: Airport Records; Coffman Associates analysis

Aircraft Rescue and Firefighting

Presently, there is no dedicated ARFF facility at AMW. Requirements for ARFF services at an airport are established under Title 14 CFR Part 139, which applies to the certification and operation of airports served by any scheduled or unscheduled passenger operation of an air carrier using an aircraft with more than nine seats. Since the airport is not a Part 139 facility, an on-site ARFF facility is neither required nor justified. At present, emergency services are provided by the Ames Fire Department Station Three, which is located approximately one mile east of the airport.

Maintenance Facilities

Currently, AMW does not have a building dedicated to airport maintenance or storage located on the airfield. However, city-owned maintenance equipment is stored at the airport on a cyclical basis for its use on the airfield. The airport should consider the addition of a building specifically dedicated to the storage of airport maintenance equipment. The alternatives in the next chapter will examine potential locations for a dedicated storage and maintenance facility in the future.

Utilities

The availability and capacity of the utilities serving the airport are factors in determining the development potential of the airport property, as well as the land immediately adjacent to the facility. As discussed in Chapter One, the availability of water, gas, sewer, and power sources are of primary concern when assessing available utilities. At present, gas utility services are provided by Alliant Energy, while electricity, water, and sewer are all provided by the City of Ames. Given the forecast potential for future landside facility growth, the utility infrastructure serving the airport may need to be expanded to serve future development.

Perimeter Fencing and Gates

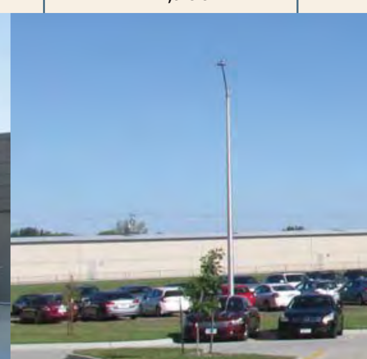
Perimeter fencing is used at airports primarily to secure the aircraft operational area. The physical barrier of perimeter fencing provides the following functions:

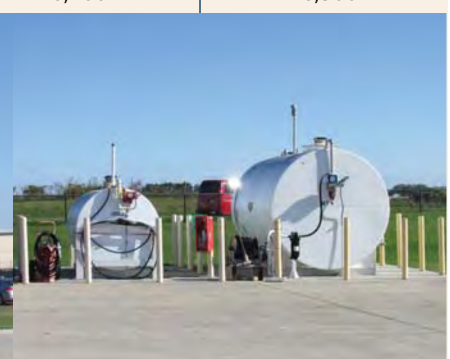
- Gives notice of the legal boundary of the outermost limits of a facility or security-sensitive area.
- Assists in controlling and screening authorized entries into a secured area by deterring entry elsewhere along the boundary.
- Supports surveillance, detection, assessment, and other security functions by providing a zone for installing intrusion-detection equipment and closed-circuit television (CCTV).
- Deters casual intruders from penetrating a secured area by presenting a barrier that requires an overt action to enter.
- Demonstrates the intent of an intruder by their overt action of gaining entry.
- Causes a delay to obtain access to a facility, thereby increasing the possibility of detection.
- Creates a psychological deterrent.
- Optimizes the use of security personnel, while enhancing the capabilities for detection and apprehension of unauthorized individuals.
- Demonstrates a corporate concern for facilities.
- Limits inadvertent access to aircraft operations area by wildlife.

Currently, the landside development area is surrounded by chain-link fencing to prevent inadvertent access onto the airfield by vehicles and/or pedestrians. However, there is no perimeter fencing in place surrounding the airfield. Signs prohibiting unauthorized entry are displayed on existing gates, fences, buildings, and other prominent locations to control inadvertent entry to the airfield. A series of controlled-access gates and manual access gates are installed in various locations to provide access for tenants on the airfield. As such, the airport should consider the addition of uniform perimeter fencing surrounding the airfield operations area (AOA).

A summary of the landside facilities previously discussed at AMW is presented on **Exhibit 3F**.

CATEGORY	AVAILABLE	SHORT TERM	INTERMEDIATE TERM	LONG TERM
AIRCRAFT STORAGE				
T-Hangar/Port-A-Port Area (s.f.)	70,950	73,100	76,400	85,700
Executive Hangar Area (s.f.)	38,800	41,800	44,800	50,800
Conventional Hangar Area (s.f.)	26,700	34,200	41,700	53,700
Office/Maintenance Area (s.f.)	-	9,600	20,000	31,900
Total Hangar Storage Area (s.f.)	136,450	158,700	182,900	222,100
AIRCRAFT APRON				
Single, Multi-engine Transient Aircraft Positions	16	16	18	20
Transient Business Jet Positions	3	2	3	4
Locally Based Aircraft Positions	0	2	3	5
Total Positions	19	20	24	29
Total Apron Area (s.y.)	10,600	17,900	20,700	26,300





CATEGORY	AVAILABLE	SHORT TERM	INTERMEDIATE TERM	LONG TERM
TERMINAL FACILITY AND AUTOMOBILE PARKING REQUIREMENTS				
GA Terminal Building Space (s.f.)	7,000	4,400	5,000	6,000
GA Terminal Parking Spaces	58*	35	40	48
Based Aircraft Auto Spaces	11*	42	45	51
Total GA Auto Parking Spaces	99*	77	85	99
Total Parking Area (s.f.)*	29,600*	27,000	29,800	34,700
SUPPORT FACILITY REQUIREMENTS				
14-Day Fuel Storage Capacity (gal.) 100LL	10,000	2,300	2,500	2,800
14-Day Fuel Storage Capacity (gal.) Jet A	10,000	8,100	8,700	10,800
Self-Service Fueling	-	Consider Self-Service Fueling Facility		Maintain
Security Fencing/Gates	-	Consider Fencing Enhancements		Maintain
Airport Maintenance Facilities	-	Consider Maintenance Facility		Maintain

*Accounts for marked parking only.

NOTE: Differences in long-term parking needs vs existing square footage are a result of the planning standard of 350 sf per parking space.

Exhibit 3F
LANDSIDE FACILITY REQUIREMENTS

SUMMARY

This chapter has outlined the safety design standards and facilities required to meet potential aviation demand projected at AMW for the next 20 years. In an effort to provide a more flexible Airport Master Plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a five-year timeframe, the intermediate term is approximately 10 years, and the long term is 20 years. By utilizing planning horizons, airport management can focus on demand indicators for initiating projects and grant requests rather than on specific dates in the future.

In Chapter Four, potential improvements to the airside and landside systems will be examined through a series of development alternatives. Most of the alternatives discussion will focus on those capital improvements that would be eligible for federal and state grant funds. Other projects of local concern will also be presented. Ultimately, an overall development plan that presents a vision beyond the 20-year scope of this Airport Master Plan will be developed for AMW.

AMES MUNICIPAL AIRPORT

CHAPTER 4

ALTERNATIVES

AMES MUNICIPAL
AIRPORT

CITY OF Ames

CHAPTER FOUR

ALTERNATIVES

In the previous chapter, airport facilities required to satisfy the demand through the long-range planning period were identified. The next step in the planning process is to evaluate reasonable ways these facilities can be provided. The purpose of this chapter is to formulate and examine rational airport development alternatives that can address the short-, intermediate-, and long-term planning horizon levels. Because there are a multitude of possibilities and combinations, it is necessary to focus on those opportunities which have the greatest potential for success. Each alternative provides a differing approach to meet existing and future facility needs, and these layouts are presented for purposes of evaluation.

Airports, especially those located in urban settings, eventually become constrained and require careful planning to ensure long-term viability. Some airports become constrained due to limited space (property) availability, while others may become constrained due to encroachment of adjacent land use development. Thoughtful consideration should be given to the layout of future facilities and impacts they could have on potential airfield improvements at Ames Municipal Airport (AMW), especially those related to the runway and taxiway system and the limited property availabilities for landside development. Proper planning at this time will ensure the long-term viability of the airport for both aviation and economic growth.

The primary goal of this planning process is to develop a viable plan for meeting the needs resulting from the projected market demand over the next 20 years. The plan of action should be developed in a manner that is consistent with the future goals and objectives of the City of Ames, airport users, and citizens of Ames, who have a vested interest in the development and operation of the Ames Municipal Airport.

The goal is to develop the underlying rationale which supports the final recommended development concept. Through this process, an evaluation of the highest and best uses of airport property will be made, while also weighing local development goals, physical and environmental constraints, and appropriate airport design standards.

The development alternatives for AMW can be categorized into two functional areas: **airside** (runways, taxiways, navigational aids, etc.) and **landside** (hangars, parking aprons, terminal area, and vehicle parking, etc.). Within each of these areas, specific capabilities and facilities are required or desired. In addition, the utilization of airport property to provide revenue support for the airport, and to benefit the economic well-being of the community and surrounding region, must be considered.

Each functional area interrelates and affects the development potential of the other. Therefore, all relevant airside and landside areas are examined individually, and then combined, to ensure the final plan is functional, efficient, and cost-effective. The total impact of all these functional areas on the existing airport must be evaluated to determine if investment in the airport will meet the needs of the community, both during and beyond the 20-year planning period.

The alternatives presented in this chapter are developed to meet projected aviation demand and comply with Federal Aviation Administration (FAA) design standards to the greatest extent practicable. While capital outlays necessary to implement a plan are important, the alternative analysis completed here will not limit or judge reasonable development plans based on projected costs. The investment necessary for each alternative is not considered at this point to ensure that the final plan first meets the needs of the airport and its users. The approach is intended to ensure that the best plan is put forth, not the lowest cost plan. Only where a project cost would be extraordinarily high is it considered as a limiting factor. Once a final plan is developed, cost estimates will be developed for each individual project considered during the next 20 years.

Through coordination with the City of Ames, the Technical Advisory Committee (TAC), and the public, an alternative, or combination of two or more, will be refined and modified as necessary into a recommended development concept. Therefore, the alternatives presented in this chapter can be considered a starting point in the evolution of a recommended development concept for the future of AMW.

NON-DEVELOPMENT ALTERNATIVES

Prior to the presentation of development alternatives for AMW, there are several non-development options that should be considered. Non-development alternatives include a “no-build” or “do-nothing” alternative, development of a new replacement airport at a new location, or closure of the existing airport and the transfer of services to another existing airport. The following presents a discussion of the three primary non-development alternatives and the impact of pursuing each.

NO-BUILD/DO-NOTHING ALTERNATIVE

The no-build alternative essentially considers making no new capital investments in the airport. Limited maintenance and upkeep would continue so that the airport remains safe for aviation activity. No new hangars or apron area would be planned to be built by the airport sponsor; however, this would not, and could not, include the prohibition of hangar construction by a private entity. The obvious result of the no-build alternative is that the airport would be unable to accommodate forecasted demand for aviation services in the area.

The primary reason a community might choose a no-build alternative is to ultimately not be bound by the grant assurances associated with the acceptance of airport development grants. Grant assurances are part of the grant package contract that the airport sponsor commits to when accepting a development grant from the FAA. As such, airport sponsors are bound to maintain the useful life of the facilities developed or equipment acquired for an airport development project. Useful life is a term not to exceed twenty (20) years from the date of acceptance of a grant offer of federal (FAA) funds for a project. There is no limit on the duration of the terms, conditions, and assurances with respect to real property acquired with federal (FAA) funds.

The unavoidable consequence of the no-build alternative is that the capability of the airport would diminish over time. Its ability to serve as a regional general aviation airport for the Ames metropolitan area would deteriorate. This would lead to diminished activity levels and would ultimately negatively impact the local and regional economy. Safety concerns would arise, especially if necessary routine maintenance were deferred and the liability for damage to aircraft or accidents would increase. The long-term consequences of the no-build alternative would be to reduce the quality of the existing airport facilities over time, producing undesirable results. This scenario would result in an overall unpleasant experience for regular users and visitors.

AMW has received more than $9.3 million in FAA development grants since 1999. These grants represent a direct economic stimulus that has lasting positive economic impacts. The City has a vested interest in maintaining and improving airport facilities for Iowa State University (ISU), business, and general aviation users. Without a commitment to ongoing improvement of the airport, users of the airport will be constrained from taking full advantage of the airport's air transportation capabilities.

RELOCATE AIRPORT ALTERNATIVE

This option considers constructing a new airport to replace the existing AMW. The new airport would have to be completed prior to closure of the existing airport. Additional studies beyond the scope of this master plan would be required. These would include a feasibility study, a site selection study, a master plan for the replacement site, and appropriate environmental documentation of the new site (typically an environmental assessment [EA] or environmental impact statement [EIS]).

An important consideration is the potential cost associated with both constructing a new airport and closing the existing airport. A broad estimate for constructing a replacement airport is in the hundreds of millions of dollars to construct a new airport with similar capabilities as the existing airport.

A more detailed analysis would need to be undertaken to identify an acceptable site and to refine the project cost estimates. A large portion of the development costs would be eligible for FAA grant funding. Typically, non-revenue-producing facilities to be located within the airport property line are eligible for

FAA funding. New terminal buildings are eligible for FAA grant funding; however, funding eligibility is restricted to public-use areas only. Elements outside the property line, such as utility extension and surface roads, and other privatized facilities are not eligible for funding. Moreover, the City could have other financial costs, such as the cost of retiring existing leases with private or public entities. As an example, an FBO could need to be compensated for its facilities and, in some cases, loss of business, potentially resulting in costs extending into millions of dollars.

Often the trigger for pursuing a replacement airport is encroachment upon the existing airport to the point where it can no longer fulfill its role in the national aviation system. While development has extended to property immediately surrounding the airport, including residential developments to the north and immediately to the east, AMW is still capable of serving its existing and future ISU, business, and general aviation users.

If a replacement airport feasibility study were to be undertaken, a detailed analysis should identify a site capable of developing equivalent airside, terminal, and landside facilities that exist at AMW today, while providing convenient access to the local and regional service areas.

TRANSFER SERVICE TO ANOTHER AIRPORT ALTERNATIVE

The feasibility of transferring services to an alternate airport relies on answering two primary questions: first, is a capable alternative airport reasonably located to accommodate AMW's primary service area (Ames metropolitan area) and, second, can a nearby airport accommodate AMW's existing and projected aviation demand factors? An analysis of regional airports has been completed to determine if transferring aviation demand is reasonable.

There are six public-use airports within 30 nautical miles of AMW. These airports include Boone Municipal (BNW); Ankeny Regional (IKV); Drake Airport (2Y1); Perry Municipal (PRO); Des Moines International (DSM); and Webster City Municipal (EBS). Of the six public-use airports, all but one (2Y1) are eligible for FAA funding through the Airport Improvement Program (AIP) and are included in the FAA's *National Plan of Integrated Airport Systems* (NPIAS). DSM's primary function is to serve scheduled commercial passenger and cargo airline services; however, the airport also caters to general aviation operators, including a wide range of corporate aviation activity. The other four NPIAS airports in the region provide various levels of general aviation services, with IKV serving to relieve general aviation traffic at DSM. Both DSM and IKV offer a wide array of corporate and general aviation services most resembling services offered at AMW.

As a regional general aviation airport, AMW's service area is largely driven by aircraft owners/operators and where they choose to base their aircraft. At present, more than 50 percent of registered aircraft that are based at AMW reside or work within 10 miles of the airport and approximately 72 percent within 20 miles. Moreover, with the City of Ames being home to ISU, the airport is frequently utilized to accommodate charter aircraft from ISU personnel, athletic teams, competing athletic teams, visitors, alumni, and business leaders in the community. AMW is also located adjacent to the ISU Research Park, which is a large advantage for businesses and business leaders as the research park tenants and visitors utilizing AMW can fly almost directly to and from their place of business. None of these airports are geographically located to provide convenient access to AMW's primary service area and its users, which would lead to a lower utilization rate and significant economic losses for the local area.

As mentioned, the City of Ames has accepted more than $9.3 million dollars in federal development grant funding through the AIP for projects at AMW since 1999. Previously discussed, acceptance of development grants obligates the airport sponsor, through grant assurances, to maintain the airport as an airport. Closing the existing airport and transferring services to another existing airport would be considered a violation of these grant assurances, requiring repayment of grants not yet fully depreciated. The investments made, as well as the economic benefits received from the airport, both public and private, could not readily be shifted or regenerated to another airport without significant costs/losses. As such, this alternative is not considered practical, reasonable, and/or financially feasible.

NON-DEVELOPMENT ALTERNATIVES SUMMARY

The purpose of this master plan is to examine aviation needs at AMW over the course of the next 20 years. Therefore, this master plan will examine the needs of the existing airport and will present a program of needed capital improvement projects to cover the scope of the plan. Nonetheless, various non-development alternatives may be considered by the airport sponsor.

Information pertaining to the three most common non-development alternatives has been presented. These are the no-build, relocate/replacement alternatives, and transfer of services. This evaluation is not intended as a recommendation to pursue one of these alternatives; instead, it is for informational purposes only. If the airport sponsor were to pursue one of these alternatives, additional study beyond the scope of this master plan would be required.

Two of the three non-development alternatives would lead to the closure, or a significantly reduced operation, of the existing airport. There is a lengthy process to obtain approval for this course of action. As outlined, the primary hindrance to considering airport closure is the fact that airports have accepted federal development grants that include certain grant assurances, one of which is to maintain the improvement for its useful life (20 years). If an airport is closed in the interim, then the sponsor could be required to refund all or a portion of the past federal investment. Moreover, private investments by any airport operator would also require some form of repayment based on negotiated lease terms. The non-development options are not found to be feasible, practical, or prudent. AMW is a vibrant facility with abundant growth potential remaining. As such, the non-development alternatives will no longer be considered further in this planning process.

AIRPORT DEVELOPMENT OBJECTIVES

It is the goal of this effort to produce a safe and efficient airfield as well as landside facilities, which includes appropriate general aviation terminal space, aircraft storage mix, and aviation businesses to best serve forecast aviation demands. However, before defining and evaluating alternatives, specific airport development objectives will be considered. As owner and operator, the City of Ames provides the overall guidance for the operation and development of the airport. It is of primary concern that the airport is marketed, developed, and operated for the betterment of the community and its users. The following development objectives have been defined for this planning effort:

- Conform to FAA and IDOT (Iowa Department of Transportation) design and safety standards, wherever practical, for the mix of aircraft that could potentially use the airport during the 20-year planning period.
- Preserve and protect public and private investments in existing airport facilities.
- Develop a safe, attractive, and efficient aviation facility in accordance with applicable federal, state, and local regulations.
- Provide adequate airport capacity which will meet the long-term planning horizon demand levels (general aviation, aviation businesses, and support facilities).
- Reflect and support the long-term planning efforts currently applicable to the region.
- Identify any future land acquisition needs.
- Develop a facility with a focus on self-sufficiency in both operational and development cost recovery.
- Ensure that future development is environmentally compatible.

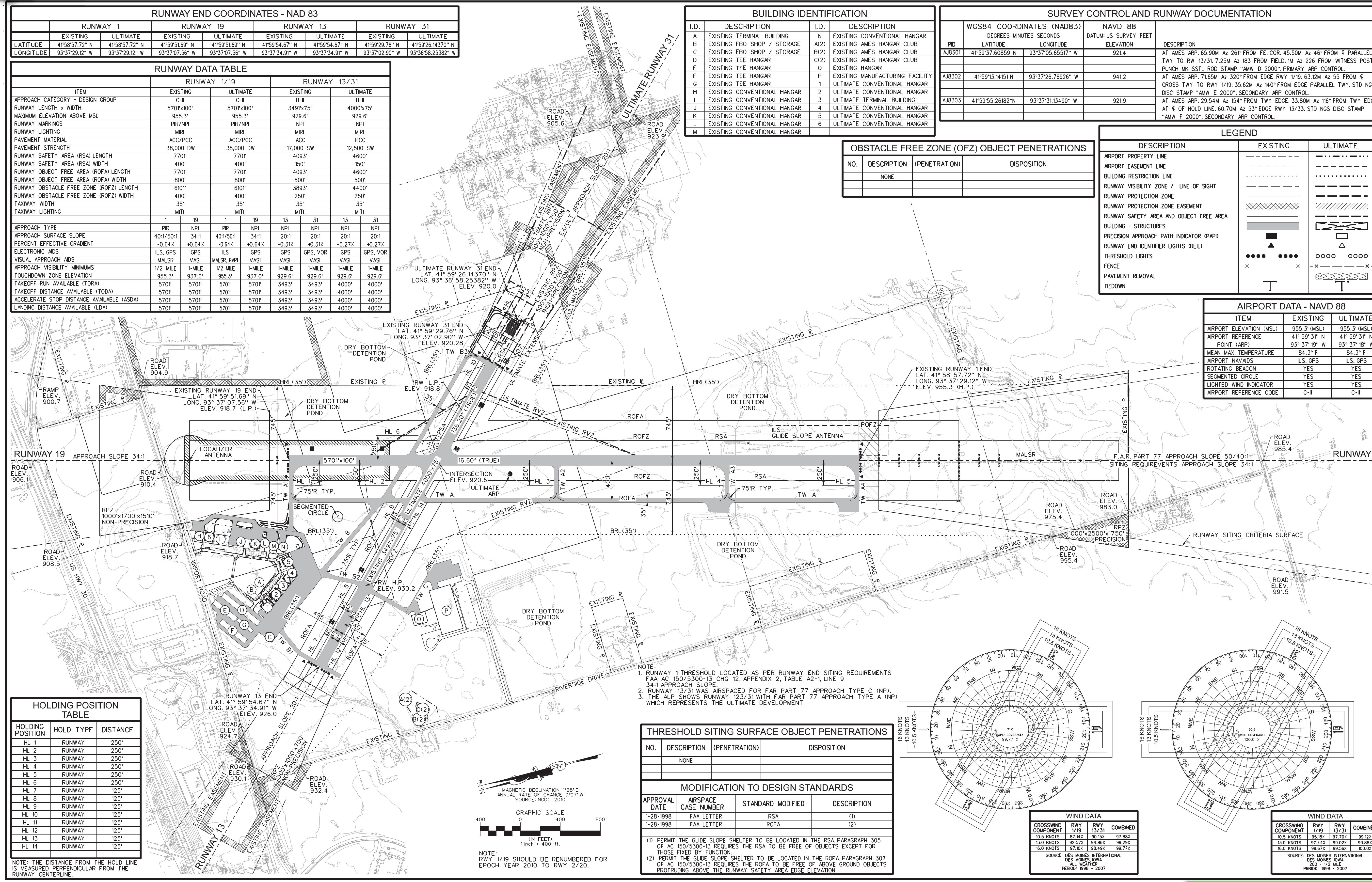
REVIEW OF PREVIOUS AIRPORT PLANS

The previous master plan for AMW was completed in 2008. As part of the planning effort, the Airport Layout Plan (ALP) was also updated and approved by the FAA in 2010. The Airport Layout Drawing (ALD) is shown on **Exhibit 4A**. The ALD provides information on existing and ultimate conditions at AMW, including:

- Airport data related to airport category, Airport Reference Code (ARC), elevation, wind conditions, temperature, and navigational aids located at the airport.
- Runway data related to the critical design aircraft, safety areas, markings, lighting, and visual and navigational aids associated with the runway and taxiway system.

Additionally, the ALD graphically depicts information and further outlines airside and landside recommendations based upon previous airport planning that include:

- Maintaining ARC B-II design standards for Runway 13-31 and ultimate C-II design standards for Runway 1-19.
- Maintain non-precision instrument approach with visibility minimums of not lower than one mile on Runways 19, 13, and 31.
- Maintain the precision instrument approach with visibility minimums of not lower than ½-mile serving Runway 1.
- A southeastern extension of Runway 13-31 to an ultimate length of 4,000 feet.
- Additional landside development in the form of a terminal facility, hangars, aircraft parking, and support facilities.



NOTE:
RWY 1/19 SHOULD BE RENUMBERED FOR EPOCH YEAR 2010 TO RWY 2/20.

RUNWAY END COORDINATES - NAD 83

	RUNWAY 1		RUNWAY 19		RUNWAY 13		RUNWAY 31	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE	EXISTING	ULTIMATE	EXISTING	ULTIMATE
LATITUDE	41°58'57.72" N	41°58'57.72" N	41°59'51.69" N	41°59'51.69" N	41°59'54.67" N	41°59'54.67" N	41°59'29.76" N	41°59'26.14370" N
LONGITUDE	93°37'29.12" W	93°37'29.12" W	93°37'07.56" W	93°37'07.56" W	93°37'34.91" W	93°37'34.91" W	93°37'02.90" W	93°36'58.25382" W

RUNWAY DATA TABLE

ITEM	RUNWAY 1/19 EXISTING		RUNWAY 1/19 ULTIMATE		RUNWAY 13/31 EXISTING		RUNWAY 13/31 ULTIMATE	
APPROACH CATEGORY - DESIGN GROUP	C-II		C-II		B-II		B-II	
RUNWAY LENGTH x WIDTH	5701'x100'		5701'x100'		3491'x75'		4000'x75'	
MAXIMUM ELEVATION ABOVE MSL	955.3'		955.3'		929.6'		929.6'	
RUNWAY MARKINGS	PIR/NPI		PIR/NPI		NPI		NPI	
RUNWAY LIGHTING	MIRL		MIRL		MIRL		MIRL	
PAVEMENT MATERIAL	ACC/PCC		ACC/PCC		ACC		PCC	
PAVEMENT STRENGTH	38,000 DW		38,000 DW		17,000 SW		12,500 SW	
RUNWAY SAFETY AREA (RSA) LENGTH	7701'		7701'		4093'		4600'	
RUNWAY SAFETY AREA (RSA) WIDTH	400'		400'		150'		150'	
RUNWAY OBJECT FREE AREA (ROFA) LENGTH	7701'		7701'		4093'		4600'	
RUNWAY OBJECT FREE AREA (ROFA) WIDTH	800'		800'		500'		500'	
RUNWAY OBSTACLE FREE ZONE (ROFZ) LENGTH	6101'		6101'		3893'		4400'	
RUNWAY OBSTACLE FREE ZONE (ROFZ) WIDTH	400'		400'		250'		250'	
TAXIWAY WIDTH	35'		35'		35'		35'	
TAXIWAY LIGHTING	MITL		MITL		MITL		MITL	
	1	19	1	19	13	31	13	31
APPROACH TYPE	PIR	NPI	PIR	NPI	NPI	NPI	NPI	NPI
APPROACH SURFACE SLOPE	40:1/50:1	34:1	40:1/50:1	34:1	20:1	20:1	20:1	20:1
PERCENT EFFECTIVE GRADIENT	-0.64%	+0.64%	-0.64%	+0.64%	-0.31%	+0.31%	-0.27%	+0.27%
ELECTRONIC AIDS	ILS, GPS	GPS	ILS	GPS	GPS	GPS, VOR	GPS	GPS, VOR
VISUAL APPROACH AIDS	MALSR	VASI	MALSR, PAPI	VASI	VASI	VASI	VASI	VASI
APPROACH VISIBILITY MINIMUMS	1/2 MILE	1-MILE	1/2 MILE	1-MILE	1-MILE	1-MILE	1-MILE	1-MILE
TOUCHDOWN ZONE ELEVATION	955.3'	937.0'	955.3'	937.0'	929.6'	929.6'	929.6'	929.6'
TAKEOFF RUN AVAILABLE (TORA)	5701'	5701'	5701'	5701'	3493'	3493'	4000'	4000'
TAKEOFF DISTANCE AVAILABLE (TODA)	5701'	5701'	5701'	5701'	3493'	3493'	4000'	4000'
ACCELERATE STOP DISTANCE AVAILABLE (ASDA)	5701'	5701'	5701'	5701'	3493'	3493'	4000'	4000'
LANDING DISTANCE AVAILABLE (LDA)	5701'	5701'	5701'	5701'	3493'	3493'	4000'	4000'

BUILDING IDENTIFICATION

I.D.	DESCRIPTION	I.D.	DESCRIPTION
A	EXISTING TERMINAL BUILDING	N	EXISTING CONVENTIONAL HANGAR
B	EXISTING FBO SHOP / STORAGE	A(2)	EXISTING AMES HANGAR CLUB
C	EXISTING FBO SHOP / STORAGE	B(2)	EXISTING AMES HANGAR CLUB
D	EXISTING TEE HANGAR	C(2)	EXISTING AMES HANGAR CLUB
E	EXISTING TEE HANGAR	O	EXISTING HANGAR
F	EXISTING TEE HANGAR	P	EXISTING MANUFACTURING FACILITY
G	EXISTING TEE HANGAR	1	ULTIMATE CONVENTIONAL HANGAR
H	EXISTING CONVENTIONAL HANGAR	2	ULTIMATE CONVENTIONAL HANGAR
I	EXISTING CONVENTIONAL HANGAR	3	ULTIMATE TERMINAL BUILDING
J	EXISTING CONVENTIONAL HANGAR	4	ULTIMATE CONVENTIONAL HANGAR
K	EXISTING CONVENTIONAL HANGAR	5	ULTIMATE CONVENTIONAL HANGAR
L	EXISTING CONVENTIONAL HANGAR	6	ULTIMATE CONVENTIONAL HANGAR
M	EXISTING CONVENTIONAL HANGAR		

SURVEY CONTROL AND RUNWAY DOCUMENTATION

PID	WGS84 COORDINATES (NAD83) DEGREES MINUTES SECONDS LATITUDE	LONGITUDE	NAVD 88 DATUM: US SURVEY FEET ELEVATION	DESCRIPTION
AJ8301	41°59'37.60859 N	93°37'05.65517" W	921.4	AT AMES ARP. 65.90M Az 261° FROM FE. COR. 45.50M Az 46° FROM ℄ PARALLEL TWY TO RW 13/31. 7.25M Az 183 FROM FIELD. 1M Az 226 FROM WITNESS POST. PUNCH MK SSTL ROD STAMP "AMW D 2000". PRIMARY ARP CONTROL.
AJ8302	41°59'13.14151 N	93°37'26.76926" W	941.2	AT AMES ARP. 71.65M Az 320° FROM EDGE RWY 1/19. 63.12M Az 55 FROM ℄ CROSS TWY TO RWY 1/19. 35.62M Az 140° FROM EDGE PARALLEL TWY. STD NGS DISC STAMP "AMW E 2000". SECONDARY ARP CONTROL.
AJ8303	41°59'55.26182"N	93°37'31.13490" W	921.9	AT AMES ARP. 29.54M Az 154° FROM TWY EDGE. 33.80M Az 116° FROM TWY EDGE AT ℄ OF HOLD LINE. 60.70M Az 53° EDGE RWY 13/33. STD NGS DISC STAMP "AMW F 2000". SECONDARY ARP CONTROL.

OBSTACLE FREE ZONE (OFZ) OBJECT PENETRATIONS

NO.	DESCRIPTION	(PENETRATION)	DISPOSITION
	NONE		

LEGEND

DESCRIPTION	EXISTING	ULTIMATE
AIRPORT PROPERTY LINE		
AIRPORT EASEMENT LINE		
BUILDING RESTRICTION LINE		
RUNWAY VISIBILITY ZONE / LINE OF SIGHT		
RUNWAY PROTECTION ZONE		
RUNWAY PROTECTION ZONE EASEMENT		
RUNWAY SAFETY AREA AND OBJECT FREE AREA		
BUILDING - STRUCTURES		
PRECISION APPROACH PATH INDICATOR (PAPI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		
THRESHOLD LIGHTS		
FENCE		
PAVEMENT REMOVAL		
TIEDOWN		

AIRPORT DATA - NAVD 88

ITEM	EXISTING	ULTIMATE
AIRPORT ELEVATION (MSL)	955.3' (MSL)	955.3' (MSL)
AIRPORT REFERENCE POINT (ARP)	41° 59' 31" N 93° 37' 19" W	41° 59' 31" N 93° 37' 18" W
MEAN MAX. TEMPERATURE	84.3° F	84.3° F
AIRPORT NAVAIDS	ILS, GPS	ILS, GPS
ROTATING BEACON	YES	YES
SEGMENTED CIRCLE	YES	YES
LIGHTED WIND INDICATOR	YES	YES
AIRPORT REFERENCE CODE	C-II	C-II

HOLDING POSITION TABLE

HOLDING POSITION	HOLD TYPE	DISTANCE
HL 1	RUNWAY	250'
HL 2	RUNWAY	250'
HL 3	RUNWAY	250'
HL 4	RUNWAY	250'
HL 5	RUNWAY	250'
HL 6	RUNWAY	250'
HL 7	RUNWAY	125'
HL 8	RUNWAY	125'
HL 9	RUNWAY	125'
HL 10	RUNWAY	125'
HL 11	RUNWAY	125'
HL 12	RUNWAY	125'
HL 13	RUNWAY	125'
HL 14	RUNWAY	125'

NOTE: THE DISTANCE FROM THE HOLD LINE IS MEASURED PERPENDICULAR FROM THE RUNWAY CENTERLINE.

NOTE:
1. RUNWAY 1 THRESHOLD LOCATED AS PER RUNWAY END SITING REQUIREMENTS FAA AC 150/5300-13 CHG 12, APPENDIX 2, TABLE A2-1, LINE 9 34:1 APPROACH SLOPE.
2. RUNWAY 13/31 WAS AIRSPACED FOR FAR PART 77 APPROACH TYPE C (NP).
3. THE ALP SHOWS RUNWAY 123/31 WITH FAR PART 77 APPROACH TYPE A (NP) WHICH REPRESENTS THE ULTIMATE DEVELOPMENT

THRESHOLD SITING SURFACE OBJECT PENETRATIONS

NO.	DESCRIPTION	(PENETRATION)	DISPOSITION
	NONE		

MODIFICATION TO DESIGN STANDARDS

APPROVAL DATE	AIRSPACE CASE NUMBER	STANDARD MODIFIED	DESCRIPTION
1-28-1998	FAA LETTER	RSA	(1)
1-28-1998	FAA LETTER	ROFA	(2)

(1) PERMIT THE GLIDE SLOPE SHELTER TO BE LOCATED IN THE RSA. PARAGRAPH 305 OF AC 150/5300-13 REQUIRES THE RSA TO BE FREE OF OBJECTS EXCEPT FOR THOSE FIXED BY FUNCTION.
(2) PERMIT THE GLIDE SLOPE SHELTER TO BE LOCATED IN THE ROFA. PARAGRAPH 307 OF AC 150/5300-13 REQUIRES THE ROFA TO BE FREE OF ABOVE GROUND OBJECTS PROTRUDING ABOVE THE RUNWAY SAFETY AREA EDGE ELEVATION.

WIND DATA

CROSSWIND COMPONENT	RWY 1/19	RWY 13/31	COMBINED
10.5 KNOTS	87.14%	90.15%	97.88%
13.0 KNOTS	92.57%	94.86%	99.29%
16.0 KNOTS	97.10%	98.49%	99.77%

SOURCE: DES MOINES INTERNATIONAL
DES MOINES, IOWA
ALL WEATHER
PERIOD: 1998 - 2007

WIND DATA

CROSSWIND COMPONENT	RWY 1/19	RWY 13/31	COMBINED
10.5 KNOTS	95.18%	97.70%	99.12%
13.0 KNOTS	97.44%	99.02%	99.88%
16.0 KNOTS	99.67%	99.56%	100.0%

SOURCE: DES MOINES INTERNATIONAL
DES MOINES, IOWA
200 - 1/2 MILE
PERIOD: 1998 - 2007

Exhibit 4A
PREVIOUS AIRPORT LAYOUT PLAN

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The assumptions made and conclusions drawn from the previous planning efforts will be independently evaluated in this master plan. Some elements from the previous planning efforts may continue to be viable and could be included in this planning effort. Other elements may no longer be viable based on changes to design standards (FAA published new design standards in September 2012), changes in the long-term vision for the airport, environmental concerns, and/or financial considerations. The remainder of this chapter will present various alternatives to consider for both the airside and landside development of the airport.

AIRPORT ALTERNATIVE CONSIDERATIONS

As previously detailed, the development alternatives are categorized into two functional areas: airside and landside. Airside considerations relate to runways, taxiways, navigational aids, lighting and marking aids, etc., and require the greatest commitment of land area to meet the physical layout of the airport, as well as the required airfield safety standards. The design of the airfield also defines minimum setback distances from the runway and object clearance standards. These criteria are defined first to ensure that the fundamental needs of the airport are met. Landside considerations include hangars, aircraft parking aprons, terminal services, as well as utilization of remaining property to provide revenue support for the airport and to benefit the economic development and well-being of the regional area.

Exhibit 4B presents both airside and landside alternative considerations that will be specifically addressed in this analysis. These issues are the result of the findings of the aviation demand forecasts and facility requirements evaluations, as well as input from the TAC, airport management, City of Ames, and the public.

The remainder of this chapter will describe various development alternatives for airside and landside facilities. Although each area is treated separately, ultimate planning will integrate the individual requirements, so they can complement one another.

AIRSIDE PLANNING CONSIDERATIONS

This section identifies and evaluates various airside development factors at AMW to meet the requirements set forth in Chapter Three. Airside facilities are, by nature, the focal point of an airport complex. Because of their primary role and the fact that they physically dominate airport land use, airfield facility needs are often the most critical factor in the determination of viable development options. A summary of the primary airside planning issues to be considered in this alternatives analysis is listed below.

AIRPORT DESIGN CRITERIA

Applicable standards for airport design are outlined in FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, Change 1. The design of airfield facilities is primarily based on the physical and operational characteristics of aircraft using the airport. As discussed in Chapter Two, a Runway Design Code (RDC) is applied to each runway at an airport to identify the appropriate design standards for the runway and associated taxiway system. The RDC is made up of the Aircraft Approach Category (AAC), the Airplane

AIRSIDE CONSIDERATIONS

- Evaluate improvements necessary to meet the appropriate existing and ultimate Federal Aviation Administration (FAA) design standards for each runway.
- Examine potential runway extensions on Runways 1-19 and 13-31.
- Analyzed improved instrument approach considerations on Runways 13-31, and 19.
- Evaluate the taxiway system in meeting airfield safety, design, and geometry standards.
- Evaluate requirements to meet CFR 14 Part 139 Certification of Airports.
- Upgrade airport visual aids.

LANDSIDE CONSIDERATIONS

- Determine efficient land uses that allow the airport to meet the needs of aviation users and promote non-aviation uses where possible.
- Identify locations for hangar development to meet projected demand.
- Evaluate options to construct support facilities needed for aviation activities.
- Examine options for additional vehicle parking access while best segregating aircraft and vehicle traffic on airport movement areas.

Exhibit 4B
DEVELOPMENT CONSIDERATIONS

Design Group (ADG), and the approach visibility minimums expressed in runway visual range (RVR) values. It relates to the largest and fastest aircraft that regularly operate at the airport. The FAA has historically defined regular use as at least 500 annual operations at the airport. While this can, at times, be represented by one specific make and model of aircraft, most of the runways' RDC values are represented by several different aircraft, which collectively operate frequently at the airport.

As a regional general aviation airport in the FAA's NPIAS, AMW should be capable of safely accommodating the needs of corporate, charter, military, public safety, recreational, and instructional aviation uses in the greater Ames metropolitan area. Analysis in Chapter Two indicated that the RDC for Runway 1-19 is currently B-II-2400. However, larger business jets, such as the Challenger 600 / 604, as well as regional transport aircraft, including the Canadair CRJ 100 / 200 / 700 and Embraer ERJ 120 / 135 / 145, have also been identified operating at AMW. While operations larger than Aircraft Reference Code (ARC) C-II do not currently meet the operational threshold of 500, AMW has historically been planned to an ARC of C-II. Given the forecast increases in business jet and regional transport aircraft activity, primarily driven by the ISU Research Park, ISU (or visiting universities), and community business leaders, AMW could reasonably support a shift to RDC C-II-2400 in the near term. The airfield should continue to be planned for some of the most demanding general aviation business jet aircraft utilizing the airport and should strive to accommodate business jets and regional transport aircraft to the greatest extent possible as demand dictates. As such, alternative design considerations for Runway 1-19 will be presented under ultimate RDC C-II-2400 standards.

Presented in Chapter Three, crosswind Runway 13-31 has the best wind coverage of the two runways serving AMW. Under these circumstances, Runway 13-31 should meet RDC B-II-5000 design standards, which coincides with regular use by mid-size business jet and turboprop aircraft. Aircraft represented by ARC B-II design standards include the Beechcraft King Air family of turboprops and most of the Cessna Citation family of business jets, among many others.

RUNWAY LENGTH

The runway length analysis in the previous chapter concluded that the existing length of Runway 1-19 (5,701 feet) is capable of safely accommodating most business jet and limited regional transport aircraft currently operating at AMW. However, during hot summer periods, some larger aircraft must depart from AMW with restricted payloads (less fuel/passengers/freight), which can limit non-stop destination distances. Furthermore, when considering wet runway conditions, landing length requirements of the aircraft analyzed in Chapter Three often increase, and many exceed, the current primary runway length. Accumulations of snow and ice will also significantly increase landing length requirements. When analyzing the runway landing length of the most demanding aircraft that conducted over 500 operations collectively at AMW in 2018, the wet runway length required at maximum landing weight (MLW) for aircraft operating under Part 91k is over 6,300 feet and approximately 8,500 feet under Part 135. It should be noted that Part 135 landing operations during wet runway conditions will likely be the primary driver for runway length justification in the short term as there are some B-II aircraft (when operating under these conditions) that could help provide justification for a runway extension project. Therefore, runway length alternatives for Runway 1-19 will explore extension options to 7,000, 8,000, and 8,500 feet.

Crosswind Runway 13-31's current length of 3,491 feet is also capable of accommodating 95 percent of the small aircraft fleet, including some small business jet and turboprop aircraft during cool temperatures and dry runway conditions. Most turbine-powered aircraft, however, must operate with sizable restrictions to their takeoff weight due to operational limitations. Runway extension options for Runway 13-31 up to 3,900 feet will be considered to accommodate 100 percent of small airplanes.

The facility requirements concluded that additional length on the primary runway may become necessary in the future depending on how the business jet and regional transport aircraft fleet mix changes and grows. An extension to the crosswind runway would provide airfield redundancy for small aircraft operators. For these reasons, the alternatives to follow consider extensions to both runways so that the airport is prepared in the future should demand for an extension materialize. At a minimum, planning for runway extensions allows the City to develop land use and zoning policies that limit the potential for encroaching developments that would restrict future airport expansion.

TAXIWAY CONFIGURATION

Primarily, the taxiway system at AMW meets the recommended design and geometry standards set forth by the FAA. However, there are certain existing non-standard taxiway geometry conditions that need to be addressed. These non-standard conditions include:

- Taxiway A1 could be considered to provide direct access from the aircraft parking apron to Runway 1-19.
- Taxiway B provides direct access from the aircraft parking apron to Runway 1-19.
- Taxiways B1 and B2 provide direct access from the aircraft parking apron to Runway 13-31.

Each of these conditions can lead to pilots inadvertently taxiing onto the runway, creating a runway incursion and other potentially dangerous airfield safety concerns. Each of these conditions is addressed in the airside alternatives to follow.

ANCILLARY IMPROVEMENTS

14 CFR Part 139 Certification of Airports

Based upon the current level and forecast growth of air taxi and charter operations presented in Chapter Two of this study, AMW may be required to become a 14 CFR Part 139 certificated airport. This is further supported by the frequency of ISU athletic charter operations and jet operations associated with the ISU Research Park. The regulation (which implemented provisions of the *Airport and Airway Development Act of 1970*, as amended November 27, 1971) set standards for: the marking and lighting of areas used for operations, firefighting and rescue equipment and services, the handling and storing of hazardous materials, the identification of obstructions, and safety inspection and reporting procedures.

The 14 CFR Part 139 certification requirements applicable to AMW relate to the type of aircraft serving the airport. In helping to define the airport's class, it is important to understand the distinction between the definition of large and small air carrier aircraft.

- A large air carrier aircraft is designed for 31 passenger seats or more.
- A small air carrier aircraft is designed for 10 to 30 passenger seats.

It should be noted that 14 CFR Part 139 does not apply to airports served by scheduled air carrier aircraft with nine seats or less and/or unscheduled air carrier aircraft with 30 seats or less. 14 CFR Part 139 defines four airport classifications as follows:

- **Class I** - an airport certificated to serve scheduled operations of large air carrier aircraft that can also serve unscheduled passenger operations of large air carrier aircraft and/or scheduled operations of small air carrier aircraft. A Class I airport may serve any class of air carrier operations.
- **Class II** - an airport certificated to serve scheduled operations of small air carrier aircraft and the unscheduled passenger operations of large air carrier aircraft. A Class II airport cannot serve scheduled large air carrier aircraft.
- **Class III** - an airport certificated to serve scheduled operations of small air carrier aircraft. A Class III airport cannot serve scheduled or unscheduled large air carrier aircraft.
- **Class IV** - an airport certificated to serve unscheduled passenger operations of large air carrier aircraft. A Class IV airport cannot serve scheduled large or small air carrier aircraft.

Airports that meet the requirements for Part 139 certification are issued an Airport Operating Certificate (AOC). AOCs serve to ensure safety in air transportation. To obtain a certificate, an airport must agree to operational and safety standards and provide for certain safety services and facilities. These requirements vary depending on the size of the airport and the type of flights available. The regulation, however, does allow FAA to issue certain exemptions to airports that serve few passengers yearly and for which some requirements might create a financial hardship.

According to 14 CFR Part 139, the following steps would need to be taken in order for AMW to receive an AOC:

1. Prepare and submit an Airport Certification Manual (ACM) to the FAA.
2. Prepare ground vehicle operating rules and regulations.
3. Prepare a ground vehicle training program.
4. Prepare a training program for airport personnel involved with Part 139 implementation.
5. Ensure that FBOs comply with the fuel training requirements.
6. Develop a record-keeping system for the following:
    a. Personnel training (24 months)
    b. Emergency personnel training (24 months)
    c. Airport tenant fueling inspection (12 months)
    d. Airport tenant fueling agent training (12 months)
    e. Self-inspection (6 months)
    f. Movement areas and safety areas training (24 months)
    g. Accident and incident (12 months)

   h. Airport condition (6 months)
7. Prepare and submit an Airport Emergency Plan to the FAA.
8. Acquire an ARFF vehicle and comply with ARFF training and operational requirements.

The ACM is a required document that defines the procedures to be followed in the routine operation of the airport and for response to emergency situations. The ACM is a working document that is updated annually. It reflects the current condition and operation of the airport and establishes the responsibility, authority, and procedures as required. There are required sections for the ACM covering administrative detail and procedural detail. Each section independently addresses: who (primary/secondary), what, how, and when as it relates to each element.

The administrative sections of the ACM cover such elements as the organizational chart, operational responsibilities, maps, descriptions, weather sensors, access, and cargo. The procedural elements cover such items as paved and unpaved areas, safety areas, lighting and marking, communications and navigational aids, airport rescue and firefighting (ARFF), handling of hazardous material, utility protection, public protection, self-inspection program, ground vehicle control, obstruction removal, wildlife management, and construction supervision.

Aircraft Rescue and Fire Fighting (ARFF)

Part 139 airports are required to provide Aircraft Rescue and Fire Fighting services during air carrier operations. Each certificated airport maintains equipment and personnel based on an ARFF index established according to the length of aircraft and scheduled daily flight frequency. In terms of flight frequency, an airport's ARFF index is determined by the longest aircraft conducting at least five or more daily departures. In terms of aircraft length, there are five indices, A through E, with A applicable to the smallest aircraft and E the largest.

At present, there is no dedicated ARFF facility at AMW. **Table 4A** presents the vehicle requirements and capacities for each index level.

The current unscheduled charter/air taxi operators at AMW utilize a variety of aircraft, though most are by business jets or turboprops with less than 10 passenger seats, which do not count toward Part 139 certification. The unscheduled charter operators at AMW associated with ISU and/or the ISU Research Park most frequently utilize aircraft, such as the Fairchild-Dornier 328 Jet (30-33 seats/Index A), Embraer ERJ 135 (30-37 seats/Index A), and Embraer ERJ-140/145 (44-50 seats/Index B). Under these circumstances, AMW could be required to comply with ARFF Index A, at a minimum, depending upon seating configurations and aircraft utilized by unscheduled operators.

TABLE 4A ARFF Index Requirements		
Index	**Aircraft Length**	**Requirements**
Index A	<90'	1. One ARFF vehicle with 500 lbs. of sodium-based dry chemical or
		2. One vehicle with 450 lbs. of potassium-based dry chemical and 100 lbs. of water and AFFF for simultaneous water and foam application
Index B	90'-126'	1. One vehicle with 500 lbs. of sodium-based dry chemical and 1,500 gallons of water and AFFF or
		2. Two vehicles, one with the requirements for Index A and the other with enough water and AFFF for a total quantity of 1,500 gallons
Index C	126'-159'	1. Three vehicles, one having Index A, and two with enough water and AFFF for all three vehicles to combine for at least 3,000 gallons of agent or
		2. Two vehicles, one with Index B and one with enough water and ARFF for both vehicles to total 3,000 gallons
Index D	159'-200'	1. One vehicle carrying agents required for Index A and
		2. Two vehicles carrying enough water and AFFF for a total quantity by the three vehicles of at least 4,000 gallons
Index E	>200'	1. One vehicle with Index A and
		2. Two vehicles with enough water and AFFF for a total quantity of the three vehicles of 6,000 gallons
AFFF: Aqueous Film-Forming Foam ARFF: Aircraft Rescue and Fire Fighting		
Source: 14 CFR Part 139		

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The strength rating of a runway does not preclude aircraft weighing more than the published strength rating from using the runway. The strength is based on design parameters which support a high volume of aircraft at or below the published weight, allowing the pavement to survive its intended useful life. The FAA reports the pavement strength for Runway 1-19 at 30,000 pounds single wheel loading (SWL) and 38,000 pounds dual wheel loading (DWL). Runway 13-31 provides a strength rating of 30,000 pounds SWL. Given the number of jet aircraft currently operating and forecast to operate at AMW, future planning should maintain the existing SWL pavement strength at 30,000 pounds and consider increasing the DWL pavement strength to 60,000 pounds on Runway 1-19 at a minimum. The strength rating on Runway 13-31 is adequate to serve a majority of general aviation aircraft. The airport should maintain the runway strength rating at 30,000 pounds SWL.

Visual Approach Aids

Precision approach path indicator (PAPI) systems provide pilots with visual guidance information while on approach to land. Chapter Three identified a need to ultimately replace the four-box VASI systems currently installed on Runway 13-31 and Runway 19 to four-box PAPI-4 systems. It is also recommended that Runway 1 be served by a PAPI-4 as these are recommended for runways that serve jet operations. PAPI systems are typically located on the left side of the runway for approaching aircraft, at a distance from the runway threshold that would be determined during the installation process to achieve the correct threshold crossing height (TCH) and obstacle clearing surface (OCS). The locations of the ultimate PAPI-4s serving Runways 1-19 and 13-31 may vary depending on whether each runway is extended.

Runway end identification lights (REILs) are flashing lights located at the runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and distinguish the runway end lighting from other lighting on the airport and in the approach areas. The FAA indicates that REILs should be considered for all lighted runway ends not planned for a more sophisticated approach lighting system. As such, REILs should ultimately be planned to serve Runways 19 and 13-31.

Airfield Signage

Airfield identification signs assist pilots in identifying their location on the airfield and directing them to their desired location. Lighted signs are installed on the runway and taxiway system on the airfield. The signage system includes runway and taxiway designations, holding positions, routing/directional, and runway exits. All existing signs should be maintained throughout the planning period. At present, there are no distance remaining signs serving AMW. As such, consideration should be given to the addition of distance remaining signage on Runway 1-19 at minimum. Airfield signage should be expanded or upgraded as airfield improvements are made.

Holding Position Separation

As discussed in Chapter Three, the FAA mandates that all taxiway holding position markings be located 250 feet from runway centerline for RDC C-II runways with approach minimums lower than ¾-mile. At present, holding positions located on Taxiway B serving the eastern and western sides of Runway 1-19 are acutely angled to the runway, causing the nearest portion of each holding position to be located 242 and 240 feet from runway centerline, respectively. Similarly, land and hold short operations (LAHSO) markings are located on Runway 13-31, 230 feet from the Runway 1-19 centerline. It is recommended that the airport locate all holding position and LAHSO markings serving Runway 1-19 at least 250 feet from runway centerline when measuring from the nearest point of each respective holding position.

For RDC B-II runways with approach minimums not lower than one mile, holding position markings are required to be placed 200 feet from runway centerline. Currently, holding position markings located on Taxiway A serving Runway 13-31 are positioned at 190 feet from runway centerline when measuring from the nearest point of the holding position. Similarly, the holding position markings located on Taxiway B2 is 194 feet from runway centerline. It is recommended that the airport relocate the identified holding position markings to at least 200 feet from runway centerline and ensure that any new holding position markings comply with the design standards of the airfield.

Weather Reporting Aids

Currently, AMW has a lighted wind cone and segmented circle, as well as a lighted wind-T on the airfield, which should be maintained throughout the planning period. In addition, an automated surface observation system (ASOS) is also located on the airfield, which provides weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur. This information is then transmitted at regular intervals (usually once per hour). Aircraft in the vicinity can receive this information if they have their radio tuned to the correct frequency (132.025 MHz). However, it has been reported that the AMW ASOS broadcast is difficult to tune into, resulting in delayed and inaccurate local weather reports. Ultimately, actions should be taken to remedy the ASOS broadcast, which could include a frequency change or relocation of the broadcasting equipment.

AIRSIDE ALTERNATIVES

Three airfield alternatives have been prepared to address the issues outlined above. The details of each alternative are described below, along with the alternative's associated advantages and disadvantages.

AIRSIDE ALTERNATIVE 1

Depicted on **Exhibit 4C**, Airside Alternative 1 considers improvements to the airfield based loosely on the current ALP. This includes a 409-foot extension of the crosswind runway to the southeast to an ultimate length of 3,900 feet. The previous ALP has an extension on Runway 13-31 to an ultimate length of 3,900 feet. Primary differences in this alternative from the ALP are an extension to primary Runway 1-19 and Taxiway A and straightening of the quasi-parallel portion of Taxiway B to maintain a consistent 250-foot separation from taxiway centerline to Runway 13-31 centerline.

Runway 1-19 | A 1,299-foot extension of Runway 1-19 to the east results in a length of 7,000 feet, which would allow 75 percent of the business jet fleet to takeoff at 90 percent maximum takeoff weight (MTOW) during the hottest periods of the summer. Additionally, a runway of this length would allow regional transport aircraft, such as the ERJ 135 and 175, to takeoff at 100 percent useful load during hot summer months. As previously mentioned, Part 135 landing requirements during wet runway conditions will likely be the best method for justifying a runway extension. Primary impacts associated with a southern runway extension to 7,000 feet include shifting the RPZ serving Runway 1 beyond airport property, which includes approximately 46.6 acres of uncontrolled property, residential property, as well as portions of South Riverside Drive and 26th Street that would ultimately have to be relocated. The proposed improvements to the runway would involve several connected projects, including:

- An extension of Taxiway A
- Construction of a holding bay located on Taxiway A serving the extended Runway 1 threshold which conforms to FAA's updated design standards for holding bays
- Relocation of the instrument landing system (ILS) glide slope antenna

- Relocation of the medium intensity approach lighting system with runway alignment indicator lights (MALSR) serving Runway 1
- Acquisition (fee-simple/easement) of approximately 46.6 acres of uncontrolled property within the shifted runway protection zone (RPZ)
- Acquire and remove residential property located within the shifted RPZ
- Remove and relocate portions of South Riverside Drive and 26th Street within the shifted RPZ
- Mitigate any overgrown vegetation and gradient incompatibilities associated with the runway safety area (RSA), runway object free area (ROFA), and runway obstacle free zone (ROFZ)

Runway 13-31 | In this alternative, the crosswind runway is extended 409 feet to the southeast, resulting in an ultimate runway length of 3,900 feet. A runway of this length will readily accommodate 100 percent of the small aircraft fleet during hot summertime conditions. The proposed improvements to Runway 13-31 would involve several connected projects, including:

- An extension of Taxiway B
- Acquisition (fee-simple/easement) of approximately 0.4 and 0.5 acres of property within the shifted RPZ
- Mitigate any overgrown vegetation and gradient incompatibilities associated with the RSA, ROFA, and ROFZ

Taxiway Geometry Improvements | This alternative considers maintaining Taxiway B as a partial parallel taxiway serving Runway 13-31; however, it proposes the existing portion of Taxiway B located on the west side of Runway 1-19 be removed and relocated to maintain a 250-foot taxiway centerline to runway centerline separation. Ultimately, this will eliminate the existing direct access provided by Taxiway B from the aircraft parking apron to Runway 1-19. Furthermore, the construction of a holding bay, which conforms to FAA's updated design standards for holding bays, is located on Taxiway A serving the extended Runway 1 threshold to alleviate potential points of congestion.

Other taxiway improvements in this alternative include the following:

- The removal and relocation of Taxiway B2. The relocated Taxiway B2 is positioned at 90 degrees to Runway 13-31, eliminating the existing acute angle taxiway connection.
- Install no-taxi islands on the aircraft apron area preceding Taxiways B1 and B2, eliminating the direct access provided to Runway 13-31.

AIRSIDE ALTERNATIVE 2

Depicted on **Exhibit 4D**, Airside Alternative 2 considers a more significant extension of Runway 1-19 to the south as well as splitting the extension of Runway 13-31 between the northwest and southeast ends.

Runway 1-19 | A 2,299-foot extension of Runway 1-19 to the south results in a full length of 8,000 feet, allowing an ERJ 145 to takeoff at 100 percent useful load and at least 75 percent of the business jet fleet at 90 percent useful load during the hottest periods of the summer. Primary impacts associated with a

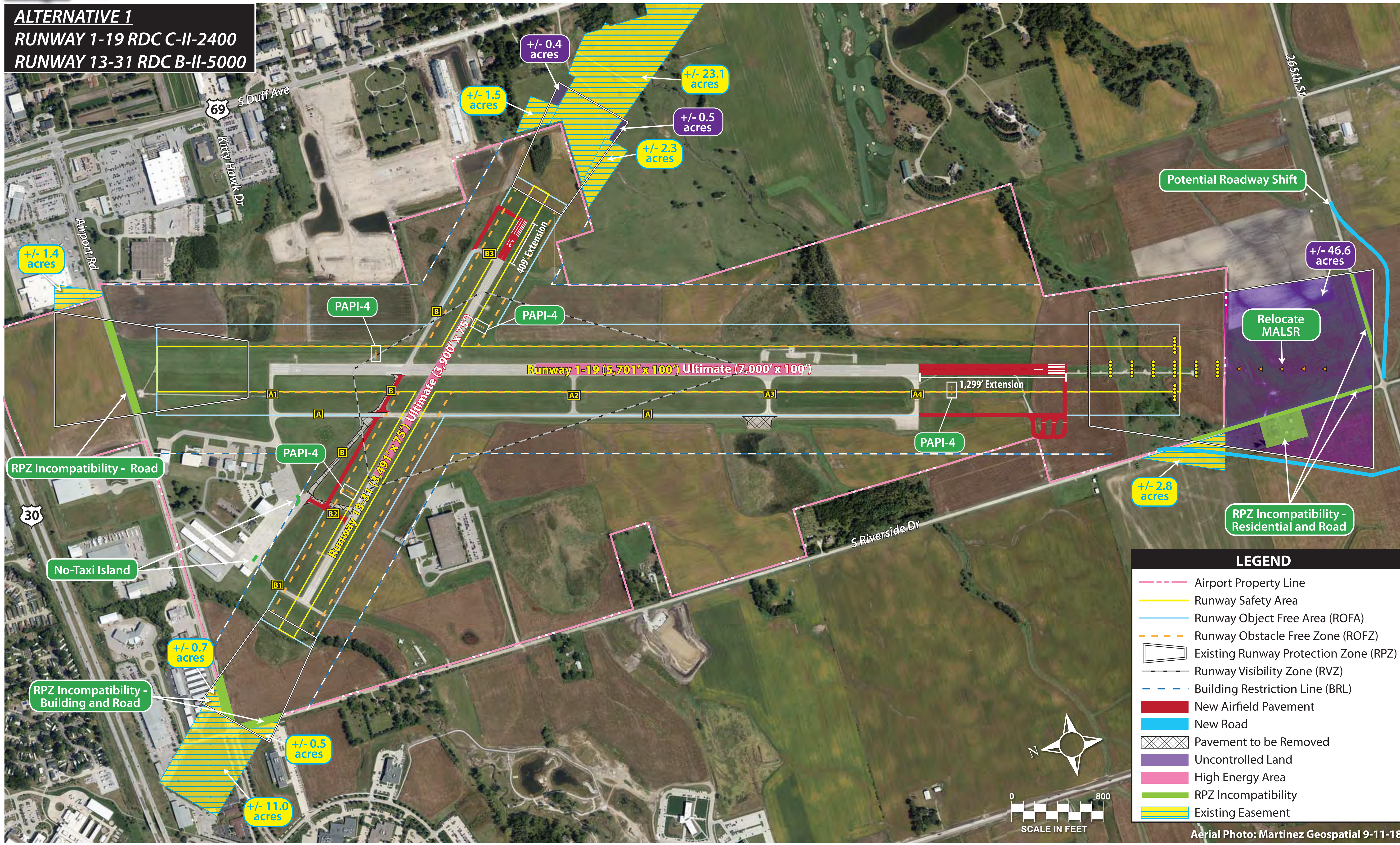
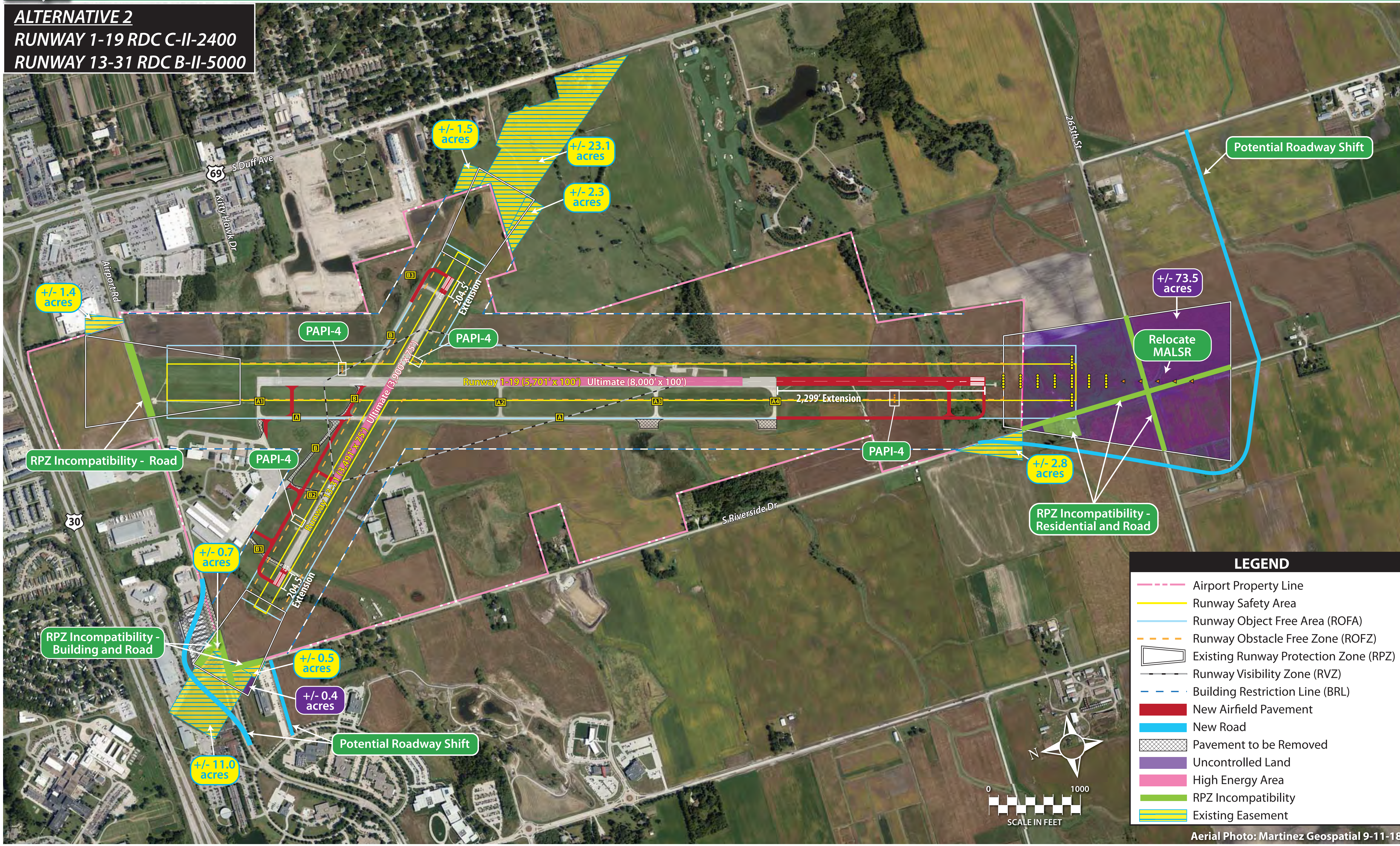


Exhibit 4C
AIRSIDE ALTERNATIVE 1


ALTERNATIVE 2
RUNWAY 1-19 RDC C-II-2400
RUNWAY 13-31 RDC B-II-5000
+/- 1.5 acres
+/- 23.1 acres
+/- 2.3 acres
+/- 1.4 acres
Potential Roadway Shift
+/- 73.5 acres
Relocate MALSR
PAPI-4
PAPI-4
PAPI-4
PAPI-4
Runway 1-19 (5,701' x 100') Ultimate (8,000' x 100')
2,299' Extension
204.5' Extension
Runway 13-31 (3,491' x 75') Ultimate (3,900' x 75')
RPZ Incompatibility - Road
+/- 2.8 acres
RPZ Incompatibility - Residential and Road
+/- 0.7 acres
RPZ Incompatibility - Building and Road
+/- 0.5 acres
+/- 0.4 acres
Potential Roadway Shift
+/- 11.0 acres
S Duff Ave
Kitty Hawk Dr
Airport Rd
265th St
S Riverside Dr
LEGEND
Airport Property Line
Runway Safety Area
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Existing Runway Protection Zone (RPZ)
Runway Visibility Zone (RVZ)
Building Restriction Line (BRL)
New Airfield Pavement
New Road
Pavement to be Removed
Uncontrolled Land
High Energy Area
RPZ Incompatibility
Existing Easement
0 1000 SCALE IN FEET
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Aerial Photo: Martinez Geospatial 9-11-18

southern runway extension to 8,000 feet include shifting the RPZ serving Runway 1 beyond airport property, which includes approximately 73.5 acres of uncontrolled property, residential property, as well as portions of South Riverside Drive and 26th Street that would ultimately have to be relocated. An extension of the runway would involve several connected projects, including:

- An extension of Taxiway A
- Construction of a bypass taxiway located on Taxiway A serving the extended Runway 1 threshold
- Relocation of the instrument landing system (ILS) glide slope antenna
- Relocation of the MALSR
- Acquisition (fee-simple/easement) of approximately 73.5 acres of uncontrolled property within the shifted RPZ
- Acquire and remove residential property located within the shifted RPZ
- Remove and relocate portions of South Riverside Drive and 26th Street within the shifted RPZ
- Mitigate any overgrown vegetation and gradient incompatibilities associated with the RSA, ROFA, and ROFZ

Runway 13-31 | This alternative considers an extension of the crosswind runway by 204.5 feet to the northwest and 204.5 feet to the southeast, resulting in an ultimate runway length of 3,900 feet. This length will readily accommodate 100 percent of the small aircraft fleet during design temperature conditions. A significant consideration of an extension to the northwest is that the RPZ would shift, ultimately removing the existing "grandfathered" condition. In turn, portions of South Riverside Drive and Airport Road would be required to be routed around the relocated RPZ and any commercial/industrial land use and includes structures that would need to be removed. The proposed improvements to Runway 13-31 would involve several connected projects, including:

- An extension of Taxiway B
- Acquisition (fee-simple/easement) of approximately 0.4 acres of property within the shifted RPZ serving the extended Runway 13. It should be noted that the RPZ serving Runway 31 would also be shifted but would remain on property owned in easement.
- Remove and relocate portions of South Riverside Drive and Airport Road within the shifted Runway 13 RPZ
- Acquire and remove commercial development incompatibilities within the shifted Runway 13 RPZ and resulting shift of Airport Road
- Mitigate any overgrown vegetation and gradient incompatibilities associated with the RSA, ROFA, and ROFZ

Taxiway Geometry Improvements | Airside Alternative 2 considers the extension of Taxiway B to serve as a full-length parallel taxiway, maintaining 250 feet taxiway centerline-to-runway centerline separation. Ultimately, this will eliminate the existing direct access provided by Taxiway B from the aircraft parking apron to Runway 1-19. Bypass taxiways are also proposed along Taxiway A, serving each end of Runway 1-19 to alleviate points of potential congestion.

Other taxiway improvements in this alternative include the following:

- This alternative considers the decoupling of Taxiway A1, creating a 90-degree perpendicular intersection with full-length parallel Taxiway A and eliminating potential direct access provided by Taxiway A1 to Runway 1-19.
- Taxiway B1 could also be decoupled, straightening the existing Taxiway B1 connection from the aircraft parking apron, creating a 90-degree intersection with full-length parallel Taxiway B. A connecting taxiway linking the proposed Taxiway B to Runway 13-31 could then be located approximately 205 feet northwest of the existing Taxiway B1. This would eliminate the existing direct access currently provided by Taxiway B1.
- Similarly, Taxiway B2 could be decoupled and straightened, creating a 90-degree linkage between the aircraft apron area and full-length parallel Taxiway B. A connecting taxiway linking the proposed Taxiway B to Runway 13-31 could then be located approximately 300 feet southeast of the existing Taxiway B2, eliminating the existing direct access provided by Taxiway B2.

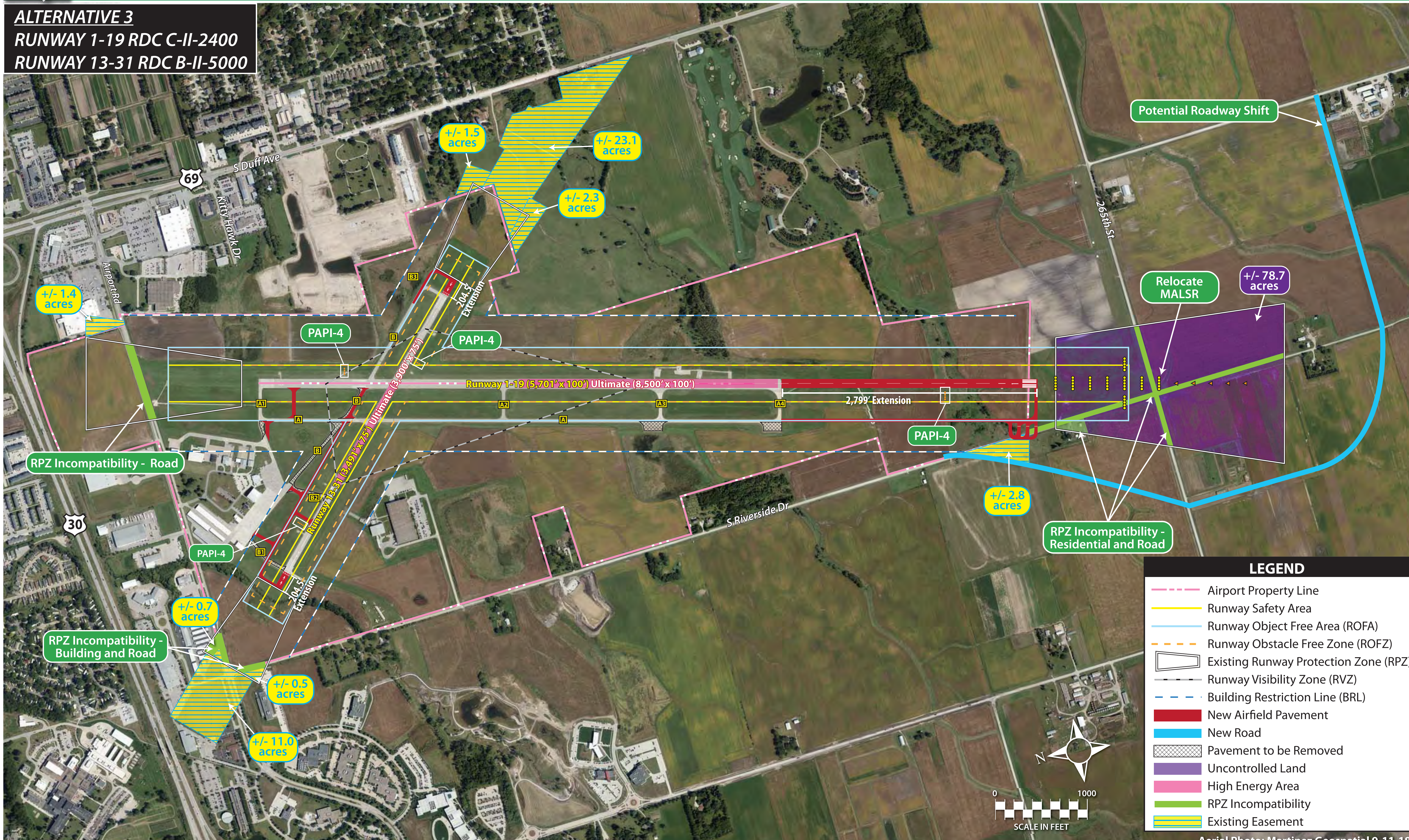
AIRSIDE ALTERNATIVE 3

Depicted on **Exhibit 4E**, Airside Alternative 3 considers the maximum reasonable extension potential for both runways, factoring existing constraints beyond Runway 13 that would limit further expansion (for example: public roads within RPZs and other incompatible developments beyond airport property that could not be reasonably removed/relocated).

Runway 1-19 | The 2,799-foot extension depicted, which results in 8,500 feet of total length (the longest length considered among all the airside alternatives), greatly increases the runway's utility to include 100 percent of the business jet fleet operating at 90 percent useful load. It should be noted, however, that a runway extension of this length could be difficult to justify under ultimate RDC C-II-2400 and would likely require a critical aircraft within the ADG III category. A significant consideration of an extension to the south is that a shift in the RPZ serving Runway 1 would extend beyond airport property, encompassing approximately 78.7 acres of uncontrolled property. The uncontrolled property contains residential uses, as well as portions of South Riverside Drive and 26th Street that would need to be removed.

The extension of the runway in this alternative involves several connected projects, including:

- An extension of Taxiway A
- Relocation of the instrument landing system (ILS) glide slope antenna
- Relocation of the MALSR
- Acquisition (fee-simple/easement) of 78.7 acres of uncontrolled property within the shifted RPZ
- Acquire and remove residential property located within the shifted RPZ
- Remove and relocate portions of South Riverside Drive and 26th Street within the shifted RPZ
- Mitigate any overgrown vegetation and gradient incompatibilities associated with the RSA, ROFA, and ROFZ


ALTERNATIVE 3
RUNWAY 1-19 RDC C-II-2400
RUNWAY 13-31 RDC B-II-5000
S Duff Ave
69
Kitty Hawk Dr
Airport Rd
30
265th St
S Riverside Dr
+/- 1.5 acres
+/- 23.1 acres
+/- 2.3 acres
+/- 1.4 acres
+/- 78.7 acres
+/- 2.8 acres
+/- 0.7 acres
+/- 0.5 acres
+/- 11.0 acres
Potential Roadway Shift
Relocate MALSR
PAPI-4
PAPI-4
PAPI-4
PAPI-4
204.5' Extension
204.5' Extension
Runway 1-19 (5,701' x 100') Ultimate (8,500' x 100')
Runway 13-31 (3,491' x 75') Ultimate (3,900' x 75')
2,799' Extension
RPZ Incompatibility - Road
RPZ Incompatibility - Residential and Road
RPZ Incompatibility - Building and Road
LEGEND
Airport Property Line
Runway Safety Area
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Existing Runway Protection Zone (RPZ)
Runway Visibility Zone (RVZ)
Building Restriction Line (BRL)
New Airfield Pavement
New Road
Pavement to be Removed
Uncontrolled Land
High Energy Area
RPZ Incompatibility
Existing Easement
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0 1000
SCALE IN FEET
Aerial Photo: Martinez Geospatial 9-11-18

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Runway 13-31 | Similar to the previous alternative, the crosswind runway is extended by 204.5 feet to the northwest and 204.5 feet to the southeast for a full length of 3,900 feet. The extensions in this alternative would still allow for 300 feet of RSA/ROFA beyond the runway end; however, due to RPZ incompatible developments to the northwest (South Riverside Drive and Airport Road and commercial properties) and residential developments just beyond the RPZ to the southeast, the new runway pavement is displaced. Displaced runway pavement can be used for takeoff but not for landing, so the real benefit of these extensions is for takeoff operations and for landing rollout. By applying declared distances, the approach and departure RPZs at both ends of the runway would remain in their existing locations.

Declared distances are used to define the effective runway length for landing and takeoff when a standard RSA cannot be achieved or an RPZ needs to be relocated. The four declared distances include:

- Takeoff Run Available (TORA) – the runway length declared available and suitable for the ground run of an aircraft taking off (factors in the positioning of the departure RPZ);
- Takeoff Distance Available (TODA) – the TORA plus the length of any remaining runway or clearway beyond the far end of the TORA; the full length of the TODA may need to be reduced because of obstacles in the departure area;
- Accelerate-Stop Distance Available (ASDA) – the runway plus stopway length declared available and suitable for the acceleration and deceleration of an aircraft aborting a takeoff (factors in the length of RSA/ROFA beyond the runway end);
- Landing Distance Available (LDA) – the runway length declared available and suitable for landing an aircraft (factors in the length of RSA/ROFA beyond the runway end and the positioning of the approach RPZ).

The declared distance pertaining to RPZs is the takeoff run available (TORA) and the landing distance available (LDA). To keep the RPZs in their existing locations, the TORA and LDA are reduced in both directions based on the runway's displaced threshold (204.5 feet for Runway 13 and 204.5 feet for Runway 31). The resulting declared distances for this alternative are presented in **Table 4B**.

TABLE 4B
Airside Alternative 3 – Runway 13-31 Declared Distances

	Existing		Airside Alternative 3	
	13	31	13	31
Takeoff Run Available (TORA)	3,491'	3,491'	3,695'	3,695'
Takeoff Distance Available (TODA)	3,491'	3,491'	3,900'*	3,900'*
Accelerated Stop Distance Available (ASDA)	3,491'	3,491'	3,900'	3,900'
Landing Distance Available (LDA)	3,491'	3,491'	3,695'	3,695'

* The TODA may need to be reduced to clear obstacles in the departure area. This will be determined during the obstruction evaluation process later in the master plan.
Source: Coffman Associates analysis.

Taxiway Geometry Improvements | Like the previous alternative, Airside Alternative 3 considers the extension of Taxiway B to serve as a full-length parallel taxiway, maintaining 250 feet taxiway centerline to runway centerline separation eliminating the existing direct access provided by Taxiway B from the aircraft parking apron to Runway 1-19. The alternative also considers the construction of a standard holding bay located on Taxiway A, serving the extended Runway 1 threshold to alleviate potential points of congestion. Similarly, a bypass taxiway is considered serving Runway 19 to relieve potential congestion.

Other taxiway improvements in this alternative include the following:

- This alternative considers the decoupling of Taxiway A1, creating a 90-degree perpendicular intersection with full-length parallel Taxiway A and eliminating potential direct access provided by Taxiway A1 to Runway 1-19.
- Taxiways B1 and B2 could be decoupled and straightened, creating a 90-degree linkage between the aircraft apron area and full-length parallel Taxiway B. A connecting taxiway linking the proposed Taxiway B to Runway 13-31 could then be located centrally between the decoupled Taxiways B1 and B2, eliminating the direct access currently provided by Taxiways B1 and B2.

INSTRUMENT APPROACH CONSIDERATIONS

The instrument approach capability at an airport is an important consideration that directly impacts the utility of the airport, with lower visibility minimums increasing the utility of an airport. From an economic development standpoint, it is important to achieve the lowest possible visibility minimums. The best approach minimums possible will prevent aircraft from having to divert to another airport, which can create additional operating costs and time delays for aircraft operators, their passengers, as well as on-airport businesses.

AMW currently has one precision instrument approach serving Runway 1. Furthermore, five instrument approaches serving Runways 1-19 and 13-31 are classified as non-precision instrument approaches.

In addition to the instrument landing system (ILS) and localizer (LOC) precision instrument approaches serving Runway 1 and the non-precision VOR instrument approach serving Runway 31, Runways 1-19 and 13-31 are served by RNAV GPS approaches. The lowest instrument approach minimums are offered by the ILS approach serving Runway 1, which provide visibility minimums down to ½-mile and cloud ceilings of 250 feet above ground level (AGL). Runways 19 and 13-31 each have instrument approach visibility minimums of not lower than one mile and have varying cloud heights.

Because of forecast fleet mix demands, the following analysis examines improved visibility minimums on each end of Runway 13-31 and on Runway 19 at AMW.

Runway 13-31: Not Lower Than ¾-Mile

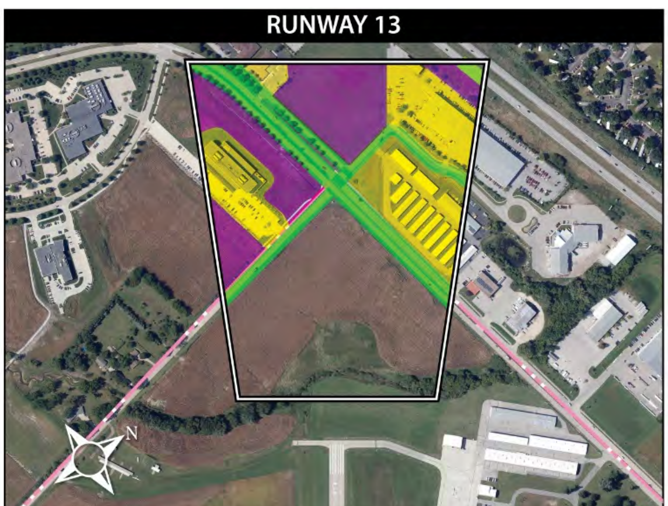
The dimensions of the RPZ will change if the instrument approach capabilities are improved with lower minimums. **Table 4C** presents the dimensions of the RPZs for Runway 13-31 based upon the various approach visibility minimums. The alternatives, presented on **Figures 4A** and **4B**, illustrate the RPZ impacts to Runways 13 and 31 for an instrument approach providing visibility minimums of not lower than ¾-mile.

Ultimately, the approach RPZs serving Runways 13 and 31 would expand to encompass a total acreage amount of 48.98 acres. Of this area, approximately 28.2 acres within the Runway 13 RPZ would extend beyond airport property as shown in **Figure 4A**. It should be noted that approximately 13.8 acres are currently owned in easement. However, the enlarged RPZ would contain three large commercial parking lots, numerous commercial properties, and would be completely traversed by Airport Road. In addition, the RPZ would encompass South Riverside Drive, Southern Hills Drive, Highway 30, and a frontage road parallel to Airport Road.

TABLE 4C
Runway Protection Zones: Runway 13-31

	Instrument Approach Capabilities	
Visibility Minimum	≥ 1-Mile	≥ ¾-Mile
Approach Runway Protection Zone		
Inner Width	500	1,000
Outer Width	700	1,510
Length	1,000	1,700
Departure Runway Protection Zone		
Inner Width	500	500
Outer Width	700	700
Length	1,000	1,000
Source: FAA AC 150/5300-13A, *Airport Design*		

Like Runway 13, the RPZ serving Runway 31 would also be expanded to include a total acreage amount of 48.98 acres for an instrument approach providing visibility minimums of not lower than ¾-mile. Under these conditions, the RPZ would extend off airport property, encompassing approximately 28.4 acres of property as presented in **Figure 4B**. Of this area, approximately 10.4 acres are currently owned in easement. Under this scenario, the expanded RPZ would include a residential property and would be traversed by a dirt road.



Runway Protection Zone	Easement	Uncontrolled
Not Lower Than 3/4-Mile	~13.8 acres	~14.4 acres

Figure 4A
Runway 13 Instrument Approach Considerations

Runway Protection Zone	Easement	Uncontrolled
Not Lower Than 3/4-Mile	~10.39 acres	~18.0 acres

Figure 4B
Runway 31 Instrument Approach Considerations

Runway 19 Alternative 1: Not Lower Than ¾-Mile

TABLE 4D Runway Protection Zones: Runway 19			
	Instrument Approach Capabilities		
Visibility Minimum	≥ 1-Mile	≥ ¾-Mile	< ¾-Mile
Approach Runway Protection Zone			
Inner Width	500	1,000	1,000
Outer Width	1,010	1,510	1,750
Length	1,700	1,700	2,500
Departure Runway Protection Zone			
Inner Width	500	500	500
Outer Width	1,010	1,010	1,010
Length	1,700	1,700	1,700
Source: FAA AC 150/5300-13A, *Airport Design*			

Similar to Runway 13-31, the RPZ serving Runway 19 would be expanded to include a total acreage amount of 48.98 acres for an instrument approach providing visibility minimums of not lower than ¾-mile. **Table 4D** presents the dimensions of the RPZs for Runway 13-31 based upon the various approach visibility minimums. Under these conditions, the RPZ would extend off airport property, encompassing approximately 1.4 acres of property, as well as a portion of a commercial retail store, as shown on **Figure 4C**. Although the RPZ would extend beyond the airport property boundary and over a commercial property, the entirety of the 1.4 acres is currently owned in easement. Like the existing RPZ, the RPZ serving Runway 19 with not lower than ¾-mile visibility minimums is traversed by Airport Road.

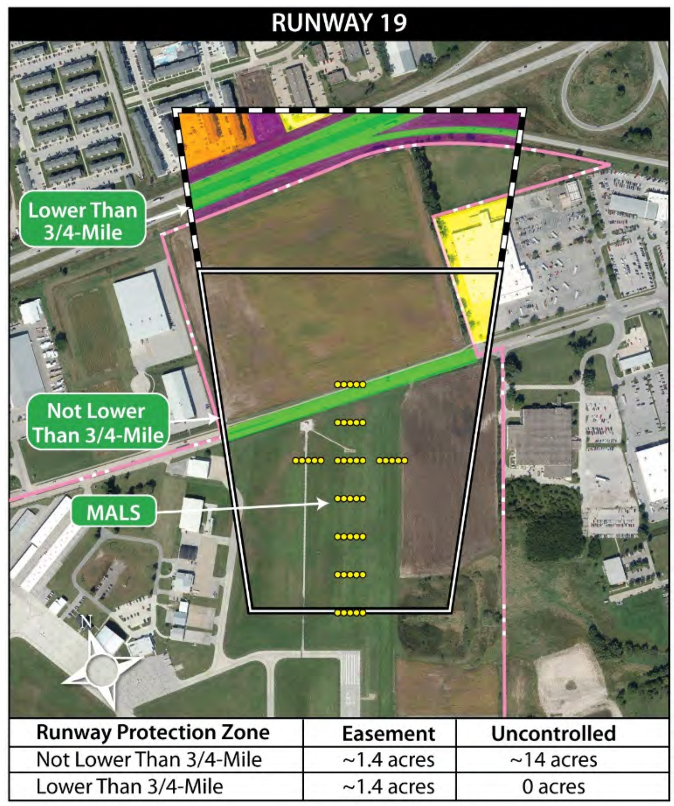


Figure 4C
Runway 19 Instrument Approach Considerations

Runway 19 Alternative 2: Lower Than ¾-Mile

As presented on **Figure 4C**, Alternative 2 examines the impacts of an instrument approach offering visibility minimums lower than ¾-mile on Runway 19. Under these conditions, the RPZ serving Runway 19 would be expanded to include a total acreage amount of 78.91 acres. Of this area, the RPZ would extend off airport property, encompassing approximately 15.4 acres of property. It should be noted that the airport owns approximately 1.4 acres of this property beyond the airport property boundary. Ultimately, the RPZ would extend over two commercial buildings, two residential buildings, automobile parking lots, and access roads. It should be mentioned that the entirety of the RPZ is traversed by Airport Road and the northernmost portion of the RPZ is traversed by 30 Highway. An approach lighting system is required to achieve an approach providing less than ¾-mile visibility minimums. As such, **Figure 4C** considers a medium intensity approach lighting system (MALS) serving Runway 19.

Moreover, a precision instrument approach such as this introduces the concept of the precision obstacle free area (POFZ). The POFZ is defined as "a volume of airspace above an area beginning at the runway threshold, at the threshold elevation, and centered on the extended runway centerline, 200 feet long by 800 feet wide." The POFZ is only in effect when the following operational conditions are met:

I. Vertically-guided approach
II. Reported ceiling below 250 feet and/or visibility less than ¾ of a statute mile
III. An aircraft on final approach within two miles of the runway threshold

When these conditions are met, aircraft holding for take-off must hold in such a position so that neither the fuselage nor the tail of the aircraft penetrates the POFZ. However, the wings of the aircraft can penetrate the surface.

Instrument Approach Analysis Summary

In addition to the RPZs, the determination of airspace obstructions that may be associated with these improved approach procedures would need to be further evaluated. The two primary resources for determining airspace obstructions are Title 14 Code of Federal Regulations (CFR) Part 77, *Objects Affecting Navigable Airspace* and *Terminal Instrument Procedures* (TERPS). Part 77 is a filter which identifies potential obstructions, whereas TERPS is the critical tool in determining actual flight obstructions, as its analysis is used to evaluate and develop instrument approach procedures, including visibility minimums and cloud heights associated with approved approaches.

Further evaluation by the FAA would be needed to determine the extent of removing or lowering potential obstructions that may exist to support an instrument approach procedure that could serve ultimate conditions proposed on Runways 13-31 and 19. The FAA has also set forth other various conditions and criteria for a runway to achieve lower visibility minimums. These conditions and criteria are outlined in **Table 4E**.

Due to advancements in technology associated with instrument approach procedures, the proposed instrument approach options would require minimal enhancements to ground-based navigational aids, as these runway ends are currently served by GPS technologies. For Runway 19, the option of lowering visibility minimums below ¾-mile would require the installation of an approach lighting system, which can cost approximately $2 million to install. However, it should be noted that over 90 percent of the total cost could be eligible for FAA/IDOT grant funding.

As previously detailed, any change to the runway environment that includes a new or revised instrument approach procedure that increases the RPZ dimensions is subject to a further evaluation of the RPZs, meeting updated guidance from the FAA. If an airport cannot fully control the entirety of the RPZ from being free of incompatible land uses, the FAA can require a change to the runway environment to properly secure the RPZs. If enhanced instrument approach procedures are pursued on either runway end at the airport, it is important that airport management properly coordinate with the FAA to ensure full use of the runway being affected.

TABLE 4E
Standards for Instrument Approach Procedures

Criteria	Visibility Minimums	
	¾-mile to < 1 Mile	< ¾-mile
HATh	≥ 250 feet	<250 feet
TERPS GQS	Clear	Clear
PA final approach surfaces	Not Required	Clear
POFZ (PA & APV only)	Not Required	Required
TERPS Chapter 3, Section 3	20:1 Clear	34:1 Clear
ALP	Required	Required
Minimum Runway Length	3,200 feet	4,200 feet (paved)
Runway Markings	Non-precision	Precision
Holding Position Signs & Markings	Non-precision	Precision
Runway Edge Lights	HIRL/MIRL	HIRL/MIRL
Parallel Taxiway	Required	Required
Approach Lights	Recommended	MALSR, SSALR, or ALSF
Applicable Runway Design Standards, (e.g., OFZ)	≥ ¾-statute mile approach visibility minimums	< ¾-statute mile approach visibility minimums
Threshold Siting Criteria to be Met	20:1 Clear	34:1 Clear
Survey Required	VGS (PA & APV)/NVGS	VGS

HATh – Height Above Threshold
TERPS – United States Standard for Terminal Instrument Procedures
GQS – Glide Path Qualification Surface
OFZ – Obstacle Free Zone
PA – Precision Approach
POFZ – Precision Obstacle Free Zone
ALP – Airport Layout Plan
HIRL – High Intensity Runway Lights
MIRL – Medium Intensity Runway Lights
MALSR – Medium Intensity Runway Lights with Runway Alignment Indicator Lights
SSALR – Simplified Short Approach Lighting System with Runway Alignment Indicator Lights
ALSF – Approach Lighting System with Sequenced Flashing Lights
VGS – Vertically Guided Survey
NVGS – Non-Vertically Guided Survey
APV – Approach with Vertical Guidance
Source: FAA Advisory Circular 150/5300-13A, *Airport Design*

LANDSIDE PLANNING CONSIDERATIONS

Generally, landside issues are related to those facilities necessary or desired for the safe and efficient parking and storage of aircraft, movement of pilots and passengers to and from aircraft, airport support facilities, and overall revenue support functions. Landside planning considerations, summarized previously on **Exhibit 4B**, will focus on strategies following a philosophy of separating activity levels. To maximize airport efficiency, it is important to locate facilities together that are intended to serve similar functions. The best approach to landside facility planning is to consider the development to be like that of a community where land use planning is the guide. For airports, the land use guide in the terminal area should generally be dictated by aviation activity levels. Due to the amount of developable land available at AMW, consideration will also be given to non-aviation uses that can provide additional revenue support to the airport and support economic development for the region.

Landside planning issues focus on facility-locating strategies following a philosophy of separating activity levels. Therefore, it is important to plan for an appropriate mix of smaller T-hangars, executive hangars, and larger conventional hangars.

The orderly development of the airport terminal area (those areas parallel to the runway and along the flight line) can be the most critical, and probably the most difficult, development to control on an airport. A development approach of “taking the path of least resistance” can have a significant effect on the long-term viability of an airport. Allowing development without regard to a functional plan can result in a haphazard array of buildings and small ramp areas, which will eventually preclude the most efficient use of valuable space along the flight line.

The alternatives to be presented are not the only options for development. In some cases, a portion of one alternative could be intermixed with another. Also, some alternative development concepts could be replaced with others. The final recommended plan only serves as a guide for the airport, which will aid in strategic planning of available properties. Many times, airport operators change their plan to meet the need of specific users. The goal in analyzing landside development alternatives is to focus future development so that airport property can be maximized.

AIRPORT LAND USE PLANNING

Ultimately, the purpose of the alternatives analysis is to identify specific uses for airport property to create the safest and most efficient operating environment and allow the airport to market itself to developers and businesses so that it can maximize its revenue potential on-airport. Land use planning is a very common practice for communities across the country. The primary purpose of airport land use planning is to adequately plan for future needs in an organized, efficient, and beneficial manner. Airport planning also commonly considers land use planning concepts to ensure that development is orderly, efficient, safe, and maximizes available land inventories.

An airport land use plan has been prepared for future development at AMW. This is a simple plan based on separation of activity levels and historic development, and it should be taken in the intent it was developed – to serve simply as a guide for the airport sponsor to consider. It is fully understood that the airport sponsor may modify the plan, if necessary, to satisfy its intended goals and needs. The airport land use plan depicted on **Exhibit 4F** includes five broad development categories:

- Airfield Operations
- General Aviation
- General Aviation Reserve
- Open Space
- Non-Aviation Revenue Support

The **Airfield Operations** land use category is designated to delineate areas not available for landside development. This area has been established based on existing airfield conditions and includes safety areas associated with each runway, as well as the clearances needed for taxiways. This area should remain clear of objects except for those fixed by navigational function. If changes are made in line with airside alternatives previously discussed, the airfield operations area would change, thereby changing landside use options as well.

General Aviation represents the full array of general aviation activities and includes users that provide aviation services or house aircraft. A good example of this type of use is a fixed base operator (FBO). These uses will generate a moderate activity level on both the airside and landside, including based aircraft and itinerant aircraft traffic. Facilities typical of general aviation uses range from T-hangars to larger conventional hangars. These users, however, are more commonly those who only have one primary hangar facility and are best suited for flight line access. This use is also characteristic of facilities which simply house based aircraft. The most common use is for T-hangars or executive box hangars. Daily activity for these areas is relatively low as the aircraft owners will commonly operate only sporadically throughout the week, or less often.

General Aviation Reserve includes those areas on airport property that are currently undeveloped and should be dedicated for potential aviation-related development in the future, given their location to the runway and taxiway system. These areas will also be further detailed during this alternatives analysis.

Open Space includes areas on airport property that are currently undeveloped and would be difficult to develop due to lack of access, current drainage patterns, or the proximity to an approach end of a runway. Although these areas are not currently ideal for development, airport management should remain open to the opportunity of development in these areas if demand warrants.

Non-Aviation Revenue Support uses are allowed on airports for areas not required for aviation purposes. In some cases, airport land inventories allow for non-aviation uses if the areas are not accessible to the airfield. This use could support commercial, industrial, or business park development and would provide the airport with an opportunity to improve revenue streams on land that would otherwise remain vacant.

Chapter Three identified numerous considerations for improved or expanded facilities, including airfield geometry improvements, terminal facility needs, and new hangar facilities. The land needed to accommodate the 20-year landside facility requirements is not anticipated to exceed the undeveloped/vacant property currently available for development. With a surplus of property that is accessible to/from the airfield system, AMW has a great opportunity to market itself to potential developers and increase land lease revenues. For areas that are not easily accessible to the airfield system, such as land adjacent to the east side of South Riverside Drive and central locations of the existing terminal area, these areas will continue to be possibilities for non-aviation-related developments, such as industrial parks, business centers, or restaurants that can increase land lease revenues for the airport. It should be noted, however, that much of the vacant airport property is currently farmed where practical.

REVENUE SUPPORT LAND USES

Due to the amount of land on airport property exceeding the space needed for forecast aviation demand, consideration is given for AMW to utilize portions of its property for non-aviation purposes to include commercial, industrial, or manufacturing development. It should be noted that the airport does not have the approval to use undeveloped property for non-aviation purposes at this time. Specific approval


S Duff Ave
69
Kitty Hawk Dr
Airport Rd
265th St
Runway 1-19 (5,701' x 100')
Runway 13-31 (3,491' x 75')
A1
A2
A3
A4
A
B
B1
B2
B3
S Riverside Dr
30
Land Release
LEGEND
Airport Property Line
Airfield Operations
General Aviation
General Aviation Reserve
Open Space
Non-Aviation Revenue Support
N
0
800
SCALE IN FEET
Aerial Photo: Martinez Geospatial 9-11-18

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from the FAA will be required to utilize undeveloped property for non-aviation uses. This planning document does not gain approval for non-aviation uses, even if these uses are ultimately shown in the master plan and on the ALP. A separate request justifying the use of airport property for non-aviation uses will be required. This study can be a source for developing that justification.

An environmental determination will also be required. While FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, states that a release of an airport sponsor from federal obligations is normally categorically excluded and would not normally require an environmental assessment (EA), the issuance of a categorical exclusion is not automatic, and the FAA must determine that no extraordinary circumstances exist at the airport. Extraordinary circumstances would include a potentially significant environmental impact to any of the environmental resources governed by federal law. An EA may be required if there are extraordinary circumstances. The generalized land use alternatives to follow outline areas on the airport which could be planned and ultimately developed for non-aviation related uses.

On-Airport Land Use Obligations

The airport has accepted grants for capital improvements from the FAA. As such, the City of Ames (airport sponsor) has agreed to certain grant assurances. Grant assurances related to land use assure that airport property will be reserved for aeronautical purposes. If the airport sponsor wishes to sell (release) airport land or lease airport land for a non-aeronautical purpose (land use change), they must petition the FAA for approval. The ALP and the Airport Property Map must then be updated to reflect the sale or land use change of the identified property.

Release of Airport Property

A release of airport property would entail the sale of land that is not needed for aeronautical purposes currently or into the future. The following documentation is required to be submitted to the FAA for consideration of a land release:

1. What is requested.
2. What agreement(s) with the United States are involved.
3. Why the release, modification, reformation, or amendment is requested.
4. What facts and circumstances justify the request.
5. What requirements of state or local law or ordinance should be provided for in the language of an FAA-issued document if the request is consented to or granted.
6. What property or facilities are involved.
7. How the property was acquired or obtained by the airport owner.
8. What is the present condition and what present use is made of any property or facilities involved.
9. What use or disposition will be made of the property or facilities.

10. What is the appraised fair market value of the property or facilities. Appraisals or other evidence required to establish fair market value.
11. What proceeds are expected from the use or disposition of the property and what will be done with any net revenues derived.
12. A comparison of the relative advantage or benefit to the airport from sale or other disposition as opposed to retention for rental income.

Each request should have a scaled drawing attached showing all airport property and facilities which are currently obligated for airport purposes by agreements with the United States. Other exhibits supporting or justifying the request, such as maps, photographs, plans, and appraisal reports should be attached as appropriate. There are no areas of airport property currently planned for release from obligation and/or sale.

Land Use Change

A land use change permits land to be leased for non-aeronautical purposes; it does not authorize the sale of airport land. Leasing airport land to produce revenue from non-aeronautical uses allows the land to earn revenue for the airport, as well as serve the interests of civil aviation by making the airport as self-sustaining as possible. Airport sponsors may petition for a land use change for the following purposes:

- So that land not needed for aeronautical purposes can be leased to earn revenue from non-aviation uses. This is land that is clearly surplus to the airport's aviation needs.

- So that land which cannot be used for aeronautical purposes can be leased to earn revenue from non-aviation uses. This is land that cannot be used by aircraft or where there are barriers or topography that prevents an aviation use.

- So that land not presently needed for aeronautical purposes can be rented on a temporary basis to earn revenue from non-aviation uses.

A land use change shall not be approved by the FAA if the land has a present or future airport or aviation purpose, meaning the land has a clear aeronautical use. However, if land is not needed for aeronautical purposes until a long-term condition is met, a land use change may be justified and granted for a short-term use. Ordinarily, land on or in proximity to the flight line and airport operations area is needed for aeronautical purposes and should not be used or planned for non-aviation purposes.
The proceeds derived from the land use change must be used exclusively for the benefit of the airport. They may not be used for a non-airport purpose, and they cannot be diverted to the airport sponsor's general fund or for general economic development unrelated to the airport.

Generally, a land use change of airport property will be reviewed on a case-by-case basis at the time that the change is necessary. However, the airport land use drawing, which is included as part of the ALP set, shows those areas likely eligible to be released from obligation.

AVIATION ACTIVITY LEVELS

The aviation development areas should be divided into high, medium, and low activity levels at the airport. The high activity area should be planned and developed to provide aviation services on the airport. Examples of high activity areas are the airport terminal and administration building and adjoining aircraft parking apron, which provides tiedown locations and circulation for aircraft. In addition, large conventional hangars used for FBOs, corporate aviation departments, or storing a large number of aircraft would be considered high activity use areas. The best location for high activity areas is along the flight line near midfield, for ease of access to all areas on the airfield. All major utility infrastructure would need to be provided to these areas.

The medium activity use category defines the next level of airport use and primarily includes smaller corporate aircraft that may desire their own executive hangar storage on the airport. The best location for medium activity use is off the immediate flight line, but still readily accessible to aircraft, including corporate jets. Due to an airport's layout and other existing conditions, if this area is to be located along the flight line, it is best to keep it out of the midfield area of the airport, to not cause congestion with transient aircraft utilizing the airport. Parking and utilities, such as water and sewer, should also be provided in this area.

The low activity use category defines the area for storage of smaller single- and multi-engine aircraft. Low activity users are personal or small business aircraft owners who prefer individual space in linear box hangars or T-hangars. Low activity areas should be in less conspicuous areas. This use category will require electricity, but generally does not require water or sewer utilities.

In addition to the functional compatibility of the aviation development areas, the proposed development concept should provide a first-class appearance for AMW. As previously mentioned, the airport serves as a very important link to the entire region, whether it is for business or pleasure. Consideration to aesthetics should be given high priority in all public areas, as the airport can serve as the first impression a visitor may have of the community.

To allow for maximum development of the airport while keeping with mandated safety design standards, it is very important to devise a plan that allows for the orderly development of airport facilities. Typically, airports will reserve property adjacent to the runway system for aviation-related activity exclusively. This will allow for the location of taxiways, aprons, and hangars.

HANGAR DEVELOPMENT

Analysis in Chapter Three indicated that the airport should plan for the construction of additional aircraft hangars over the next 20 years. Hangar development takes on a variety of sizes corresponding with several different intended uses.

Commercial general aviation activities are essential to providing the necessary services on an airport. This includes privately owned businesses involved with, but not limited to, aircraft rental and flight training, aircraft charters, aircraft maintenance, line service, and aircraft fueling. These types of operations are commonly referred to as FBOs or specialized aviation service operators (SASOs). The facilities associated with businesses such as these include large, conventional-type hangars that hold several aircraft. High levels of activity often characterize these operations, with a need for apron space for the storage and circulation of aircraft. These facilities are best placed along ample apron frontage with good visibility from the runway system for transient aircraft. Utility services are needed for these types of facilities, as well as vehicle parking areas.

Aircraft hangars used for the storage of smaller aircraft primarily involve T-hangars, shade hangars, or linear box hangars. Since storage hangars often have lower levels of activity, these types of facilities can be located away from the primary apron areas in more remote locations of the airport. Limited utility services are needed for these areas.

Other types of hangar development can include executive hangars for accommodating either one larger aircraft or multiple smaller aircraft. Typically, these types of hangars are used by corporations with company-owned aircraft or by an individual or group of individuals with multiple aircraft. These hangar areas typically require all utilities and segregated roadway access.

Table 4F summarizes the aircraft hangar types and corresponding size and aviation uses that are typically associated with each facility. Currently, there is approximately 136,450 square feet of hangar space (including maintenance area) provided on the airport, made up of a combination of hangar types previously discussed.

TABLE 4F
Aircraft Hangar Types

Hangar Type	Typical Size	Aviation Uses
Conventional	Clear span hangars greater than 10,000 square feet	FBOs, SASOs, and other commercial aviation activities resulting in high activity uses
Executive	Clear span hangars less than 10,000 square feet	SASOs, corporate flight departments, and private aircraft storage resulting in medium-to-high activity uses
T-Hangar/ Linear Box	Individual storage spaces offering 1,200 - 1,500 square feet	Private aircraft storage resulting in low activity uses

FBO – Fixed Base Operator
SASO – Specialized Aviation Service Operator

As depicted on **Exhibit 4F**, there are two large areas dedicated for General Aviation Reserve, which are ideal for future potential general aviation-related development. These areas include airport property southwest of the terminal area beyond Runway 13-31 and west of Runway 1-19, along South Riverside Drive. Furthermore, alternative development considers redevelopment of the existing terminal area. Given the development potential for these portions of airport property, alternatives to follow will detail development options for the areas identified.

TERMINAL AREA ALTERNATIVES

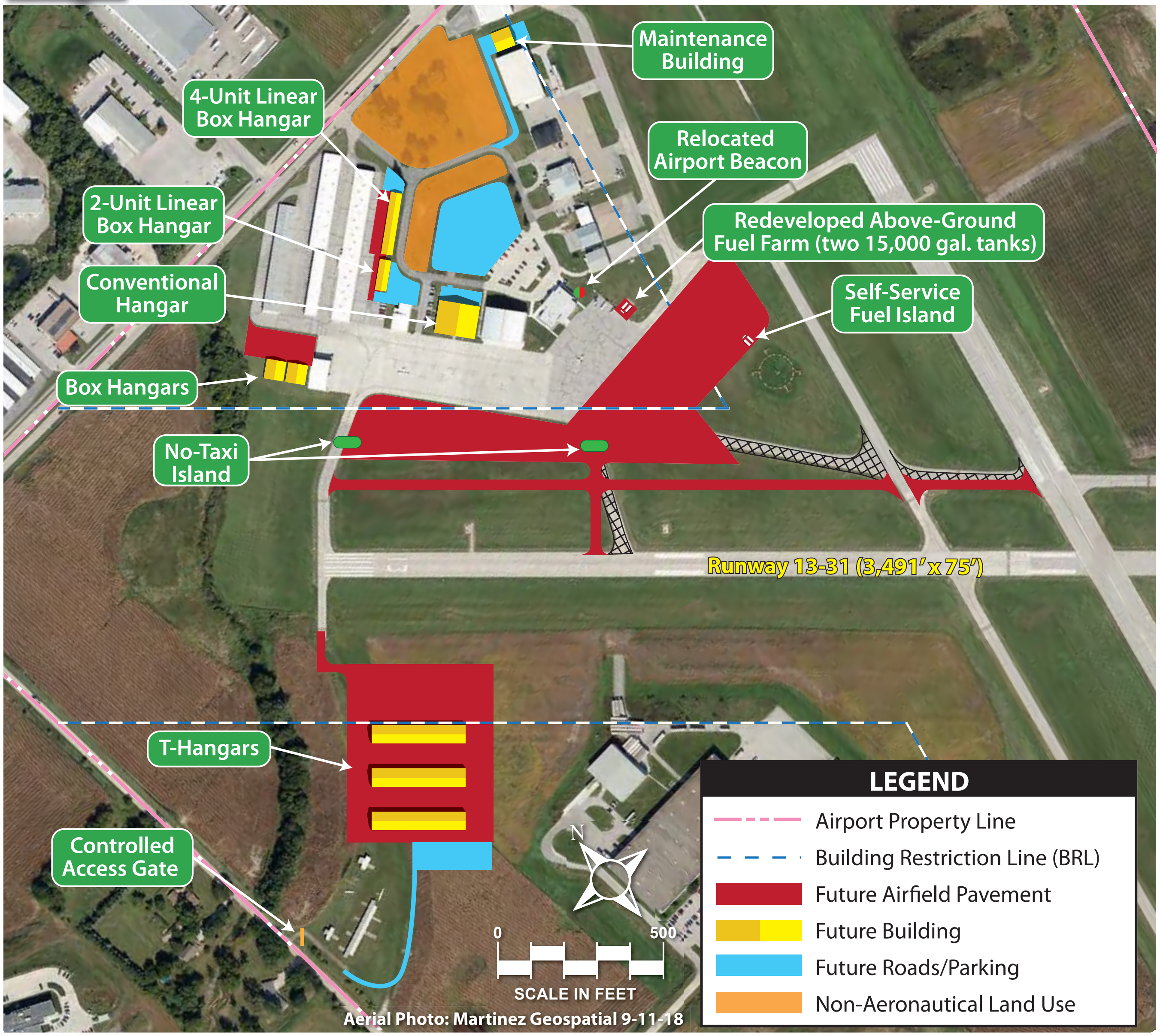
The existing airport terminal area serving AMW is centrally located on the main aircraft apron with automobile parking and access provided on the north side of the terminal building via Airport Road. The existing level of airside and landside access serving the terminal area make this portion of airport property an ideal location for future expansion and/or redevelopment. Moreover, there are some areas adjacent to the terminal area that have very limited airfield access and could ultimately be utilized for non-aeronautical purposes. Alternative analysis presented on **Exhibits 4G, 4H,** and **4J** examine potential development options for the terminal area and nearby potential development areas. Because the ultimate disposition of the taxiway system will affect the flow of aircraft traffic, taxiway geometry enhancements have also been presented along with landside development options.

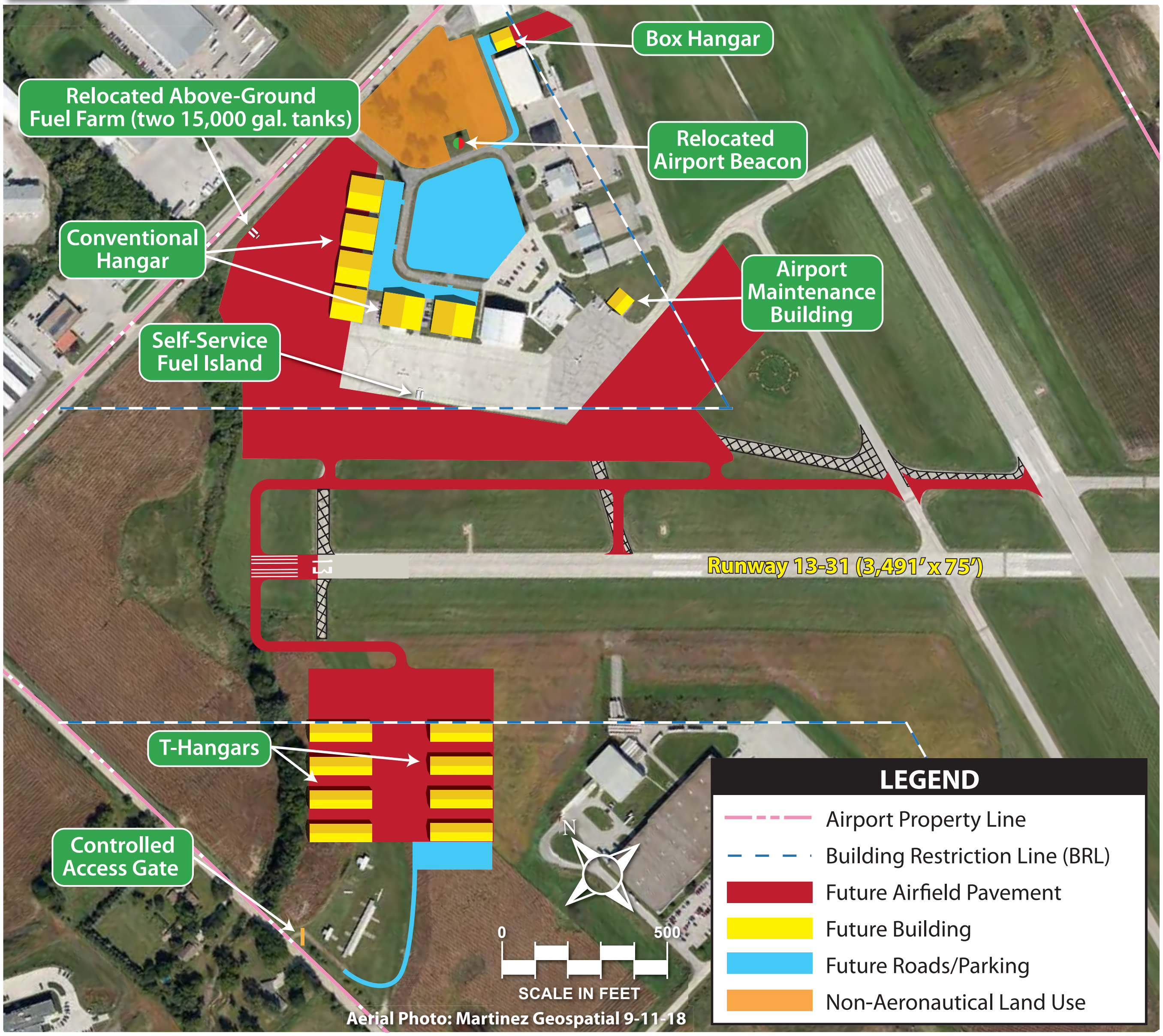
Terminal Area Alternative 1

Alternative 1, presented on **Exhibit 4G**, proposes the construction of a 100-foot by 125-foot conventional hangar in place of the old airport terminal building, located immediately north of the newly constructed conventional hangar. Currently, the old airport terminal facility is planned to be demolished and is a prime development area for a large conventional hangar due to its location on the apron area and access to the flight line. This alternative also considers the construction of two 60- by 60-foot box hangars located to the north and west of the proposed conventional hangar. The proposed box hangars could be served by 1,700 square yards (sy) of apron area. Additionally, a 35- by 190-foot four-unit linear box hangar and 35- by 95-foot two-unit linear box hangar are located immediately south of the existing T-hangars. Furthermore, the main aircraft apron could be expanded to the southwest and southeast to include an additional 27,000 sy of apron area and approximately 18,750 square feet (sf) of automobile access and parking area. If demand warrants, three 55- by 285-foot T-hangars could be located on the southwest side of Runway 13-31, near the Runway 13 threshold. The proposed T-hangars could be served by approximately 8,750 sy of apron area and 18,750 sf of automobile parking area. Automobile access could be provided via South Riverside Drive through a controlled access gate.

As a result of recent reports from the current FBO, this alternative proposes the replacement of the two 10,000-gallon 100LL and Jet A underground fuel tanks with two 15,000-gallon 100LL and Jet A above-ground fuel tanks. Ultimately, the added fuel capacity will help the FBO keep up with current demands and the above-ground fuel farm will allow for regular inspection. In addition to the upgraded fuel farm, the addition of a 100LL and Jet A self-service fuel island is proposed on the eastern corner of the expanded apron area. Given that the airport does not currently have a dedicated airport maintenance and storage building, a 60- by 60-foot airport maintenance facility is located on the northeast side of the terminal development area, in-line with the existing row of executive box hangars.

Approximately 57,800 sf of automobile parking area is proposed adjacent to the northern side of the existing terminal area parking lot. A parking lot of this size and location requires the relocation of the airport beacon. As such, it is proposed that the airport beacon be relocated immediately east of the existing terminal building. It should be noted that additional automobile parking and access is located adjacent to the proposed conventional hangar as well as the linear box hangars. In an effort to maximize the use of airport property, approximately 3.1 acres of property located in the terminal area are designated for non-aeronautical land use.


Maintenance Building
4-Unit Linear Box Hangar
Relocated Airport Beacon
2-Unit Linear Box Hangar
Redeveloped Above-Ground Fuel Farm (two 15,000 gal. tanks)
Conventional Hangar
Self-Service Fuel Island
Box Hangars
No-Taxi Island
Runway 13-31 (3,491' x 75')
T-Hangars
Controlled Access Gate
N
0
500
SCALE IN FEET
Aerial Photo: Martinez Geospatial 9-11-18
LEGEND
Airport Property Line
Building Restriction Line (BRL)
Future Airfield Pavement
Future Building
Future Roads/Parking
Non-Aeronautical Land Use


Box Hangar
Relocated Above-Ground Fuel Farm (two 15,000 gal. tanks)
Relocated Airport Beacon
Conventional Hangar
Airport Maintenance Building
Self-Service Fuel Island
Runway 13-31 (3,491' x 75')
T-Hangars
Controlled Access Gate
N
0
500
SCALE IN FEET
Aerial Photo: Martinez Geospatial 9-11-18
LEGEND
Airport Property Line
Building Restriction Line (BRL)
Future Airfield Pavement
Future Building
Future Roads/Parking
Non-Aeronautical Land Use

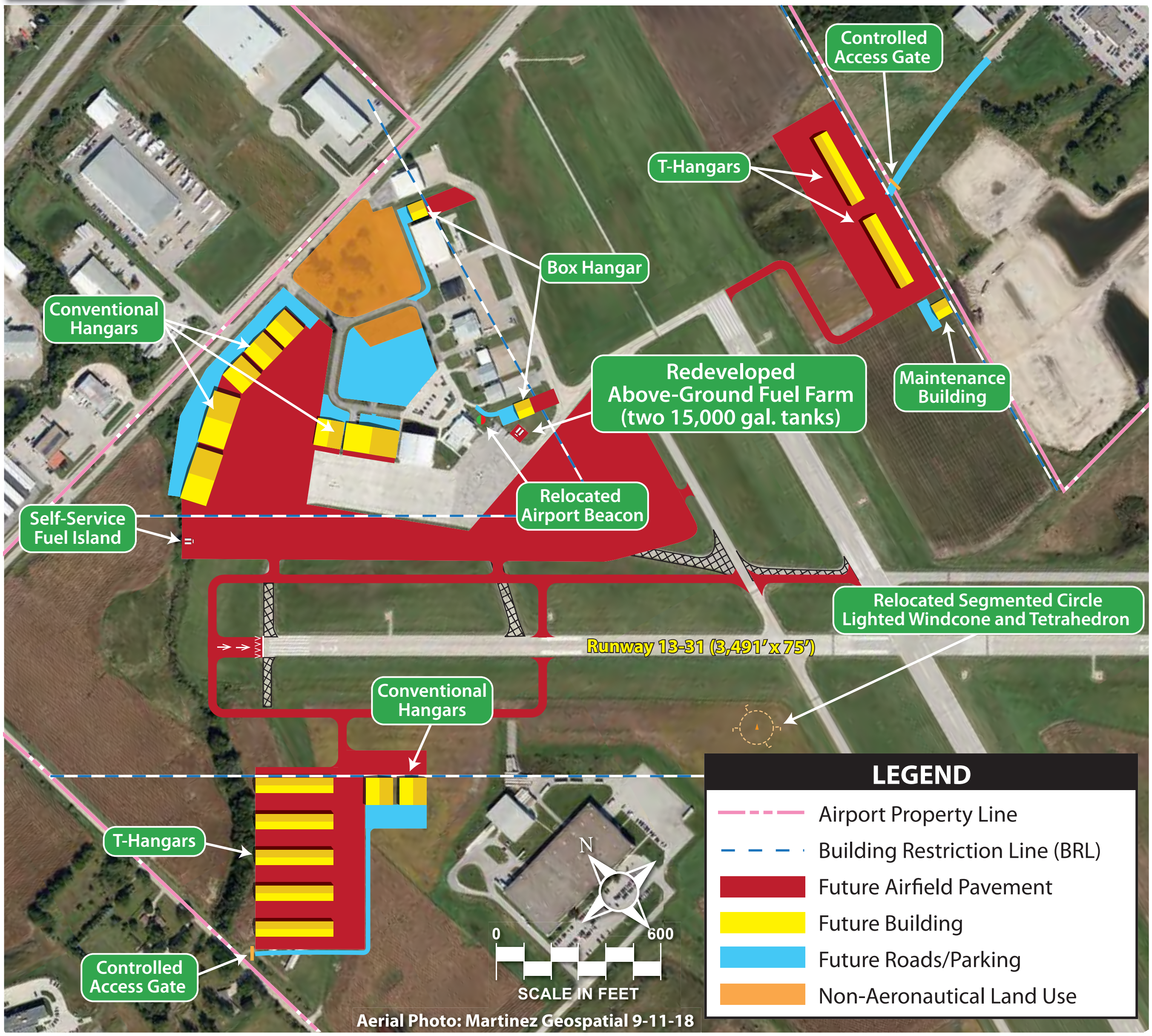


Exhibit 4J
TERMINAL AREA ALTERNATIVE 3

Terminal Area Alternative 2

As presented on **Exhibit 4H**, Alternative 2 also considers the construction of a 100-foot by 125-foot conventional hangar in place of the old airport terminal building. Additionally, a second 100- by 125-foot conventional hangar is placed on the north, ultimately requiring redevelopment of the existing executive box hangar in that location. However, this alternative analyzes potential ways of maximizing hangar development along the flight line and on the main aircraft apron. Similarly, this alternative considers redevelopment of the existing T-hangars to include four 100- by 100-foot conventional hangars and an expanded apron area in an effort to maximize the potential of the terminal and main aircraft apron areas. The expanded main aircraft apron area in this alternative is comprised of an additional 60,100 sy. To complete the existing row of executive box hangars located along the northeast side of the terminal development area, a 60- by 60-foot box hangar is proposed.

As a result of the proposed redevelopment of the existing T-hangar area, consideration is given to the construction of eight 55- by 190-foot T-hangars located southwest of Runway 13-31, near the Runway 13 threshold. Ultimately, the T-hangar development area could be served by approximately 9,200 sy of apron area and 18,750 sf of automobile parking area. Automobile access could be provided via South Riverside Drive through a controlled access gate.

Given the need for additional fuel capacity and the ability for routine fuel tank inspection, it is proposed that the fuel farm be relocated to the northernmost edge of the proposed main aircraft apron area. The relocated fuel farm could include two above-ground 15,000-gallon 100LL and Jet A fuel tanks. Additionally, a 100LL and Jet A self-service fuel island is centrally located on the western edge of the existing aircraft apron area. Due to the need for a dedicated airport maintenance building, it is proposed that a 60- by 60-foot airport maintenance facility be constructed in the location of the existing underground fuel farm.

Approximately 102,000 sf of automobile parking area is proposed adjacent to the northern side of the existing terminal area parking lot. A parking lot of this size and location requires the relocation of the airport beacon. As such, it is proposed that the airport beacon be relocated immediately north of its existing location. It should be noted that additional automobile parking and access is located adjacent to the proposed conventional hangars. In an effort to maximize the use of airport property to produce revenue, approximately 3.0 acres of property located in the terminal area are designated for non-aeronautical land use.

Terminal Area Alternative 3

Alternative 3, presented on **Exhibit 4J**, considers complete maximization of available hangar development areas and expansion of the main aircraft apron area. Ultimately, this alternative considers the redevelopment of the existing T-hangar buildings, old terminal building, and the existing executive box hangar adjacent to the old terminal building. Proposed hangar development in these areas considers the construction of three 100- by 200-foot conventional hangars and four 100- by 100-foot conventional hangars. Additionally, this alternative considers expanding the main aircraft apron area by approximately 71,500 sy. Similar to Alternative 1, it is proposed that the existing 100LL and Jet A underground fuel tanks be replaced with two 15,000-gallon 100LL and Jet A above-ground fuel tanks. In addition to the upgraded fuel farm, the addition of a 100LL and Jet A self-service fuel island is proposed on the northwestern corner of the expanded apron area.

To complete the existing row of executive box hangars located along the northeast side of the terminal development area, two 60- by 60-foot box hangars are proposed. Due to the redevelopment of the existing T-hangars, consideration is given to the construction of five 55- by 285-foot T-hangars and two 100- by 100-foot conventional hangars located southwest of Runway 13-31, near the Runway 13 threshold. Ultimately, automobile access could be provided via South Riverside Drive through a controlled access gate and could be served by approximately 13,100 sf of automobile parking area. Furthermore, should demand warrant, two 55- by 285-foot T-hangars are proposed on the east side of Runway 1-19, near the Runway 19 threshold. These hangars could be accessed via an extension from Kitty Hawk Drive and a controlled access gate. In addition, a dedicated airport maintenance facility is proposed adjacent to the T-hangars.

This alternative considers approximately 81,100 sf of automobile parking area that is proposed adjacent to the northern side of the existing terminal area parking lot. As such, it is proposed that the airport beacon be relocated immediately east of the terminal building. Additional automobile parking and access is located adjacent to the proposed conventional hangars. In an effort to maximize the use of airport property to produce revenue, approximately 2.8 acres of property located in the terminal area are designated for non-aeronautical land use.

SOUTHWEST DEVELOPMENT AREA ALTERNATIVES

The southwest development area is positioned along Taxiway A on the west side of Runway 1-19. This development area would provide easy airside access via Taxiway A, while landside access could be provided from South Riverside Drive, located to the west of the airfield. **Exhibits 4K**, **4L**, and **4M** present three alternative development options for the proposed area.

Southwest Development Area Alternative 1

Alternative 1, presented on **Exhibit 4K**, proposes the construction of six 55- by 285-foot T-hangars, as well as three 100- by 100-foot conventional hangars. Under this scenario, the proposed hangar development could be supported by approximately 39,000 sy of apron area. Given that the southwest development area is somewhat removed from the terminal area and main aircraft apron, consideration is given to the addition of a 100LL and Jet A self-service fuel island. Automobile access is provided via the Sigler access road. Consideration is also given to a controlled access gate to prevent unauthorized access. Proposed automobile parking encompasses approximately 90,000 sf under this scenario.

Southwest Development Area Alternative 2

As presented on **Exhibit 4L**, Alternative 2 considers six 55- by 285-foot T-hangars and three 125- by 200-foot conventional hangars. Under this scenario, the proposed hangar development could be supported

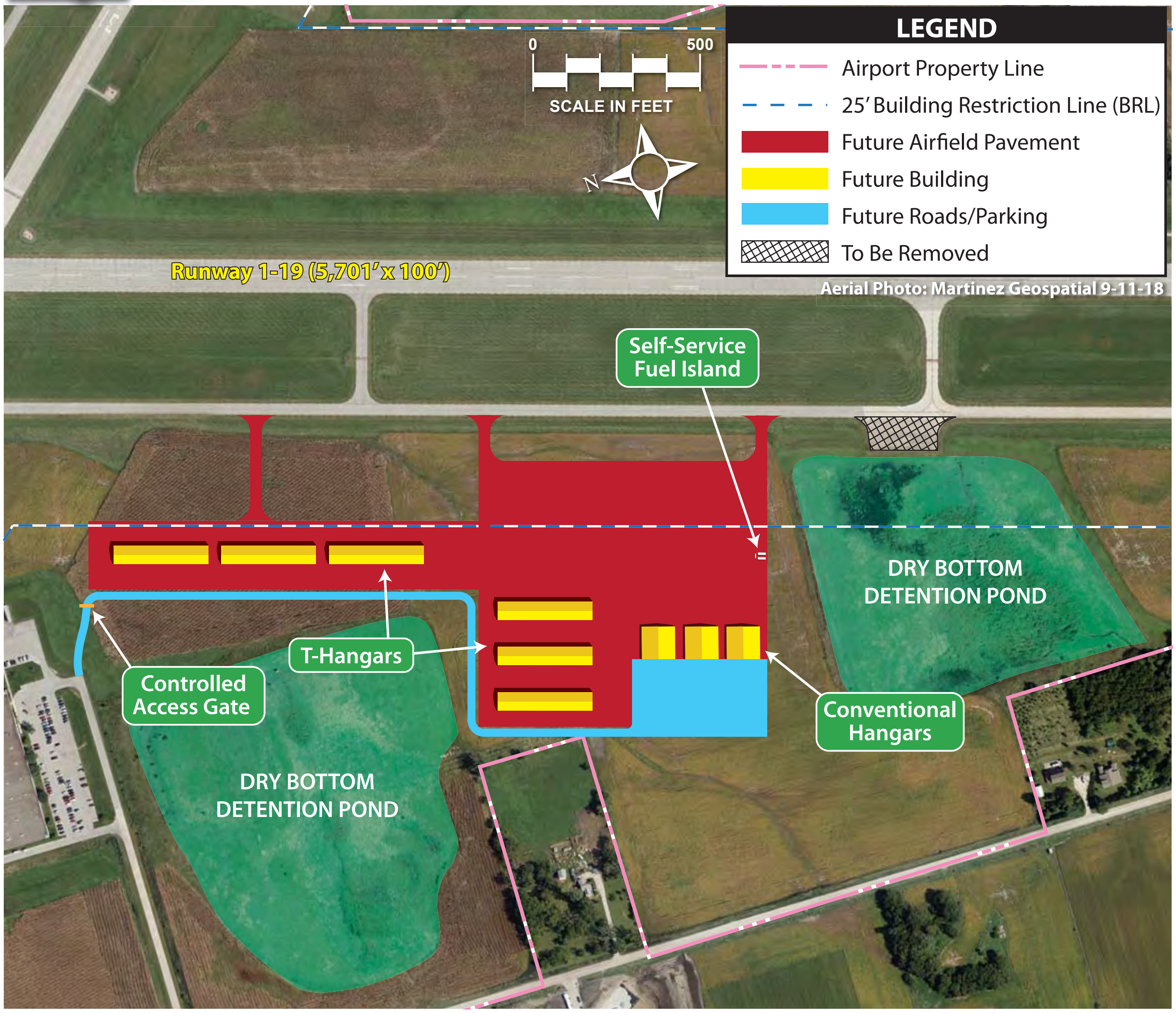


Exhibit 4K
SOUTHWEST AREA ALTERNATIVE 1

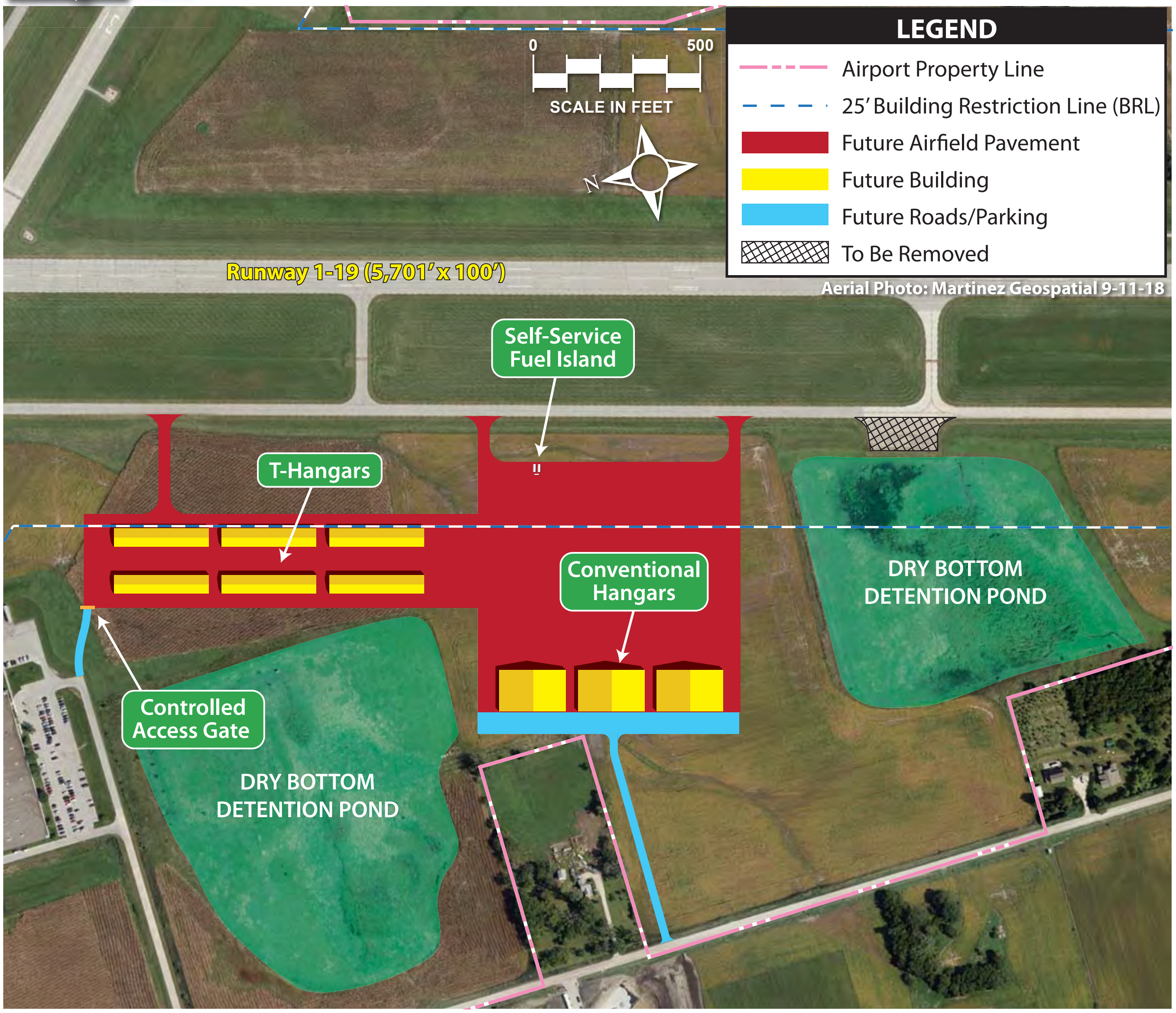
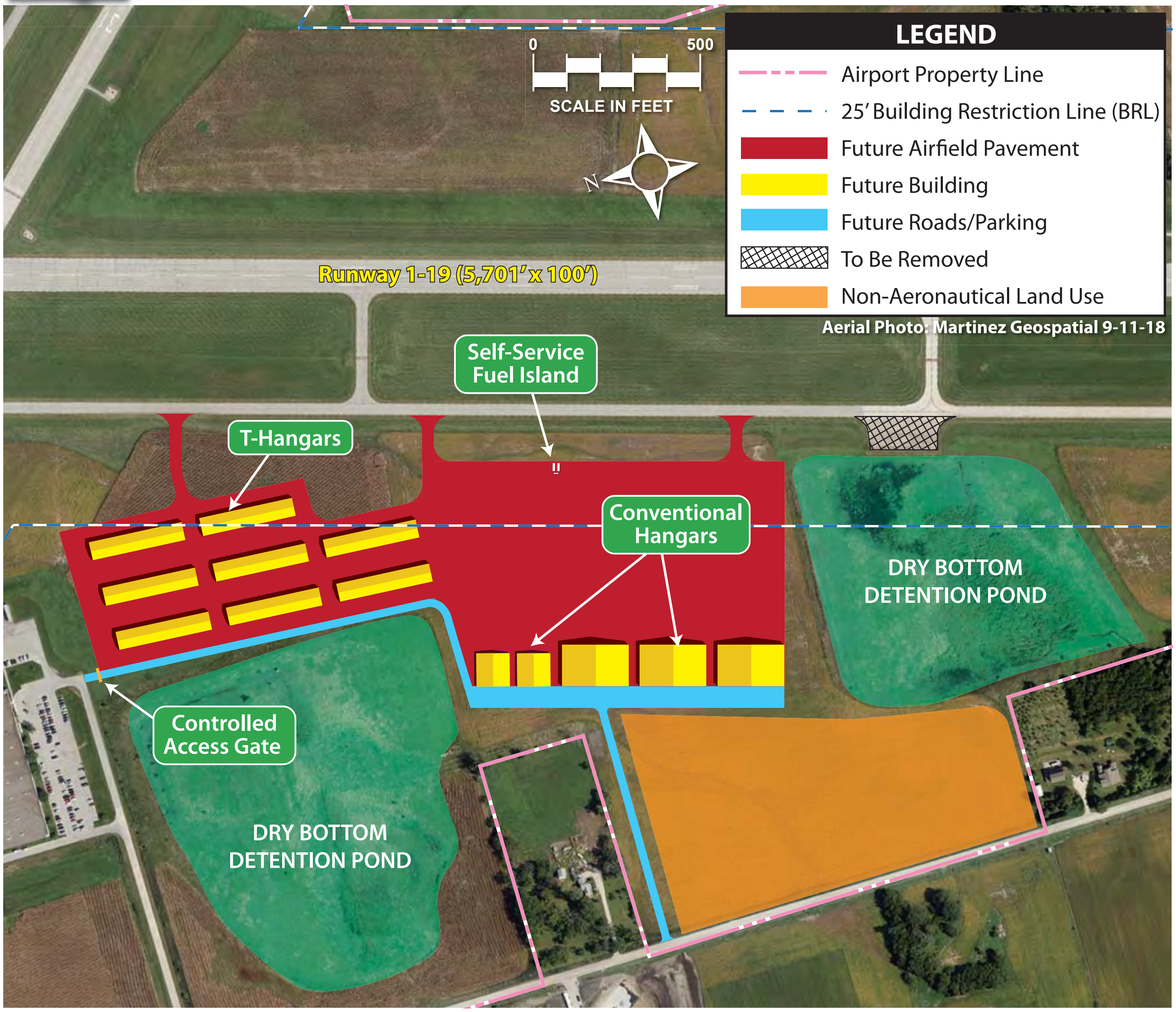


Exhibit 4L
SOUTHWEST AREA ALTERNATIVE 2


LEGEND
Airport Property Line
25' Building Restriction Line (BRL)
Future Airfield Pavement
Future Building
Future Roads/Parking
To Be Removed
Non-Aeronautical Land Use
Aerial Photo: Martinez Geospatial 9-11-18
0
500
SCALE IN FEET
N
Runway 1-19 (5,701' x 100')
Self-Service Fuel Island
T-Hangars
Conventional Hangars
DRY BOTTOM DETENTION POND
Controlled Access Gate
DRY BOTTOM DETENTION POND

by approximately 46,000 sy of apron area. This alternative also considers the addition of a 100LL and Jet A self-service fuel island located on the east side of the apron area. Automobile access is provided via South Riverside Drive and the Sigler access road. Consideration is also given to a controlled access gate at the Sigler access point, near the T-hangars to prevent unauthorized access. Proposed automobile parking encompasses approximately 58,100 sf.

Southwest Development Area Alternative 3

Alternative 3 maximizes development located within the southwest development area. Presented on **Exhibit 4M**, this alternative considers eight 55- by 285-foot T-hangars, three 125- by 200-foot conventional hangars, as well as two 100- by 100-foot conventional hangars. The proposed hangar development could be supported by approximately 53,000 sy of apron area. This alternative also considers the addition of a 100LL and Jet A self-service fuel island located on the east side of the apron area. Automobile access is provided via South Riverside Drive and the Sigler access road. Consideration is also given to a controlled access gate at the Sigler access point, near the T-hangars to prevent unauthorized access. Proposed automobile parking encompasses approximately 71,200 sf. Furthermore, to maximize the use of airport property to produce revenue, approximately 12 acres of property located immediately west of the southwest development area are designated for non-aeronautical land use.

ALTERNATIVE ANALYSIS SUMMARY

The process utilized in assessing airside, terminal, and general aviation development alternatives involved a detailed analysis of facility requirements, as well as future growth potential. Current airport design standards were considered at each stage of development.

Several development alternatives related to both the airside and the landside have been presented. On the airside, the major considerations involve extending Runways 1-19 and 13-31, increasing approach visibility minimums, and correcting taxiway geometry in areas that do not meet design standards. The alternatives have shown there are several positive and negative impacts that need to be weighed, including potential impacts on surrounding land uses, such as residential and commercial uses and public roadways.

On the landside, alternatives were presented to consider additional hangar development and potential for aviation-related and non-aviation-related revenue support. The alternatives focused on meeting the long-term facility demands of each of the various general aviation activities within the existing airport property boundary.

After review by the City of Ames, the TAC, and public, a recommended concept will be presented in the next chapter. The resulting plan will represent an airside facility that fulfills safety and design standards and a landside complex that can be developed as demand dictates.

CITY OF Ames

AMES MUNICIPAL AIRPORT

CHAPTER 5

MASTER PLAN CONCEPT

CHAPTER FIVE

MASTER PLAN CONCEPT

The preparation of the Airport Master Plan has included technical efforts in the previous chapters intended to establish the role of Ames Municipal Airport (AMW), forecast potential aviation demand, establish airside and landside facility needs, and evaluate options for improving the airport to meet those facility needs. The planning process has included the development of draft working papers that have been presented to the Technical Advisory Committee (TAC). The TAC is comprised of stakeholders/constituents with an investment or interest in the airport and surrounding area. This diverse group has provided extremely valuable input into the master plan. Additionally, a series of Public Information Workshops have been conducted as part of this planning process, providing the interested members of the community an opportunity to be involved and educated about the study.

The alternatives that outlined future growth and development scenarios in Chapter Four have been refined into a recommended development concept for the master plan, which is included for presentation in this chapter. An overview of environmental conditions that need to be considered when development projects are undertaken is provided later in this chapter.

One of the objectives of the master plan is to allow decision-makers the ability to either accelerate or slow development goals based on actual demand. If demand slows, development of the airport beyond routine safety and maintenance projects could be minimized. If aviation demand accelerates, development could be expedited. Any plan can account for limited development, but the lack of a plan for accelerated growth can sometimes be challenging. Therefore, to ensure flexibility in planning and development to respond to unforeseen needs, the Master Plan Concept considers balanced development potential for AMW.

MASTER PLAN DEVELOPMENT CONCEPT

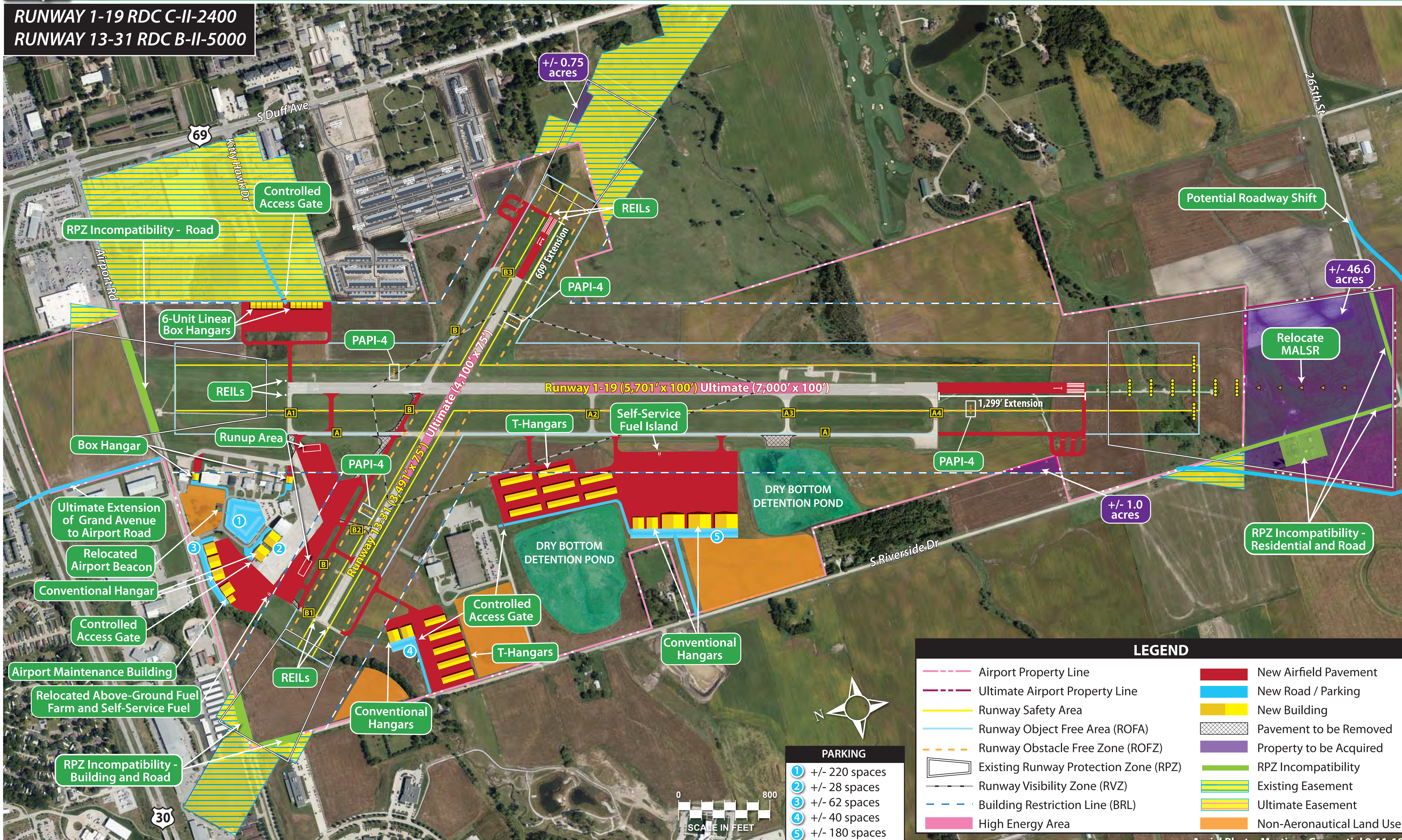
AMW is classified as a regional general aviation airport within the Federal Aviation Administration's (FAA) *National Plan of Integrated Airport Systems* (NPIAS). Most of the airport's operations can be attributed to general aviation activities, including business aviation, as well as some air taxi and charter operations occurring at the airport. NPIAS airports are considered important to the national aviation system and are eligible for development grant funding from the FAA. At the state level, the Iowa Department of Transportation – Aviation Bureau (IDOT) classifies AMW as an enhanced service airport. It is not anticipated that the airport's classifications will change because of the recommendations in this master plan. In fact, this plan fully supports the continued and necessary development of the airport to serve in the function of a regional general aviation role.

The Master Plan Concept, as shown on **Exhibit 5A**, presents the recommended configuration for AMW, which preserves and enhances the role of the facility, while meeting FAA design and safety standards to the extent practicable. It is important to note that the concept provides for anticipated facility needs over the next 20 years, as well as establishing a vision and direction for meeting facility needs beyond the 20-year planning period of this study. A phased program to achieve the Master Plan Concept is presented in Chapter Six. When assessing development needs, this chapter has separated the airport into airside and landside functional areas. The following sections describe the Master Plan Concept in detail.

AIRSIDE DEVELOPMENT CONCEPT

The airside plan generally considers those improvements related to the runway and taxiway system and often requires the greatest commitment of land area to meet the physical layout of an airport. Operational activity at AMW is anticipated to grow beyond the 20-year planning horizon of this master plan, and the airport is projected to continue to serve the full range of general and business aviation operations, in addition to air taxi and charter activities. The principal airfield recommendations should always focus first upon safety and security. Of key importance is to ensure that proposed airfield improvements will be designed to meet all appropriate FAA airport design standards. Recommendations are then designed to improve the operational efficiency, circulation, and capability of the airfield. The major airside issues addressed in the Master Plan Concept include the following:

- Upgrading to ultimate Runway Design Code (RDC) C-II standards on Runway 1-19 and maintaining RDC B-II design standards on Runway 13-31.


RUNWAY 1-19 RDC C-II-2400
RUNWAY 13-31 RDC B-II-5000
S Duff Ave
69
Kitty Hawk Dr
Airport Rd
265th St
+/- 0.75 acres
Controlled Access Gate
REILs
RPZ Incompatibility - Road
609' Extension
PAPI-4
6-Unit Linear Box Hangars
PAPI-4
REILs
Potential Roadway Shift
+/- 46.6 acres
Relocate MALSR
Runway 1-19 (5,701' x 100') Ultimate (7,000' x 100')
1,299' Extension
Runway 13-31 (3,491' x 75') Ultimate (4,100' x 75')
Box Hangar
Runup Area
T-Hangars
Self-Service Fuel Island
PAPI-4
PAPI-4
DRY BOTTOM DETENTION POND
DRY BOTTOM DETENTION POND
+/- 1.0 acres
RPZ Incompatibility - Residential and Road
Ultimate Extension of Grand Avenue to Airport Road
Relocated Airport Beacon
Conventional Hangar
Controlled Access Gate
Controlled Access Gate
S Riverside Dr
Airport Maintenance Building
T-Hangars
Conventional Hangars
REILs
Relocated Above-Ground Fuel Farm and Self-Service Fuel
Conventional Hangars
RPZ Incompatibility - Building and Road
30
N
0
800
SCALE IN FEET
PARKING
1 +/- 220 spaces
2 +/- 28 spaces
3 +/- 62 spaces
4 +/- 40 spaces
5 +/- 180 spaces
LEGEND
Airport Property Line
Ultimate Airport Property Line
Runway Safety Area
Runway Object Free Area (ROFA)
Runway Obstacle Free Zone (ROFZ)
Existing Runway Protection Zone (RPZ)
Runway Visibility Zone (RVZ)
Building Restriction Line (BRL)
High Energy Area
New Airfield Pavement
New Road / Parking
New Building
Pavement to be Removed
Property to be Acquired
RPZ Incompatibility
Existing Easement
Ultimate Easement
Non-Aeronautical Land Use
Aerial Photo: Martinez Geospatial 9-11-18

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- Consider runway extension options for Runway 1-19 to better accommodate business jet operators and regional transport aircraft utilizing the airport, pending further justification and coordination with the FAA. Given that Runway 13-31 is better oriented for prevailing wind conditions, extension options for Runway 13-31 are also considered to better accommodate smaller turbine-powered aircraft operating at AMW.

- Address safety area deficiencies on Runway 1-19, which primarily include vegetation obstructions associated with upgrading Runway 1-19 to ultimate RDC C-II standards and runway protection zone (RPZ) incompatibilities introduced by the runway extension.

- Realign non-standard taxiways and relocate hold positions to meet FAA airfield geometry and hold position separation standards.

- Analyze property acquisition needed to protect the runway environment, including airspace and safety areas adjacent to and beyond all runway ends.

- Enhance visual approach aids serving the runway with the installation of four-box precision approach path indicator (PAPI-4) systems serving all runways and runway end identifier lights (REILs) on runway ends 13, 31, and 19. In addition, improvements to the pilot-controlled lighting (PCL) system and automated surface observation system (ASOS) broadcast will be made by placing these units atop a tower to eliminate line-of-sight issues.

RUNWAY DIMENSIONAL STANDARDS

The FAA has established design criteria to define the physical dimensions of the runways and taxiways, as well as the imaginary surfaces surrounding them which protect the safe operation of aircraft at airports. These design standards also define the criteria for the placement of landside facilities.

As discussed in previous chapters, the design criteria primarily center on an airport's critical design aircraft. The critical design aircraft is the most demanding aircraft, or family of aircraft, which currently, or are projected to, conduct 500 or more operations (takeoffs or landings) per year at an airport. Factors included in airport design are an aircraft's wingspan, approach speed, tail height, and, in some cases, the instrument approach visibility minimums for each runway. The FAA has established the RDC to relate these design aircraft factors to airfield design standards. The most restrictive RDC is also considered the overall Airport Reference Code (ARC) for an airport.

Analysis in Chapters Two and Three concluded that the existing RDC for Runway 1-19 is B-II. With a length of 5,701 feet, Runway 1-19 can accommodate most general aviation activity, including small and mid-sized business jets, as well as limited air taxi and charter activity. Future planning considers numerous upgrades to the runway (to be discussed), as well as upgrading to an ultimate RDC of C-II for Runway 1-19.

Crosswind Runway 13-31 is 3,491 feet long and can accommodate 95 percent of the small aircraft fleet, which includes some small business jets and turboprops. The existing and ultimate Runway 13-31 RDC is categorized as B-II; however, several upgrades (to be discussed) are planned throughout the planning horizon.

Table 5A provides a summary of the RDCs for each runway based upon the Master Plan Concept. In addition to the physical and operational components of an aircraft, the RDC also considers the instrument approach capabilities of a runway expressed in runway visual range (RVR) values. For Runway 1-19, the existing and ultimate RVR value of 2400 indicates approach visibility minimums not lower than ½-mile, which correspond to the instrument landing system (ILS) and localizer (LOC) approaches serving Runway 1. For Runway 13-31, the RVR of 5000 indicates approach visibility minimums not lower than one mile, which correspond to the existing and ultimate GPS and very high frequency omni-directional range (VOR) instrument approaches.

TABLE 5A
Ultimate Runway Design Codes
Ames Municipal Airport

Runway	Existing Runway Design Code	Planned Runway Design Code*
1-19	B-II-2400	C-II-2400
13-31	B-II-5000	B-II-5000

* The existing and ultimate ARC for Ames Municipal Airport is B-II and C-II, respectively, based upon the most demanding RDC associated with Runway 1-19.

RUNWAY 1-19

Runway 1-19 is 5,701 feet long, 100 feet wide, served by instrument approach visibility minimums not lower than ½-mile and oriented in a north-south manner. The existing runway width should be maintained throughout the long-term planning horizon. The runway's existing pavement strength is 30,000 pounds single wheel loading (S) and 38,000 pounds dual wheel loading (D). Ultimately, the runway strength rating should be increased to accommodate larger aircraft currently operating at AMW, such as business jets, air taxi, and regional transport aircraft, which are forecast to increase in the future. At minimum, it is recommended that the pavement strength of Runway 1-19 be maintained at 30,000 pounds (S) and increased to 60,000 pounds (D). However, the airport should monitor the aircraft frequently operating on Runway 1-19. Should demand dictate, the runway strength should be increased to accommodate the heaviest aircraft (or group of aircraft) operating on a regular basis.

Given the results of the runway analysis presented in Chapter Three, the length and width of Runway 1-19 is adequate to accommodate the majority of aircraft operating at the airport. The existing runway length is capable of handling 100 percent of small airplanes with 10 or more passenger seats and 75 percent of the business jet fleet at 60 percent useful load; however, additional runway length could benefit larger and faster business jet operators, as well as regional jets and turboprops ferrying Iowa State University (and competing university) athletic teams by making the airport more accessible during hot summer months, providing the opportunity for aircraft to depart with more fuel, allowing for longer stage lengths and an increase in usable payload. Additional runway length would also improve landing situations for business jets and regional transport aircraft operating under Part 91k or Part 135, especially during wet or contaminated runway conditions. As such, the recommended plan includes extending Runway 1-19 by 1,299 feet to an ultimate length of 7,000 feet.

Analysis in Chapter Three indicated that the existing runway safety area (RSA), runway object free area (ROFA), runway obstacle free zone (ROFZ), and precision obstacle free zone (POFZ) serving Runway 1-19 are free of obstructions or incompatibilities. As shown on **Exhibit 5A**, the ultimate RSA, ROFA, ROFZ, and POFZ conform to all clearing and grading criteria with the exception of obstructing vegetation and gradient requirements associated with ultimate RDC C-II-2400 standards and the extension of Runway 1-19. Upon the extension of Runway 1-19 and upgrading to ultimate RDC C-II-2400 standards, it is recommended that the ultimate RSA, ROFA, ROFZ, and POFZ are cleared of all obstructing vegetation and graded accordingly.

Under existing B-II and ultimate C-II conditions, the RPZ serving Runway 1 with instrument approach minimums not lower than ½-mile will remain the same size; however, the ultimate proposed southerly runway extension to a length of 7,000 feet would impose roadway and uncontrolled/unowned property incompatibilities to the RPZ serving Runway 1. The proposed 1,299-foot runway extension to the south would shift the ultimate RPZ serving Runway 1 beyond existing airport property. The relocated RPZ would encompass approximately 46.6 acres of land, including a residential property, and would be traversed by portions of 265th Street and South Riverside Drive. Additionally, approximately one acre of property would need to be acquired to accommodate the proposed holding bay serving the extended Runway 1 threshold. Upon extending Runway 1-19, the Master Plan Concept proposes that the airport acquire all uncontrolled property within the ultimate Runway 1 RPZ and property required to accommodate the ultimate taxiway system, as well as relocate 265th Street and South Riverside Drive outside the RPZ. As presented on **Exhibit 5A**, the residential property within the ultimate Runway 1 RPZ would need to be considered for future acquisition; however, this action should not be taken unless or until the airport can justify a runway extension.

Upon upgrading to ultimate C-II design standards, the RPZ serving Runway 19 will increase in dimension to 500 feet at the inner portion, 1,010 feet at the outer portion, and 1,000 feet long. Although the RPZ serving the ultimate Runway 19 would remain on airport property, it is completely traversed by Airport Road, which is now generally considered an incompatible land use by the FAA; however, since the interim guidance only addresses new or modified RPZs, existing or historically planned incompatibilities are generally considered grandfathered conditions. For example, roads that are in the current RPZ are typically allowed to remain as grandfathered unless the runway environment changes. Given that Runway 1-19 has historically been planned to C-II design standards, the existing location of Airport Road should be acceptable. In addition, it should be noted that the City of Ames has long-term plans of extending Grand Avenue to the south as shown on **Exhibit 5A**, intersecting with Airport Road directly west of the RPZ serving Runway 19.

In any event, airport officials and the City of Ames should continue to monitor activity within the existing and proposed safety areas and RPZs serving Runway 1-19 and maintain them free of incompatible land uses to the extent practicable. Continued coordination with IDOT and FAA officials will be important when implementing any projects that could require changes to the existing RPZs at AMW.

RUNWAY 13-31

As the crosswind runway, Runway 13-31 should be designed to accommodate the smaller and mid-size aircraft that utilize AMW as high crosswind conditions impact them more. Runway 13-31 is 3,491 feet long and 75 feet wide, oriented in a northwest-southeast manner, with instrument approach visibility minimums of not lower than one mile. The current strength rating of Runway 13-31 is 30,000 pounds S, which should be maintained throughout the planning horizon. At its existing length, Runway 13-31 meets FAA requirements to accommodate 95 percent of the small general aviation aircraft fleet, which is 3,300 feet; however, given that Runway 13-31 is better oriented for the prevailing winds in the region when compared to Runway 1-19, alternative analysis presented in Chapter Four explored several extension options for Runway 13-31. Based upon Runway Length and Alternative Analysis conducted in previous chapters, Runway 13-31 is planned to be extended southeast to a length of 4,100 feet, while maintaining RDC B-II design standards.

Under existing and ultimate RDC B-II standards, the RSA and ROFZ serving Runway 13-31 should be maintained clear of obstructions and graded according to FAA standard. As discussed in Chapter Three, the existing ROFA has vegetation and crops obstructing the north and southeast corners, as well as portions along the southwestern side. It is recommended that the airport remove all overgrown vegetation and crops in order to satisfy the ROFA design standards. Under ultimate conditions, the RSA and ROFA serving the extended runway will encompass a portion of an airport drainage basin. Upon construction of this project, the airport should relocate the basin further southwest to comply with all clearing and grading standards associated with the ultimate safety areas.

As presented on **Exhibit 5A**, the RPZ serving the existing and ultimate Runway 13 end extends beyond airport property to the northwest, encompassing approximately 1.2 acres of property (combined), which is owned in easement. In addition, the easement-owned portions of the Runway 13 RPZ contain segments of South Riverside Drive and Airport Road, as well as a self-storage facility and a parking lot. Given that the airport owns easements on all property within the RPZ serving Runway 13 and there are no proposed changes that would affect the RPZ, the airport should maintain the Runway 13 RPZ in its "grandfathered" condition under current FAA RPZ guidance. In the future, the airport should take steps to ensure there are no changes imposed to the Runway 13 RPZ that would require the relocation of existing roadways or structures. Furthermore, the existing Runway 31 RPZ extends off airport property to the southeast, encompassing approximately 1.35 acres of property, which is also owned in easement. As previously discussed, the Master Plan Concept considers a 609-foot runway extension to the southeast, which would shift the RPZ serving Runway 31 further off airport property. Of all the property contained within the ultimate Runway 31 RPZ that extends off airport property, all except for approximately 0.75-acre is owned in easement. As such, it is recommended that the airport acquire an avigation easement for the 0.75-acre of uncontrolled property associated with the ultimate Runway 31 RPZ.

BUILDING RESTRICTION LINE

Although achieving the lowest instrument approach visibility minimums is advantageous for airport operations, there are multiple safety area requirements tied to the minimums associated with the runway's instrument approach procedure(s). As a result, impacts to the airport environment imposed by the ultimate instrument approach visibility minimums need to be addressed. The runway type and capability of the instrument approach minimums contribute to the determination of the building restriction line (BRL), which is a product of 14 CFR Part 77 primary and transitional surface clearance requirements and identifies suitable building locations on the airport.

Given that the strength rating for Runways 1-19 and 13-31 is over 12,500 pounds, they are classified as "other than utility" runways under Part 77. The width of the primary surface for other-than-utility visual and non-precision instrument runways having minimums greater than ¾-statute mile is 500 feet (250 feet to each side of runway centerline). The width of the primary surface serving other-than-utility runways having minimums of ¾-statute mile or lower is 1,000 feet (500 feet to each side of runway centerline). The recommended concept for current and long-term planning at AMW considers instrument approach procedures having not lower than ½-mile serving Runway 1 and not lower than one-mile minimums serving Runway 19 and 13-31. Thus, the primary surface will remain 1,000 feet wide on Runway 1-19 and 500 feet wide on Runway 13-31. The transitional surface then extends out and up from the edge of the primary surface at a ratio of seven feet laterally for every one-foot increase. Based upon these criteria and using a planned building height, the BRL or obstructions to the BRL can be determined. **Exhibit 5A** presents the BRL separation at 745 feet from runway centerline for Runway 1-19 and a BRL separation at 495 feet from runway centerline for Runway 13-31 based upon the instrument approach capabilities of each runway and the selected allowable structure height of 35 feet.

As shown on the Master Plan Concept, there are three aircraft hangars located within the existing and ultimate 35-foot BRL. One of the aircraft hangars located within the 35-foot BRL is positioned immediately west of Runway 1-19 and Taxiway A, and the other two proposed hangars are located immediately east of the Runway 19 threshold. The proposed height of each of these hangars is approximately 20 to 25 feet tall. Given the proposed structure height, each of the hangar facilities has been selectively located and are not obstructions to the transitional surface.

INSTRUMENT APPROACHES

As discussed earlier, AMW has straight-in instrument approach capabilities to Runways 1-19 and 13-31. Runway 1 is served by precision instrument approach procedures down to ½-mile, while Runways 19 and 13-31 are served by non-precision area navigation (RNAV) GPS approaches not lower than one mile. The precision instrument approach serving Runway 1 and the RNAV GPS approach to Runway 19 provide for 250-foot cloud ceilings. The RNAV GPS approaches to Runway 13-31 provide for one-mile approach visibility minimums and cloud ceilings at 294 and 275 feet, respectively. Except for the ILS or LOC instrument approach to Runway 1, it is important to note that aircraft with approach speeds between 141 and 166 knots (Category D) are not authorized to conduct a straight-in instrument approach at the airport.

Chapter Four examined multiple instrument approach enhancement alternatives serving each runway end. Visibility minimums for Runway 1 are planned to remain at not lower than ½-mile. The minimums associated with ultimate instrument approach procedures serving Runways 19 and 13-31 are planned to remain at not lower than one mile over the long-term planning period due to numerous roadway, commercial, and residential property RPZ incompatibilities that would be encompassed with lower minimums.

VISUAL APPROACH AIDS

Future planning considers various enhancements to visual approach aids serving the runway system at AMW, as depicted on **Exhibit 5A**. Currently, Runways 19, 13, and 31 are served by four-box visual approach slope indicators (VASIs); however, VASI lighting systems have begun to be phased-out by the FAA and are being replaced by precision approach path indicator PAPI systems. Ultimately, PAPI-4s are planned to serve all runway ends to further enhance the use of each runway as well as overall airfield safety. These systems will provide pilots with improved visual approach guidance information during landing phases of flight.

REILs are flashing lights located at the runway threshold end that facilitate rapid identification of the runway end at night and during poor visibility conditions. REILs provide pilots with the ability to identify the runway thresholds and the runway end lighting from other lighting on the airport and in the approach areas. Given that the existing instrument approach visibility minimums serving Runways 19, 13, and 31 are planned to be maintained at not lower than one mile, the Master Plan Concept considers the implementation of REILs serving Runway 19 and each end of Runway 13-31.

Moreover, the medium intensity approach lighting system with runway alignment indicator lights (MALSR) serving Runway 1 should be maintained throughout the planning horizon. It should be mentioned, however, that the proposed runway extension of Runway 1-19 will require the relocation of the MALSR as depicted on **Exhibit 5A**.

COMMUNICATION AND WEATHER REPORTING AIDS

At present, AMW is served by an automated surface observation system (ASOS), which provides weather observations 24 hours per day. The system updates weather observations every minute, continuously reporting significant weather changes as they occur. This information is then transmitted at regular intervals (usually once per hour). Aircraft in the vicinity can receive this information if they have their radio tuned to the correct frequency (132.025 MHz). However, numerous reports have been made by local and transient pilots that the existing ASOS broadcast is difficult to tune into and is often sporadic. Many times, pilots will call the FBO for current weather reports due to inconsistency of the ASOS broadcast system. Additionally, pilots experience many of the same issues with the PCL system and are unable to activate necessary lighting systems when needed. It has been reported that pilots will often call the Des Moines International Airport Control Tower to have them activate the lighting systems at AMW. Similarly, the FBO has reported that they have left the taxiway lighting system on overnight to ensure that expected arrivals would have taxiway lights.

Through correspondence with the FAA and the National Weather Service, it has been determined that issues with the ASOS broadcast and the PCL system stem from a lack of line-of-sight between aircraft in the vicinity and the antennas serving these systems. As such, it is proposed that the ASOS and PCL antennas be raised on a tower providing 360-degree line-of-sight coverage.

TAXIWAY DESIGN AND GEOMETRY ENHANCEMENTS

While no significant airfield capacity improvements should be necessary during the planning period, the Master Plan Concept considers improving airfield safety and efficiency through the implementation of relocated and extended taxiways. The taxiway system is planned to maintain Taxiway Design Group (TDG) 2 standards for all taxiways, which calls for a taxiway width of 35 feet.

At present, the taxiway system serving AMW is found to be adequate in meeting current and future air traffic demand; however, the portions of the existing airfield taxiway geometry conflicts with the current FAA taxiway design standards established in AC 150/5300-13A, *Airport Design*. Currently, Taxiways A1 and B provide direct access to Runway 1-19 from the aircraft apron area. Similarly, Taxiways B1 and B2 provide direct access from the aircraft apron area to Runway 13-31. Direct access connections such as this have been linked to increased risk of a runway incursion and should be considered for modification.

As such, the Master Plan Concept considers removing and realigning Taxiway A1 as it connects to the apron area, thereby eliminating the direct access provided to Runway 1-19. Additionally, the northwestern portion of Taxiway B is relocated and extended to serve as a full-length parallel taxiway for Runway 13-31. In doing so, taxiway connectors extending from the apron area can be decoupled from Taxiways B1 and B2, eliminating the direct access provided from the apron area to Runway 13-31. Furthermore, Taxiway B2 is acutely angled to Runway 13-31 and is oriented at less than 90 degrees perpendicular to the runway, which limits visibility of the runway environment. In general, taxiway connectors such as this are termed “high-speed” exits, which are common for commercial service airports; however, FAA’s updated geometry recommends avoiding these layouts where practical and implementing them only when airport capacity concerns justify their use. Given the FAA taxiway design criteria, it is recommended that Taxiway B2 be removed and relocated approximately 250 feet northwest and oriented at 90 degrees perpendicular to Runway 13-31 to increase pilot visibility and situational awareness of the runway environment.

Previously discussed in Chapters Three and Four, FAA taxiway design standards present the concept of the “high energy area.” The high energy area is defined as the middle third of a runway and is typically the location where aircraft are moving rapidly for takeoff or landing. Within this area, aircraft are more vulnerable to accidents with aircraft crossing through as they cannot readily slow or stop to avoid impacts. Current FAA guidance highly discourages the location of taxiways routing aircraft across a runway through the high energy area. Currently, full-length parallel Taxiway A serving Runway 1-19 crosses through the high energy area of Runway 13-31, due to the nature of the intersecting runway configuration. Given the efficiency and functionality provided by full-length parallel taxiways, it would be highly inefficient in terms of airfield capacity and cost for the airport to route all taxiways around the high energy areas of the intersecting runway configuration. Thus, it has been determined that a high energy area crossing provided by existing and ultimate full-length parallel Taxiway A is justified and shall remain.

HOLDING BAYS

Taxiway holding bays improve taxiway circulation efficiency by providing a location for aircraft to perform engine run-up procedures and allow aircraft to bypass each other, if necessary. Currently, there are two holding bays serving Runway 1. Per FAA guidance, the existing holding bays provide a wide expanse of pavement which is now considered non-standard design. As such, a holding bay serving the extended Runway 1 is proposed on the ultimate Taxiway A, while an additional holding bay is proposed serving the extended Runway 31 on Taxiway B. The holding bays depicted on **Exhibit 5A** reflect FAA's design standards for holding bays and are sized to accommodate small- and mid-sized business jet aircraft. It should be noted, however, that holding bays such as this are typically justified when operations reach a level of 30 per hour.

Given the proximity of Runways 19 and 13 to the existing and proposed apron areas, standard hold bays cannot be incorporated without removing apron area. As such, dedicated run-up areas are depicted on the ultimate apron areas near the Runway 19 and 13 thresholds. It should be noted that a portion of the hold bay serving the extended Runway 13 extends over a detention basin for the airport. Upon construction of this project, additional drainage and fill will be required to ensure proper taxiway gradient standards are met.

LANDSIDE DEVELOPMENT CONCEPT

The primary goal of landside facility planning is to provide adequate space to meet reasonably anticipated aviation needs, while also optimizing operational efficiency and land use. Achieving these goals yields a development scheme which segregates functional uses, while maximizing the airport's revenue potential. Chapter Three identified several opportunities to improve the existing landside facilities to better accommodate future aviation demand. This section will specify the recommended improvements pertaining to landside facilities. Landside facilities can include terminal buildings, hangars, aircraft parking aprons, and aviation support services, as well as the utilization of remaining airport property to provide revenue support and to benefit the economic well-being of the regional area. Also important is identifying the overall land use classification of airport property to preserve the aviation purpose of the facility well into the future. **Exhibit 5A** presents the planned landside development for AMW.

As a regional general aviation airport, most of the landside development proposed within the Master Plan Concept will accommodate the general aviation owners and operators, as well as current and future service providers at AMW. At present, general aviation landside facilities are located on the north side of the airfield, between the Runway 19 and 13 thresholds, and include 17 separate hangar facilities providing approximately 136,450 square feet (sf) of hangar capacity, as well as aircraft apron space totaling approximately 10,600 square yards (sy).

Multiple layouts of potential landside facilities were presented in Chapter Four that included hangar development, aircraft apron layouts, and the placement of aviation support services. The Master Plan Concept provides a compilation of proposed landside facilities, which attempts to maximize potential aviation development space on the airfield. Primarily, new development is planned near existing facilities to take advantage of existing infrastructure availability and reduce future development costs. However, long-term landside development also considers new development locations that could help meet forecast demands.

The major landside issues addressed in the Master Plan Concept include the following:

- Designation of areas that can accommodate aviation development potential near the existing terminal area, on the west side of Runway 13-31, and the southwestern development area located immediately west of Runway 1-19. All proposed development includes aircraft storage hangars and aircraft apron space.

- Relocate and increase fuel farm capacity.

- Implement self-service fuel capability on the terminal apron area and on the southwest development area apron.

- Provide a site for a future airport maintenance and snow removal equipment (SRE) storage facility.

- Designate areas for additional automobile parking and new airport access extending from Kitty Hawk Drive and South Riverside Drive serving the landside development areas.

AIRCRAFT STORAGE HANGARS AND FUTURE AVIATION DEVELOPMENT

Analysis in Chapter Three indicated that an additional 85,650 sf of aircraft storage hangar capacity may be needed through the long-term planning period in order to meet potential aviation demand. Recommended hangar development is proposed in the form of T-hangar, linear/executive box, and large conventional hangars; however, future demand will ultimately dictate the size and type of hangar facilities that could be built. Ultimately, the Master Plan Concept seeks to maximize hangar development potential along the flight line and on the main aircraft apron, while identifying locations on existing airport property for future development.

Terminal Development Area

As presented on **Exhibit 5A** and in **Figure 5A**, the Master Plan Concept considers significant aviation-related development and redevelopment of the existing airport terminal area, which is centrally located on the main aircraft apron with automobile parking and access provided on the north side of the terminal building via Airport Road.

In the near term, the old terminal facility is planned to be demolished. The soon-to-be developable property is a prime location for a large conventional hangar due to its position on the apron area and access to the flight line. Once demolished, the development concept considers the construction of a 100- by 125-foot conventional hangar in place of the old airport terminal building. To maximize the potential of the main aircraft apron area, the Master Plan Concept considers expanding the existing apron to the south and west by approximately 56,500 sy. Additionally, a second 100- by 125-foot conventional hangar is planned immediately north of the old terminal building, which will require the redevelopment of the existing executive box hangar in that location. To complete the existing row of executive box hangars located along the northeast side of the terminal development area, two 60- by 60-foot box hangars are considered.

Figure 5A
Terminal Area Master Plan Concept

Automobile access to the proposed box hangars is provided via the existing airport entrance road. Similarly, automobile parking and access is provided on the east side of the two proposed conventional hangars and totals approximately 18,200 sf. Approximately 100,000 sf of automobile parking is proposed adjacent to the northern side of the existing terminal area parking lot, which requires the relocation of the airport beacon. Ultimately, the airport beacon could be relocated approximately 300 feet north of its existing location.

Continuing north along the western side of the terminal area, the Master Plan Concept also considers the complete redevelopment of the existing T-hangar buildings and replacing them with four 100- by 100-foot conventional hangars on the northernmost side of the proposed apron area. Furthermore, a 60- by 60-foot airport maintenance and storage facility is located immediately west of the four proposed conventional hangars. The Master Plan Concept also considers relocating and increasing the capacity of the fuel farm, which will be detailed in the Support Facilities section of this chapter.

Automobile parking and access to these facilities is provided via the existing airport entrance road and totals approximately 40,100 sf of parking area. Due to predominant wind and snowfall patterns, the four proposed conventional hangars and the airport maintenance building are oriented in a south-facing manner, which will help with clearing snow and maintaining the hangar doors clear of ice during thaw and refreeze conditions.

Given the redevelopment of the existing T-hangars, the Master Plan Concept proposes the construction of four 55- by 285-foot 12-unit T-hangars and one 55- by 190-foot eight-unit T-hangar, located southwest of Runway 13-31, near the Runway 13 threshold. In addition, two 100- by 100-foot conventional hangars are planned directly north of the proposed T-hangars. Like the proposed hangar development on the main aircraft apron, all hangar development located west of Runway 13-31 is oriented in a manner that allows east and west facing door fronts for purposes of snow and ice clearing efficiency. Automobile access to these hangars is provided via South Riverside Drive through a controlled access gate and is served by approximately 17,400 sf of automobile parking area. Furthermore, two six-unit linear box hangars are proposed on the east side of Runway 1-19, near the Runway 19 threshold. These hangars could be accessed by a western roadway extension of Kitty Hawk Drive through a controlled access gate.

Southwest Development Area

As previously mentioned, the Master Plan Concept presents areas located on existing airport property that would be suited for future aviation development if demand warrants. Through the alternatives process, multiple development layouts were explored for the southwest development area, which is positioned along Taxiway A on the west side of Runway 1-19. This development area is ideal as it would provide airside access via Taxiway A, while landside access could be provided from South Riverside Drive on the west side of the airfield. **Exhibit 5A** and **Figure 5B** present the Master Plan Concept as it relates to the southwest development area.

Ultimately, the development concept considers the construction of eight 12-unit T-hangars, two 100- by 100-foot conventional hangars, as well as three 125- by 200-foot conventional hangars. The proposed hangar development could also be supported by approximately 53,000 sy of apron area. Given that the southwest development area is somewhat removed from the terminal area, the Master Plan Concept considers the addition of two 12,500-gallon above-ground fuel tanks providing 100LL and Jet A fuel with self-service capability via credit card reader. As mentioned, automobile access is provided via South Riverside Drive. Consideration is also given to providing automobile access from the Sigler access road with a controlled access gate near the T-hangars to prevent unauthorized access. In total, the proposed automobile parking area encompasses approximately 71,200 sf.

Non-Aeronautical Land Use

Given that the land needed to accommodate the 20-year landside facility requirements, identified in Chapter Three, is not anticipated to exceed the undeveloped/vacant property currently available for development, the Master Plan Concept considers non-aeronautical land uses on airport property to maximize the revenue potential of the airfield. Non-aeronautical developments could include, but are not limited to, business centers, industrial parks, or restaurants. The areas proposed for non-aeronautical use include approximately three acres of property in the central terminal area, as well as approximately 12 acres of property located immediately west of the southwest development area. These areas are ideal as they are not easily accessible to the airfield system. It should be noted, however, that much of the existing vacant property is currently farmed where practical.

Figure 5B
Southwest Development Area Master Plan Concept

As stated in Chapter Four, the airport does not have the approval to use undeveloped property for non-aviation purposes at this time. Specific approval from the FAA will be required to utilize undeveloped property for non-aviation uses. This planning document does not gain approval for non-aviation uses, even if these uses are ultimately shown in the master plan and on the Airport Layout Plan (ALP). A separate request justifying the use of airport property for non-aviation uses could be required; however, this study can be a source for developing that justification.

SUPPORT FACILITIES

As mentioned in Chapters Three and Four, support facilities are integral to the operation of the airport; however, these facilities are not categorized as airside or landside facilities. The facility requirements analysis identified several improvements that will ultimately contribute to the airport's ability to accommodate the forecast aviation activity levels.

Airport Maintenance and Snow Removal Equipment Facility

The airport does not currently have a designated airport maintenance or snow removal equipment (SRE) facility. Currently, the airport utilizes city-owned maintenance equipment that is stored at the airport on a cyclical basis for use on the airfield. As such, a 60- by 60-foot airport maintenance and SRE building is proposed immediately west of the four large conventional hangars located in the terminal area, adjacent to Airport Road.

Aviation Fuel Storage

Chapter Four analyzed multiple locations to relocate and replace the existing fuel farm. As a result, the Master Plan Concept considers relocating the fuel farm to the northwestern corner of the proposed apron area, adjacent to the Runway 13 threshold. The relocated fuel farm consists of two above-ground 15,000-gallon 100LL and Jet A fuel tanks. Ultimately, the added fuel capacity will help the FBO keep up with current and forecast demands, while the above-ground fuel farm will allow for easier and more regular inspection of the fuel farm. Additionally, the fuel tanks are equipped with self-service fueling capability and credit card reader.

Airport Utilities

At this time, any significant landside development, particularly west of the Runway 13 threshold or in the southwest development area, could be limited by the existing utility infrastructure, or the lack thereof. Minimum water flow requirements (for sprinkler and firefighting purposes) may vary depending upon the type of hangars and facilities built, requiring water storage and pumping capabilities. All future development should consider enhancements to utility infrastructure that could include increased water storage and pumping capacity, sewer, and improved electrical and natural gas capabilities. In addition to utilities, the airport should also evaluate the drainage system in place prior to any significant landside developments to ensure it will adequately support development.

ENVIRONMENTAL OVERVIEW

An analysis of potential environmental impacts associated with proposed airport projects is an essential consideration in the master plan process. The primary purpose of this discussion is to review the proposed Master Plan Concept and associated capital program for the airport to determine whether the projects identified in the master plan could, individually or collectively, significantly impact existing environmental resources. The information contained in this section was obtained from previous studies, official internet websites, and analysis by the consultant.

Construction of any and all improvements depicted on the Master Plan Concept will require compliance with the *National Environmental Policy Act* (NEPA) *of 1969*, as amended. This includes privately funded projects and those projects receiving federal funding. For projects not categorically excluded under FAA

Order 1050.1F, *Environmental Impacts: Policies and Procedures*, compliance with NEPA is generally satisfied through the preparation of an Environmental Assessment (EA). In instances where significant environmental impacts are expected, as determined by the FAA, an Environmental Impact Statement (EIS) may be required. While this portion of the master plan is not designed to satisfy the NEPA requirements, it provides a preliminary review of environmental issues that may need to be considered in more detail within the environmental review processes. It is important to note that the FAA is ultimately responsible for determining the level of environmental documentation required for airport actions.

The environmental inventory included in Chapter One provides baseline information about the airport environs. This section provides an overview of potential impacts on existing resources that could result from the implementation of the planned improvements outlined in the recommended concept plan. While this portion of the study is not designed to satisfy NEPA requirements for a Documented Categorical Exclusion (CatEx), EA, or EIS, it is intended to supply a preliminary review of environmental issues that might affect the implementation of the master plan.

POTENTIAL ENVIRONMENTAL CONCERNS

Table 5B summarizes potential environmental resources that may be affected by the implementation of the recommended development concept for AMW. Analysis under NEPA includes direct, indirect, and cumulative impacts. Direct impacts are those caused by the action and occur at the same time and place (see 40 Code of Federal Regulations [CFR] § 1508.8(a)). Examples of direct impacts include:

- Construction of a facility or runway in a wetland which results in the loss of a portion of the wetland; or
- Noise generated by the proposed action or alternative(s) which adversely affects noise-sensitive land uses.

Indirect impacts are those caused by an action, although later in time or farther removed in distance, but are still reasonably foreseeable (see 40 CFR § 1508.8[b]). Indirect impacts may include growth-inducing impacts and other effects related to induced changes in the pattern of land use, population density or growth rate, and related impacts on air and water and other natural systems, including ecosystems (see 40 CFR § 1508.8[b]).

Cumulative impacts take into consideration the environmental impact of past, present, and future actions. Cumulative impacts vary based on the project type, geographic location, potential to impact resources, and other factors, such as the current condition of potentially affected impact categories.

TABLE 5B
Summary of Potential Environmental Concerns
Ames Municipal Airport - Story County, IA

Environmental Impact Category	FAA Order 1050.1F Significance Threshold/Factors to Consider	Potential Concern
Air Quality	**Threshold: The action would cause pollutant concentrations to exceed one or more of the National Ambient Air Quality Standards (NAAQS), as established by the United States (U.S.) Environmental Protection Agency (EPA) under the *Clean Air Act*, for any of the time periods analyzed, or to increase the frequency or severity of any such existing violations.**	**Potential Impact.** Story County currently complies with federal NAAQS standards, and, therefore, general conformity review per the *Clean Air Act* is not required. However, operations and based aircraft at the airport are projected to grow over the 20-year planning period, which could increase air pollutant emissions associated with the airport. According to the most recent FAA *Aviation Emissions and Air Quality Handbook* (January 2015), an emissions inventory under NEPA may be necessary for any proposed action that would result in a reasonably foreseeable increase in emissions due to plan implementation. For construction emissions, a qualitative or quantitative emissions inventory under NEPA may be required, depending on the type of environmental review needed for development projects outlined in the master plan concept.
Biological Resources	**Threshold: The U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) determines that the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species, or would result in the destruction or adverse modification of federally designated critical habitat.** FAA has not established a significance threshold for non-listed species. However, factors to consider are if an action would have the potential for: ▪ Long term or permanent loss of unlisted plant or wildlife species; ▪ Adverse impacts to special status species or their habitats;	*For federally listed species:* **Potential Impact.** The USFWS Information for Planning and Consulting (IPaC) identified four threatened or endangered species: the Indiana bat, the northern long-eared bat, the prairie bush-clover, and the prairied fringed orchid within the vicinity of the airport. Impacts to these species should be assessed prior to action in this area and may require consultation with the USFWS. *For designated critical habitat:* **Potential Impact.** Critical habitat for the Topeka shiner has been identified within five miles of the airport. Coordination with the USFWS may be required to determine if an evaluation of potential effect to critical habitat is needed. *For non-listed species:* **Potential Impact.** Non-listed species of concern include those

	▪ Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or ▪ Adverse impacts on a species' reproductive rates, non-natural mortality, or ability to sustain the minimum population levels required for population maintenance.	protected by the *Migratory Bird Treaty Act*. The potential for impacts to migratory birds should be evaluated on a project-specific basis. This may include pre-construction surveys or scheduling construction outside of nesting seasons for these species.
Climate	FAA has not established a significance threshold for Climate; refer to FAA Order 1050.1F's, *Desk Reference*, for the most up-to-date methodology for examining impacts associated with climate change.	**Potential Impact.** An increase in greenhouse gas (GHG) emissions could occur over the 20-year planning horizon of the airport master Plan (AMP). A project-specific analysis may be required per FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, based on the parameters of the individual projects.
Coastal Resources	FAA has not established a significance threshold for Coastal Resources. Factors to consider are if an action would have the potential to: ▪ Be inconsistent with the relevant state coastal zone management plan(s); ▪ Impact a coastal barrier resources system unit; ▪ Pose an impact on coral reef ecosystems; ▪ Cause an unacceptable risk to human safety or property; or ▪ Cause adverse impacts on the coastal environment that cannot be satisfactorily mitigated.	**No Impact.** The airport is inland, and not located within a coastal zone.
Department of Transportation (DOT) *Act*: Section 4(f)	**Threshold: The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a "constructive use" based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource. Resources that are protected by Section 4(f) are publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance; and publicly or privately-owned land from an historic site of national, state, or local significance. Substantial impairment occurs when the activities, features, or attributes of the**	**Potential Impact.** Several Section 4(f) resources are located less than one mile from the airport, such as Ames Dog Park, Squaw Creek Park, Teagarden Park, Greenbriar Park, Country Gables Park, Han Peter Christofferson Park, and Moore Park. Airport activities would not result in a physical use of these resources; however, constructive use of these properties may need to be considered. The FAA is responsible for determining which federal, state, or local entities need to be consulted to determine whether impacts will substantially impair the resource. If necessary, the Section 4(f) compliance process can involve the preparation of a Section

	resource that contribute to its significance or enjoyment are substantially diminished.	4(f) statement, which evaluates other feasible alternatives.
Farmlands	**Threshold: The total combined score on Form AD-1006, *Farmland Conversion Impact Rating*," ranges between 200 and 260.** (Form AD-1006 is used by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) to assess impacts under the *Farmland Protection Policy Act* (FPPA).) FPPA applies when airport activities meet the following conditions: ▪ Federal funds are involved; ▪ The action involves the potential for the irreversible conversion of important farmlands to non-agricultural uses. Important farmlands include pastureland, cropland, and forest considered to be prime, unique, or statewide or locally important land; or ▪ None of the exemptions to FPPA apply. These exemptions include: o When land is not considered "farmland" under FPPA, such as land already developed or already irreversibly converted. These instances include when land is designated as an urban area by the U.S. Census Bureau or the existing footprint includes rights-of-way. o When land is already committed to urban development. o When land is committed to water storage. o The construction of non-farm structures necessary to support farming operations. o The construction/land development for national defense purposes.	**Potential Impact.** Over half the airport property is classified as "prime farmland," "farmland of statewide importance," or "prime farmland if drained." Farmland designation for the airport is identified on **Exhibit 1K**. According to the U.S. Census Bureau, the northern portion of the airport is in an urbanized area, and, therefore, may be exempt from FPPA requirements. However, the southern portion of the airport and proposed property acquisition to accommodate the extension of Runway 1-19 is in a non-urbanized area and contains prime farmland soils, and, therefore, FPPA may apply. As part of the NEPA process for acquisition of this property, coordination with the NRCS on the completion of Form AD-1006 may be required
Hazardous Materials, Solid Waste, and Pollution Prevention	FAA has not established a significance threshold for Hazardous Materials, Solid Waste, and Pollution Prevention. However, factors to consider are if an action would have the potential to:	**Potential Impact.** The airport has a fuel farm and provides the opportunity for aircraft maintenance activities that could involve fossil fuels or other types of hazardous materials or wastes. These operations are regulated

	▪ Violate applicable federal, state, tribal, or local laws or regulations regarding hazardous materials and/or solid waste management; ▪ Involve a contaminated site; ▪ Produce an appreciably different quantity or type of hazardous waste; ▪ Generate an appreciably different quantity or type of solid waste or use a different method of collection or disposal and/or would exceed local capacity; or ▪ Adversely affect human health and the environment.	and monitored by the appropriate regulatory agencies, such as the U.S. Environmental Protection Agency (EPA) and the Iowa Department of Natural Resources. The recommended master plan development concept does not anticipate land uses that would produce an appreciably different quantity or type of hazardous waste. However, should this type of land use be proposed, further NEPA review and/or a permit would be required. According to the U.S. EPA *EJSCREEN*, there are no known hazardous materials or waste contamination sites currently on airport property. The master plan concept recommends the relocation and addition of new self-serve fueling islands with above-ground storage tanks (ASTs). ASTs exceeding 1,100 gallons are required to be registered through the Iowa State Fire Marshall Division. The airport is responsible for the registration process. The master plan concept recommends land acquisition in two locations. The first location is an approximate 46.6-acre parcel south of the airport to accommodate a proposed expansion of Runway 1-19 and required Runway Protection Zone (RPZ). The second location is a 0.75-acre parcel east of Runway 13-31 to acquire property within the RPZ not currently under airport control. Since property acquisition is proposed, an Environmental Due Diligence Audit (EDDA) is required as part of the land transaction process. Per Order 1050.19B, *Environmental Due Diligence Audits in the Conduct of FAA Real Property Transactions*, the airport is responsible to execute a Phase I EDDA prior to the acquisition of real property.
Historical, Architectural, Archaeological, and Cultural Resources	FAA has not established a significance threshold for Historical, Architectural, Archaeological, and Cultural Resources. Factors to consider are if an action would result in a finding of "adverse effect" through the Section 106 process. However, an adverse effect finding	**No Impact.** As identified in Chapter One, three historic properties have been identified within the vicinity of the airport. These properties are: ▪ Gilmour B. MacDonald and Edith Craig House ▪ Bandshell Park Historic District ▪ Skunk River Bridge

	does not automatically trigger the preparation of an EIS (i.e., a significant impact).	These resources are more than one mile from the airport, and it is unlikely activities proposed on the master plan concept will affect these resources. However, all future projects should plan to include an archaeological survey prior to design.
Land Use	FAA has not established a significance threshold for Land Use. There are also no specific independent factors to consider. The determination that significant impacts exist is normally dependent on the significance of other impacts.	**Potential Impact.** No historical, architectural, archaeological, or culturally significant resources are located in the immediate vicinity of the airport. The closest resource is the Gilmour B. MacDonald and Edith Craig House located approximately 1.3 miles northwest of the airport and is unlikely to be impacted by airport activities. The proposed master plan concept includes land acquisition within the RPZ to prevent incompatible land use development in these areas. A single-family residential land use is present within the proposed land acquisition area, and potential impacts may result.
Noise and Noise-Compatible Land Use	**Threshold: The action would increase noise by Day-Night Average Sound Level (DNL) 1.5 decibel (dB) or more for a noise-sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe.** Another factor to consider is that special consideration needs to be given to the evaluation of the significance of noise impacts on noise-sensitive areas within Section 4(f) properties where the land use compatibility guidelines in Title 14 CFR part 150 are not relevant to the value, significance, and enjoyment of the area in question.	**No Impact.** Existing and anticipated noise contours are highlighted on **Exhibits 5B** and **5C** for Ames Municipal Airport. As shown on **Exhibit 5B** for existing conditions, the DNL 65 dB noise exposure level is contained on airport property. For the 2038 condition (**Exhibit 5C**), the DNL 65 dB noise exposure contours expand due to anticipated airport growth and runway extensions. Even with anticipated growth, the DNL 65 dB contours are mostly contained on airport property, with the exception of two small areas east of the airport, south of Runway 13-31, where the DNL 65 dB contour extends beyond the property line. This area is currently undeveloped. It is important to note that operational growth, unless tied to a specific project, will not result in noise impacts under FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. Impacts on noise-sensitive land uses are only identified through NEPA documentation for specific projects or through the voluntary 14 CFR Part 150 process.

Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks		
Socioeconomics	FAA has not established a significance threshold for Socioeconomics. However, factors to consider are if an action would have the potential to: ▪ Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area); ▪ Disrupt or divide the physical arrangement of an established community; ▪ Cause extensive relocation when sufficient replacement housing is unavailable; ▪ Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities; ▪ Disrupt local traffic patterns and substantially reduce the levels of service of roads serving the airport and its surrounding communities; or ▪ Produce a substantial change in the community tax base.	**Potential Impact.** The proposed development plan for the airport could potentially encourage economic growth for the City of Ames and Story County. Results include new construction jobs, new jobs for the airport and other commercial uses, new housing, and increase the local tax base. The Master Plan Concept recommends a 1,299-foot extension of Runway 1-19 to the south. Should this extension move forward, relocating the RPZ will be necessary, which may require the acquisition of an existing residence along S. Riverside Drive, identified on **Exhibit 5A**. Per FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, if the acquisition of real property or displacement of persons is involved, the sponsor is required to comply with 49 CFR Part 24, *Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally-Assisted Programs*. The sponsor may be responsible for property acquisition, payment, relocation, and dwelling accommodations.
Environmental Justice	FAA has not established a significance threshold for Environmental Justice. However, factors to consider are if an action would have the potential to lead to a disproportionately high and adverse impact to an environmental justice population (i.e., a low-income or minority population), due to: ▪ Significant impacts in other environmental impact categories; or ▪ Impacts on the physical or natural environment that affect an environmental justice population in a way that FAA determines is unique to the environmental justice population and significant to that population.	**Potential Impact.** Both low-income and minority populations have been identified in the vicinity of the airport. Executive Order (E.O.) 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*, and the accompanying Presidential Memorandum, and Order DOT 5610.2, *Environmental Justice*, require the FAA to provide for meaningful public involvement for minority and low-income populations, as well as analysis that identifies and addresses potential impacts on these populations that may be disproportionately high and adverse. Environmental justice impacts may be avoided or minimized through early and consistent communication with the public and allowing ample time for public consideration. If disproportionately high or adverse impacts are noted, mitigation and enhancement measures and offsetting benefits can be taken into consideration.

Exhibit 5B
EXISTING (2018) NOISE CONTOURS

RUNWAY 1-19 RDC C-II-2400
RUNWAY 13-31 RDC B-II-5000

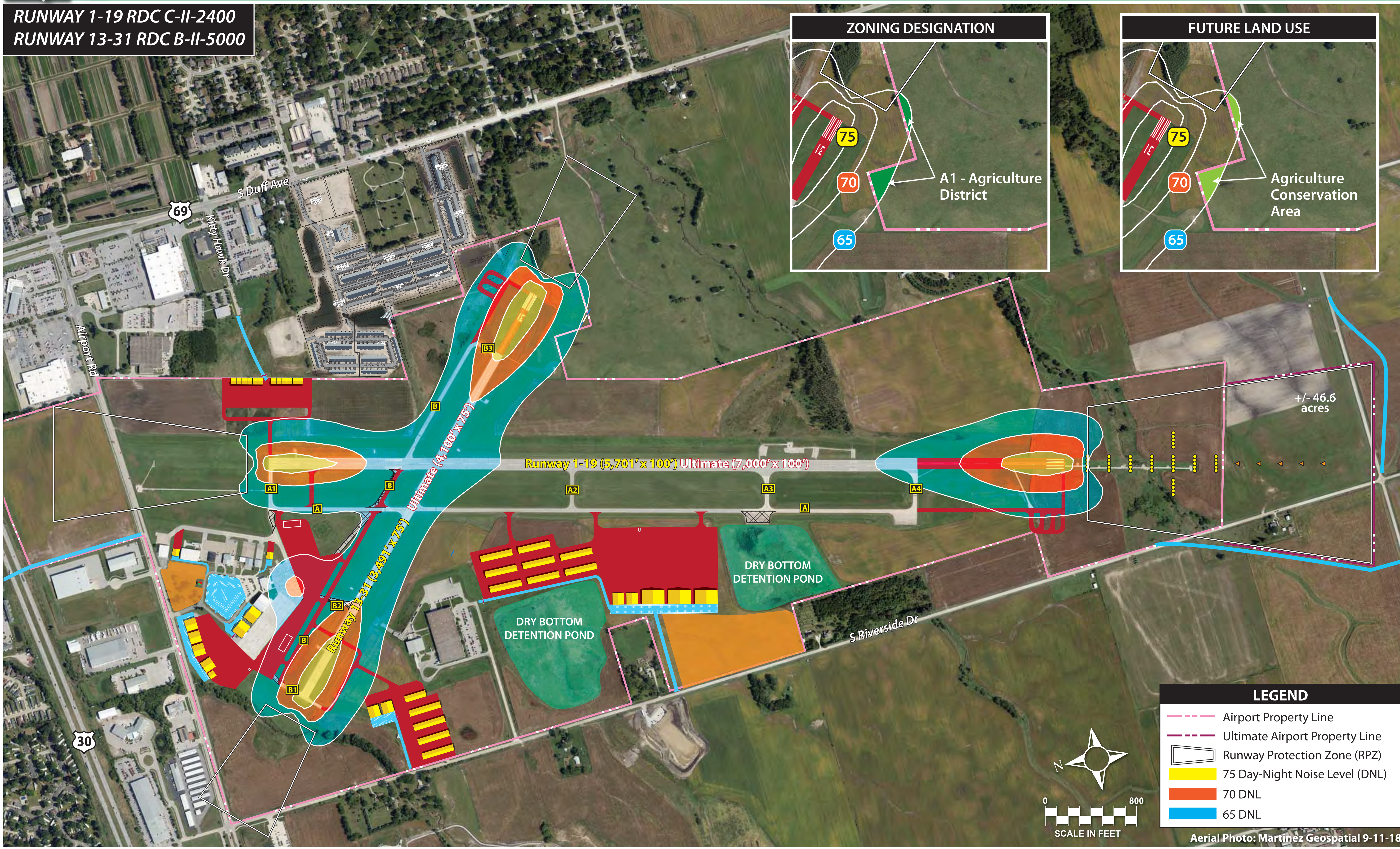

Exhibit 5C
FUTURE (2038) NOISE CONTOURS

Children's Environmental Health and Safety Risks	FAA has not established a significance threshold for Children's Environmental Health and Safety Risks. However, factors to consider are if an action would have the potential to lead to a disproportionate health or safety risk to children.	**Potential Impact.** Per E.O. 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, federal agencies are directed to identify and assess environmental health and safety risks that may disproportionately affect children. These risks include those that are attributable to products or substances that a child is likely to come in contact with or ingest, such as air, food, drinking water, recreational waters, soil, or products to which they may be exposed. An elementary school has been identified east of the airport, as well as both single- and multi-family residential uses near the airport which could include small children. Best management practices (BMPs) should be implemented to decrease environmental health risks to children. During the construction of the projects outlined on the Master Plan Concept, appropriate measures should be taken to prevent access by unauthorized persons and children to construction project areas.
Visual		
Light Emissions	The FAA has not established a significance threshold for light emissions. However, a factor to consider is the degree to which an action would have the potential to: ▪ Create annoyance or interfere with normal activities from light emissions; and ▪ Affect the visual character of the area due to the light emissions, including the importance, uniqueness, and aesthetic value of the affected visual resource.	**Potential Impact.** New lighting associated with the recommended master plan development concept would remain on the airfield and other developed portions of the airport. Proposed lighting would most likely be associated with new development, such as wall pack lighting on new hangars and edge lighting for extended runways and taxiways, or temporary construction lighting as a result of nighttime work. Therefore, there is the potential for the new multi-family residential complex directly east of the airport to be impacted as a result of lighting associated with the implementation of the recommended Master Plan Concept. It may be necessary to evaluate whether there are any factors in light of context and intensity to determine if there are any significant impacts and warrant a special lighting study. The airport is responsible for the undertaking of the lighting study.

Visual Effects	FAA has not established a significance threshold for Visual Resources/Visual Character. However, a factor to consider is the extent an action would have on the potential to: ▪ Affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources; ▪ Contrast with the visual resources and/ or visual character in the study area; and ▪ Block or obstruct the views of the visual resources, including whether these resources would still be viewable from other locations.	**Potential Impact.** Development planned in the Master Plan Concept could change the overall visual character of the airport with additional roads and structures planned on-site. New development could change the rural character of the area and contrast with the visual character from surrounding uses, most notably to existing residential located east of the airport with new hangars and apron proposed. While there may be changes to the visual character of the airport as a result of the Master Plan Concept, this area is not designated as unique or visually important by the City of Ames or Story County. However, potential visual effects from neighboring residential uses could be minimized by preserving as much natural vegetation as possible.
Water Resources		
Wetlands	**Threshold: The action would:** **1. Adversely affect a wetland's function to protect the quality or quantity of municipal water supplies, including surface waters and sole source and other aquifers;** **2. Substantially alter the hydrology needed to sustain the affected wetland system's values and functions or those of a wetland to which it is connected;** **3. Substantially reduce the affected wetland's ability to retain floodwaters or storm runoff, thereby threatening public health, safety or welfare (the term welfare includes cultural, recreational, and scientific resources or property important to the public);** **4. Adversely affect the maintenance of natural systems supporting wildlife and fish habitat or economically important timber, food, or fiber resources of the affected or surrounding wetlands.** **5. Promote development of secondary activities or services that would cause the circumstances listed above to occur; or** 6. **Be inconsistent with applicable state wetland strategies.**	**Potential Impact.** Freshwater emergent wetlands, freshwater ponds, freshwater forested/ shrub wetlands, and streams have been identified on airport property, although this information is based on aerial photography interpretation from 1985. Field surveys and wetland delineations may be required to determine the presence or absence of wetlands in project areas. Project areas that may require field surveys prior to project implementation include the new hangars, fuel islands, new aprons, and lands for non-aeronautical land uses. Removal or relocation of wetlands may require a Section 404 permit under the *Clean Water Act*, which regulates the discharge of dredged or fill material into waters of the United States, including wetlands.

Floodplains	**Threshold: The action would cause notable adverse impacts on natural and beneficial floodplain values. Natural and beneficial floodplain values are defined in Paragraph 4.k of DOT Order 5650.2, *Floodplain Management and Protection.***	**Potential Impact.** A 100-year floodplain was identified by FEMA on airport property (identified on **Exhibit 1K**). E.O. 11988, *Floodplain Management*, requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of 100-year floodplains and to avoid direct or indirect support of floodplain development where there is a practicable alternative. In the City of Ames, whenever there is excavating, filling, grading, construction of new structures, or remodeling of existing buildings in the floodplain, a Flood Plain Development Permit application must be submitted. Generally, any projects within the floodway are restricted, while activities in the floodway fringe may be allowed, provided that performance standards are attained. For development in Story County, a floodplain development permit obtained from the Floodplain Manager is required. In addition, an elevation certificate is required for new and substantially improved structures for development in the county. The airport is responsible for obtaining proper floodplain permitting from both jurisdictions.
Surface Waters	**Threshold: The action would:** **1. Exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or** **2. Contaminate public drinking water supply such that public health may be adversely affected.**	**Potential Impact.** The airport is located within the Upper Mississippi Region Watershed.[1] The City of Ames manages airport stormwater discharges with a National Pollutant Discharge Elimination System (NPDES) Industrial Stormwater General Permit issued and regulated by the Iowa Department of Natural Resources. Improvements to the airport will require a revised permit to be issued addressing operational and structural source controls, treatment with BMPs, and sediment and erosion control. FAA's Advisory Circular (AC) 150/5370-10G, *Standards for Specifying Construction of Airports, Item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control* should also be implemented during construction projects at the airport.

[1] Story County Planning and Development *Cornerstone to Capstone - Story County Comprehensive Plan 2036* (2016) (http://www.storycountyiowa.gov/1176/The-C2C-Plan); November 2019.

Groundwater	**Threshold: The action would:** **1. Exceed groundwater quality standards established by federal, state, local, and tribal regulatory agencies: or** **2. Contaminate an aquifer used for public water supply such that public health may be adversely affected.** Factors to consider are when a project would have the potential to: ▪ Adversely affect natural and beneficial groundwater values to a degree that substantially diminishes or destroys such values; ▪ Adversely affect groundwater quantities such that the beneficial uses and values of such groundwater are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated; or ▪ Present difficulties based on water quality impacts when obtaining a permit or authorization.	**No Impact.** Projects proposed in the Master Plan Concept depicted on **Exhibit 5A** would not substantially change the amount of water used by the airport. Additionally, the airport property does not serve as a significant source of groundwater recharge and is not located near a sole source aquifer.
Wild and Scenic Rivers	FAA has not established a significance threshold for Wild and Scenic Rivers. Factors to consider are when an action would have an adverse impact on the values for which a river was designated (or considered for designation) through: ▪ Destroying or altering a river's free-flowing nature; ▪ A direct and adverse effect on the values for which a river was designated (or under study for designation); ▪ Introducing visual, audible, or other types of intrusion that is out of character with the river or would alter outstanding features of the river's setting; ▪ Causing the river's water quality to deteriorate; ▪ Allowing the transfer or sale of	**No Impact.** There are no designated Wild and Scenic Rivers or rivers on the NRI which will be affected by development activities at Ames Municipal Airport. No adverse effects on a river's outstandingly remarkable values (i.e., scenery, recreation, geology, fish, wildlife, and history) are anticipated.

	property interests without restrictions needed to protect the river or the river corridor; or ▪ Any of the above impacts preventing a river on the Nationwide Rivers Inventory (NRI) or a Section 5(d) river that is not included in the NRI from being included in the Wild and Scenic River System or causing a downgrade in its classification (e.g., from wild to recreational).	

Source: Coffman Associates, Inc. analysis

LAND USE COMPATIBILITY

Land use planning in the area surrounding AMW occurs through regulatory and non-regulatory means. The primary regulatory tool for directing land use is the zoning ordinance, which limits the type, size, and density of land uses in various locations. Examples of land use types include residential, commercial, industrial, and agricultural. Non-regulatory means of land use controls include the comprehensive or strategic land use plan. These documents can be adopted for the greater municipality or for specific areas.

It is important to note the distinction between primary land use concepts used in evaluating development with the airport environs and existing land use, comprehensive plan, and zoning land use. Existing land use refers to property improvements as they *exist today,* according to county records.

The comprehensive plan land use map identifies the *projected or future* land use, according to the goal and policies of the locally adopted comprehensive plan. This document guides future development within the city and county planning area and provides the basis for zoning designations.

Zoning identifies the type of land use *permitted* on a given piece of property, according to the city and county zoning ordinances and maps. Local governments are required to regulate the subdivision of all lands within their corporate limits. Zoning ordinances should be consistent with the general plan, where one has been prepared. In some cases, the land use prescribed in the zoning ordinance or depicted in the general plan may differ from the existing land use.

The following sections describe the applicable land use policies for the area within the vicinity of AMW. Specifically, these sections pertain to the lands within the 65 DNL noise contours and the Part 77 Approach Surface out to one mile from the end of the runways. For the purposes of this analysis, a study area consisting of a one-mile buffer from each runway end was established, incorporating land from both the City of Ames and Story County. The study area is approximately 4,029.7 acres, including the airport.

EXISTING LAND USE

AMW is located within the limits of the City of Ames and adjacent to unincorporated land within Story County. The City of Ames borders the airport along the west, north, and east sides of the airport, while Story County borders the airport along the west, south, and east sides of the airport. For those properties in the City of Ames, primary land uses include agriculture, commercial, industrial, and low-density residential. Within Story County, land use is agricultural within the Ames Urban Fringe.

The Ames Urban Fringe is an area within two miles of the municipal boundary of the city addressing future land use outside city limits. According to Title IX, Chapter 414 of the *Iowa Code*, a city may extend its police powers of land use up to two miles into unincorporated lands outside city limits, as long as those unincorporated areas do not have a zoning ordinance.[2] The Ames Urban Fringe was discussed in Chapter One.

COMPREHENSIVE PLAN

The comprehensive plan is a general policy document used by government agencies to identify and describe a community's characteristics, articulate goals and policies, and explore alternative plans for future growth, which, in turn, forms subdivision regulations and zoning ordinances to carry out the plan's goals. Often, municipalities include goals and policies for their airports in their comprehensive plans, which are typically derived from an AMP. Comprehensive plans aid local decision-makers regarding complicated issues during the development process or a maintenance issue. The most current comprehensive plan for the City of Ames, titled *Land Use Policy Plan* (LUPP), was adopted in 1997 and last amended in 2009. The LUPP addresses land use, mobility, environmental and open space, and plan implementation for the city through 2030.[3] The following future land use designations are located within the study area within the City of Ames.

- **Agricultural/Farmstead:** This land use designation is limited to areas associated with crop production, animal husbandry, or fallow areas.
- **Low-Density Residential:** The low-density residential classification is intended for all single-family and two-family residential uses that do not exceed 7.26 units per dwelling acre (DU/acre).
- **Medium-Density Residential:** Includes all single-family, two-family, multi-family, and existing manufactured uses with a density that is not less than 7.26 DU/acre and does not exceed 22.31 DU/acre.
- **High-Density Residential:** Includes all multi-family residential that is more than 11.20 DU/acre.
- **Village/Suburban Residential:** Includes all residential uses (single-family, multi-family, and manufactured housing) that are more than eight DU/acre and located in specifically designated locations. This future land use designation is intended to support neighborhood commercial uses.

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[2] *Extending Beyond City Limits* - Title IX, Chapter 414, Section 23 of the *Iowa Code* (https://www.legis.iowa.gov/law/iowaCode/chapters?title=IX&year=2019); August 2019.
[3] City of Ames Planning Department – *Land Use Policy Plan* (https://www.cityofames.org/government/departments-divisions-i-z/planning/land-use-policy-plan); August 2019.

- **Highway-Oriented Commercial:** This land use type is intended for commercial uses associated with strip developments adjacent to primary arterials, and typically has a floor area ratio (FAR)[4] between 0.25 and 0.50, depending on the location.
- **Planned Industrial:** Includes uses that involve a clustered or industrial park setting to achieve greater integration of uses, access, and appearance, and typically located near limited-access thoroughfares.
- **University Affiliated:** This land designation is limited to facilities associated with the Iowa State University campus and other affiliated research and agricultural farms.
- **Parks/Open Space:** Public-controlled areas allocated for recreation.

Currently, the city is working on a comprehensive plan update, *Ames Plan 2040*, initiated in early 2019.[5] That effort is anticipated to take approximately 18 months.

The comprehensive plan for Story County, *The Cornerstone to Capstone Plan* (C2C Plan), identifies the land use south of the airport as an Agricultural Conservation Area within the Ames Urban Fringe.[6] Property immediately south of the airport is part of an Airport Protection Area, discussed later in this section.

- **Airport Protection Area:** Land close to the airport that accentuates and enhances life and maintains the integrity of aviation operations.
- **Agricultural Conservation Area:** An area encompassed by large areas of highly valuable farmland, with farming and agricultural production as the primary activity.

As shown on **Exhibit 5D** and summarized in **Table 5C**, land use classifications within the study area include agriculture, low- and medium-density residential, commercial, industrial, and public/quasi-public uses within the City of Ames. In Story County, land use classifications are as indicated in the table, which are primarily as an agriculture preservation area.

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[4] Floor area ratio (FAR) is the amount of floor area in relation to the amount of lot area, determined by dividing the gross floor area of all buildings on a lot by the area of that lot (City of Ames, Ordinance 4220, June 23, 2013).

[5] City of Ames Planning Department – *Ames Plan 2040*; (https://www.cityofames.org/government/departments-divisions-i-z/planning/comprehensive-plan); August 2019.

[6] Story County Planning and Development – *The Cornerstone to Capstone Plan* (http://www.storycountyiowa.gov/1176/The-C2C-Plan); August 2019.

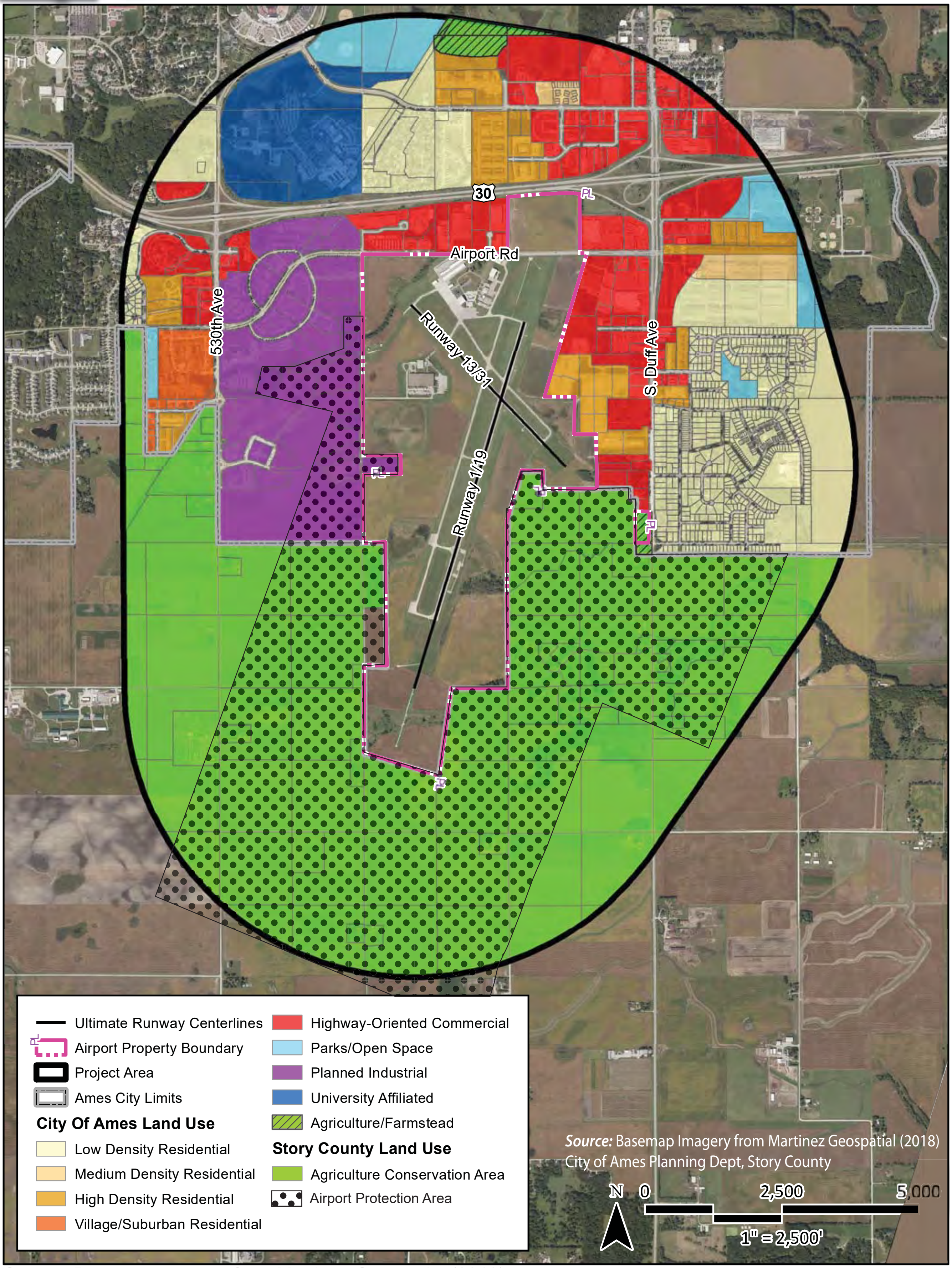

Exhibit 5D
FUTURE LAND USE

TABLE 5C City of Ames and Story County General Land Use Classification Study Area Summary		
Land Use Designation	**Acreage**	**Percent of Study Area**
Ames Municipal Airport	663.80	16.47%
City of Ames		
Agricultural/Farmstead	24.63	0.61%
Low-Density Residential	431.95	10.72%
Medium-Density Residential	27.03	0.67%
High-Density Residential	159.15	3.95%
Village/Suburban Residential	37.18	0.92%
Highway-Oriented Commercial	400.39	9.94%
Planned Industrial	319.6	7.93%
University Affiliated	142.16	3.53%
Parks/Open Space	90.70	2.25%
City of Ames Subtotal	**1632.79**	**40.52%**
Story County		
Agriculture Conservation Area	1,733.12	43.01%
Story County Subtotal	**1,733.12**	**42.73%**
Study Area Total	**4,029.71**	**100.00%**
Sources: City of Ames, IA GIS Property Data Map and Story County GIS Property Data Map, August 2019; Coffman Associates, Inc. analysis		

ZONING

Used in conjunction with subdivision regulations and as an essential tool to achieve goals and policies outlined in the comprehensive plan, zoning regulations are used to divide land into districts, or zones, and regulate land use activities in those districts; specify permitted uses; intensity and density of each use; and the bulk sizes of each building. Traditional zoning ordinances separate land into four basic uses: residential, commercial (including office), industrial, and agricultural. Both the City of Ames and Story County created sub-categories under these basic land uses based on intensity, density, and community impact.

City of Ames Chapter 29: Zoning Code

Chapter 29 of the City of Ames *Municipal Code*[7] outlines the zoning classifications used to regulate the general growth of the city. The following zoning districts are found within the study area around AMW under the City of Ames jurisdiction:

- **Agriculture (A):** The purpose of the "A" zone is to accommodate areas predominately agricultural in character or undeveloped urban use. The "A" zoning district also serves to protect agricultural land use and newly annexed land that is not zoned.

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[7] *Municipal Code, City of Ames, Iowa – Chapter 29 Zoning* (https://www.cityofames.org/government/departments-divisions-i-z/legal/city-of-ames-municipal-code/zoning-table-of-contents-municipal-code-chapter-29); November 2019.

- **Residential Low-Density (RL):** The purpose of the RL zoning designation is to allow for primarily single-family dwellings, while allowing some existing two-family dwelling units or other uses traditionally found in a low-density residential environment.

- **Residential Low-Density Park (RLP):** This zoning district is intended to provide for mobile home and manufactured home parks in certain developed areas with compatible uses, adequate utilities and road infrastructure, convenient to community facilities, and open space.

- **Residential Medium Density (RM):** The Residential Medium district is intended to provide for medium-density residential uses and serve as a transition from low-density residential to higher forms for residential uses.

- **Suburban Residential/Medium Density (F-S RM):** A floating zone intended to allow for modern development patterns similar to development patterns of the previous 20-30 years, designed to create a "generally distinct and homogeneous land use" pattern.

- **Residential High Density (RH):** Intended to allow for certain high-density residential in the city, including land uses around Iowa State University and areas adjacent to commercial and employment centers.

- **Planned Residence – Floating Zone (F-PRD):** The floating zone provides some flexibility in the style and layout of residential development in newly annexed areas of the city that the LLUP identifies as "Village/Suburban Residential" or in the *Ames Urban Fringe Plan* as "Urban Residential." The F-PRD specifically is intended to permit a variety of housing types and layout.

- **Neighborhood Commercial (NC):** The Neighborhood Commercial zoning district is intended for small-scale retail centers and services near residential development. The NC district is intended to be pedestrian-oriented development and to scale with the surrounding area.

- **Highway-Oriented Commercial (HOC):** The HOC zone is intended to allow for auto-oriented commercial development in areas currently developed for this use. The HOC zoning designation allows for a substantial number of retail and service uses and is expected to be generally accommodating to vehicular traffic.

- **General Industrial (GI):** The General Industrial zoning designation is intended to permit uses in locations where there is a need for a "desirable industrial environment." This district is also intended to allow for a more streamlined developer/city staff permit review.

- **Planned Industrial (PI):** The Planned Industrial zoning district is applied to areas where a need to provide a "desirable industrial environment," such as manufacturing and processing, warehouse and freight, or transportation/utility/communication uses.

- **Government/Airport District (S-GA):** The S-GA district allows only for structures and uses related to or owned by federal, state, county, school districts, or municipal governments. Structures located within this zoning district are generally exempt from local zoning codes, except for height limitations when cited within the vicinity of an airport.

- **Research Park Innovation District (RI):** The RI is an activity node district supporting integrated commercial and concentrated employment to allow for a mix of uses and interaction to provide a collaborative environment with multi-modal transportation facilities.

Story County Chapter 86: Land Development Regulations - District Requirements

Chapters 85 through 93 of the Story County *Code of Ordinances*[8] address zoning and land division requirements for the county. The following zoning districts are found within the study area around AMW within Story County:

- **Agriculture District (A-1):** The A-1 district is intended to accommodate land uses compatible with agriculture and protect agriculture land uses from urban encroachment. Priority agriculture lands are designated as "Agriculture Conservation Areas" in the C2C Plan, which is intended to preserve rural character and to limit development of new non-farm residential structures on large lots.

SUBDIVISION REGULATIONS

Subdivision regulations are legal devices employed to administer the division of land into two or more lots, parcels, or sites for the building and location, design, and installation of supporting infrastructure. The subdivision regulations are one of two instruments commonly employed to carry out the goals and policies outlined in the comprehensive plan.

Subdivision regulations can be used to specify requirements for airport-compatible land development by requiring developers to plat and develop land to minimize noise impacts or reduce noise exposure to new development. Subdivision regulations can also be used to protect the airport proprietor from litigation for noise impacts at a later date. The most common requirement is the dedication of a noise or avigation easement to the airport sponsor by the land developer as a condition of the development approval. Easements typically authorize overflights of property, with noise levels attendant to such operations.

[8] Story County *Code of Ordinances* (http://www.storycountyiowa.gov/115/Code-of-Ordinances); December 2019.

City of Ames Chapter 23: Subdivisions

According to *Chapter 23, Subdivision* of the *Ames Municipal Code*, there are no specific procedures related to airport land use compatibility in the subdivision process. Airport land use compatibility is addressed as part of the zoning code in Chapter 29.[9]

Story County Chapter 87: Land Development Regulations – Land Division Requirements

According to the land division requirements, located in *Chapter 87: Land Development Regulations – Land Division Requirements* of the *Story County Code of Ordinances*, there are no specific procedures outlined to airport land use compatibility.[10]

Study Area Land Use Summary

Using zoning maps available from both the City of Ames and Story County, the zoning districts within the study area are summarized in **Table 5D** and depicted on **Exhibit 5E**. As indicated in the table, the largest amount of land within the study areas is agriculturally zoned, with a city and county combined percentage of over 45 percent of the study area.

TABLE 5D
City of Ames and Story County Zoning Classification
Study Area Summary

Zoning District	Acreage	Percent of Study Area[1]
Ames Municipal Airport	663.80	16.47%
City of Ames		
Agriculture (A)	113.77	2.82%
Residential Low Density (RL)	209.69	5.20%
Residential Low-Density Park (RLP)	65.30	1.62%
Residential Medium Density (RM)	0.53	0.01%
Suburban Residential/Medium Density (F-S RM)	10.69	0.27%
Residential High Density (RH)	102.00	2.53%
Planned Residence – Floating Zone (F-PRD)	104.48	2.59%
Neighborhood Commercial (NC)	1.04	0.03%
Highway-Oriented Commercial (HOC)	335.43	8.32%
General Industrial (GI)	20.48	0.51%
Planned Industrial (PI)	115.28	2.86%
Government/Airport District (S-GA)	374.21	9.29%
Research Park Innovation (RI)	179.89	4.46%
City of Ames Subtotal	**1,632.79**	**40.51%**
Story County		
Agriculture District (A-1)	1,733.12	43.01%
Story County Subtotal	**1,733.12**	**43.01%**
Study Area Total	**4,029.71**	**100.00%**

Sources: City of Ames, IA GIS Property Data Map and Story County GIS Property Data Map, August 2019; Coffman Associates, Inc. analysis
[1] Percentage totals may differ slightly due to rounding of numbers.

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[9] *Municipal Code, City of Ames, Iowa – Chapter 23 Subdivisions* (http://www.cityofames.org/home/showdocument?id=261); August 2019.
[10] Story County *Code of Ordinances – Chapter 87, Land Development Regulations: Land Division Requirements* (http://www.storycountyiowa.gov/115/Code-of-Ordinances); December 2019.

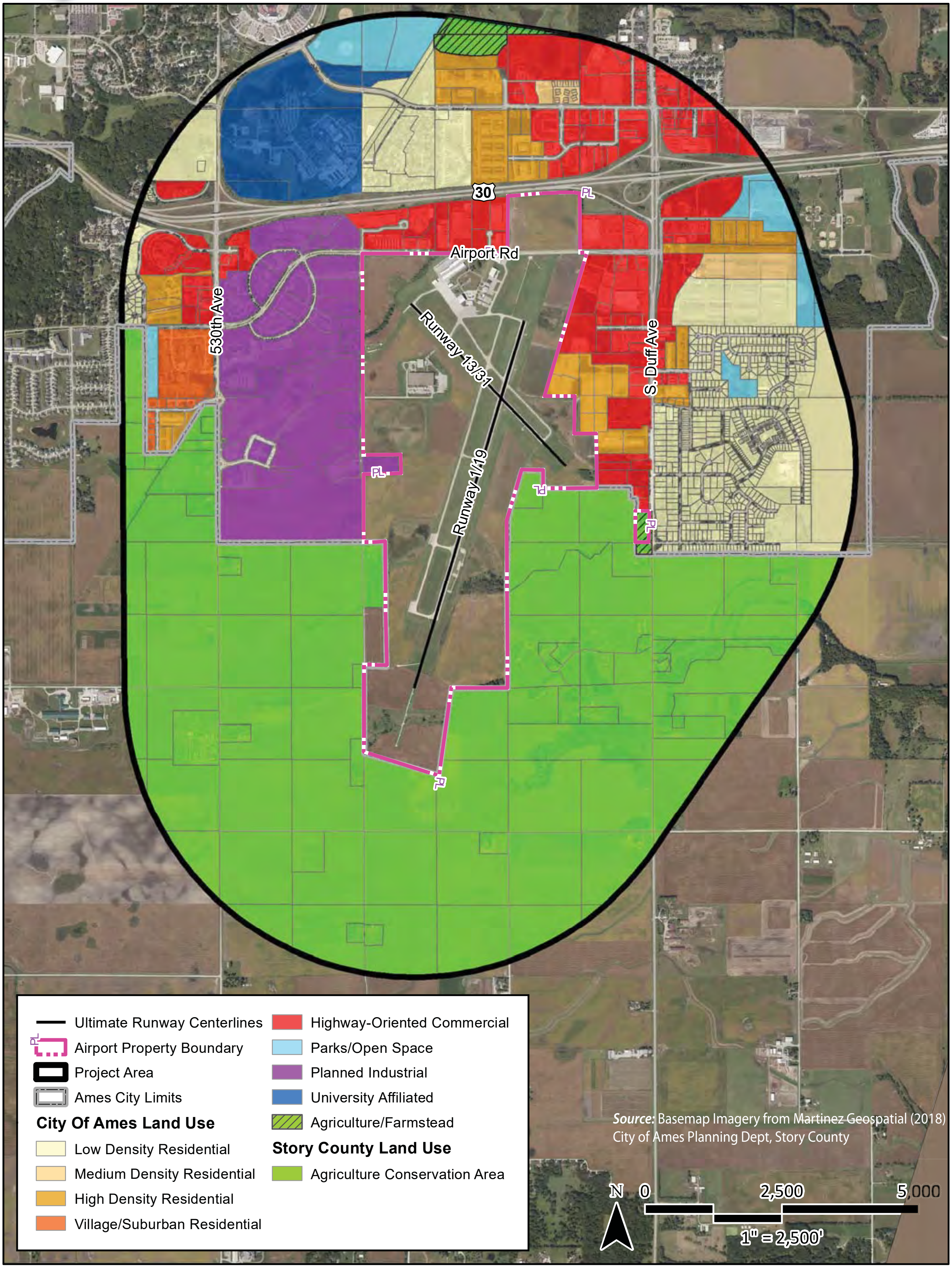
30
Airport Rd
530th Ave
S. Duff Ave
Runway 13/31
Runway 1/19
PL
Ultimate Runway Centerlines
Airport Property Boundary
Project Area
Ames City Limits
City Of Ames Land Use
Low Density Residential
Medium Density Residential
High Density Residential
Village/Suburban Residential
Highway-Oriented Commercial
Parks/Open Space
Planned Industrial
University Affiliated
Agriculture/Farmstead
Story County Land Use
Agriculture Conservation Area
Source: Basemap Imagery from Martinez Geospatial (2018)
City of Ames Planning Dept, Story County
N
0
2,500
5,000
1" = 2,500'

Table 5E summarizes the minimum lot areas, maximum density in FAR unless otherwise noted, and maximum height, known as bulk standards, for each zoning district within the study area.

TABLE 5E
Zoning Ordinance Summary
Bulk Standards

Zoning District	Minimum Lot Are	Maximum Density (FAR[1])	Maximum Height (feet)
City of Ames			
Agriculture (A) Residential Low Density (RL)	1 acre 6,000 sf[4]: single-family 7,000 sf: two-family	NA[2] 0.35: single-family 0.40: two-family	40 ft[3] of 3 stories 40 ft or 3 stories
Residential Low-Density Park (RLP) Residential Medium Density (RM)	10 acres 6,000 ft: single-family 7,000 sf: two-family 3,500 sf: single-family Attached dwelling 7,000 sf: apartments over Two units	7/acre At least 7.26 DU/acre, not to Exceed 22.31 DU/acre	15 ft or 1 story 50 ft or 4 stories
Suburban Residential/Medium Density (F-S RM)	6,000 sf: single-family 7,000 sf: two-family 2,400 sf: single-family Attached dwelling 7,000 sf: for the first two units, 1,800 sf for each additional unit	22.31 DU/acre	50 ft or 4 stories
Residential High Density (RH)	Lot area is based on dwelling type	NA	100 ft or 9 stories
Planned Residence – Floating Zone (F-PRD)	2-acre minimum for development	Density is based on the base residential zoning	Structures are to be compatible with the surrounding structures. No maximum height limitations in the F-PRD district.
Neighborhood Commercial (NC)	20,000 sf site development size; greater than 20,000 sf requires a Special Use Permit	0.70	35 ft
Highway-Oriented Commercial (HOC)	No minimum, except for mixed uses when residential is included	0.50	85 ft or 7 stories
General Industrial (GI)	NA	0.85	100 ft or 9 stories
Planned Industrial (PI)	1 acre	0.35	100 ft
Government/Airport District) (S-GA)	Since both residential and commercial uses are permitted in the S-GA zone, the minimum lot size is dependent on use.	0.75	40 ft or 3 stories
Research Innovation District (RI)	1 acre	0.35 for areas outside of a Hub Activity Area[5], no limit if within a Hub Activity Area	100 ft

TABLE 5E (Continued)
Zoning Ordinance Summary
Bulk Standards

Zoning District	Minimum Lot Are	Maximum Density (FAR[1])	Maximum Height (feet)
Story County			
Agricultural District (A-1)	35 acres: single-family 1 acre: Farmstead severed from farm NA: Other permitted uses	NA	40 ft
Notes:			

Sources: City of Ames *Municipal Code* and *Story County Code of Ordinances* December 2019)
[1] FAR – Floor Area Ratio
[2] N/A – Not Applicable
[3] ft – feet
[4] sf – square feet
[5] A Hub Activity Area is an "area of concentrated commercial uses providing support services intended primarily to provide service and retail uses supportive of the surrounding businesses and their employees." – Section 29.903 of Chapter 29 of the *City of Ames Municipal Code* (https: www.cityofames.org/government/departments-divisions-i-z/legal/city-of-ames-municipal-code): December 2019.

Airport Protection Area

Initially discussed in Chapter One, the Airport Protection Area (APA)[11] is an overlay land use designation within the Ames Urban Fringe zone intended to reduce risk, increase safety, and promote land use compatibility between the airport and surrounding land uses. The primary goal of the APA is to reduce the consequences of accidents related to aviation and to ensure compatibility issues related to noise, pollution, height, and land use compatibility. The APA is depicted on **Exhibit 1J**.

BUILDING CODE

Building codes were established to provided minimum standards to safeguard life, limb, health, and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures. Building codes may be required to provide sound insulation in new residential, office, and institutional buildings when warranted by existing or potential high aircraft noise levels. However, Chapter 5 of the *Ames Municipal Code* addressing building code standards does not currently enforce aircraft attenuation.[12]

[11] The *Ames Urban Fringe Plan* (July 2006) is a collaborative planning effort developed by Story County, City of Ames, City of Gilbert, and Boone County to provide planning guidelines within a two-mile buffer around the City of Ames. A copy of the plan can be access on the Story County Planning and Development website (http://www.storycountyiowa.gov/1243/Ames-Urban-Fringe-Plan); December 2019.
[12] *City of Ames Municipal Code Chapter 5 Building, Electrical, Mechanical and Plumbing Code* – (https://www.cityofames.org/government/departments-divisions-i-z/legal/city-of-ames-municipal-code/); August 2019.

Story County does not currently have adopted building codes and relies on the zoning code for development standards.[13] The Story County Code of Ordinances does have noise standards for certain land uses (such as for non-commercial wind energy conversion systems) however, these standards are not specific to airport land uses or aircraft.

NON-COMPATIBLE DEVELOPMENT ANALYSIS

Areas with the potential for non-compatible development, when compared to the noise exposure contours and height restrictions within the Part 77 approach surfaces out to one mile, have been evaluated. Further discussion of these areas can be found in Chapter One. This was accomplished by evaluating city- and county-adopted land use plans and zoning designations for those parcels encompassed by the noise contours to determine if noise-sensitive land uses could be developed in those areas. Both the noise contours and height restrictions within the Part 77 approach surface area are addressed below.

Noise Exposure Contours

The standard methodology for analyzing noise conditions at airports involves the use of a computer simulation model. The purpose of the noise model is to produce noise exposure contours that are overlain on a map of the airport and vicinity to graphically represent aircraft noise conditions. When compared to land use, zoning, and general plan maps, the noise exposure contours may be used to identify areas that are currently or have the potential to be exposed to aircraft noise.

To achieve an accurate representation of an airport's noise conditions, the noise model uses a combination of industry-standard information and user-supplied inputs specific to the airport. The software provides noise characteristics, standard flight profiles, and manufacturer-supplied flight procedures for aircraft which commonly operate at AMW. As each aircraft has different design and operating characteristics (number and type of engines, weight, and thrust levels), each aircraft emits different noise levels. The most common way to spatially represent the noise levels emitted by an aircraft is a noise exposure contour.

Airport-specific information, including runway configuration, flight paths, aircraft fleet mix, runway use distribution, local terrain and elevation, average temperature, and numbers of daytime and nighttime operations, are also used in modeling inputs.

Based on assumptions provided by the user, the noise model calculates average 24-hour aircraft sound exposure within a grid covering the airport and surrounding areas. The grid values, represented with the day-night noise level metric or DNL, at each intersection point on the grid represent a noise level for that geographic location. To create the noise contours, an isoline, similar to those on a topographic map, is drawn connecting points of the same DNL noise value. In the same way that a topographic contour represents the same elevation, the noise contour identifies areas of equal noise exposure.

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[13] Jones, Stephanie – Administrative Assistant with the Story County, IA Planning and Development Department; December 2019.

DNL is the metric currently accepted by the FAA, U.S. EPA, and Department of Housing and Urban Development (HUD) as an appropriate measure of cumulative noise exposure. These three agencies have each identified the 65 DNL noise contour as the threshold of incompatibility.

The *Iowa Airport Land Use Guidebook*[14] (IALUG) provides airport sponsors and their host communities a resource document setting guidelines addressing land use compatibility issues and to protect airports. Recognizing the importance of maintaining safe operational environments for both the airport and surrounding communities, determine the primary factor for how land use compatibility relates to land uses around the airport. The IALUG defines certain land uses that are not compatible, limited in compatibility, or allowed in certain defined geographic areas around the airport, and prescribes recommended land use zoning districts and compatible land uses within each district. The IALUG employed FAA AC 150/5300-13, *Airport Design* and FAR Part 77, *Objects Affecting Navigable Airspace,* to determine appropriate land uses around an airport.

The guidelines summarized in **Exhibit 5F** indicate that all land uses are acceptable in areas below 65 DNL. At or above the 65 DNL threshold, residential land uses without acoustic treatment, mobile homes, and transient lodging are all incompatible. The exhibit notes that homes of standard construction and transient lodging may be considered compatible where local communities have determined these uses are permissible; however, acoustic treatment of these structures is recommended to meet noise level reduction thresholds when comparing the outdoor noise level to the indoor noise level. Schools and other public use facilities are also generally considered to be incompatible with noise exposure above 65 DNL. As with residential development, communities can make a policy decision that these uses are acceptable with appropriate sound attenuation measures. Hospitals and nursing homes, places of worship, auditoriums, and concert halls are structures which are generally compatible if measures to achieve noise level reduction are incorporated into the design and construction of structures. Outdoor music shells and amphitheaters are not compatible and should be prohibited within the 65 DNL noise contour. Additionally, agricultural uses and livestock farming are generally considered compatible with the exception of related residential components of these uses, which should incorporate sound attenuation measures.

Noise exposure contours were prepared for AMW for a baseline condition (2018) and a long-range condition (2038) based on the operational forecasts presented in Chapter Two. The resulting contours are shown in **Exhibit 5B** and on **Exhibit 5C**. As shown on the exhibits, the 70 and 75 DNL noise contours remain entirely on airport property in both the baseline and long-range forecast. As depicted on **Exhibit 5B** denoting baseline conditions, the 65 DNL noise exposure contour remains entirely on airport property. While the long-range forecast condition shown in **Exhibit 5C** is projected to remain mostly on airport property, there is an exception to a small area along the eastern property line, south of Runway 13-31 identified on **Exhibit 5C**. Based on aerial photography, non-airport land encompassed by the 65 DNL noise exposure contour is undeveloped grassland adjacent to the airport, which is zoned A-1 and designated as an Agriculture Conservation Area on the C2C Plan. Single-family residential is a permitted use within the A-1 district.

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[14] Iowa Department of Transportation – Aviation Bureau *Iowa Airport Land Use Guidebook* (January 2008) (https://iowadot.gov/aviation/airports); November 2019.

LAND USE	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
Public Use						
Schools	Y	N[1]	N[1]	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	Y[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail-building materials, hardware and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y[5]	Y[5]	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally-determined land uses for those determined to be appropriate by local authorities in response to locally-determined needs and values in achieving noise compatible land uses.

See other side for notes and key to table.

KEY

Y (Yes) Land Use and related structures compatible without restrictions.

N (No) Land Use and related structures are not compatible and should be prohibited.

NLR Noise Level Reduction (outdoor-to-indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, 35 Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

NOTES

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

Source: ***14 CFR Part 150***, Appendix A, Table 1.

Height Restrictions

Using a similar process to the non-compatible development analysis for noise contours, the zoning and future land use within the Part 77 approach surface area out to one mile from the end of the runways were evaluated. Future land use designations are not included in this analysis, as both the Ames' LLUP and Story County's C2C Plan does not specify height limitations for future land uses.

As identified in **Exhibit 5G**, areas within the Part 77 approach surface area out to one mile of the runway ends are zoned Agricultural, Residential Low Density, Residential Low-Density Park, Residential Medium High Density, Planned Residence District, Highway-Oriented District, both General and Planned Industrial, and Government/Airport District. As noted in **Table 5E** above, the maximum height limit for the residential districts is 40 feet for lower density residential, 50 feet for medium residential uses, and 100 feet for high-density residential. The maximum height allowed for all zoning designations found in the Part 77 approach surface area is 100 feet, which is applied to the high-density residential, both industrial districts, and the research innovation district. **Exhibit 5G** highlights the ultimate land use approach areas. While no height limitation is placed on the A-1 zoning district in Story County, the APA is in place to ensure structure height is compatible with the airport.

RECOMMENDATIONS

Based on the information presented above and the non-compatible development analysis, the following recommendations are provided to maintain airport land use compatibility in the vicinity of AMW.

Incorporate Airport Land Use Compatibility Goals and Policies into Comprehensive Plans for the City of Ames and Story County. A comprehensive plan is the starting point guiding a city's and county's development and is the recommending policy document for development. It is recommended the city and county include, with input from the AMW, goals, policies, and objectives for the airport when the comprehensive plans are scheduled for updates.

Incorporate the Part 77 Map into the Local Zoning Ordinance as an Airport Overlay Zone. Currently, the Ames Municipal Code does not reference protected surface areas within the Part 77 map area. An Airport Overlay Zone is intended for two important purposes:

1. to protect the airport from the encroachment of land uses that are incompatible with airport activities and that may limit airport growth; and
2. minimize public exposure to excessive noise and other safety hazards commonly associated with aviation land uses.

To ensure the city's codes are the most up-to-date with the needs of the airport, it is recommended the city incorporate the most current Part 77 map to prohibit incompatible uses or structures that could affect the airport. Additionally, the Part 77 surfaces review process should state that Determinations of No Hazard including mitigations that negatively affect the airport will be rejected. It is recommended the Story County also incorporate the same Part 77 map to ensure consistency around the airport in both jurisdictions.

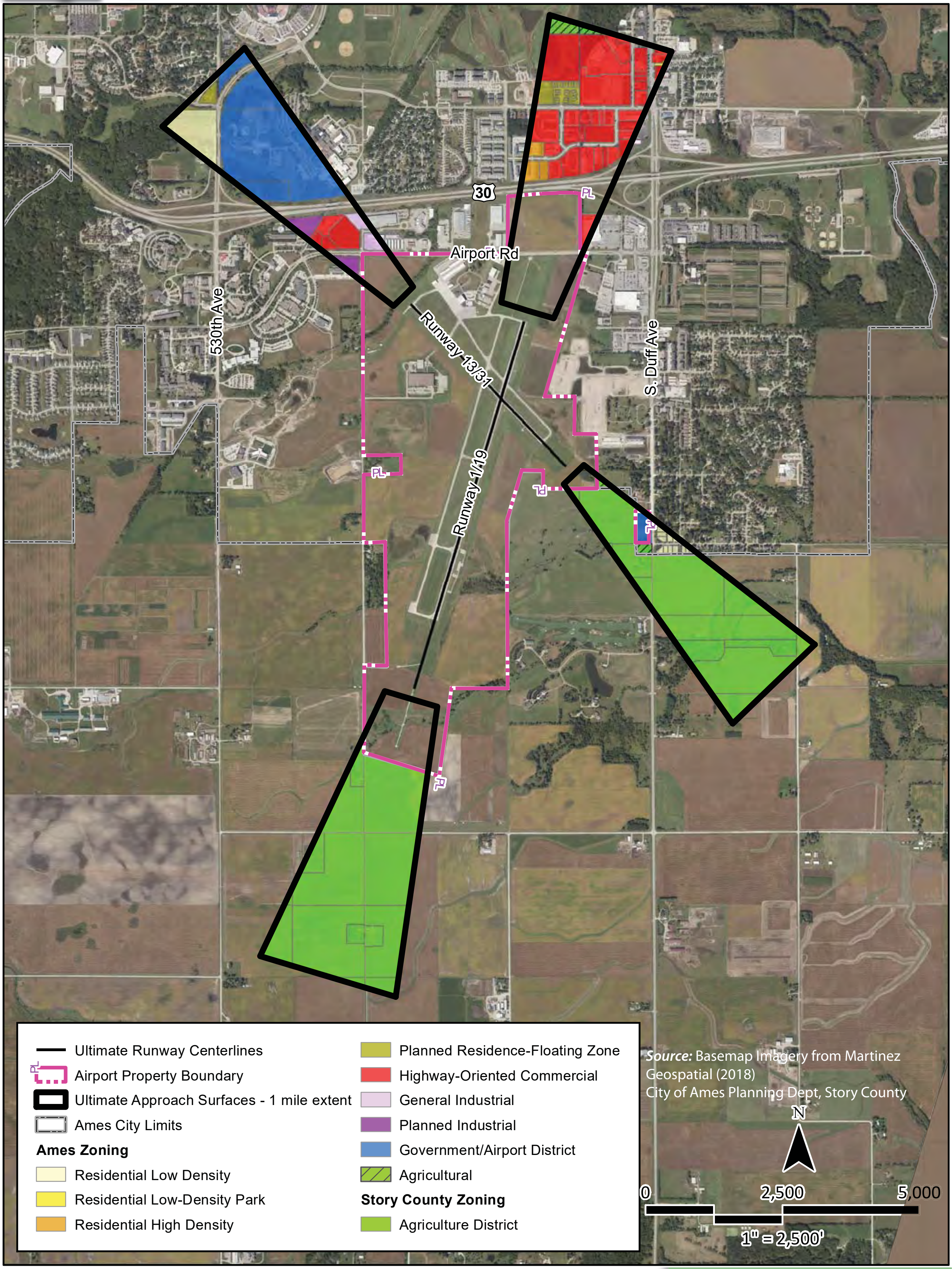


Exhibit 5G
APPROACH SURFACE ZONING

Incorporate Land Division Guidelines for Airport-compatible Development into Local Subdivision Regulations. Subdividing land is typically the initial step of the development process. At this stage, it is important to ensure that land arrangement is compatible with the airport and appropriate avigation easements are dedicated.

Adopt Fair Disclosure Requirements for Real Estate Transactions within the Vicinity of the Airport. Fair disclosure regulations in real estate transactions are intended to ensure that prospective buyers of property are informed that the property is, or will be, exposed to potentially disruptive aircraft noise or overflights. It is not uncommon, around even the busiest airports, for newcomers to report having bought property without having been informed about airport noise levels. At the most formal level, fair disclosure can be implemented through city and county ordinances requiring a deed notice for property within the vicinity based on an existing boundary, such as the Part 77 Horizontal Surface. The following is an example of deed notice language that would notify the property owner of the proximity of an airport and expectations for living in the vicinity of the airport:

> *The subject property is within the vicinity of Ames Municipal Airport, located at 2501 Ames Drive, Ames, IA 50010. Properties within this area are routinely subject to overflights by aircraft using this public-use airport and, as a result, residents may experience inconvenience, annoyance, or discomfort arising from the noise of such operations. Residents also should be aware that the current volume of aircraft activity may increase in response to the population and economic growth within the City of Ames and Story County. Any subsequent deed conveying this parcel or subdivisions thereof shall contain a statement in substantially this form.*

AIRPORT RECYCLING, REUSE, and WASTE REDUCTION

The *FAA Modernization and Reform Act of 2012* (FMRA), which amended Title 49, United States Code (USC), included several changes to the FAA's AIP. Two of these changes are related to recycling, reuse, and waste reduction at airports.

- Section 132(b) of FMRA expanded the definition of airport planning to include "developing a plan for recycling and minimizing the generation of airport solid waste, consistent with applicable State and local recycling laws, including the cost of a waste audit."
- Section 133 of FMRA added a provision requiring airports that have or plan to prepare a master plan, and that receive AIP funding for an eligible project, ensure that the new or updated master plan addresses issues relating to solid waste recycling at the airport, including:
    - The feasibility of solid waste recycling at the airport;
    - Minimizing the generation of solid waste at the airport;
    - Operation and maintenance requirements;
    - A review of waste management contracts; and,
    - The potential for cost savings or the generation of revenue.

Typically, airport sponsors have purview over waste handling services in facilities they own and operate, such as the terminal building and maintenance facilities. Tenants of airport-owned buildings/hangars or tenants that own their facilities are typically responsible for coordinating their waste handling services. While the focus of this plan is on airport-operated facilities, the airport should work to incorporate facility-wide strategies that create consistency in waste disposal mechanisms. This would ultimately result in the reduction of materials sent to the landfill.

Understanding the waste stream for Ames Municipal Airport requires an understanding of the types of waste typically generated at airports. Generally, airport waste can be divided into eight categories:[15]

- **Municipal Solid Waste** (MSW) – more commonly known as trash or garbage – consists of everyday items that are used and then discarded, like product packaging.

- **Construction and Demolition Waste** (C&D) is considered non-hazardous trash resulting from land clearing, excavation, demolition, renovation or repair of structures, roads and utilities, including concrete, wood, metals, drywall, carpet, plastic, pipe, cardboard, and salvaged building components. C&D is also generally labeled as MSW.

- **Green Waste** is a form of MSW yard waste consisting of tree, shrub and grass clippings, leaves, weeds, small branches, seeds, and pods.

- **Food Waste** includes unconsumed food products or waste generated and discarded during food preparation. Also considered MSW.

- **Deplaned Waste** is waste removed from passenger aircraft. Deplaned waste includes bottles, cans, newspapers, mixed paper (i.e., napkins or paper towels), plastic cups, service ware, food waste, and food-soiled paper/packaging. Deplaned waste can represent as much as 20 percent of an airport's total MSW stream.

- **Lavatory Waste** is a special waste that is emptied through a hose and pumped into a lavatory service vehicle. The waste is then transported to a triturator[16] facility for pretreatment prior to discharge in the sanitary sewage system. Due to the chemicals in lavatory waste, it can present environmental and human health risks if mishandled. Caution must be taken to ensure lavatory waste is not released to the public sanitary sewerage system before pretreatment.

- **Spill Clean and Remediation Wastes** are also special wastes and are generated during cleanup of spills and/or the remediation of contamination from several types of sites on an airport.

- **Hazardous Wastes** are governed by the *Resource Conservation and Recovery Act* (RCRA), as well as the regulations in 40 Code of Federal Regulations (CFR), Subtitle C, Parts 260 to 270. The Environmental Protection Agency (EPA) developed less stringent regulations for certain hazardous waste, known as universal waste, described in 40 CFR Part 237 – *The Universal Waste Rule*.

[15] Recycling, Reuse and Waste Reduction at Airports, FAA (April 24, 2013)
[16] A triturator facility turns lavatory waste into fine particulates for further processing.

As seen on **Exhibit 5H**, there are six potential areas of the airport contributing to the waste stream, including the terminal, airfield, aircraft maintenance hangars, cargo hangars, offices, and airport construction projects. To create a comprehensive waste reduction and recycling plan for the airport, all potential inputs must be considered.

EXISTING SERVICES

Currently, there is not a dedicated person or department overseeing waste management for AMW. Solid waste services at the airport terminal are provided by Waste Management. MSW dumpsters are located adjacent to the airport terminal, the Iowa State University hangar, and Hap's Air Service hangar. No information is available regarding the weight of MSW hauled or the cost of service, and dumpsters are emptied twice weekly.

At this time, there is no recycling program at AMW.

SOLID WASTE MANAGEMENT SYSTEM

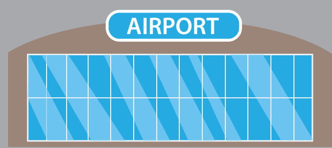
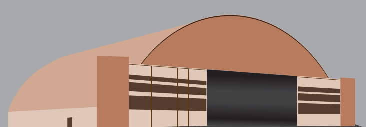
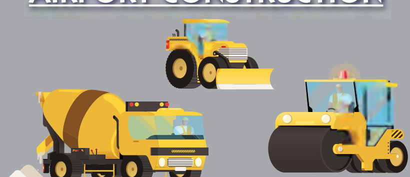
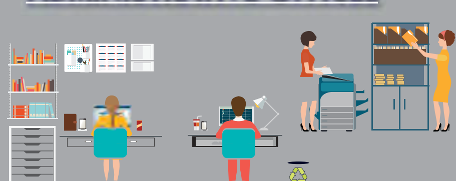
Waste management services at AMW are currently managed independently by various tenants and entities in what is known as a *decentralized* waste management system. As a result, there are no quantities of existing waste removal, which creates difficulty setting quantifiable goals for waste reduction. However, to maximize waste reduction and recycling efforts, the airport should actively engage tenants by transitioning to a *centralized* waste management system. **Exhibit 5J** summarizes the differences between these two styles.

Centralized waste management systems provide greater opportunity for participation from airport tenants who may not be incentivized to recycle on their own. The centralized system is advantageous in that it has fewer participants involved in the overall management of the solid waste and recycling efforts. This management style allows greater control by the airport over the type, placement, and maintenance of compactors and dumpsters; saving space; and eliminating the need for each tenant to have their separate containers. A centralized strategy can be inefficient for some airports as it requires more effort and oversight on the part of airport management. Ultimately, a centralized waste management system will streamline waste and recycling collection, maximizing the opportunity to reduce waste generation and increase the diversion of recyclables.

RECYCLING GOALS

Some steps can be taken to initiate a recycling program since the airport currently does not participate in one. First and foremost, it is important to get the buy-in from tenants to ensure the effort is a success. Such activities can include:

WASTE STREAMS FOR AMES MUNICIPAL AIRPORT

AIRPORT AREA	POTENTIAL INPUTS	POTENTIAL OUTPUTS
TERMINAL 	Passengers Employees	Food Waste, Paper Plastic, Aluminum Cans Trash, Green Waste Deplaned Waste
AIRFIELD 	Aircraft Operations	Runway Rubber Green Waste
HANGARS 	Aircraft Maintenance Movements	Plastic Vehicle Waste (Tires & Fluids)
AIRCRAFT 	Aircraft Ground Support Equipment (GSE)	Vehicle Waste Plastic Wastewater Hazmat
AIRPORT CONSTRUCTION 	Construction Re-Construction Demolition	Reused Concrete Reused Asphalt Vehicle Waste Soils, Building Materials Wood, General Waste
ADMINISTRATIVE OFFICES 	Employees	Food Waste Paper, Plastic Aluminum Cans Trash, Cardboard

Source: Recycling, Reuse, and Waste Reduction at Airports, FAA (April 24, 2013)

COMPONENTS OF AN AIRPORT WASTE MANAGEMENT SYSTEM

DECENTRALIZED

Airport Tenants

FBOs & Others
↓
Janitorial Service
↓
Waste and Recycling Receptacles

Waste/Recycling Removal Contracts

Airport Management

Airport Management Office | Terminal
↓
Janitorial Service
↓
Waste and Recycling Receptacles

Waste/Recycling Removal Contracts

CENTRALIZED

Airport Management

FBOs & Others | Airport Management Office | Terminal

FBOs & Others → Janitorial Service
Airport Management Office, Terminal → Janitorial Service
↓
Shared Waste and Recycling Receptacles

Single waste removal and recycling contract with the airport management. The cost is either factored into the airport lease fees, or billed separately, like a utility.

Source: Natural Resources Defense Council, Trash Landings: How Airlines and Airports Can Clean Up Their Recycling Programs, December 2006.

- Make recycling a part of everyday business. Airport administration can provide training, education, and support to personnel, tenants, and others who conduct business at the airport. In-person meetings with airport tenants should be held to create a mutual understanding of the airport's solid waste and recycling goals and how tenants play a vital role in the airport's overall success.

- Establish consistent internal procedures to ensure there are no unacceptable items contaminating recycling containers or recyclables thrown in the trash. Clearly marked signage of what can and cannot be accepted placed near the solid waste and recycling containers is a significant act of a consistent, effective recycling system.

A second step in initiating a recycling program is to conduct a waste audit, which is the most comprehensive and intensive way to assess the airport's waste stream composition, opportunities for waste reduction, and capture of recyclables. This will ensure that waste and recycling containers are rightsized for the existing operation, as well as having a collection schedule that picks up only when the containers are full.

Finally, the implementation of an effective program requires accurate data of current local waste and recycling cost rates. Since recycling services are offered by various companies in Ames, the airport could track recycling cost rates and waste quantities to identify the most beneficial service available. Quantitative data can be measured from available information provided by the airport and the current MSW provider, such as:

Examination of Records
- Waste hauling and disposal records and contracts
- Supply and equipment invoices
- Other waste management costs (commodity rebates, container costs, etc.)

Facility Walk-Through
- Qualitative waste information
- Understanding waste pickup and hauling practices

Waste Audit
- Collection and analysis of the types of waste produced

While the airport may or may not incorporate a recycling program with landside recycle dumpsters, other sustainable opportunities are available to reduce MSW. **Table 5F** outlines objectives that could help reduce waste generation at the airport. To increase the effectiveness of tracking progress at the airport, a baseline state of all suggested metrics should be established to provide a comparison over time.

TABLE 5F
Waste Management and Recycling Recommended Goals
Ames Municipal Airport – Story County, IA

Goals	Objectives
Reduce the amount of solid waste generated	Switch to online bill pay to eliminate monthly paper bills
	Conduct a waste audit to identify the most common types of waste
	Eliminate the purchase of items that are not recyclable (i.e., Styrofoam, plastic bags)
	Make electronic files, not paper files, when possible
	Set copiers and printers to print on both sides of paper by default
	Reduce the amount of "junk mail" received
Reuse of materials or equipment	Grass clippings as mulch
	Offer reusable dishes to employees
	Cardboard boxes
Increase the amount of material recycled	Improve waste tracking and data management
	Incorporate recycling requirements and/or recommendations into tenant lease agreements
	Expand recycling marketing and promotion efforts throughout public areas
	Require contractors to implement strategies to reduce, reuse, and recycle construction and demolition waste

Source: Coffman Associates, Inc.

SUMMARY

This chapter has been prepared to help the City of Ames in making decisions on the future growth and development of AMW by describing narratively and graphically the Development Concept. The plan represents an airfield facility that fulfills aviation needs for the airport, while conforming to safety and design standards to the extent practicable. It also provides a guide for a landside complex that can be developed as demand dictates.

Flexibility will be very important to future development at the airport, as activity may not occur as predicted. The Development Concept provides airport stakeholders with a general guide that, if followed, can maintain the airport's long-term viability and allow the airport to continue to provide general aviation services for the region. The next chapter of this master plan will consider strategies for funding the recommended improvements and will provide a reasonable schedule for undertaking the projects based on safety and demand the next 20 years and beyond.

CITY OF
Ames

AMES MUNICIPAL AIRPORT

CHAPTER 6

CAPITAL IMPROVEMENT PROGRAM

AMES MUNICIPAL AIRPORT

CITY OF Ames

CHAPTER SIX

CAPITAL IMPROVEMENT PROGRAM

The analyses completed in previous chapters evaluated development needs at Ames Municipal Airport (AMW) beyond the next 20 years based on forecast activity, facility requirements, safety standards, and operational efficiency. Now that the recommended Master Plan Concept has been established and specific needs and improvements for the airport have been recognized, the next step is to determine a realistic schedule for project implementation as well as the associated costs for the plan. This chapter will provide a description and overall cost for each project identified in the capital improvement program (CIP) and development schedule. The program has been evaluated from a variety of perspectives and represents a comparative analysis of basic budget factors, demand, and priority assignments.

The presentation of the capital program has been organized into three sections. First, the airport's capital program needs are identified by various categories, ranging from meeting safety and design standards to satisfying demand. Second, the airport development schedule and CIP cost estimates are presented in narrative and graphic form. The CIP has been developed following Federal Aviation Administration (FAA) guidelines for master plans and identifies those projects that are likely eligible for FAA and Iowa Department of Transportation – Aviation Bureau (IDOT) grant funding. Third, capital improvement funding sources on the federal, state, and local levels are identified and discussed.

AIRPORT DEVELOPMENT NEEDS

In an effort to identify capital needs at the airport, this section provides analysis regarding the associated development needs of those projects included in the CIP. While some projects will be demand-based, others will be dictated by design standards, safety, or rehabilitation needs. Each development need is categorized according to this schedule. The applicable category (or categories) included are presented on **Exhibit 6A**. The proposed projects can be categorized as follows:

1) **Safety/Security (SS)** – these are capital needs considered necessary for operational safety and protection of aircraft and/or people and property on the ground near the airport.

2) **Environmental (EN)** – these are capital needs which are identified to enable the airport to operate in an environmentally acceptable manner or meet needs identified in the Environmental Overview outlined in Chapter Five.

3) **Maintenance (MN)** – these are capital needs required to maintain the existing infrastructure at the airport.

4) **Efficiency (EF)** – these are capital needs intended to optimize aircraft ground operations or passengers' use of the terminal building.

5) **Demand (DM)** – these are capital needs required to accommodate levels of aviation demand. The implementation of these projects should only occur when demand for these needs is verified.

6) **Opportunities (OP)** – these are capital needs intended to take advantage of opportunities afforded by the airport setting. Typically, this will involve improvements to property intended for lease to aviation- or non-aviation-related development.

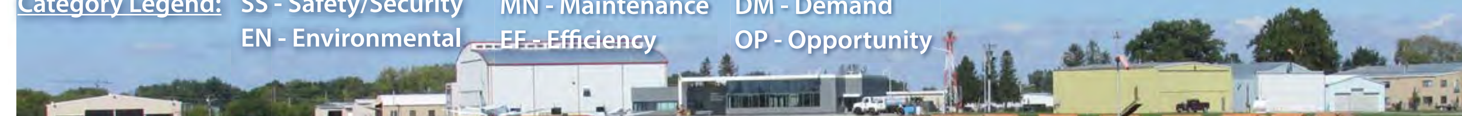
AIRPORT DEVELOPMENT SCHEDULE AND COST SUMMARIES

Now that the specific needs and improvements for AMW have been established, the next step is to determine a realistic schedule and the associated costs for implementing the recommended Master Plan Concept. The capital program considers the interrelationships among the projects in order to determine an appropriate sequence of projects, while remaining within reasonable fiscal constraints.

This section will examine the overall cost of each item in the capital program. The CIP, programmed by years, has been developed to cover the first five years of the plan. **For purposes of this Master Plan, the remaining projects are grouped into intermediate (years 6-20) and long-term (beyond 20-years) planning horizons.** More detailed information is provided for the five-year horizon, with less detail provided for the longer planning periods. **By utilizing planning horizons instead of specific years for intermediate and long-term development, the City of Ames will have greater flexibility to adjust capital needs as demand dictates. Table 6A** summarizes the key milestones for each of the three planning horizons.

Project # and Description		Project Category	Federal/State Funding	Airport/Local Share	Private	Total Project Cost Estimate
SHORT-TERM PROJECT DESCRIPTION (0-5 Years)						
Planning Year 2020						
1	No project - Rollover Entitlement Funds		$-	$-	$-	$-
2020 Total			*$-*	*$-*	*$-*	*$-*
Planning Year 2021						
2	Phase 1 - Runway 1-19 Electrical Lighting	SS/MN	$370,000	$196,233	$-	$566,233
3	Construct 50' x 50' Box Hangar Including Supporting Pavement and Automobile Access	DM/OP	$-	$-	$602,900	$602,900
2021 Total			*$370,000*	*$196,233*	*$602,900*	*$1,169,133*
Planning Year 2022						
4	Hangar Repairs - Replace Doors[1]	MN	$150,000	$30,000	$-	$180,000
2022 Total			*$150,000*	*$30,000*	*$-*	*$180,000*
Planning Year 2023						
5	Phase 2 - Taxiway A Electrical	SS/MN	$260,151	$28,906	$-	$289,057
6	Hangar Repairs[1]	MN	$150,000	$30,000	$-	$180,000
2023 Total			*$410,151*	*$58,906*	*$-*	*$469,057*
Planning Year 2024						
7	No project - Rollover Entitlement Funds	-	$-	$-	$-	$-
2024 Total			*$-*	*$-*	*$-*	*$-*
Planning Year 2025						
8	Phase 3 - Runway 13-31 Electrical	SS/MN	$239,409	$26,601	$-	$266,010
9	Construct 50' x 50' Box Hangar Including Supporting Pavement and Automobile Access	DM/OP	$-	$-	$726,100	$726,100
2025 Total			*$239,409*	*$26,601*	*$726,100*	*$992,110*
TOTAL SHORT-TERM PROGRAM (0-5 Years)			**$1,169,560**	**$311,740**	**$1,329,000**	**$2,810,300**
INTERMEDIATE-TERM PROJECT DESCRIPTION (6-20 Years)						
10	Design and Construct Crack/Joint Repair and Sealcoat on Runway 1-19	MN/SS	$315,000	$35,000	$-	$350,000
11	Design and Construct Mill and 3" Overlay on Runway 1-19	MN/SS	$1,620,000	$180,000	$-	$1,800,000
12	Acquire Snow Removal Equipment	MN/SS	$202,500	$22,500	$-	$225,000
13	Demolition of Old Terminal Building	OP	$67,500	$7,500	$-	$75,000
14	Construct Two 100' x 125' Conventional Hangars, Apron Area Lighting, and Automobile Parking (Includes Demolition of Existing Hangar)	DM/OP	$-	$-	$7,169,600	$7,169,600
15	Phase 4 - Taxiway B Electrical	SS/MN	$242,712	$26,968	$-	$269,680
16	Rehabilitate Taxiway A	MN/SS	$189,000	$21,000		$210,000
17	Rehabilitate Taxiway B	MN/SS	$199,800	$22,200		$222,000
18	Implement REILs Serving Runways 13-31 and 19 and PAPI-4s Serving Runways 13-31 and 1-19	SS	$311,130	$34,570	$-	$345,700
19	Relocate/Construct Four 12-Unit T-Hangars, One 8-Unit T-Hangar, Supporting Pavement, Access Taxiways, and Automobile Access	DM/OP	$-	$-	$12,819,800	$12,819,800
20	Construct Two 100' x 100' Conventional Hangars and Automobile Parking	DM/OP	$-	$-	$4,110,600	$4,110,600
21	Construct Northwest Apron Expansion	DM/OP	$3,867,120	$429,680	$ -	$4,296,800
22	Relocate Existing Aircraft Maintenance Building, Construct 50' x 50' Airport Maintenance Building, and Construct Automobile Parking and Access	DM/OP	$-	$-	$1,517,900	$1,517,900
23	Relocate Airport Beacon	OP	$21,420	$2,380	$-	$23,800
24	Construct Terminal Area Automobile Parking Expansion	DM/OP	$833,850	$92,650	$-	$926,500
TOTAL INTERMEDIATE-TERM PROGRAM (6-20 Years)			**$7,870,032**	**$874,448**	**$25,617,900**	**$34,362,380**
LONG-TERM PROJECT DESCRIPTION (Beyond 20 Years)						
25	Acquire Approximately 0.75 Acres in Easement	SS	$23,670	$2,630	$-	$26,300
26	Conduct Environmental Assessment for Runway 13-31 Extension	EN/DM	$148,500	$16,500	$-	$165,000
27	Construct 609' Runway 13-31/Taxiway B Extension and Hold Bay (Includes Relocation of the PAPI-4 and REILs)	SS/DM	$2,543,760	$282,640	$-	$2,826,400
28	South Apron Rehabilitation	MN/SS	$760,000	$84,444	$-	$844,444
29	South Apron Expansion and Construct Bypass Taxiway Serving Runway 19	DM/SS	$3,623,400	$402,600	$-	$4,026,000
30	Rehabilitate Airport Access Road	MN	$810,450	$90,050		$900,500
31	Construct Apron Expansion, Three 100' x 100' Conventional Hangars, and Automobile Parking	DM/OP	$-	$-	$7,296,200	$7,296,200
32	Relocate Fuel Farm and Construct Two 15,000 Gallon (One Jet A and One 100LL) Above-Ground Fuel Tanks with Self Service Capability	MN/OP	$1,053,680	$263,420	$-	$1,317,100
33	Construct Tower for ASOS and PCL Equipment	SS/MN	$81,000	$9,000	$-	$90,000
34	Conduct Environmental Assessment for Runway 1-19 Extension	EN/DM	$148,500	$16,500		$165,000
35	Acquire Approximately 47.6 Acres (Including the Residential Property) and Relocate Portions of S Riverside Dr and 265th St	SS/DM	$2,164,410	$240,490	$-	$2,404,900
36	Construct 1,299' Runway 1-19/Taxiway A Extension and Hold Bay (Includes Relocation of the PAPI-4 and MALSR)	SS/DM	$5,824,980	$647,220	$-	$6,472,200
37	Construct Two 6-Unit Linear Box Hangars, Supporting Pavement, Access Taxiways, and Automobile Access	DM/OP	$-	$-	$8,607,100	$8,607,100
38	Construct Ultimate Parallel Taxiway B and Connectors and Remove Portions of Existing Taxiways B, B1, and B2	SS/DM	$1,694,700	$188,300	$-	$1,883,000
39	Construct Southwest GA Apron Area and Access Taxiways	DM/OP	$7,897,950	$877,550	$-	$8,775,500
40	Construct Two 125' x 200' Conventional Hangars and Automobile Parking and Access	DM/OP	$-	$-	$18,434,000	$18,434,000
41	Implement Two 12,500 Gallon Fuel Tanks with 100LL and Jet A Self-Service Capability	DM/OP	$1,078,470	$119,830	$-	$1,198,300
42	Construct One 125' x 200' Conventional Hangar, Two 100' x 100' Conventional Hangars, and Automobile Parking	DM/OP	$-	$-	$16,202,600	$16,202,600
43	Construct Eight 12-Unit T-Hangars, Supporting Pavement, Access Taxiway, and Automobile Access	DM/OP	$-	$-	$23,332,400	$23,332,400
TOTAL LONG-TERM PROGRAM (Beyond 20 Years)			**$27,853,470**	**$3,241,174**	**$73,872,300**	**$104,966,944**
CAPITAL IMPROVEMENT PROGRAM TOTAL			**$36,893,062**	**$4,427,362**	**$100,819,200**	**$142,139,624**

Category Legend: SS - Safety/Security MN - Maintenance DM - Demand
EN - Environmental EF - Efficiency OP - Opportunity



NOTE: An estimate of FAA and IDOT funding eligibility has been included, although actual funding is not guaranteed.

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TABLE 6A
Planning Horizon Activity Levels
Ames Municipal Airport

	Base Year	Short-Term	Intermediate-Term	Long-Term
BASED AIRCRAFT				
Single Engine Piston	64	67	71	80
Multi-Engine Piston	3	2	1	0
Turboprop	1	2	3	5
Jet	4	5	6	8
Helicopter	0	1	2	2
Other	6	6	6	6
TOTAL BASED AIRCRAFT	**78**	**83**	**89**	**101**
ANNUAL OPERATIONS				
Itinerant				
General Aviation	22,777	24,300	26,200	29,900
Air Taxi	1,656	2,100	2,500	3,000
Military	499	500	500	500
Total Itinerant	**24,932**	**26,900**	**29,200**	**33,400**
Local				
General Aviation	13,377	14,300	15,400	17,600
Military	0	0	0	0
Total Local	**13,377**	**14,300**	**15,400**	**17,600**
TOTAL OPERATIONS	**38,309**	**41,200**	**44,600**	**51,000**

A key aspect of this planning document is the use of demand-based planning milestones to provide flexibility. The short-term planning horizon contains items of highest need and/or priority. As short-term horizon activity levels are reached, it will then be time to program for the intermediate term based upon the next activity milestones. Similarly, when the intermediate-term milestones are reached, it will be time to program for the long-term activity milestones.

Many development items included in the recommended concept will need to follow demand indicators, which essentially establish triggers for key improvements. For example, the Master Plan Concept includes the development of new aircraft hangars. Growth in based aircraft is the trigger for these projects. If growth slows or does not occur as projected, new hangar development can be delayed. As a result, the capital expenditures will be undertaken as needed, which leads to a responsible use of capital assets. Some development items do not depend on demand. Other projects are necessary to enhance the safety of the airport, maintain existing infrastructure, or meet FAA design standards. These types of projects typically are associated with day-to-day operations and should be monitored and identified by airport management regardless of changes in demand indicators.

Because of economic realities, few airports are constructing hangars on their own and are relying on private developers instead. In some cases, private developers can keep construction costs lower, which, in turn, lowers the monthly lease rates necessary to amortize a loan. Many airports use third-party funding when the planned improvements will primarily be used by a private business or other organization. In addition, lease revenue generated from third-party funded options is a potential revenue source. The airport sponsor's responsibility related to new hangars can be to provide public access taxiways, typically in conjunction with FAA and/or state development grants. These taxiways are then able to be utilized by hangar tenants for aircraft access to the runway/taxiway system.

Given that a master plan is a conceptual document, implementation of the capital projects should only be undertaken after further refinement of their design and costs through architectural or engineering analyses. Moreover, some projects may require additional infrastructure improvements (i.e., drainage improvements, extension of utilities, etc.) that may increase the estimated cost of the project or increase the timeline for completion.

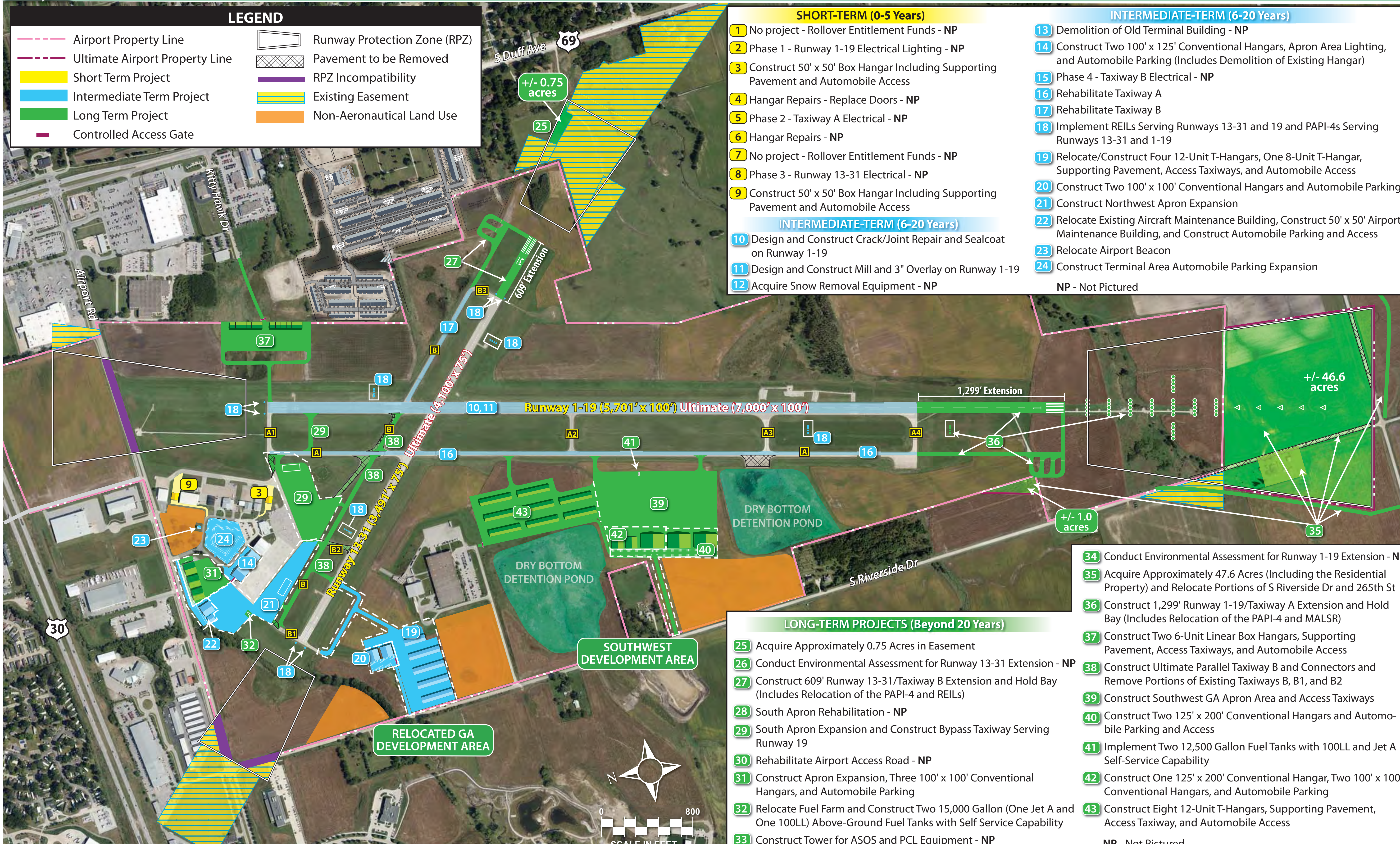
Once a list of necessary projects was identified and refined, project-specific cost estimates were prepared. The cost estimates also include design, construction administration, and contingencies that may arise on the project. **Capital costs presented here should be viewed only as "order-of-magnitude" estimates subject to further refinement during design. Nevertheless, they are considered sufficient for planning purposes.** Some projects, particularly those in the short-term period, have been taken from the airport's five-year Airport Capital Improvement Program (ACIP) currently on file with the FAA. Cost estimates for projects included in the short-, intermediate-, and long-term CIP were provided by aviation engineers with Foth Infrastructure and Environment, LLC. As previously stated, each project should only be undertaken after further refinement of their design and costs through detailed architectural or engineering analyses.

Exhibit 6A presents the proposed long-term CIP for AMW. **An estimate of FAA and IDOT funding eligibility has been included, although actual funding is not guaranteed.** For those projects that would be eligible for federal funding, Airport Improvement Program (AIP) grants-in-aid provide up to 90 percent of the total project cost. The remaining share (10 percent) must be funded locally by the City of Ames. It should be noted, however, that IDOT maintains a separate aviation funding program, which will be detailed later in the chapter. Funding allocation for the state-funded programs and project selection are approved by the Iowa Transportation Commission. As a result, the cost breakdown for each project in the CIP has a primary focus on federal versus state and local funding.

As detailed in the CIP, many of the projects listed are eligible for federal funding. While eligible, each project must meet some level of justification prior to a grant being approved and issued by the FAA. **Exhibit 6B** graphically depicts the development staging by overlaying each project onto the aerial photograph of AMW.

The FAA utilizes a national priority rating system to help objectively evaluate potential airport projects. Projects are weighted toward safety, infrastructure preservation, meeting design standards, and capacity enhancement. The FAA will participate in the highest priority projects before considering lower priority projects, even if a lower priority project is considered a more urgent need by the local sponsor. Nonetheless, the project should remain a priority for the airport and funding support should continue to be requested in subsequent years.

Some projects identified in the CIP will require environmental documentation. The level of documentation necessary for each project must be determined in consultation with the FAA and IDOT. There are three major levels of environmental review to be considered under the *National Environmental Policy Act* (NEPA) that include categorical exclusions (CatEx), Environmental Assessments (EA), and Environmental Impact Statements (EIS). Each level requires more time to complete and more detailed information. Guidance on what level of documentation is required for a specific project is provided in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*. The Environmental Overview presented in Chapter Five addresses NEPA and provides an evaluation of various environmental categories for AMW.



SHORT-TERM (0-5 Years)

1. No project - Rollover Entitlement Funds - **NP**
2. Phase 1 - Runway 1-19 Electrical Lighting - **NP**
3. Construct 50' x 50' Box Hangar Including Supporting Pavement and Automobile Access
4. Hangar Repairs - Replace Doors - **NP**
5. Phase 2 - Taxiway A Electrical - **NP**
6. Hangar Repairs - **NP**
7. No project - Rollover Entitlement Funds - **NP**
8. Phase 3 - Runway 13-31 Electrical - **NP**
9. Construct 50' x 50' Box Hangar Including Supporting Pavement and Automobile Access

INTERMEDIATE-TERM (6-20 Years)

10. Design and Construct Crack/Joint Repair and Sealcoat on Runway 1-19
11. Design and Construct Mill and 3" Overlay on Runway 1-19
12. Acquire Snow Removal Equipment - **NP**

INTERMEDIATE-TERM (6-20 Years)

13. Demolition of Old Terminal Building - **NP**
14. Construct Two 100' x 125' Conventional Hangars, Apron Area Lighting, and Automobile Parking (Includes Demolition of Existing Hangar)
15. Phase 4 - Taxiway B Electrical - **NP**
16. Rehabilitate Taxiway A
17. Rehabilitate Taxiway B
18. Implement REILs Serving Runways 13-31 and 19 and PAPI-4s Serving Runways 13-31 and 1-19
19. Relocate/Construct Four 12-Unit T-Hangars, One 8-Unit T-Hangar, Supporting Pavement, Access Taxiways, and Automobile Access
20. Construct Two 100' x 100' Conventional Hangars and Automobile Parking
21. Construct Northwest Apron Expansion
22. Relocate Existing Aircraft Maintenance Building, Construct 50' x 50' Airport Maintenance Building, and Construct Automobile Parking and Access
23. Relocate Airport Beacon
24. Construct Terminal Area Automobile Parking Expansion

NP - Not Pictured

LONG-TERM PROJECTS (Beyond 20 Years)

25. Acquire Approximately 0.75 Acres in Easement
26. Conduct Environmental Assessment for Runway 13-31 Extension - **NP**
27. Construct 609' Runway 13-31/Taxiway B Extension and Hold Bay (Includes Relocation of the PAPI-4 and REILs)
28. South Apron Rehabilitation - **NP**
29. South Apron Expansion and Construct Bypass Taxiway Serving Runway 19
30. Rehabilitate Airport Access Road - **NP**
31. Construct Apron Expansion, Three 100' x 100' Conventional Hangars, and Automobile Parking
32. Relocate Fuel Farm and Construct Two 15,000 Gallon (One Jet A and One 100LL) Above-Ground Fuel Tanks with Self Service Capability
33. Construct Tower for ASOS and PCL Equipment - **NP**
34. Conduct Environmental Assessment for Runway 1-19 Extension - **NP**
35. Acquire Approximately 47.6 Acres (Including the Residential Property) and Relocate Portions of S Riverside Dr and 265th St
36. Construct 1,299' Runway 1-19/Taxiway A Extension and Hold Bay (Includes Relocation of the PAPI-4 and MALSR)
37. Construct Two 6-Unit Linear Box Hangars, Supporting Pavement, Access Taxiways, and Automobile Access
38. Construct Ultimate Parallel Taxiway B and Connectors and Remove Portions of Existing Taxiways B, B1, and B2
39. Construct Southwest GA Apron Area and Access Taxiways
40. Construct Two 125' x 200' Conventional Hangars and Automobile Parking and Access
41. Implement Two 12,500 Gallon Fuel Tanks with 100LL and Jet A Self-Service Capability
42. Construct One 125' x 200' Conventional Hangar, Two 100' x 100' Conventional Hangars, and Automobile Parking
43. Construct Eight 12-Unit T-Hangars, Supporting Pavement, Access Taxiway, and Automobile Access

NP - Not Pictured

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The following sections will describe in greater detail the projects identified for the airport over the long-term planning horizon. The projects are grouped based upon a detailed evaluation of existing and projected demand, safety, rehabilitation needs, and local priority. **While the CIP identifies the priority ranking of the projects, the list should be evaluated and revised on a regular basis. It is also important to note that certain projects, while listed separately for purposes of evaluation in this study, could be combined with other projects during time of construction/implementation.**

SHORT-TERM PROGRAM (YEARS 0 – 5)

The short-term projects are those anticipated to be needed in years zero through five of the CIP. The list of projects is further divided into yearly timeframes and are prioritized based on the needs of AMW. Projects related to safety and preservation generally have the highest priority. The short-term program considers nine projects for the planning period as presented on **Exhibit 6A** and depicted on **Exhibit 6B**. The following provides a detailed breakdown of each project.

FY 2020 Projects

Project #1: No Project – Rollover Entitlement Funds
Description: By forgoing a project during the year 2020, the airport is able to bank up $150,000 of non-primary entitlement AIP funding, which can be carried over and combined for up to four years thereby allowing for completion of a more expensive project.
Cost Estimate: $0
Funding Eligibility: NA

FY 2021 Projects

Project #2: Phase 1 - Runway 1-19 Electrical Lighting
Description: The electrical system on all runways and taxiways at AMW are in extremely poor condition and require constant efforts to keep runways lighted for significant traffic, both local and transient. This project is the first in a series of four and will replace runway edge and threshold lighting for Runway 1-19. This project also includes relighting of portions of the taxiways from the apron to Runway 1-19.
Cost Estimate: $566,233
Funding Eligibility: FAA or State (F/S) – 90 percent, Airport or Local (A/L) – 10 percent

Project #3: Construct 50' x 50' Box Hangar, Including Supporting Pavement and Automobile Access
Description: There is current interest in constructing a hangar in the terminal area near the existing fuel farm. As such, this project is for the construction of a 50- by 50-foot box hangar with supporting pavement and automobile parking and access from Airport Drive.
Cost Estimate: $602,900
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, Private (P) – 100 Percent

FY 2022 Projects

Project #4: Hangar Repairs - Replace Doors
Description: As part of the IDOT general aviation vertical infrastructure (GAVI) program, landside projects that are typically not funded by AIP can be funded up to 85 percent when funding is available for the program. This project considers hangar door replacement under the GAVI program.
Cost Estimate: $180,000
Funding Eligibility: F/S – 85 percent, A/L – 15 percent, P – 0 Percent

FY 2023 Projects

Project #5: Phase 2 – Taxiway A Electrical
Description: The electrical system on all runways and taxiways at AMW are in extremely poor condition and require constant efforts to keep runways lighted for significant traffic, both local and transient. This project is the second in a series of four and will replace taxiway edge lighting for Taxiway A. Lighting this taxiway will allow aircraft to stay off the primary runway when taxiway to Runway 1, thereby increasing safety.
Cost Estimate: $289,057
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #6: Hangar Repairs
Description: Like the previous project, this project is for the repair of existing hangars at AMW and seeks funding through the GAVI program.
Cost Estimate: $180,000
Funding Eligibility: F/S – 85 percent, A/L – 15 percent, P – 0 Percent

FY 2024 Projects

Project #7: No Project – Rollover Entitlement Funds
Description: By forgoing a project during the year 2024, the airport is able to bank up $150,000 of non-primary entitlement AIP funding, which can be carried over and combined for up to four years thereby allowing for completion of a more expensive project.
Cost Estimate: $0
Funding Eligibility: NA

FY 2025 Projects

Project #8: Phase 3 – Runway 13-31 Electrical
Description: The electrical system on all runways and taxiways at AMW are in extremely poor condition and require constant efforts to keep runways lighted for significant traffic, both local and transient. This project is the third in a series of four and will replace runway edge and threshold lighting for Runway 13-31, which is the airport's crosswind runway.
Cost Estimate: $266,010
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #9: Construct 50' x 50' Box Hangar, Including Supporting Pavement and Automobile Access
Description: In order to utilize all existing area suited for hangar development, this project considers the construction of a 50- by 50-foot box hangar located north of the Iowa State University hangar, with supporting pavement and automobile parking and access provided from Airport Drive.
Cost Estimate: $726,100
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Short-Term Program Summary

The short-term CIP, detailed on **Exhibit 6A**, includes projects that enhance the overall safety, efficiency, and maintenance of the airfield, while also implementing landside improvements. The total investment necessary for the short-term CIP is approximately $2.8 million. Of the total short-term program, approximately $1.2 million is eligible for federal or state funding assistance, while the airport or local share is $311,740. The remaining $1.3 million is for hangar or otherwise ineligible projects and funding is to be provided through private funding outlets.

INTERMEDIATE-TERM PROGRAM (YEARS 6 – 20)

The intermediate-term projects are those that are anticipated to be necessary in years six through 20 of the Master Plan. These projects are not tied to specific years for implementation; instead, they have been prioritized so that airport management has the flexibility to determine when they need to be pursued based on current conditions. It is not unusual for certain projects to be delayed or advanced based on changing conditions, such as funding availability or changes in the aviation industry. This planning horizon includes 15 projects as listed on **Exhibit 6A** and depicted on **Exhibit 6B**. The following section includes a description of each project.

Project #10: Design and Construct Crack/Joint Repair and Sealcoat on Runway 1-19
Description: As part of a routine airport maintenance, this project has been included to ensure that the airport maintains existing infrastructure as well as a safe operating environment.
Cost Estimate: $350,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #11: Design and Construct Mill and 3” Overlay on Runway 1-19
Description: As part of a routine airport maintenance, this project has been included to ensure that the airport maintains existing infrastructure as well as a safe operating environment.
Cost Estimate: $1,800,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #12: Acquire Snow Removal Equipment
Description: At present, the airport does not have dedicated snow removal equipment (SRE). Currently, the airport utilizes city-owned equipment that is stored at the airport on a cyclical basis for use on the airfield. As such, this project is for the purchase of dedicated airport SRE.
Cost Estimate: $225,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #13: Demolition of Old Terminal Building
Description: At present, the old airport terminal building is being used to house the electrical vault for the airport. Given that a new airport terminal building was opened in 2017 and a new electrical vault is to be constructed as part of Project #1, the old terminal building should be demolished. Ultimately, this will create space for future hangar development.
Cost Estimate: $75,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #14: Construct Two 100' x 125' Conventional Hangars, Apron Area Lighting, and Automobile Parking (Includes Demolition of Existing Hangar)
Description: With the demolition of the old terminal building, there is new opportunity for hangar development along the main aircraft apron area and flightline. As discussed in Chapter Five, the airport seeks to maximize business and corporate hangar development in the existing terminal area and near the flightline. This project is the construction of two 100- by 125-foot conventional hangars in place of the old terminal building. As part of this project, it is recommended that the airport implement apron area lighting, which can be affixed atop the hangar buildings to be constructed. It should be noted, to construct the northernmost conventional hangar will require redevelopment of the existing executive box hangar in its place.
Cost Estimate: $7,169,600
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Project #15: Phase 4 – Taxiway B Electrical
Description: The electrical system on all runways and taxiways at AMW are in extremely poor condition and require constant efforts to keep runways lighted for significant traffic, both local and transient. This project is the fourth in a series of four and will replace taxiway edge lighting for Taxiway B, which serves Runway 13-31, the airport's crosswind runway.
Cost Estimate: $269,680
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #16: Rehabilitate Taxiway A
Description: As part of a routine airport maintenance, this project has been included to ensure that the airport maintains existing infrastructure as well as a safe operating environment.
Cost Estimate: $210,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #17: Rehabilitate Taxiway B
Description: As part of a routine airport maintenance, this project has been included to ensure that the airport maintains existing infrastructure as well as a safe operating environment.
Cost Estimate: $222,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #18: Implement REILs Serving Runways 13-31 and 19 and PAPI-4s Serving Runways 13-31 and 1-19
Description: Given that the existing instrument approach visibility minimums serving Runways 13-31 and 19 are planned to be maintained at not lower than one mile, this project considers the implementation of REILs serving Runway 19 and each end of Runway 13-31, as well as PAPI-4s serving each end of Runways 13-31 and 1-19. It should be noted that FAA funding participation on this project will be less than

90 percent as the existing VASI systems serving Runways 1-19 and 13-31 are FAA owned and maintained and are not eligible for AIP funded replacement.
Cost Estimate: $345,700
Funding Eligibility: F/S – 60 percent, A/L – 40 percent, P – 0 Percent

Project #19: Relocate/Construct Four 12-Unit T-Hangars, One Eight-Unit T-Hangar, Supporting Pavement, Access Taxiways, and Automobile Access
Description: Upon completion of Project #10, consideration is given to the relocation/construction of four 12-unit T-hangars, one eight-unit T-hangar, as well as supporting pavement, access taxiways, and automobile access from South Riverside Drive.
Cost Estimate: $12,819,800
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Project #20: Construct Two 100' x 100' Conventional Hangars and Automobile Parking
Description: This project is for the construction of two 100- by 100-foot conventional hangars located southwest of the Runway 13 threshold in the general aviation redevelopment area. These hangars could serve specialty aviation service operators (SASOs) or could be used to store multiple smaller general aviation aircraft. Approximately 17,400 square feet (sf) of automobile parking could serve the conventional hangars.
Cost Estimate: $4,110,600
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Project #21: Construct Northwest Apron Expansion
Description: Given the need for additional apron area, it is proposed that the apron area be expanded to the north and west, encompassing an additional 26,800 sy.
Cost Estimate: $4,296,800
Funding Eligibility: F/S – 100 percent, A/L – 10 percent, P – 0 Percent

Project #22: Relocate Existing Aircraft Maintenance Building, Construct 50' x 50' Airport Maintenance Building, and Construct Automobile Parking and Access
Description: To make room for additional apron areas and to maximize large conventional hangar development in the terminal area, the existing aircraft maintenance operation could be relocated to the proposed 100- by 100-foot conventional hangar located on the northwest side of the ultimate apron area. This will leave more room for apron area and allow for the relocation of the fuel farm (to be discussed). Additionally, this project considers the construction of a 50- by 50-foot dedicated airport maintenance facility located on the northwest side of the ultimate apron area, nearest to the Runway 13 threshold.
Cost Estimate: $1,517,900
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Project #23: Relocate Airport Beacon
Description: Based upon conversations with the FBO and airport staff, additional paved parking is desired in the future. As such, approximately 100,000 sf of automobile parking is proposed adjacent to the northern side of the existing terminal area parking lot, which requires the relocation of the airport beacon.
Cost Estimate: $23,800
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #24: Construct Terminal Area Automobile Parking Expansion
Description: Upon relocating the airport beacon, this project is for the construction of the additional 100,000 sf of automobile parking adjacent to the northern side of the existing terminal area parking lot.
Cost Estimate: $926,500
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Intermediate-Term Program Summary

The total costs associated with the intermediate-term program are estimated at $34.4 million. Of this total, approximately $7.9 million could be eligible for federal or state funding, while the airport or local share is projected at nearly $900,000. The remaining funding for hangar construction or otherwise ineligible projects, estimated at $25.6 million, is to be provided through private funding mechanisms.

LONG-TERM PROGRAM (BEYOND 20 YEARS)

The long-term planning horizon considers 19 projects beyond the 20-year period. The improvements are presented on **Exhibit 6A** and depicted on **Exhibit 6B**.

Project #25: Acquire Approximately 0.75-Acre in Easement
Description: Prior to extending Runway 13-31, the airport must have ownership over all property within the ultimate RPZ. As such, the airport should acquire approximately 0.75-acre of property in easement that will be located in the ultimate Runway 31 RPZ.
Cost Estimate: $26,300
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #26: Conduct Environmental Assessment for Runway 13-31 Extension
Description: Prior to extending Runway 13-31, this project is for the environmental documentation required for the runway extension.
Cost Estimate: $165,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #27: Construct 609' Runway 13-31/Taxiway B Extension and Hold Bay (Includes Relocation of the PAPI-4)
Description: Given the results of the runway length and orientation analysis presented in Chapter Three, a runway extension on Runway 13-31 could better serve small- to medium-sized aircraft operating at AMW as this runway is better oriented for the prevailing winds. At the same time, Taxiway B should be extended to serve the ultimate Runway 31 threshold. Additionally, this project includes the construction of a hold bay serving Runway 31, as well as the relocation of the PAPI-4 corresponding with the runway extension.
Cost Estimate: $2,826,400
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #28: South Apron Rehabilitation (Design and Construct)
Description: Routine airport maintenance considers the rehabilitation of approximately 7,600 sy (square yards) of the south apron area located immediately south of the new airport terminal building.
Cost Estimate: $844,444
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #29: South Apron Expansion and Construct Bypass Taxiway Serving Runway 19
Description: Previously identified in Chapter Three, the airport has a long-term need for at least 26,300 sy of apron area. To better accommodate existing and future apron area demands, the airport should expand the south apron area by approximately 14,900 sy. Given the proximity of the existing and ultimate south apron area to Taxiway A, it is not possible to construct a holding bay serving Runway 19. As such, this project also considers the construction of a bypass taxiway serving the Runway 19 end to reduce congestion and the possibility for head-to-head traffic.
Cost Estimate: $4,026,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #30: Rehabilitate Airport Access Road
Description: As part of routine airport maintenance, this project considers the rehabilitation of the existing airport access road. It should be noted, however, that any portion of the airport access road that does not serve airport traffic exclusively is not eligible for federal funding.
Cost Estimate: $900,500
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #31: Construct Apron Expansion, Three 100' x 100' Conventional Hangars, and Automobile Parking
Description: As a result of the efforts to redevelop the existing terminal area to maximize conventional hangar space, this project is the construction of three 100- by 100-foot conventional hangars, approximately 7,900 sy of additional apron area, and automobile parking. The proposed conventional hangars are located on the northernmost side of the ultimate apron area adjacent to Airport Road.
Cost Estimate: $7,296,200
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Project #32: Relocate Fuel Farm and Construct Two 15,000-Gallon (One Jet A and One 100LL) Above-Ground Fuel Tanks with Self Service Capability
Description: This project is the relocation of the fuel farm to the northwestern corner of the proposed apron area, adjacent to the Runway 13 threshold. The relocated fuel farm consists of two above-ground 15,000-gallon 100LL and Jet A fuel tanks to help the FBO keep up with current and forecast demands, while the above-ground fuel farm will allow for easier and more regular inspection. Additionally, the fuel tanks are equipped with self-service fueling capability and credit card reader. It should be noted that FAA funding participation for this project will be less than 90 percent as costs for demolition and remediation are not eligible for AIP funding.
Cost Estimate: $1,317,100
Funding Eligibility: F/S – 80 percent, A/L – 20 percent, P – 0 Percent

Project #33: Relocate ASOS
Description: As described in Chapter Five, the existing airport surface observation system (ASOS) broadcast, pilot-controlled lighting (PCL) system is difficult to tune into and is often sporadic. As such, this project is for the construction of a tower for the ASOS and PCL equipment.
Cost Estimate: $90,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #34: Conduct Environmental Assessment for Runway 1-19 Extension
Description: Prior to extending Runway 1-19, this project is for the environmental documentation required for the runway extension and property acquisition.
Cost Estimate: $165,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #35: Acquire Approximately 47.6 Acres (Including the Residential Property) and Relocate Portions of South Riverside Drive and 265th Street
Description: Similar to Project #25, the airport must remove all incompatibilities within the ultimate RPZ serving an extended runway. Prior to the extension of Runway 1-19, the airport should acquire approximately 46.6 acres and residential property within the ultimate RPZ serving Runway 1 as well as approximately one acre to accommodate the ultimate holding bay serving the Runway 1 threshold. Additionally, portions of South Riverside Drive and 265th Street should be relocated out of the ultimate Runway 1 RPZ.
Cost Estimate: $2,404,900
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #36: Construct 1,299' Runway 1-19/Taxiway A Extension and Hold Bay (Includes Relocation of the PAPI-4 and MALSR)
Description: As previously discussed in Chapter Five, additional runway length could benefit larger and faster business jet operators and regional transport aircraft by making the airport more accessible during hot summer months, providing the opportunity for aircraft to depart with more fuel, allowing for longer stage lengths and an increase in usable payload. Additional runway length would also improve landing situations for business jets and regional transport aircraft operating under Part 91k or Part 135, especially during wet or contaminated runway conditions. As such, the recommended plan includes extending Runway 1-19 by 1,299 feet to an ultimate length of 7,000 feet. This project also includes an extension of Taxiway A, construction of an aircraft hold bay, and relocation of the PAPI-4 and medium intensity approach lighting system with runway alignment indicator lights (MALSR) to serve the ultimate Runway 1.
Cost Estimate: $6,472,200
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #37: Construct Two 6-Unit Linear Box Hangars, Supporting Pavement, Access Taxiways, and Automobile Access
Description: Should demand warrant, this project is for the construction of two six-unit linear box hangars located on the east side of Runway 1-19, near the Runway 19 threshold. These hangars could be accessed by a western roadway extension of Kitty Hawk Drive through a controlled access gate.
Cost Estimate: $8,607,100
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Project #38: Construct Ultimate Parallel Taxiway B and Connectors and Remove Portions of Existing Taxiways B, B1, and B2
Description: Identified in Chapter Three, there are multiple taxiway geometry deficiencies associated with the quasi-parallel Taxiway B and the Taxiway B1 and B2 connectors. As such, this project is for the relocation of Taxiway B to serve as a full-length parallel taxiway serving Runway 13-31. At the time of construction, the Taxiway B1 and B2 connectors should be decoupled from the stub connectors providing access from the apron area to Taxiway B, eliminating direct access.
Cost Estimate: $1,883,000
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #39: Construct Southwest GA Apron Area and Access Taxiways
Description: If the airport experiences continued demand for apron and hangar space, this project is for the construction of approximately 53,000 sy of additional apron area and access taxiways serving the southwest GA development area.
Cost Estimate: $8,775,500
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #40: Construct Two 125' x 200' Conventional Hangars and Automobile Parking and Access
Description: This project is the continued development of the southwest GA development area and includes the construction of two large clear-span 125- by 200-foot conventional hangars, as well as automobile parking and access provided via South Riverside Drive.
Cost Estimate: $18,434,000
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Project #41: Implement Two 12,500-Gallon Fuel Tanks with 100LL and Jet A Self-Service Capability
Description: Given that the southwest development area is somewhat removed from the terminal area, this project considers the implementation of two 12,500-gallon above-ground fuel tanks, providing 100LL and Jet A fuel with self-service capability via credit card reader.
Cost Estimate: $1,198,300
Funding Eligibility: F/S – 90 percent, A/L – 10 percent, P – 0 Percent

Project #42: Construct One 125' x 200' Conventional Hangar, Two 100' x 100' Conventional Hangars, and Automobile Parking
Description: To complete the hangar development proposed along the western edge of the southwest apron, this project is for the construction of one 125- by 200-foot and two 100- by 100-foot conventional hangars and automobile parking.
Cost Estimate: $16,202,600
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Project #43: Construct Eight 12-Unit T-Hangars, Supporting Pavement, Access Taxiway, and Automobile Access
Description: Should the airport experience continued demand for T-hangar storage, this project includes the construction of eight 12-unit T-hangars and taxiway access from Taxiway A. Automobile access is provided from the Sigler access road through a controlled access gate near the T-hangars to prevent unauthorized access.
Cost Estimate: $23,332,400
Funding Eligibility: F/S – 0 percent, A/L – 0 percent, P – 100 Percent

Long-Term Program Summary

The total costs associated with the long-term program are estimated at $105.0 million. Of this total, approximately $27.9 million could be eligible for federal or state funding, while the airport or local matching share is approximately $3.2 million. The remaining private share is projected at $73.9 million.

CAPITAL IMPROVEMENT PROGRAM SUMMARY

The list of projects needed to accomplish the vision for AMW has been prioritized and cost estimates have been developed. Projects considered for the short-term planning horizon (years 0-5) have been divided into yearly increments. Projects considered for the intermediate (years 6-20) and long term (beyond 20-years) have been prioritized and grouped together. **The grouping of projects is necessary to provide the needed flexibility for the airport to adjust as necessary. In addition, on an annual basis, the airport and FAA assemble and review a five-year CIP. Therefore, the list of projects and the prioritization of the projects can and likely will change in the future.**

The total CIP proposes approximately $142.1 million in airport development needs. It is important to note that this total has been inflated at three percent per year throughout the intermediate- and long-term planning horizons to account for inflation and the rising costs of construction. Of this total, approximately $36.9 million could be eligible for federal or state funding assistance. The airport or local funding estimate for the proposed CIP is approximately $4.4 million and the estimated project costs to be funded through private funding mechanisms is estimated at $100.8 million. The private funding estimate is largely driven by the construction costs of hangar development. It should be clearly stated that costs associated with hangar development will likely be offset by the airport in pursuing private developers for hangar construction. Nevertheless, the CIP can serve as a road map of airport improvements to help guide the City of Ames, IDOT, and the FAA.

Table 6B presents AMW's pro forma cash flow for the long-term planning horizon based on the existing balance of the city's airport construction fund as well as projections of airport revenues, annual non-primary entitlement (NPE) funds, and the airport or local share required to fund the CIP. Based upon financial data provided by airport management, the airport has historically averaged $45,500 in annual net revenue. As a conservative measure, this level of net airport revenue has been held constant into the future for purposes of the pro forma cash flow analysis. However, actual future airport revenues may differ as airport demand could slow or revenue enhancing projects could be undertaken to increase revenue over time and are not accounted for in this analysis. This table shows the projected airport construction fund balance, when considering a constant projected airport revenue of $45,500, NPE funding of $150,000 on an annual basis, and the airport or local share of the anticipated CIP projects.

TABLE 6B Pro Forma Cash-Flow Ames Municipal Airport				
	Projected Average Net Airport Revenue	Non-Primary Airport Entitlement Funds	Less: Airport or Local Share of CIP Projects	Airport Construction Fund Balance
2020	$ -	$ -	$ -	**$306,627**
2021	$45,500	$150,000	$(196,233)	**$305,894**
2022	$45,500	$150,000	$(30,000)	**$471,394**
2023	$45,500	$150,000	$(58,906)	**$607,988**
2024	$45,500	$150,000	$ -	**$803,488**
2025	$45,500	$150,000	$(26,601)	**$972,387**
Intermediate-Term	$682,500	$2,250,000	$(874448)	**$3,030,439**
Long-Term	-	-	$(3,224,674)	**-**
Source: City of Ames Financial Records; Coffman Associates Analysis				

Considering the existing airport construction fund balance of $306,627, the city or airport is able to fund the entirety of the airport or local share of short-term CIP. Based upon this analysis, the airport construction fund could accumulate nearly $1.0 million by the end of the short-term planning horizon to utilize for airport related projects and FAA or IDOT grant matches. By the end of the intermediate-term (years 6-20) planning horizon, the airport or local funding requirements total nearly $900,000. According to these assumptions, the airport construction fund could grow to over $3.0 million by the end of the intermediate term. **Given the undetermined length of the long-term planning horizon for the CIP, the cash flow analysis could not be completed for all projects listed. However, it can be assumed that the airport will undertake proposed projects as necessary as demands and funding sources dictate.** Should a funding shortfall arise, there are several actions AMW could pursue to meet the financial requirements of the intermediate and long-term CIP, some of which are presented as follows:

- Re-phase certain projects in the CIP, moving them to years when AMW can afford the airport or local share of the CIP.
- Identify another funding source for the projects in the CIP currently assigned to the airport or local share.
- Obtain additional aviation services or other mechanisms to increase annual airport revenues.

CAPITAL IMPROVEMENT FUNDING SOURCES

There are generally four sources of funds used to finance airport capital development projects: airport revenues, revenue/general obligation bonds, federal/state/local grants, and passenger facility charges (PFCs), which are reserved for commercial service airports. Access to these sources of financing varies widely among airports, with some large airports maintaining substantial cash reserves and most small commercial service and general aviation airports often requiring subsidies from their sponsors (local and state governments) to fund operating expenses and to finance modest improvements.

Financing capital improvements at AMW will not rely solely on the financial resources of the City of Ames. Capital improvement funding is available through various grant-in-aid programs on the federal and state levels. While more federal funding could be available during some years, the CIP for this master plan was developed with project phasing to appropriately space projects. The following discussion outlines key sources of funding potentially available for capital improvements at the airport.

FEDERAL GRANTS

Through federal legislation over the years, various grant-in-aid programs have been established to develop and maintain a system of public use airports across the United States. The purpose of this system and its federally based funding is to maintain national defense and to promote interstate commerce. Recent legislation affecting federal funding was enacted on February 17, 2012 and was titled, the *FAA Modernization and Reform Act of 2012*. The law authorized FAA appropriations (AIP) at $3.35 billion for fiscal years 2012 through 2015. In 2016, Congress passed legislation (H.R. 636, *FAA Extension, Safety, and Security Act of 2016*) amending the law to expire on September 30, 2017. Subsequently, Congress passed a bill (H.R. 3823, *Disaster Tax Relief and Airport and Airway Extension Act of 2017*) authorizing appropriations to the FAA through March 31, 2018, and the *Consolidated Appropriations Act, 2018*, extended FAA's funding and authority through September 30, 2018. In October 2018, Congress passed legislation entitled, *FAA Reauthorization Act of 2018*, which will fund the FAA's AIP at $3.35 billion annually until 2023.

Several projects identified in the CIP are eligible for FAA funding through the AIP, which provides entitlement funds to airports based, in part, on their annual enplaned passengers and pounds of landed cargo weight. Additional AIP funds, designated as discretionary, may also be used for eligible projects based on the FAA's national priority system. Although the AIP has been reauthorized several times and the funding formulas have been periodically revised to reflect changing national priorities, the program has remained essentially the same. Public use airports that serve civil aviation, like AMW, may receive AIP funding for eligible projects, as described in FAA's *Airport Improvement Program Handbook.* The airport must fund the remaining project costs using a combination of other funding sources, as discussed further below.

Eligible airports, which include those in the *National Plan of Integrated Airport Systems* (NPIAS), such as AMW, can apply for airport improvement grants. **Table 6C** presents the approximate distribution of the AIP funds as described in FAA Order 5100.38D, Change 1, *Airport Improvement Program Handbook*, issued February 26, 2019. Currently, the airport is eligible to apply for grants which may be funded through several categories.

Funding for AIP-eligible projects is undertaken through a cost-sharing arrangement in which the FAA share varies by airport size and is generally 75 percent for large and medium hub airports and 90 percent for all other airports. As a regional general aviation airport, the federal share of eligible capital improvement projects for AMW is 90 percent. In exchange for this level of funding, the airport sponsor is required to meet various Grant Assurances, including maintaining the improvement for its useful life, usually 20 years.

TABLE 6C Federal AIP Funding Distribution		
Funding Category	**Percent of Total**	**Funds***
Apportionment/Entitlement		
Passenger Entitlements	27.01%	$904,840,000
Cargo Entitlements	3.50%	$117,250,000
Alaska Supplemental	0.67%	$22,450,000
Nonprimary Entitlements	12.01%	$402,340,000
State Apportionment	7.99%	$267,670,000
Carryover	22.85%	$765,480,000
Small Airport Fund		
Small Hubs	2.33%	$78,060,000
Nonhubs	4.67%	$156,450,000
Nonprimary (GA and Reliever)	9.33%	$312,560,000
Discretionary		
Capacity/Safety/Security/Noise	4.36%	$146,060,000
Pure Discretionary	1.45%	$48,580,000
Set Asides		
Noise and Environmental	3.37%	$112,900,000
Military Airports Program	0.39%	$13,070,000
Reliever	0.06%	$2,010,000
Totals	100.00%	$3,350,000,000

* FAA *Modernization and Reform Act of 2018*
AIP: Airport Improvement Program
Source: FAA Order 5100.38D, Change 1, Airport Improvement Program Handbook

AIP funds are sourced from the Aviation Trust Fund, which was established in 1970 to provide funding for aviation capital investment programs (aviation development, facilities and equipment, and research and development). The Aviation Trust Fund also finances the operation of the FAA and is funded by user fees, including taxes on airline tickets, aviation fuel, and various aircraft parts.

Apportionment (Entitlement) Funds

AIP provides funding for eligible projects at airports through an apportionment (entitlement) program. Non-primary airports included in the NPIAS, such as AMW, can receive up to $150,000 each year in non-primary entitlement (NPE) funds. These funds can be carried over and combined for up to four years, thereby allowing for completion of a more expensive project.

The FAA also provides a state apportionment based on a federal formula that considers area and population. The FAA then distributes these funds for projects at various airports throughout the state.

Small Airport Fund

If a large or medium hub commercial service airport chooses to institute a passenger facility charge (PFC), which is a fee of up to $4.50 on each airline ticket for funding of capital improvement projects, then their apportionment is reduced. A portion of the reduced apportionment goes to the small airport fund. The small airport fund is reserved for small-hub primary commercial service airports, nonhub commercial service airports, reliever, and general aviation airports. As a regional general aviation airport, AMW is eligible for funds from this source.

Discretionary Funds

In a number of cases, airports face major projects that will require funds in excess of the airport's annual entitlements. Thus, additional funds from discretionary apportionments under AIP become desirable. The primary feature about discretionary funds is that they are distributed on a priority basis. The priorities are established by the FAA, utilizing a priority code system. Under this system, projects are ranked by their purpose. Projects ensuring airport safety and security are ranked as the most important priorities, followed by maintaining current infrastructure development, mitigating noise and other environmental impacts, meeting standards, and increasing system capacity.

It is important to note that competition for discretionary funding is not limited to airports in the State of Iowa or those within the FAA Central Region. **The funds are distributed to all airports in the country and, as such, are more difficult to obtain as competition for these grants is high. High priority projects will often fare favorably, while lower priority projects may not receive discretionary grants.**

Set-Aside Funds

Portions of AIP funds are set-asides designed to achieve specific funding minimums for noise compatibility planning and implementation, select former military airfields (Military Airports Program), and select reliever airports. AMW is not eligible for this funding category as a regional general aviation airport.

FAA Facilities and Equipment (F&E) Program

The Airway Facilities Division of the FAA administers the Facilities and Equipment (F&E) Program. This program provides funding for the installation and maintenance of various navigational aids and equipment of the national airspace system. Under the F&E program, funding is provided for FAA airport traffic control towers (ATCTs), en route navigational aids, on-airport navigational aids, and approach lighting systems.

While F&E still installs and maintains some navigational aids, on-airport facilities at general aviation airports have not been a priority. Therefore, airports often request funding assistance for navigational aids through AIP and then maintain the equipment on their own[1].

IOWA AIRPORT IMPROVEMENT PROGRAM

The State of Iowa recognizes the valuable contribution to the state's transportation economy that airports make. Therefore, IDOT administers two major categories of state aviation funding: the Airport

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[1] Guidance on the eligibility of a project for federal AIP grant funding can be found in FAA Order 5100.38D, *Airport Improvement Program Handbook*, which can be accessed at:
http://www.faa.gov/airports/aip/aip_handbook/media/AIP-Handbook-Order-5100-38D

Improvement Program and the Vertical Infrastructure programs. Funding allocation for the programs and project selection are approved by the Iowa Transportation Commission.

Airport Improvement Program

The Airport Improvement Program, funded by the State Aviation Fund, includes aviation safety programs and aviation planning and development programs. These programs assist airports and IDOT in preserving and enhancing the air transportation system in Iowa. The categories of funding are:

Aviation Safety

- Immediate Safety Enhancements (ISE): This program is intended to assist airports with repairs to safety-related equipment and infrastructure that may malfunction or become damaged outside of the typical grant application process. Typical projects include airport lighting, communication equipment, navigational aids, obstruction removal, and pavement repair. The state share is 70 percent, with a maximum grant of $10,000.

- Wildlife Mitigation: This program is intended to assist airports in mitigating and removing wildlife from airports to reduce the potential for wildlife strikes. An initial Wildlife Hazard Assessment is required. Eligible projects include wildlife harassment and control. The state share is 85 percent.

Aviation Planning and Development

- Airport Development Grants: This grant program aids airport sponsors in the preservation and development of the airfield and related infrastructure. Eligible projects include runway, apron, taxiway construction and rehabilitation; pavement maintenance; drainage; obstruction removal; signage and lighting; hangar and terminal renovations; navigation and communication aids; land acquisition; fuel facilities; certain security-related projects; and certain planning studies. The state share is up to 85 percent, with a minimum grant of $5,000. The provision of additional local share increases the prioritization of the project.

- Air Service Development – Sustainment: This program aims to sustain and/or increase capture rates of existing demand through ongoing marketing and educational programs. Eligible projects include ongoing marketing and educational programs; leverage of local and federal funds in the collection of data, additional studies, or matching funds for federal grants, such as the Small Community Air Service Development Program. The state share is 80 percent with a grant maximum of $28,000.

- Air Service Development – Enhancement: This program is available when opportunities arise that may require financial incentives or market entry support. Eligible projects include incentives or other support for service on new routes, entry of a new carrier into the market, and increasing seat capacity or flight frequencies. The state share will vary, and a significant local share is expected.

- Land Use Planning and Zoning: This program is designed to encourage airports, cities, and counties to enact airport zoning that protects compatible land uses near airports. Eligible projects include updating existing airport zoning or development of new airport zoning. The state share is up to 85 percent with a maximum grant of $25,000.

Vertical Infrastructure Programs

Vertical infrastructure programs assist airports in preserving and enhancing vertical infrastructure at the airports. Vertical infrastructure funding for general aviation and commercial service airports depends on annual appropriations from the Rebuild Iowa Infrastructure Fund and/or Restricted Capital Accounts.

General Aviation Vertical Infrastructure Program (GAVI)

- This program provides for the preservation and development of the vertical infrastructure at general aviation airports. Eligible projects include landside construction and major renovation of airport terminals, hangars, maintenance buildings, and fuel facilities. The state share is up to 85 percent with a minimum grant of $5,000. The provision of additional local share increases the prioritization of the project. Maximum cap may vary depending on funding availability.

Commercial Service Vertical Infrastructure Program (CSVI)

- This program provides for the preservation and development of the vertical infrastructure at commercial service airports. Eligible projects include landside construction and renovation of airport terminals, hangars, maintenance buildings, and fuel facilities. No local match is required. Funds are distributed to the commercial service airports by a 50/40/10 formula: one-half of the funds are allocated equally between each airport; 40 percent of the funds are allocated based on the percentage of enplaned passengers at each airport versus the total number of enplaned passengers in the state; and 10 percent of the funds are allocated based on the percentage of the air cargo tonnage at each airport versus the total tonnage in the state. Given AMW's status as an enhanced service airport within the *Iowa Aviation System Plan (2010-2013)*, the airport is not eligible for funding through the CSVI program.

LOCAL FUNDING

The balance of project costs, after consideration has been given to grants, must be funded through local resources. The goal for the operation of the airport is to generate ample revenues to cover all operating and maintenance costs, as well as the local matching share of capital expenditures. As with many airports, this is not always possible and other financial methods will be needed.

Although state funding could be provided to AMW via the State Aviation or Rebuild Iowa Infrastructure Funds, statewide funding provided on an annual basis is limited. According to **Exhibit 6A**, state or local funding will be needed in each planning horizon. This includes a total of $311,740 in the short term, $874,448 in the intermediate term, and $3.2 million in the long term. As such, it will be imperative for the City of Ames to exercise local funding options to finance future growth at AMW. As previously mentioned, it is anticipated that the costs of hangar development will largely be sourced from private developers.

There are several local financing options to consider when funding future development at airports, including airport revenues, issuance of a variety of bond types, and leasehold financing. These strategies could be used to fund the local matching share or complete a project if grant funding cannot be arranged. Below is a brief description of the most common local funding options:

Leasehold/Third-Party Financing: Leasehold or third-party financing refers to a developer or tenant financing improvements under a long-term ground lease. The obvious advantage of such an arrangement is that it relieves the airport of all responsibility for raising the capital funds for improvements. Many airports use third-party funding when the planned improvements will primarily be used by a private business or other organization. Such projects are not ordinarily eligible for federal funding. Projects of this kind typically include hangars, fixed base operator facilities, fuel storage, exclusive aircraft parking aprons, industrial aviation use facilities, non-aviation office/commercial/industrial developments, and other similar projects. Private development proposals are considered on a case-by-case basis. Often, airport funds for infrastructure, preliminary site work, and site access are required to facilitate privately developed projects on airport property. The CIP anticipates third-party funding of approximately $100.8 million for several hangar construction projects, including conventional hangars, linear box, and T-hangars. In addition, lease revenue generated from third-party funded options is a potential revenue source.

Bonding: Bonding is a common method used to finance large capital projects at airports. A bond is an instrument of indebtedness of the bond issuer to the bond holders; thus, a bond is a form of loan or IOU. While bond terms are negotiable, typically the bond issuer is obligated to pay the bond holder interest at regular intervals and/or repay the principal later.

General Revenue: The operations of the airport generate revenues, which are secured by federal grant assurances to be utilized at the airport. All receipts, excluding bond proceeds or related grants and interest, are irrevocably pledged to the punctual payment of operating and maintenance expenses, payment of debt service for as long as bonds remain outstanding, or for additions or improvements to airport facilities.

All public use airports should establish standard basis rates for various leases. All lease rates should be set to adjust to a standard index, such as the Consumer Price Index, to assure that fair and equitable rates continue to be charged into the future. The condition and location of hangar space should also be considered when establishing the lease rates. Standard basis rates should be established for sponsor-owned hangars, terminal building office space, and ground leases. Fuel flowage fees and aircraft tie-down fees should also be uniform.

FUNDING AIRPORT OPERATIONS

The airport is operated by the City of Ames through the collection of various rates and charges from general aviation revenue sources. These revenues are generated specifically by airport operations. There are, however, restrictions on the use of revenues collected by the airport. All receipts, excluding bond proceeds or related grants and interest, are irrevocably pledged to the punctual payment of operating and maintenance expenses, payment of debt service for as long as bonds remain outstanding, or to additions or improvements to airport facilities.

Table 6D presents historical operating revenues and expenses for the airport from fiscal year (FY) 2015/16 to FY 2018/19. As presented in the table, charges for airport services is the largest revenue center for the airport. Over the past five years, Contractual Services have consistently been the highest expense for the airport.

TABLE 6D
Financial Information
Ames Municipal Airport

	FY 2014/15	FY 2015/16	FY 2016/17	FY 2017/18	FY 2018/19[1]
Revenues					
Charges for Services	123,716	126,002	130,468	153,852	167,621
Airport Farm	113,713	76,622	74,421	68,495	72,031
Total Revenues	**237,429**	**202,624**	**204,889**	**222,347**	**239,652**
Expenses					
Personal Services	54,919	62,143	35,198	41,565	33,505
Internal Services	-	-	-	35,804	30,218
Contractual Services	91,171	120,715	109,736	125,689	71,600
Commodities	3,745	4,489	1,626	12,394	11,900
Total Expenses	**149,835**	**187,347**	**146,560**	**215,452**	**147,223**
Net Income	**87,594**	**15,277**	**58,329**	**6,895**	**92,429**

[1]Adjusted budged for FY 2018/19
Source: City of Ames Financial Records

The operation of the airport generates revenues, which are secured by federal grant assurances, to be utilized only on the airport. While these revenues generated are significant, they are oftentimes not enough to fund both airport operating expenditures and capital improvement requirements. Most general aviation airports in the U.S. do not generate enough revenues to cover operating expenses. According to records, AMW has been fortunate enough to cover its expenses with operating revenues in recent years. As previously mentioned, airport management has reported an average historical net revenue of $45,500 for the airport. An operating profit, however, should not be taken for granted. All potential revenue sources, including community tax or bonding, should be considered to support future capital expenditures, if necessary.

To ensure the airport maximizes revenue potential in the future, AMW should periodically review aviation services rates and charges (i.e., ground lease rates, rental rates, etc.) at other airports to be sure that rates and charges at AMW are competitive and like aviation services at other airports. This can generate more opportunities for the city to establish other means of revenue collection or future rates and charges. Additionally, all new leases at the airport should have inflation clauses allowing for periodic rate increases in line with inflationary factors.

AIRPORT RATES AND CHARGES

The FAA places several stipulations on rates and charges establishment and collection; however, two primary considerations need to be addressed. First, the rates and charges must be fair, equally applied, and resemble fair market value. Second, the rates and charges collected must be returned to and used only by and/or for the airport. In other words, the revenues generated by airport operations cannot be diverted to the general use of the City of Ames. The FAA requires funds to be used at airports, as these funds are many times needed to either support the day-to-day operational costs or offset capital improvement costs.

The following provides several activities that enhance revenue production for an airport, some of which are currently being practiced at AMW.

Aircraft Parking/Tiedowns

Aircraft parking fees, also referred to as tiedown fees, are typically assessed to those aircraft utilizing a portion of an aircraft parking area that is owned by the airport. These fees are most generally assessed on a daily or monthly basis, depending upon the specific activity of a particular aircraft.

Aircraft parking fees can be established in several different ways. Typically, airports assess aircraft parking fees in accordance with an established schedule in which an aircraft within a designated weight and/or size pays a similar fee (i.e., small aircraft, single engine aircraft). Aircraft parking fees may also be charged according to a "cents per 1,000 pounds" basis in which larger aircraft with increased weights would obviously pay more for utilizing the aircraft parking apron. There are also instances in which aircraft parking fees are not assessed on an airport.

An airport sponsor may also include in a lease agreement with an aviation-related commercial operator at the airport to collect aircraft parking fees on portions of an aircraft parking apron in which the airport does not own or is leasing to a commercial operator, such as a SASO. As a result, the airport could directly collect parking fees from an aircraft utilizing this space or allow the commercial operator to collect the parking fee, in which the agreement may allow the commercial operator to retain a portion of the parking fee as an administrative or service fee.

As previously discussed, aircraft parking fees can be assessed on a daily or monthly basis. Daily aircraft parking fees are typically assessed to transient aircraft utilizing the airport on a short-term basis, while monthly fees are charged to aircraft that utilize a particular parking area for the permanent storage of their aircraft. Monthly aircraft parking fees are often assessed at airports that contain a waiting list for aircraft hangar storage space. It is also common practice at many airports to waive a daily aircraft parking fee in the event the aircraft purchases fuel prior to departing the airport.

Previous rates and charges analysis conducted by the consultant outside this study have indicated that daily aircraft parking fees can vary from $3 to $20 depending on the type of aircraft, and monthly aircraft parking fees can range between $20 to $230 per month depending on the type and size of the aircraft. At AMW, daily tiedowns are free and $10 per night. However, nightly tiedown fees are waived with the purchase of fuel. The current monthly tiedown rate is $50 per month.

Aircraft Storage Hangars

There are several types of aircraft storage hangars that can accommodate aircraft on an airport. In order to establish hangar fees, an airport typically factors in such qualities as hangar size, location, and utilities. Aircraft hangar fees are most often charged on a monthly basis.

Common aircraft storage hangars are typically categorized as shade hangars, T-hangars, and conventional hangars. Shade hangars consist of tiedown spaces with a protective roof covering. T-hangars provide for separate, single-aircraft storage areas. Conventional hangars provide a larger enclosed space that can accommodate larger multi-engine piston or turbine aircraft and/or multiple aircraft storage. Conventional hangars can also be utilized by aviation-related commercial operators for their business activities on an airport.

Location can also play a role in determining hangar rates. Aircraft storage hangars with direct access to improved taxiways/taxilanes and adjacent to aviation services being offered at an airport can oftentimes be more expensive to rent. In addition, the type of utility infrastructure being offered to the hangar can also help determine storage fees. Smaller aircraft storage hangars, such as a T-hangar or small box hangar, can either be granted access through a manual sliding door or electric door. It is common for hangars that provide electric doors to have higher rental fees, as the cost associated with constructing these hangars would exceed the cost associated with simpler structures.

At some airports, hangar facilities are constructed by the airport sponsor, while at other airports, hangars are built by private entities. In some cases, airports have both public and private hangar facilities available. Hangars can be expensive to construct and offer minimal return on investment in the short term. In order to amortize the cost of constructing hangars, lease rates should be developed at a minimum to recover development and finance costs.

T-hangars often range from $100 to $450 per month depending on several factors previously listed. Larger conventional-style hangars can be leased per aircraft space or for the entire hangar. Monthly rates similar to those for individual T-hangar units often apply to leased aircraft space in a conventional hangar.

At AMW, the city charges a lease/rental rate of $115 per month for T-hangars with sliding doors and $120 per month for T-hangars with bi-fold doors. Additionally, a large conventional transient hangar is also available for lease/rent at $0.13 cents per square foot on a daily basis or $7.00 per square foot on a monthly basis.

Ground Rental/Lease

Ground rentals can be applied to aviation and non-aviation development on an airport. Also known as a land lease, a ground lease can be structured to meet the particular needs of an airport operator in terms of location, terrain features, amount of land needed, and type of facility infrastructure included.

One of the single most valuable assets available to an airport is leasable land with access to the runway/taxiway system. For aviation-related businesses, it is critical that they be located on an airport. Airport property is available for long-term lease but, in most cases, it cannot be sold. At the expiration of the lease and any extensions, the improvements on the leased land revert back to the airport sponsor. In order for this arrangement to make financial sense, most ground leases are at least 20 years in length and include extension opportunities. Those who lease land on an airport are typically interested in constructing a hangar for their own private use, for sub-lease, or for operation of an airport business. Therefore, the long-term lease arrangement is important in order to obtain capital funding for the construction of a hangar or other type of facility. It should also be noted that ground leases should include the opportunity to periodically review the lease and adjust the rate according to the consumer price index (CPI). Typical lease agreements range from 20 to 30 years with options for extensions.

Ground leases are typically established on a yearly fee schedule based upon the amount of square feet leased. The amount charged can vary greatly depending on the level of improvements to the land. For example, undeveloped land with readily accessible utilities and taxiway access can generate more revenue than unimproved property. Previous surveys at other airports across the country conducted by the consultant have determined ground lease rates to range from $0.08 per square foot per year to approximately $1.00 per square foot per year. Typically, airports in larger metropolitan areas set land lease rates at approximately $0.25 cents per square foot per year. The current land lease rate at AMW is under city review. Over the next five years, the land lease rate for private hangars is planned to increase according to the CPI. The land lease rate set to take effect FY 2022/23 is planned at $0.278 cents per square foot and will increase on an annual basis thereafter based upon average CPI.

Some airports will have other leasable space available. For example, airports with a terminal building may have office or counter space available for aviation and non-aviation related businesses. Some example businesses could include SASOs, aircraft sales, flight instruction, aircraft insurance, and a restaurant. At AMW, Central Iowa Air Service, the FBO, currently leases the airport terminal building on an annual basis at $65,000 with yearly increases.

Under certain circumstances, an airport sponsor may utilize portions of the airport for non-aeronautical purposes, such as commercial and/or industrial development if certain areas are not needed to satisfy aviation demand or are not accessible to aviation activity. Prior to an airport pursuing a ground lease with a commercial operator for non-aeronautical purposes, the sponsor must formally request the FAA release the land in question from its federal obligations.

At present, AMW has approximately 435 acres of property that is not being utilized for aeronautical purposes. Of the 435 acres, approximately 306 acres are leased for agricultural purposes at an annual rate of $235 per acre.

Fuel Sales and Flowage

Fuel sales are typically managed at an airport in one of two ways: the airport sponsor acts as the fuel distributor or fueling operations are sub-contracted to a fixed-base operator (FBO). If the airport sponsor acts as the fuel distributor, then the airport would receive revenues equal to the difference between wholesale and retail prices. Of course, there are added expenses, such as employing people to fuel the aircraft.

When these services are undertaken by an FBO, which is the case at AMW, the airport sponsor typically receives a fuel flowage fee per gallon of fuel. By way of agreement with the airport sponsor, FBOs would be required to pay a fuel flowage fee for each gallon of fuel sold or received into inventory. In the case of self-fueling entities, a fuel flowage fee could apply for each gallon of fuel dispensed. Fuel flowage fees are typically paid on a "cents per gallon" basis. In some instances, fuel flowage fees will be established based upon the type of aviation activity. For example, commercial airline service operators may be assessed a higher fuel flowage fee than general aviation aircraft, or no fuel flowage fee at all if being assessed a landing fee (to be discussed in the next section). Fuel flowage fees can also be distinguished by type of fuel (100LL or Jet A). At AMW, the City of Ames receives a flat-rate fuel flowage fee of $0.08 per gallon. Previous surveys conducted by the consultant have determined fuel flowage rates to range from $0.10 per gallon to approximately $0.20 cents per gallon. As such, AMW should consider increasing the fuel flowage rate up to $0.15-$0.20 cents per gallon to maximize potential fuel flowage revenue.

The owner of the fuel farm can also be the airport sponsor or an FBO operator. If the airport sponsor owns the fuel farm and the FBO operator undertakes the fueling activities, then a separate fuel storage fee can be charged or a higher fuel flowage fee may be assessed.

Landing Fees

Landing fees typically only apply to larger aircraft, such as those over 60,000 pounds, for example, and only those involved in commercial airline or air taxi operations. Landing fees are not common on general aviation airports and are generally discouraged due to collection difficulty. Moreover, landing fees are somewhat discouraging to aircraft operators, who will many times elect to utilize a nearby airport that does not collect a landing fee.

When landing fees are assessed, they are most commonly based upon aircraft weight and a "cents per 1,000 pounds" approach. In addition, some airport sponsors may use a flat-fee approach wherein aircraft within a specified weight range are charged the same fee.

Landing fees may be collected directly by the airport sponsor, or an airport may have an agreement with a commercial operator to collect landing fees. Similar to what was discussed with aircraft parking fees, under this scenario, the agreement may allow the commercial operator, such as an FBO, to retain a portion of the landing fee as an administrative or service fee.

Like most general aviation airports, a landing fee has not been imposed at AMW. Unless industry practices significantly change in the future, the implementation of landing fees is discouraged.

MASTER PLAN IMPLEMENTATION

To implement the master plan recommendations, it is key to recognize that planning is a continuous process and does not end with approval of this document. The airport should implement measures that allow them to track various demand indicators, such as based aircraft, hangar demand, and operations. The issues that this master plan is based on will remain valid for several years. The primary goal is for AMW to best serve the air transportation needs of the region, while striving toward economic self-sufficiency.

The actual need for facilities is best established by activity levels rather than a specified date. For example, projections have been made as to when additional hangars and apron space may be needed at the airport. In reality, the timeframe in which the development is needed may be substantially different. Actual demand may be slower to develop than expected. On the other hand, high levels of demand may establish the need to accelerate development. **Although every effort has been made in this master planning process to conservatively estimate when facility development may be needed, aviation demand will dictate timing of facility improvements.**

In addition, numerous projects have been identified that will not depend on increased demand. These include enhancing airfield geometry and regular pavement maintenance.

The value of this study is keeping the issues and objectives at the forefront of the minds of managers and decision-makers. In addition to adjustments in aviation demand, when to undertake the improvements recommended in this master plan will impact how long the plan remains valid. **The format of this plan reduces the need for formal and costly updates by simply adjusting the timing of project implementation.** Updating can be done by the City of Ames, thereby improving the plan's effectiveness.

In summary, the planning process requires the City of Ames to consistently monitor the progress of the airport in terms of aircraft operations, based aircraft, and peaking characteristics. Analysis of aircraft demand is critical to the timing and need for new airport facilities. The information obtained from continually monitoring airport activity will provide the data necessary to determine if the development schedule should be accelerated or decelerated.

CITY OF Ames

AMES MUNICIPAL AIRPORT

APPENDIX A

GLOSSARY OF TERMS

Glossary of Terms

A

ABOVE GROUND LEVEL: The elevation of a point or surface above the ground.

ACCELERATE-STOP DISTANCE AVAILABLE (ASDA): See declared distances.

ADVISORY CIRCULAR: External publications issued by the FAA consisting of nonregulatory material providing for the recommendations relative to a policy, guidance and information relative to a specif c aviation subject.

AIR CARRIER: An operator which: (1) performs at least f ve round trips per week between two or more points and publishes f ight schedules which specify the times, days of the week, and places between which such f ights are performed; or (2) transports mail by air pursuant to a current contract with the U.S. Postal Service. Certif ed in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

AIRCRAFT: A transportation vehicle that is used or intended for use for f ight.

AIRCRAFT APPROACH CATEGORY: A grouping of aircraft based on 1.3 times the stall speed in their landing conf guration at their maximum certif cated landing weight. The categories 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.

AIRCRAFT OPERATION: The landing, takeoff, or touch-and-go procedure by an aircraft on a runway at an airport.

AIRCRAFT OPERATIONS AREA (AOA): A restricted and secure area on the airport property designed to protect all aspects related to aircraft operations.

AIRCRAFT OWNERS AND PILOTS ASSOCIATION: A private organization serving the interests and needs of general aviation pilots and aircraft owners.

AIRCRAFT RESCUE AND FIRE FIGHTING: A facility located at an airport that provides emergency vehicles, extinguishing agents, and personnel responsible for minimizing the impacts of an aircraft accident or incident.

AIRFIELD: The portion of an airport which contains the facilities necessary for the operation of aircraft.

AIRLINE HUB: An airport at which an airline concentrates a significant portion of its activity and which often has a significant amount of connecting traffic.

AIRPLANE DESIGN GROUP (ADG): A grouping of aircraft based upon wingspan. The groups are as follows:

- Group I: Up to but not including 49 feet.
- Group II: 49 feet up to but not including 79 feet.
- Group III: 79 feet up to but not including 118 feet.
- Group IV: 118 feet up to but not including 171 feet.
- Group V: 171 feet up to but not including 214 feet.
- Group VI: 214 feet or greater.

AIRPORT AUTHORITY: A quasi-governmental public organization responsible for setting the policies governing the management and operation of an airport or system of airports under its jurisdiction.

AIRPORT BEACON: A navigational aid located at an airport which displays a rotating light beam to identify whether an airport is lighted.

AIRPORT CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute funds for airport development and the needs of the National Airspace System to meet specif ed national goals and objectives.

AIRPORT ELEVATION: The highest point on the runway system at an airport expressed in feet above mean sea level (MSL).

AIRPORT IMPROVEMENT PROGRAM: A program authorized by the Airport and Airway Improvement Act of 1982 that provides funding for airport planning and development.

AIRPORT LAYOUT DRAWING (ALD): The drawing of the airport showing the layout of exis. ng and proposed airport facilities.

AIRPORT LAYOUT PLAN (ALP): A scaled drawing of the existing and planned land and facilities necessary for the operation and development of the airport.

AIRPORT LAYOUT PLAN DRAWING SET: A set of technical drawings depicting the current and future airport conditions. The individual sheets comprising the set can vary with the complexities of the airport, but the FAA-required drawings include the Airport Layout Plan (sometimes referred to as the Airport Layout Drawing (ALD), the Airport Airspace Drawing, and the Inner Portion of the Approach Surface Drawing, On-Airport Land Use Drawing, and Property Map.

AIRPORT MASTER PLAN: The planner's concept of the long-term development of an airport.

AIRPORT MOVEMENT AREA SAFETY SYSTEM: A system that provides automated alerts and warnings of potential runway incursions or other hazardous aircraft movement events.

AIRPORT OBSTRUCTION CHART: A scaled drawing depicting the Federal Aviation Regulation (FAR) Part 77 surfaces, a representation of objects that penetrate these surfaces, runway, taxiway, and ramp areas, navigational aids, buildings, roads and other detail in the vicinity of an airport.

AIRPORT REFERENCE CODE (ARC): A coding system used to relate airport design criteria to the operational (Aircraft Approach Category) to the physical characteristics (Airplane Design Group) of the airplanes intended to operate at the airport.

AIRPORT REFERENCE POINT (ARP): The latitude and longitude of the approximate center of the airport.

AIRPORT SPONSOR: The entity that is legally responsible for the management and operation of an airport, including the fulf llment of the requirements of laws and regulations related thereto.

AIRPORT SURFACE DETECTION EQUIPMENT: A radar system that provides air traffic controllers with a visual representation of the movement of aircraft and other vehicles on the ground on the airf eld at an airport.

AIRPORT SURVEILLANCE RADAR: The primary radar located at an airport or in an air traffic control terminal area that receives a signal at an antenna and transmits the signal to air traffic control display equipment def ning the location of aircraft in the air. The signal provides only the azimuth and range of aircraft from the location of the antenna.

AIRPORT TRAFFIC CONTROL TOWER (ATCT): A central operations facility in the terminal air traffic control system, consisting of a tower, including an associated instrument f ight rule (IFR) room if radar equipped, using air/ground communications and/or radar, visual signaling and other devices to provide safe and expeditious movement of terminal air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER: A facility which provides en route air traffic control service to aircraft operating on an IFR f ight plan within controlled airspace over a large, multi-state region.

AIRSIDE: The portion of an airport that contains the facilities necessary for the operation of aircraft.

AIRSPACE: The volume of space above the surface of the ground that is provided for the operation of aircraft.

AIR TAXI: An air carrier certif cated in accordance with FAR Part 121 and FAR Part 135 and authorized to provide, on demand, public transportation of persons and property by aircraft. Generally operates small aircraft "for hire" for specif c trips.

AIR TRAFFIC CONTROL: A service operated by an appropriate organization for the purpose of providing for the safe, orderly, and expeditious f ow of air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC): A facility established to provide air traffic control service to aircraft operating on an IFR f ight plan within controlled airspace and principally during the en route phase of f ight.

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER: A facility operated by the FAA which is responsible for the central f ow control, the central altitude reservation system, the airport reservation position system, and the air traffic service contingency command for the air traffic control system.

AIR TRAFFIC HUB: A categoriza. on of commercial service airports or group of commercial service airports in a metropolitan or urban area based upon the proportion of annual national enplanements existing at the airport or airports. The categories are large hub, medium hub, small hub, or non-hub. It forms the basis for the apportionment of entitlement funds.

AIR TRANSPORT ASSOCIATION OF AMERICA: An organization consisting of the principal U.S. airlines that represents the interests of the airline industry on major aviation issues before federal, state, and local government bodies. It promotes air transportation safety by coordinating industry and governmental safety programs and it serves as a focal point for industry efforts to standardize practices and enhance the efficiency of the air transportation system.

ALERT AREA: See special-use airspace.

ALTITUDE: The vertical distance measured in feet above mean sea level.

ANNUAL INSTRUMENT APPROACH (AIA): An approach to an airport with the intent to land by an aircraft in accordance with an IFR f ight plan when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude.

APPROACH LIGHTING SYSTEM (ALS): An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams by which the pilot aligns the aircraft with the extended centerline of the runway on his f nal approach and landing.

APPROACH MINIMUMS: The altitude below which an aircraft may not descend while on an IFR approach unless the pilot has the runway in sight.

APPROACH SURFACE: An imaginary obstruction limiting surface def ned in FAR Part 77 which is longitudinally centered on an extended runway centerline and extends outward and upward from the primary surface at each end of a runway at a designated slope and distance based upon the type of available or planned approach by aircraft to a runway.

APRON: A specif ed portion of the airf eld used for passenger, cargo or freight loading and unloading, aircraft parking, and the refueling, maintenance and servicing of aircraft.

AREA NAVIGATION: The air navigation procedure that provides the capability to establish and maintain a f ight path on an arbitrary course that remains within the coverage area of navigational sources being used.

AUTOMATED TERMINAL INFORMATION SERVICE (ATIS): The continuous broadcast of recorded non-control information at towered airports. Information typically includes wind speed, direction, and runway in use.

AUTOMATED SURFACE OBSERVATION SYSTEM (ASOS): A reporting system that provides frequent airport ground surface weather observation data through digitized voice broadcasts and printed reports.

AUTOMATIC WEATHER OBSERVATION STATION (AWOS): Equipment used to automatically record weather conditions (i.e. cloud height, visibility, wind speed and direction, temperature, dew point, etc.)

AUTOMATIC DIRECTION FINDER (ADF): An aircraft radio navigation system which senses and indicates the direction to a non-directional radio beacon (NDB) ground transmitter.

AVIGATION EASEMENT: A contractual right or a property interest in land over which a right of unobstructed f ight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a f xed point (as the observer's heading).

B

BASE LEG: A f ight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline. See "traffic pattern."

BASED AIRCRAFT: The general aviation aircraft that use a specif c airport as a home base.

BEARING: The horizontal direction to or from any point, usually measured clockwise from true north or magnetic north.

BLAST FENCE: A barrier used to divert or dissipate jet blast or propeller wash.

BLAST PAD: A prepared surface adjacent to the end of a runway for the purpose of elimina. ng the erosion of the ground surface by the wind forces produced by airplanes at the initiation of takeoff operations.

BUILDING RESTRICTION LINE (BRL): A line which identif es suitable building area locations on the airport.

C

CAPITAL IMPROVEMENT PLAN: The planning program used by the Federal Aviation Administration to identify, prioritize, and distribute Airport Improvement Program funds for airport development and the needs of the National Airspace System to meet specif ed national goals and objectives.

CARGO SERVICE AIRPORT: An airport served by aircraft providing air transportation of property only, including mail, with an annual aggregate landed weight of at least 100,000,000 pounds.

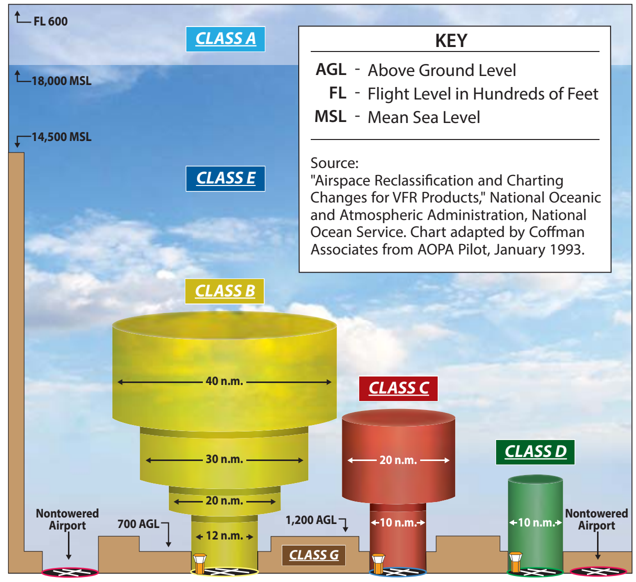
CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 200 feet above the horizontal plane containing the runway threshold.

CATEGORY II: An ILS that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 100 feet above the horizontal plane containing the runway threshold.

CATEGORY III: An ILS that provides acceptable guidance information to a pilot from the coverage limits of the ILS with no decision height specif ed above the horizontal plane containing the runway threshold.

CEILING: The height above the ground surface to the location of the lowest layer of clouds which is reported as either broken or overcast.

CIRCLING APPROACH: A maneuver initiated by the pilot to align the aircraft with the runway for landing when f ying a predetermined circling instrument approach under IFR.



CLASS A AIRSPACE: See Controlled Airspace.

CLASS B AIRSPACE: See Controlled Airspace.

CLASS C AIRSPACE: See Controlled Airspace.

CLASS D AIRSPACE: See Controlled Airspace.

CLASS E AIRSPACE: See Controlled Airspace.

CLASS G AIRSPACE: See Controlled Airspace.

CLEAR ZONE: See Runway Protection Zone.

COMMERCIAL SERVICE AIRPORT: A public airport providing scheduled passenger service that enplanes at least 2,500 annual passengers.

COMMON TRAFFIC ADVISORY FREQUENCY: A radio frequency identif ed in the appropriate aeronautical chart which is designated for the purpose of transmitting airport advisory information and procedures while operating to or from an uncontrolled airport.

COMPASS LOCATOR (LOM): A low power, low/medium frequency radio-beacon installed in conjunction with the instrument landing system at one or two of the marker sites.

CONICAL SURFACE: An imaginary obstruction-limiting surface def ned in FAR Part 77 that extends from the edge of the horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

CONTROLLED AIRPORT: An airport that has an opera. ng airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of def ned dimensions within which air traffic control services are provided to instrument f ight rules (IFR) and visual f ight rules (VFR) f ights in accordance with the airspace classif cation. Controlled airspace in the United States is designated as follows:

- **CLASS A**: Generally, the airspace from 18,000 feet mean sea level (MSL) up to but not including f ight level FL600. All persons must operate their aircraft under IFR.

- **CLASS B**:
Generally, the airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports. The conf guration of Class B airspace is unique to each airport, but typically consists of two or more layers of air space and is designed to contain all published instrument approach procedures to the airport. An air traff c control clearance is required for all aircraft to operate in the area.

- **CLASS C**: Generally, the airspace from the surface to 4,000 feet above the airport elevation (charted as MSL) surrounding those airports that have an operational control tower and radar approach control and are served by a qualifying number of IFR operations or passenger enplanements. Although individually tailored for each airport, Class C airspace typically consists of a surface area with a f ve nautical mile (nm) radius and an outer area with a 10 nautical mile radius that extends from 1,200 feet to 4,000 feet above the airport elevation. Two-way radio communication is required for all aircraft.

- **CLASS D**: Generally, that airspace from the surface to 2,500 feet above the air port elevation (charted as MSL) surrounding those airports that have an operational control tower. Class D airspace is individually tailored and conf gured to encompass published instrument approach procedure. Unless otherwise authorized, all persons must establish two-way radio communication.

- **CLASS E**: Generally, controlled airspace that is not classif ed as Class A, B, C, or D. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be conf gured to contain all instrument procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument f ight rules are required to establish two-way radio communication with air traffic control.

- **CLASS G**: Generally, that airspace not classif ed as Class A, B, C, D, or E. Class G airspace is uncontrolled for all aircraft. Class G airspace extends from the surface to the overlying Class E airspace.

CONTROLLED FIRING AREA: See special-use airspace.

CROSSWIND: A wind that is not parallel to a runway centerline or to the intended f ight path of an aircraft.

CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended f ight path of an aircraft.

CROSSWIND LEG: A f ight path at right angles to the landing runway off its upwind end. See "traffic pattern."

D

DECIBEL: A unit of noise representing a level relative to a reference of a sound pressure 20 micro newtons per square meter.

DECISION HEIGHT/ DECISION ALTITUDE: The height above the end of the runway surface at which a decision must be made by a pilot during the ILS or Precision Approach Radar approach to either continue the approach or to execute a missed approach.

DECLARED DISTANCES: The distances declared available for the airplane's takeoff runway, takeoff distance, accelerate-stop distance, and landing distance requirements. The distances are:

- **TAKEOFF RUNWAY AVAILABLE (TORA):** The runway length declared available and suitable for the ground run of an airplane taking off.

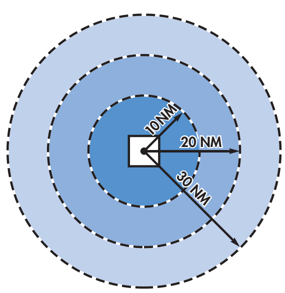
- **TAKEOFF DISTANCE AVAILABLE (TODA):** The TORA plus the length of any remaining runway and/or clear way beyond the far end of the TORA.
- **ACCELERATE-STOP DISTANCE AVAILABLE (ASDA):** The runway plus stopway length declared available for the accelera. on and deceleration of an aircraft aborting a takeoff.
- **LANDING DISTANCE AVAILABLE (LDA):** The runway length declared available and suitable for landing.

DEPARTMENT OF TRANSPORTATION: The cabinet level federal government organization consisting of modal operating agencies, such as the Federal Aviation Administration, which was established to promote the coordination of federal transportation programs and to act as a focal point for research and development efforts in transportation.

DISCRETIONARY FUNDS: Federal grant funds that may be appropriated to an airport based upon designation by the Secretary of Transportation or Congress to meet a specif ed national priority such as enhancing capacity, safety, and security, or mitigating noise.

DISPLACED THRESHOLD: A threshold that is located at a point on the runway other than the designated beginning of the runway.

DISTANCE MEASURING EQUIPMENT (DME): Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.



DNL: The 24-hour average sound level, in Aweighted decibels, obtained after the addition of ten decibels to sound levels for the periods between 10 p.m. and 7 a.m. as averaged over a span of one year. It is the FAA standard metric for determining the cumulative exposure of individuals to noise.

DOWNWIND LEG: A f ight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg. Also see "traffic pattern."

E

EASEMENT: The legal right of one party to use a portion of the total rights in real estate owned by another party. This may include the right of passage over, on, or below the property; certain air rights above the property, including view rights; and the rights to any specif ed form of development or activity, as well as any other legal rights in the property that may be specif ed in the easement document.

ELEVATION: The vertical distance measured in feet above mean sea level.

ENPLANED PASSENGERS: The total number of revenue passengers boarding aircraft, including originating, stop-over, and transfer passengers, in scheduled and nonscheduled services.

ENPLANEMENT: The boarding of a passenger, cargo, freight, or mail on an aircraft at an airport.

ENTITLEMENT: Federal funds for which a commercial service airport may be eligible based upon its annual passenger enplanements.

ENVIRONMENTAL ASSESSMENT (EA): An environmental analysis performed pursuant to the National Environmental Policy Act to determine whether an action would signif cantly affect the environment and thus require a more detailed environmental impact statement.

ENVIRONMENTAL AUDIT: An assessment of the current status of a party's compliance with applicable environmental requirements of a party's environmental compliance policies, practices, and controls.

ENVIRONMENTAL IMPACT STATEMENT (EIS): A document required of federal agencies by the National Environmental Policy Act for major projects are legislative proposals affecting the environment. It is a tool for decision-making describing the positive and negative effects of a proposed action and citing alternative actions.

ESSENTIAL AIR SERVICE: A federal program which guarantees air carrier service to selected small cities by providing subsidies as needed to prevent these cities from such service.

F

FEDERAL AVIATION REGULATIONS: The general and permanent rules established by the execu. ve departments and agencies of the Federal Government for aviation, which are published in the Federal Register. These are the aviation subset of the Code of Federal Regulations.

FEDERAL INSPECTION SERVICES: The provision of customs and immigration services including passport inspection, inspection of baggage, the collection of duties on certain imported items, and the inspections for agricultural products, illegal drugs, or other restricted items.

FINAL APPROACH: A f ight path in the direction of landing along the extended runway centerline. The f nal approach normally extends from the base leg to the runway. See "traffic pattern."

FINAL APPROACH AND TAKEOFF AREA (FATO). A def ned area over which the f nal phase of the helicopter approach to a hover, or a landing is completed and from which the takeoff is initiated.

FINAL APPROACH FIX: The designated point at which the f nal approach segment for an aircraft landing on a runway begins for a non-precision approach.

FINDING OF NO SIGNIFICANT IMPACT (FONSI): A public document prepared by a Federal agency that presents the rationale why a proposed action will not have a signif cant effect on the environment and for which an environmental impact statement will not be prepared.

FIXED BASE OPERATOR (FBO): A provider of services to users of an airport. Such services include, but are not limited to, hangaring, fueling, f ight training, repair, and maintenance.

FLIGHT LEVEL: A measure of altitude used by aircraft f ying above 18,000 feet. Flight levels are indicated by three digits representing the pressure altitude in hundreds of feet. An airplane f ying at f ight level 360 is f ying at a pressure altitude of 36,000 feet. This is expressed as FL 360.

FLIGHT SERVICE STATION: An operations facility in the national f ight advisory system which utilizes data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data and which provides pre-f ight and in-f ight advisory services to pilots through air and ground based communication facilities.

FRANGIBLE NAVAID: A navigational aid which retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft.

G

GENERAL AVIATION: That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certif cate of convenience and necessity, and large aircraft commercial operators.

GENERAL AVIATION AIRPORT: An airport that provides air service to only general aviation.

GLIDESLOPE (GS): Provides vertical guidance for aircraft during approach and landing. The glideslope consists of the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or

2. Visual ground aids, such as VASI, which provide vertical guidance for VFR approach or for the visual portion of an instrument approach and landing.

GLOBAL POSITIONING SYSTEM (GPS): A system of 48 satellites used as reference points to enable navigators equipped with GPS receivers to determine their latitude, longitude, and altitude.

GROUND ACCESS: The transportation system on and around the airport that provides access to and from the airport by ground transportation vehicles for passengers, employees, cargo, freight, and airport services.

H

HELIPAD: A designated area for the takeoff, landing, and parking of helicopters.

HIGH INTENSITY RUNWAY LIGHTS: The highest classif cation in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

HIGH-SPEED EXIT TAXIWAY: A long radius taxiway designed to expedite aircra. turning off the runway after landing (at speeds to 60 knots), thus reducing runway occupancy time.

HORIZONTAL SURFACE: An imaginary obstruction-limiting surface def ned in FAR Part 77 that is specif ed as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specif c horizontal dimensions of this surface are a function of the types of approaches existing or planned for the runway.

I

INITIAL APPROACH FIX: The designated point at which the initial approach segment begins for an instrument approach to a runway.

INSTRUMENT APPROACH PROCEDURE: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument f ight conditions from the beginning of the initial approach to a landing, or to a point from which a landing may be made visually.

INSTRUMENT FLIGHT RULES (IFR): Procedures for the conduct of f ight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to def ne weather conditions and the type of f ight plan under which an aircraft is operating.

INSTRUMENT LANDING SYSTEM (ILS): A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer.
2. Glide Slope.
3. Outer Marker.
4. Middle Marker.
5. Approach Lights.

INSTRUMENT METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specif c visibility and ceiling conditions that are less than the minimums specif ed for visual meteorological conditions.

ITINERANT OPERATIONS: Operations by aircraft that are not based at a specif ed airport.

K

KNOTS: A unit of speed length used in navigation that is equivalent to the number of nautical miles traveled in one hour.

L

LANDSIDE: The portion of an airport that provides the facilities necessary for the processing of passengers, cargo, freight, and ground transportation vehicles.

LANDING DISTANCE AVAILABLE (LDA): See declared distances.

LARGE AIRPLANE: An airplane that has a maximum certif ed takeoff weight in excess of 12,500 pounds.

LOCAL AREA AUGMENTATION SYSTEM: A differential GPS system that provides localized measurement correction signals to the basic GPS signals to improve navigational accuracy integrity, continuity, and availability.

LOCAL OPERATIONS: Aircraft operations performed by aircraft that are based at the airport and that operate in the local traffic pattern or within sight of the airport, that are known to be departing for or arriving from f ights in local practice areas within a prescribed distance from the airport, or that execute simulated instrument approaches at the airport.

LOCAL TRAFFIC: Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from the local practice areas, or aircraft executing practice instrument approach procedures. Typically, this includes touch and-go training operations.

LOCALIZER: The component of an ILS which provides course guidance to the runway.

LOCALIZER TYPE DIRECTIONAL AID (LDA): A facility of comparable utility and accuracy to a localizer, but is not part of a complete ILS and is not aligned with the runway.

LONG RANGE NAVIGATION SYSTEM (LORAN): Long range navigation is an electronic navigational aid which determines aircraft position and speed by measuring the difference in the time of reception of synchronized pulse signals from two f xed transmitters. Loran is used for en route navigation.

LOW INTENSITY RUNWAY LIGHTS: The lowest classif ca. on in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

M

MEDIUM INTENSITY RUNWAY LIGHTS: The middle classif cation in terms of intensity or brightness for lights designated for use in delineating the sides of a runway.

MICROWAVE LANDING SYSTEM (MLS): An instrument approach and landing system that provides precision guidance in azimuth, elevation, and distance measurement.

MILITARY OPERATIONS: Aircraft operations that are performed in military aircraft.

MILITARY OPERATIONS AREA (MOA): See special-use airspace

MILITARY TRAINING ROUTE: An air route depicted on aeronautical charts for the conduct of military f ight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The f ight route to be followed if, after an instrument approach, a landing is not affected, and occurring normally:

1. When the aircraft has descended to the decision height and has not established visual contact; or
2. When directed by air traffic control to pull up or to go around again.

MOVEMENT AREA: The runways, taxiways, and other areas of an airport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports with a tower, air traffic control clearance is required for entry onto the movement area.

N

NATIONAL AIRSPACE SYSTEM: The network of air traffic control facilities, air traffic control areas, and navigational facilities through the U.S.

NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS: The national airport system plan developed by the Secretary of Transportation on a biannual basis for the development of public use airports to meet national air transportation needs.

NATIONAL TRANSPORTATION SAFETY BOARD: A federal government organization established to investigate and determine the probable cause of transportation accidents, to recommend equipment and procedures to enhance transportation safety, and to review on appeal the suspension or revocation of any certif cates or licenses issued by the Secretary of Transportation.

NAUTICAL MILE: A unit of length used in navigation which is equivalent to the distance spanned by one minute of arc in latitude, that is, 1,852 meters or 6,076 feet. It is equivalent to approximately 1.15 statute mile.

NAVAID: A term used to describe any electrical or visual air navigational aids, lights, signs, and associated supporting equipment (i.e. PAPI, VASI, ILS, etc.)

NAVIGATIONAL AID: A facility used as, available for use as, or designed for use as an aid to air navigation.

NOISE CONTOUR: A continuous line on a map of the airport vicinity connecting all points of the same noise exposure level.

NON-DIRECTIONAL BEACON (NDB): A beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction f nding equipment can determine his or her bearing to and from the radio beacon and home on, or track to, the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

NON-PRECISION APPROACH PROCEDURE: A standard instrument approach procedure in which no electronic glide slope is provided, such as VOR, TACAN, NDB, or LOC.

NOTICE TO AIRMEN: A notice containing information concerning the establishment, condition, or change in any component of or hazard in the National Airspace System, the timely knowledge of which is considered essential to personnel concerned with f ight operations.

O

OBJECT FREE AREA (OFA): An area on the ground centered on a runway, taxiway, or taxilane centerline provided to enhance the safety of aircra. operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

OBSTACLE FREE ZONE (OFZ): The airspace below 150 feet above the established airport elevation and along the runway and extended runway centerline that is required to be kept clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ because of their function, in order to provide clearance for aircraft landing or taking off from the runway, and for missed approaches.

ONE-ENGINE INOPERABLE SURFACE: A surface emanating from the runway end at a slope ratio of 62.5:1. Air carrier airports are required to maintain a technical drawing of this surface depicting any object penetrations by January 1, 2010.

OPERATION: The take-off, landing, or touch-and-go procedure by an aircraft on a runway at an airport.

OUTER MARKER (OM): An ILS navigation facility in the terminal area navigation system located four to seven miles from the runway edge on the extended centerline, indicating to the pilot that he/she is passing over the facility and can begin f nal approach.

P

PILOT CONTROLLED LIGHTING: Runway lighting systems at an airport that are controlled by activating the microphone of a pilot on a specif ed radio frequency.

PRECISION APPROACH: A standard instrument approach procedure which provides runway alignment and glide slope (descent) information. It is categorized as follows:

- **CATEGORY I (CAT I)**: A precision approach which provides for approaches with a decision height of not less than 200 feet and visibility not less than 1/2 mile or Runway Visual Range (RVR) 2400 (RVR 1800) with operative touchdown zone and runway centerline lights.
- **CATEGORY II (CAT II)**: A precision approach which provides for approaches with a decision height of not less than 100 feet and visibility not less than 1200 feet RVR.
- **CATEGORY III (CAT III)**: A precision approach which provides for approaches with minima less than Category II.

PRECISION APPROACH PATH INDICATOR (PAPI): A lighting system providing visual approach slope guidance to aircraft during a landing approach. It is similar to a VASI but provides a sharper transition between the colored indicator lights.

PRECISION APPROACH RADAR: A radar facility in the terminal air traffic control system used to detect and display with a high degree of accuracy the direction, range, and elevation of an aircraft on the f nal approach to a runway.

PRECISION OBJECT FREE AREA (POFA): An area centered on the extended runway centerline, beginning at the runway threshold and extending behind the runway threshold that is 200 feet long by 800 feet wide. The POFA is a clearing standard which requires the POFA to be kept clear of above ground objects protruding above the runway safety area edge elevation (except for frangible NAVAIDS). The POFA applies to all new authorized instrument approach procedures with less than 3/4 mile visibility.

PRIMARY AIRPORT: A commercial service airport that enplanes at least 10,000 annual passengers.

PRIMARY SURFACE: An imaginary obstruction limiting surface def ned in FAR Part 77 that is specif ed as a rectangular surface longitudinally centered about a runway. The specif c dimensions of this surface are a function of the types of approaches existing or planned for the runway.
PROHIBITED AREA: See special-use airspace.

PVC: Poor visibility and ceiling. Used in determining Annual Service Volume. PVC conditions exist when the cloud ceiling is less than 500 feet and visibility is less than one mile.

R

RADIAL: A navigational signal generated by a Very High Frequency Omni-directional Range or VORTAC station that is measured as an azimuth from the station.

REGRESSION ANALYSIS: A statistical technique that seeks to identify and quantify the relationships between factors associated with a forecast.

REMOTE COMMUNICATIONS OUTLET (RCO): An unstaffed transmitter receiver/facility remotely controlled by air traffic personnel. RCOs serve f ight service stations (FSSs). RCOs were established to provide ground-to-ground communications between air traffic control specialists and pilots at satellite airports for delivering en route clearances, issuing departure authorizations, and acknowledging instrument f ight rules cancellations or departure/ landing times.

REMOTE TRANSMITTER/RECEIVER (RTR): See remote communications outlet. RTRs serve ARTCCs.

RELIEVER AIRPORT: An airport to serve general aviation aircraft which might otherwise use a congested air-carrier served airport.

RESTRICTED AREA: See special-use airspace.

RNAV: Area navigation - airborne equipment which permits f ights over determined tracks within prescribed accuracy tolerances without the need to overf y ground-based navigation facilities. Used en route and for approaches to an airport.

RUNWAY: A def ned rectangular area on an airport prepared for aircraft landing and takeoff. Runways are normally numbered in relation to their magnetic direction, rounded off to the nearest 10 degrees. For example, a runway with a magnetic heading of 180 would be designated Runway 18. The runway heading on the opposite end of the runway is 180 degrees from that runway end. For example, the opposite runway heading for Runway 18 would be Runway 36 (magnetic heading of 360). Aircraft can takeoff or land from either end of a runway, depending upon wind direction.

RUNWAY ALIGNMENT INDICATOR LIGHT: A series of high intensity sequentially f ashing lights installed on the extended centerline of the runway usually in conjunc. on with an approach lighting system.

RUNWAY DESIGN CODE: A code signif ying the design standards to which the runway is to be built.

RUNWAY END IDENTIFICATION LIGHTING (REIL): Two synchronized f ashing lights, one on each side of the runway threshold, which provide rapid and positive identif cation of the approach end of a particular runway.

RUNWAY GRADIENT: The average slope, measured in percent, between the two ends of a runway.

RUNWAY PROTECTION ZONE (RPZ): An area off the runway end to enhance the protection of people and property on the ground. The RPZ is trapezoidal in shape. Its dimensions are determined by the aircraft approach speed and runway approach type and minima.

RUNWAY REFERENCE CODE: A code signifying the current operational capabilities of a runway and associated taxiway.

RUNWAY SAFETY AREA (RSA): A def ned surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

RUNWAY VISIBILITY ZONE (RVZ): An area on the airport to be kept clear of permanent objects so that there is an unobstructed line of- site from any point f ve feet above the runway centerline to any point f ve feet above an intersecting runway centerline.

RUNWAY VISUAL RANGE (RVR): An instrumentally derived value, in feet, representing the horizontal distance a pilot can see down the runway from the runway end.

S

SCOPE: The document that identif es and def nes the tasks, emphasis, and level of effort associated with a project or study.

SEGMENTED CIRCLE: A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

SHOULDER: An area adjacent to the edge of paved runways, taxiways, or aprons providing a transi. on between the pavement and the adjacent surface; support for aircraft running off the pavement; enhanced drainage; and blast protection. The shoulder does not necessarily need to be paved.

SLANT-RANGE DISTANCE: The straight line distance between an aircraft and a point on the ground.

SMALL AIRCRAFT: An aircraft that has a maximum certif ed takeoff weight of up to 12,500 pounds.

SPECIAL-USE AIRSPACE: Airspace of def ned dimensions identif ed by a surface area wherein activities must be conf ned because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Special-use airspace classif cations include:

- **ALERT AREA**: Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft.
- **CONTROLLED FIRING AREA**: Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons or property on the ground.
- **MILITARY OPERATIONS AREA (MOA)**: Designated airspace with def ned vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument f ight rule (IFR) traffic and to identify for visual f ight rule (VFR) traffic where these activities are conducted.
- **PROHIBITED AREA**: Designated airspace within which the f ight of aircraft is prohibited.
- **RESTRICTED AREA**: Airspace designated under Federal Aviation Regulation (FAR) 73, within which the f ight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use. When not in use by the using agency, IFR/VFR operations can be authorized by the controlling air traffic control facility.
- **WARNING AREA:** Airspace which may contain hazards to nonparticipating aircraft.

STANDARD INSTRUMENT DEPARTURE (SID): A preplanned coded air traffic control IFR departure routing, preprinted for pilot use in graphic and textual form only.

STANDARD INSTRUMENT DEPARTURE PROCEDURES: A published standard f ight procedure to be utilized following takeoff to provide a transition between the airport and the terminal area or en route airspace.

STANDARD TERMINAL ARRIVAL ROUTE (STAR): A preplanned coded air traffic control IFR arrival routing, preprinted for pilot use in graphic and textual or textual form only.

STOP-AND-GO: A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point. A stop-and-go is recorded as two operations: one operation for the landing and one operation for the takeoff.

STOPWAY: An area beyond the end of a takeoff runway that is designed to support an aircraft during an aborted takeoff without causing structural damage to the aircraft. It is not to be used for takeoff, landing, or taxiing by aircraft.

STRAIGHT-IN LANDING/APPROACH: A landing made on a runway aligned within 30 degrees of the f nal approach course following completion of an instrument approach.

T

TACTICAL AIR NAVIGATION (TACAN): An ultrahigh frequency electronic air navigation system which provides suitably-equipped aircraft a continuous indication of bearing and distance to the TACAN station.

TAKEOFF RUNWAY AVAILABLE (TORA): See declared distances.

TAKEOFF DISTANCE AVAILABLE (TODA): See declared distances.

TAXILANE: The portion of the aircraft parking area used for access between taxiways and aircraft parking positions.

TAXIWAY: A def ned path established for the taxiing of aircraft from one part of an airport to another.

TAXIWAY DESIGN GROUP: A classif cation of airplanes based on outer to outer Main Gear Width (MGW) and Cockpit to Main Gear (CMG) distance.

TAXIWAY SAFETY AREA (TSA): A def ned surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

TERMINAL INSTRUMENT PROCEDURES: Published f ight procedures for conducting instrument approaches to runways under instrument meteorological conditions.

TERMINAL RADAR APPROACH CONTROL: An element of the air traffic control system responsible for monitoring the en-route and terminal segment of air traffic in the airspace surrounding airports with moderate to high levels of air traffic.

TETRAHEDRON: A device used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.

THRESHOLD: The beginning of that portion of the runway available for landing. In some instances the landing threshold may be displaced.

TOUCH-AND-GO: An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway. A touch-and go is recorded as two operations: one operation for the landing and one operation for the takeoff.

TOUCHDOWN: The point at which a landing aircraft makes contact with the runway surface.

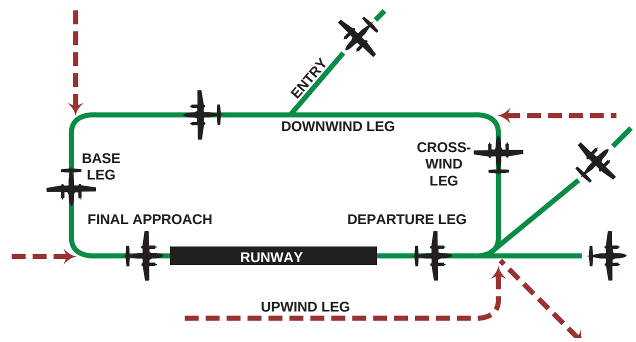
TOUCHDOWN AND LIFT-OFF AREA (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off.

TOUCHDOWN ZONE (TDZ): The f rst 3,000 feet of the runway beginning at the threshold.

TOUCHDOWN ZONE ELEVATION (TDZE): The highest elevation in the touchdown zone.

TOUCHDOWN ZONE (TDZ) LIGHTING: Two rows of transverse light bars located symmetrically about the runway centerline normally at 100- foot intervals. The basic system extends 3,000 feet along the runway.

TRAFFIC PATTERN: The traffic f ow that is prescribed for aircra. landing at or taking off from an airport. The components of a typical traffic pattern are the upwind leg, crosswind leg, downwind leg, base leg, and f nal approach.



U

UNCONTROLLED AIRPORT: An airport without an air traffic control tower at which the control of Visual Flight Rules traffic is not exercised.

UNCONTROLLED AIRSPACE: Airspace within which aircraft are not subject to air traffic control.

UNIVERSAL COMMUNICATION (UNICOM): A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOM's are shown on aeronautical charts and publications.

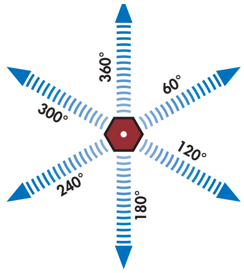
UPWIND LEG: A f ight path parallel to the landing runway in the direction of landing. See "traffic pattern."

V

VECTOR: A heading issued to an aircraft to provide navigational guidance by radar.

VERY HIGH FREQUENCY/ OMNIDIRECTIONAL RANGE (VOR): A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the national airspace system. The VOR periodically identif es itself by Morse Code and may have an additional voice identif cation feature.

VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE/ TACTICAL AIR NAVIGATION (VORTAC): A naviga. on aid providing VOR azimuth, TACAN azimuth, and TACAN distance-measuring equipment (DME) at one site.



VICTOR AIRWAY: A control area or portion thereof established in the form of a corridor, the centerline of which is def ned by radio navigational aids.

VISUAL APPROACH: An approach wherein an aircraft on an IFR f ight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

VISUAL APPROACH SLOPE INDICATOR (VASI): An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he is on path if he sees red/white, above path if white/white, and below path if red/red. Some airports serving large aircraft have three-bar VASI's which provide two visual guide paths to the same runway.

VISUAL FLIGHT RULES (VFR): Rules that govern the procedures for conducting f ight under visual conditions. The term VFR is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of f ight plan.

VISUAL METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specif c visibility and ceiling conditions which are equal to or greater than the threshold values for instrument meteorological conditions.

VOR: See "Very High Frequency Omnidirectional Range Station."

VORTAC: See "Very High Frequency Omnidirectional Range Station/Tactical Air Navigation."

W

WARNING AREA: See special-use airspace.

WIDE AREA AUGMENTATION SYSTEM: An enhancement of the Global Positioning System that includes integrity broadcasts, differential corrections, and additional ranging signals for the purpose of providing the accuracy, integrity, availability, and continuity required to support all phases of f ight.

Abbreviations

AC: advisory circular

ADF: automatic direction f nder

ADG: airplane design group

AFSS: automated f ight service station

AGL: above ground level

AIA: annual instrument approach

AIP: Airport Improvement Program

AIR-21: Wendell H. Ford Aviation Investment and Reform Act for the 21st Century

ALS: approach lighting system

ALSF-1: standard 2,400-foot high intensity approach lighting system with sequenced f ashers (CAT I conf guration)

ALSF-2: standard 2,400-foot high intensity approach lighting system with sequenced f ashers (CAT II conf guration)

AOA: Aircraft Operation Area

APV: instrument approach procedure with vertical guidance

ARC: airport reference code

ARFF: aircra.   rescue and f re f ghting

ARP: airport reference point

ARTCC: air route traffic control center

ASDA: accelerate-stop distance available

ASR: airport surveillance radar

ASOS: automated surface observation station

ATCT: airport traffic control tower

ATIS: automated terminal information service

AVGAS: aviation gasoline - typically 100 low lead (100LL)

AWOS: automatic weather observation station

BRL: building restriction line

CFR: Code of Federal Regulation

CIP: capital improvement program

DME: distance measuring equipment

DNL: day-night noise level

DWL: runway weight bearing capacity of aircraft with dual-wheel type landing gear

DTWL: runway weight bearing capacity of aircraft with dual-tandem type landing gear

FAA: Federal Aviation Administration

FAR: Federal Aviation Regulation

FBO: f xed base operator

FY: f scal year

GPS: global positioning system

GS: glide slope

HIRL: high intensity runway edge lighting

IFR: instrument f ight rules (FAR Part 91)

ILS: instrument landing system

IM: inner marker

LDA: localizer type directional aid

LDA: landing distance available

LIRL: low intensity runway edge lighting

LMM: compass locator at middle marker

LOM: compass locator at outer marker

LORAN: long range navigation

MALS: medium intensity approach lighting system with indicator lights

MIRL: medium intensity runway edge lighting

MITL: medium intensity taxiway edge lighting

MLS: microwave landing system

MM: middle marker

MOA: military operations area

MSL: mean sea level

NAVAID: navigational aid

NDB: nondirectional radio beacon

NM: nautical mile (6,076.1 feet)

NPES: National Pollutant Discharge Elimination System

NPIAS: National Plan of Integrated Airport Systems

NPRM: notice of proposed rule making

ODALS: omnidirectional approach lighting system

OFA: object free area

OFZ: obstacle free zone

OM: outer marker

PAC: planning advisory commi. ee

PAPI: precision approach path indicator

PFC: porous friction course

PFC: passenger facility charge

PCL: pilot-controlled lighting

PIW public information workshop

PLASI: pulsating visual approach slope indicator

POFA: precision object free area

PVASI: pulsating/steady visual approach slope indicator

PVC: poor visibility and ceiling

RCO: remote communications outlet

RRC: Runway Reference Code

RDC: Runway Design Code

REIL: runway end identif cation lighting

RNAV: area navigation

RPZ: runway protection zone

RSA: runway safety area

RTR: remote transmitter/receiver

RVR: runway visibility range

RVZ: runway visibility zone

SALS: short approach lighting system

SASP: state aviation system plan

SEL: sound exposure level

SID: standard instrument departure

SM: statute mile (5,280 feet)

SRE: snow removal equipment

SSALF: simplif ed short approach lighting system with runway alignment indicator lights

STAR: standard terminal arrival route

SWL: runway weight bearing capacity for aircraft with single-wheel tandem type landing gear

TACAN: tactical air navigational aid

TAF: Federal Aviation Administration (FAA) Terminal Area Forecast

TDG: Taxiway Design Group

TLOF: Touchdown and lift-off

TDZ: touchdown zone

TDZE: touchdown zone elevation

TODA: takeoff distance available

TORA: takeoff runway available

TRACON: terminal radar approach control

VASI: visual approach slope indicator

VFR: visual f ight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omni-directional range

VORTAC: VOR and TACAN collocated

CITY OF Ames

AMES MUNICIPAL AIRPORT

APPENDIX B

FORECAST LETTER

U.S. Department
of Transportation

**Federal Aviation
Administration**

Central Region
Iowa, Kansas
Missouri, Nebraska

901 Locust
Kansas City, Missouri 64106
(816) 329-2600

March 07, 2019

Mr. Damion Pregitzer
Traffic Engineer
Ames Municipal Airport
515 Clarke Ave
Ames, IA 50010

Dear Mr. Pregitzer:

Forecast/Critical Design Aircraft Approval
Ames Municipal (AMW), Ames, IA
AIP No. 3-19-0004-024-2018

The submitted Aviation Demand Forecast is Approved.

The existing Critical Design Aircraft, **B-II family**, is **Approved**. The proposed ultimate Critical Design Aircraft, **C-II family**, is **Approved**.

Please have the operations numbers updated on your 5010 Master Record to match the current year information from the forecast.

You may proceed with developing the remainder of the report and the Airport Layout Plan drawings. If you have any questions regarding this project, please call me at (816) 329-2637 or via email at jeff.deitering@faa.gov.

Sincerely,

Jeffrey D. Deitering, P.E.
Iowa State Planner

CC: Mike Dmyterko, Coffman Associates, Inc.
Shane Wright, Iowa Office of Aviation

CITY OF
Ames

AMES MUNICIPAL AIRPORT

APPENDIX C

AIRPORT LAYOUT PLANS

AIRPORT LAYOUT PLAN

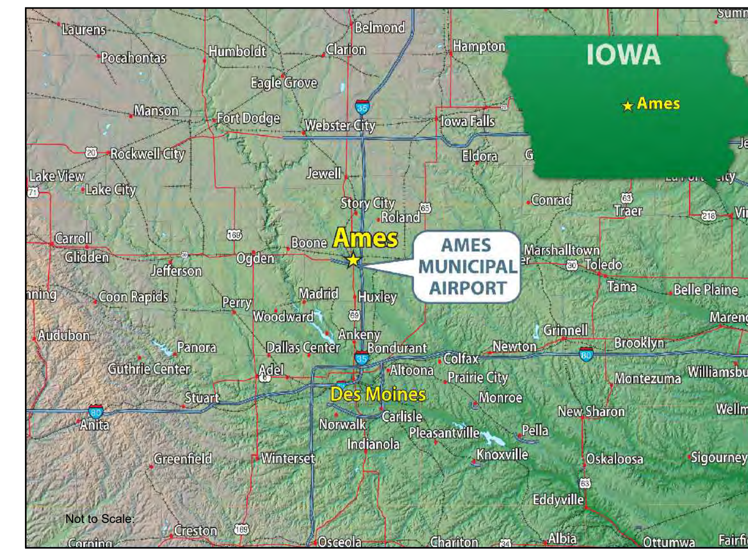
Prepared for

AMES MUNICIPAL AIRPORT

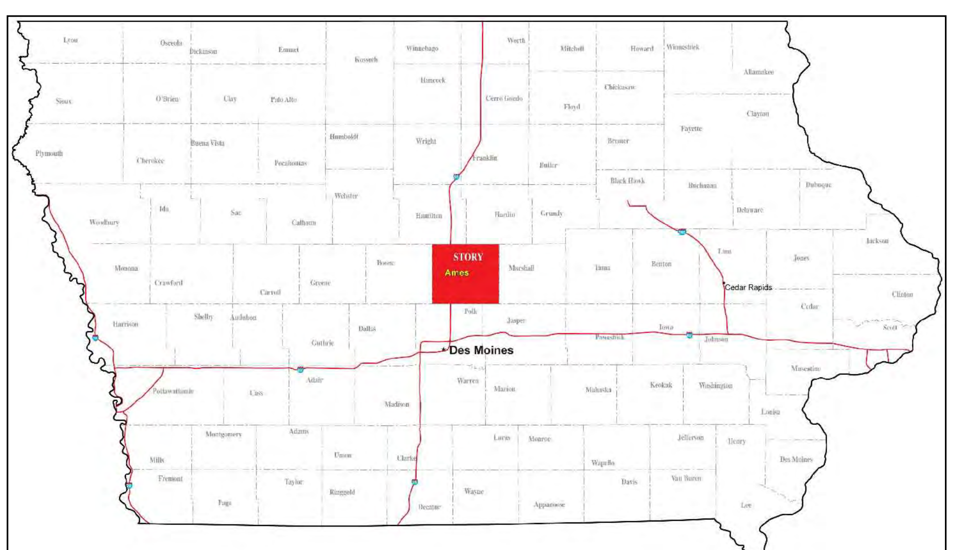
AMES, IOWA

VICINITY MAP

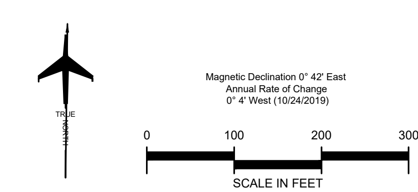
INDEX OF DRAWINGS



LOCATION MAP



COUNTY MAP



FOR APPROVAL BY

Airport Manager: Damion Pregitzer DATE:

NO.	REVISIONS	DATE	BY	APP'D.
	-			
	-			

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AMES MUNICIPAL AIRPORT

TITLE SHEET

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 1 OF 18

Coffman Associates
Airport Consultants
www.coffmanassociates.com

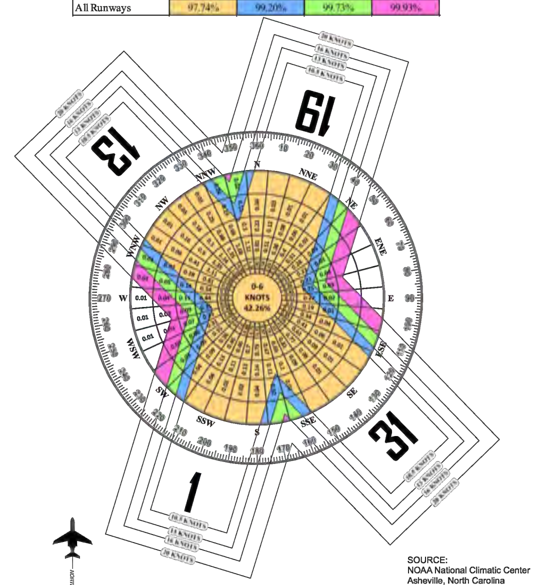
AIRPORT DATA		
OWNER: CITY OF AMES	CITY: AMES, IA	COUNTY: STORY, IA
AMES MUNICIPAL AIRPORT (AMW)	EXISTING	ULTIMATE
AIRPORT REFERENCE CODE (ARC)	B-II	C-II
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH	83.9° F (July)	SAME
AIRPORT ELEVATION (NAVD 88)	955.6' MSL	972.0' MSL
AIRPORT NAVIGATIONAL AIDS	ILS OR LOC RWY 1	ILS OR LOC RWY 1
	RNAV (GPS) RWY 1-19	RNAV (GPS) RWY 1-19
	RNAV (GPS) RWY 13-31	RNAV (GPS) RWY 13-31
	VOR RWY 31	VOR RWY 31
	MIRL, MITL	HIRL, MIRL, MITL
	MALSR	MALSR
	VASI-4	PAPI, REIL
AIRPORT REFERENCE POINT (ARP)	Latitude 41° 59' 31.40" N	41° 59' 27.19" N
COORDINATES (NAD 83)	Longitude 93° 37' 18.60" W	93° 37' 18.91" W
MISCELLANEOUS FACILITIES	Lighted Windcone	SAME
	ASOS	SAME
	Airport Beacon	SAME
CRITICAL DESIGN AIRCRAFT	B-II-2	C-II-2
CRITICAL DESIGN AIRCRAFT TYPE	King Air 300	Challenger 600
WINGSPAN OF DESIGN AIRCRAFT (FEET)	57.92'	64.33'
APPROACH SPEED OF DESIGN AIRCRAFT (KNOTS)	107 knots	125 knots
UNDERCARRIAGE WIDTH OF DESIGN AIRCRAFT (MGM)	17.17'	12.97'
MAGNETIC DECLINATION	42' East (November 2019)	SAME
SOURCE: https://www.ngdc.noaa.gov/geomag-web/	Annual Rate of Change 0° 4' West	SAME
NPIAS CODE	GA	SAME
STATE SYSTEM PLAN ROLE	Enhanced Service	SAME

MODIFICATIONS TO STANDARDS APPROVAL TABLE			
APPROVAL DATE	AIRSPACE CASE NUMBER	STANDARD MODIFIED	DESCRIPTION
		NONE REQUIRED	

RUNWAY DATA TABLE		RUNWAY 1-19				RUNWAY 13-31			
		EXISTING		ULTIMATE		EXISTING		ULTIMATE	
RUNWAY IDENTIFICATION		RUNWAY 1	RUNWAY 19	RUNWAY 1	RUNWAY 19	RUNWAY 13	RUNWAY 31	RUNWAY 13	RUNWAY 31
RUNWAY DESIGN CODE (RDC)		B-II-2400		C-II-2400		B-II-5000		SAME	
APPROACH REFERENCE CODE (APRC)		D/IV/2400, D/V/2400		SAME		B/II/5000		SAME	
DEPARTURE REFERENCE CODE (DPRC)		D/IV, D/V		SAME		B/II		SAME	
RUNWAY SURFACE MATERIAL		Asphalt		SAME		Concrete		SAME	
RUNWAY PAVEMENT STRENGTH WHEEL (IN THOUSAND LBS. #1)		30 (S), 38 (D)		30 (S), 60 (D)		30 (S)		SAME	
RUNWAY PAVEMENT STRENGTH PCN		N/A		SAME		N/A		SAME	
RUNWAY PAVEMENT SURFACE TREATMENT		NONE		SAME		NONE		SAME	
RUNWAY EFFECTIVE GRADIENT (in percent)		0.64%		0.76%		0.16%		0.08%	
RUNWAY WIND COVERAGE (20 KNOTS/23 MPH)		98.98%		SAME		99.59%		SAME	
RUNWAY DIMENSIONS (L X W)		5,701' x 100'		7,000' x 100'		3,491' x 75'		4,100' x 75'	
RUNWAY DISPLACED THRESHOLD		N/A	N/A	SAME	SAME	N/A	N/A	SAME	SAME
RUNWAY SAFETY AREA (Standard Beyond Runway End)		600' x 300'	600' x 300'	1,000' x 500'	1,000' x 500'	300' x 150'	300' x 150'	SAME	SAME
RUNWAY SAFETY AREA (Actual L x W)		6,901' x 300'		9,000' x 500'		4,091' x 150'		4,700' x 150'	
RUNWAY END COORDINATES (NAD 83)	LAT	41° 58' 57.72" N	41° 59' 51.69" N	41° 58' 45.43" N	SAME	41° 59' 54.66" N	41° 59' 29.77" N	SAME	41° 59' 25.42" N
	LONG	93° 37' 29.12" W	93° 37' 7.55" W	93° 37' 34.03" W	SAME	93° 37' 34.91" W	93° 37' 2.91" W	SAME	93° 36' 57.32" W
RUNWAY END ELEVATION		955.6' MSL	919.0' MSL	972.0' MSL	SAME	925.9' MSL	920.2' MSL	SAME	922.0' MSL
RUNWAY LIGHTING		MIRL		HIRL		MIRL		MIRL	
RUNWAY PROTECTION ZONE DIMENSIONS		1,000' x 2,500' x 1,750'	500' x 1,000' x 700'	1,000' x 2,500' x 1,750'	500' x 1,700' x 1,010'	500' x 1,000' x 700'	500' x 1,000' x 700'	SAME	SAME
RUNWAY MARKING		Precision	Nonprecision	SAME	SAME	Nonprecision	Nonprecision	SAME	SAME
14 CFR PART 77 APPROACH SLOPE		50:1 / 40:1	34:1	SAME	SAME	34:1	34:1	SAME	SAME
14 CFR PART 77 APPROACH CATEGORY/TYPE		PIR	NP-C	SAME	SAME	NP-C	NP-C	SAME	SAME
VISIBILITY MINIMUMS		1/2 mile	1 mile	SAME	SAME	1 mile	1 mile	SAME	SAME
TYPE OF AERONAUTICAL SURVEY REQUIRED FOR APPROACH		VG	VG	SAME	SAME	VG	VG	SAME	SAME
DEPARTURE SURFACE (YES/NO)		YES	YES	SAME	SAME	YES	YES	SAME	SAME
OBJECT FREE AREA (Standard Beyond Runway End)		600' x 800'	600' x 800'	1,000' x 800'	1,000' x 800'	300' x 500'	300' x 500'	SAME	SAME
OBJECT FREE AREA (Actual L x W)		6,901' x 800'		9,000' x 800'		4,091' x 500'		4,700' x 500'	
OBSTACLE FREE ZONE (Standard Beyond Runway End)		200' x 400'	200' x 400'	200' x 400'	SAME	200' x 400'	200' x 400'	SAME	SAME
OBSTACLE FREE ZONE (Actual L x W)		6,101' x 400'		7,400' x 400'		3,891' x 400'		4,500' x 400'	
OBSTACLE CLEARANCE SURFACE (EB 99, updated 2018)		Runway Type 5	Runway Type 4	SAME	SAME	Runway Type 4	Runway Type 4	SAME	SAME
INSTRUMENT APPROACH PROCEDURES		ILS OR LOC	N/A	ILS OR LOC	SAME	N/A	N/A	SAME	SAME
		RNAV (LPV)	RNAV (LPV)	RNAV (LPV)	SAME	RNAV (LPV)	RNAV (LPV)	SAME	RNAV (LPV)
							VOR		VOR
RUNWAY VISUAL NAVIGATIONAL AIDS		MALSR	N/A	SAME	SAME	N/A	N/A	SAME	SAME
		NONE	VASI-4	PAPI-4	PAPI-4	VASI-4	VASI-4	PAPI-4	PAPI-4
		NONE	NONE	NONE	REIL	NONE	NONE	REIL	REIL
TOUCHDOWN ZONE ELEVATION (TDZE)		955.6' MSL	937.4' MSL	972.0' MSL	SAME	929.3' MSL	929.3' MSL	SAME	929.1' MSL
TAXIWAY WIDTH (TDG)		35' TDG 2	35' TDG 2	SAME	SAME	35' TDG 2	35' TDG 2	SAME	SAME
TAXIWAY SAFETY AREA DIMENSIONS		79'		SAME		79'		SAME	
TAXIWAY AND TAXILANE OBJECT FREE AREA WIDTH		131' / 115'		SAME		131' / 115'		SAME	
TAXIWAY CENTERLINE TO FIXED OR MOVABLE OBJECT		65.5'		SAME		65.5'		SAME	
TAXIWAY LIGHTING		MITL		SAME		MITL		SAME	
TAXIWAY HOLDING MARKING/HOLDSIGN		250'		SAME		200'		SAME	
TAXIWAY EDGE SAFETY MARGIN		7.5'	7.5'	SAME	SAME	7.5'	7.5'	SAME	SAME
VERTICAL DATUM		NAVD 88		SAME		NAVD 88		SAME	
HORIZONTAL DATUM		NAD 83		SAME		NAD 83		SAME	

1 PAVEMENT STRENGTHS ARE EXPRESSED IN SINGLE (S), DUAL (D), DUAL TANDEM (2D) WHEEL LOAD CAPACITIES

ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 1-19	85.52%	91.92%	96.65%	98.98%
Runway 13-31	91.47%	95.52%	98.51%	99.59%
All Runways	97.74%	99.20%	99.75%	99.93%

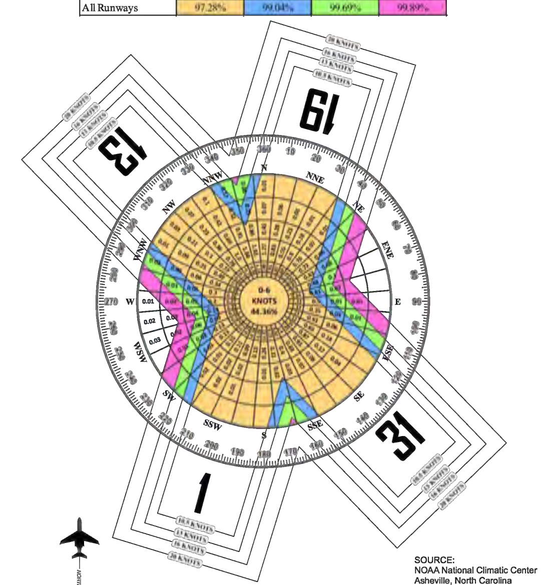


Magnetic Declination
00° 44' 00" East (Feb. 2019)
Annual Rate of Change
00° 04' 00" West (Feb. 2019)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Ames Municipal Airport
Ames, Iowa

OBSERVATIONS:
114,281 All Weather Observations
Jan. 1, 2009 - Dec. 31 2018

IFR WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 1/19	86.31%	91.92%	96.65%	98.74%
Runway 13/31	90.31%	94.77%	98.33%	99.59%
All Runways	97.28%	99.04%	99.69%	99.89%



Magnetic Declination
00° 44' 00" East (Feb. 2019)
Annual Rate of Change
00° 04' 00" West (Feb. 2019)

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Ames Municipal Airport
Ames, Iowa

OBSERVATIONS:
21,504 IFR Observations
Jan. 1, 2009 - Dec. 31 2018

RUNWAY DECLARED DISTANCE	EXISTING		ULTIMATE		EXISTING		ULTIMATE	
	1	19	1	19	13	31	13	31
TAKE OFF RUN AVAILABLE (TORA)	5701'	5701'	7000'	7000'	3491'	3491'	4100'	4100'
TAKEOFF DISTANCE AVAILABLE (TODA)	5701'	5701'	7000'	7000'	3491'	3491'	4100'	4100'
ACCELERATE-STOP DISTANCE AVAILABLE (ASDA)	5701'	5701'	7000'	7000'	3491'	3491'	4100'	4100'
LANDING DISTANCE AVAILABLE (LDA)	5701'	5701'	7000'	7000'	3491'	3491'	4100'	4100'

AIRPORT NAVAID (Owned by FAA)
ASOS
Radio Transmitter/Receiver (RTR)
19 VASI
13 VASI
31 VASI
01 MALSR
01 Endfire Glide Slope
01 Localizer

TRUE

Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

0 100 200 300
SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.
	-			
	-			

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AMES MUNICIPAL AIRPORT

AIRPORT DATA SHEET

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 2 OF 18

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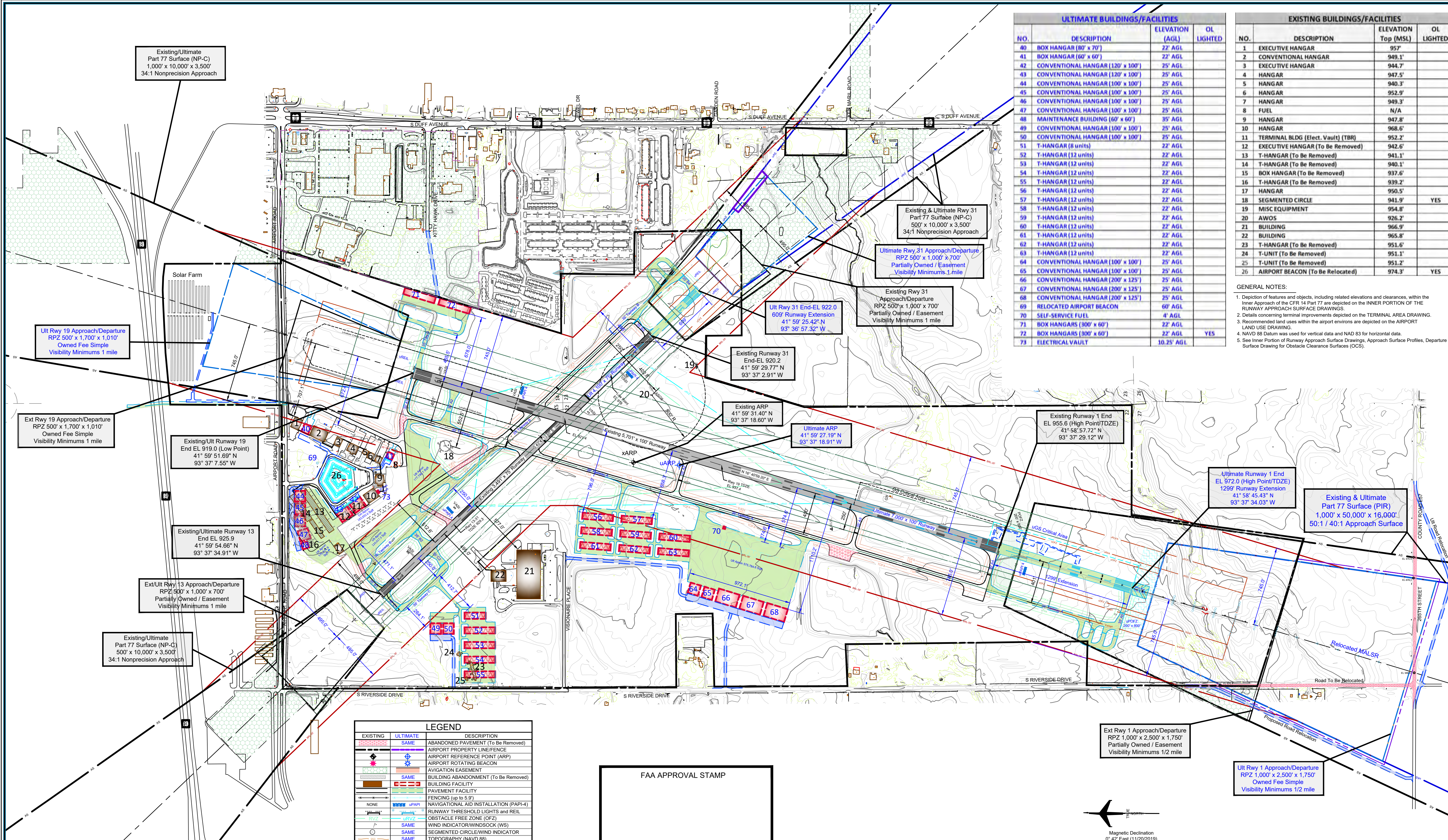


ULTIMATE BUILDINGS/FACILITIES			
NO.	DESCRIPTION	ELEVATION (AGL)	OL LIGHTED
40	BOX HANGAR (80' x 70')	22' AGL	
41	BOX HANGAR (60' x 60')	22' AGL	
42	CONVENTIONAL HANGAR (120' x 100')	25' AGL	
43	CONVENTIONAL HANGAR (120' x 100')	25' AGL	
44	CONVENTIONAL HANGAR (100' x 100')	25' AGL	
45	CONVENTIONAL HANGAR (100' x 100')	25' AGL	
46	CONVENTIONAL HANGAR (100' x 100')	25' AGL	
47	CONVENTIONAL HANGAR (100' x 100')	25' AGL	
48	MAINTENANCE BUILDING (60' x 60')	35' AGL	
49	CONVENTIONAL HANGAR (100' x 100')	25' AGL	
50	CONVENTIONAL HANGAR (100' x 100')	25' AGL	
51	T-HANGAR (8 units)	22' AGL	
52	T-HANGAR (12 units)	22' AGL	
53	T-HANGAR (12 units)	22' AGL	
54	T-HANGAR (12 units)	22' AGL	
55	T-HANGAR (12 units)	22' AGL	
56	T-HANGAR (12 units)	22' AGL	
57	T-HANGAR (12 units)	22' AGL	
58	T-HANGAR (12 units)	22' AGL	
59	T-HANGAR (12 units)	22' AGL	
60	T-HANGAR (12 units)	22' AGL	
61	T-HANGAR (12 units)	22' AGL	
62	T-HANGAR (12 units)	22' AGL	
63	T-HANGAR (12 units)	22' AGL	
64	CONVENTIONAL HANGAR (100' x 100')	25' AGL	
65	CONVENTIONAL HANGAR (100' x 100')	25' AGL	
66	CONVENTIONAL HANGAR (200' x 125')	25' AGL	
67	CONVENTIONAL HANGAR (200' x 125')	25' AGL	
68	CONVENTIONAL HANGAR (200' x 125')	25' AGL	
69	RELOCATED AIRPORT BEACON	60' AGL	
70	SELF-SERVICE FUEL	4' AGL	
71	BOX HANGARS (300' x 60')	22' AGL	
72	BOX HANGARS (300' x 60')	22' AGL	YES
73	ELECTRICAL VAULT	10.25' AGL	

EXISTING BUILDINGS/FACILITIES			
NO.	DESCRIPTION	ELEVATION Top (MSL)	OL LIGHTED
1	EXECUTIVE HANGAR	957'	
2	CONVENTIONAL HANGAR	949.1'	
3	EXECUTIVE HANGAR	944.7'	
4	HANGAR	947.5'	
5	HANGAR	940.3'	
6	HANGAR	952.9'	
7	HANGAR	949.3'	
8	FUEL	N/A	
9	HANGAR	947.8'	
10	HANGAR	968.6'	
11	TERMINAL BLDG (Elect. Vault) (TBR)	952.2'	
12	EXECUTIVE HANGAR (To Be Removed)	942.6'	
13	T-HANGAR (To Be Removed)	941.1'	
14	T-HANGAR (To Be Removed)	940.1'	
15	BOX HANGAR (To Be Removed)	937.6'	
16	T-HANGAR (To Be Removed)	939.2'	
17	HANGAR	950.5'	
18	SEGMENTED CIRCLE	941.9'	YES
19	MISC EQUIPMENT	954.8'	
20	AWOS	926.2'	
21	BUILDING	966.9'	
22	BUILDING	965.8'	
23	T-HANGAR (To Be Removed)	951.6'	
24	T-UNIT (To Be Removed)	951.1'	
25	T-UNIT (To Be Removed)	951.2'	
26	AIRPORT BEACON (To Be Relocated)	974.3'	YES

GENERAL NOTES:

1. Depiction of features and objects, including related elevations and clearances, within the Inner Approach of the CFR 14 Part 77 are depicted on the INNER PORTION OF THE RUNWAY APPROACH SURFACE DRAWINGS.
2. Details concerning terminal improvements depicted on the TERMINAL AREA DRAWING.
3. Recommended land uses within the airport environs are depicted on the AIRPORT LAND USE DRAWING.
4. NAVD 88 Datum was used for vertical data and NAD 83 for horizontal data.
5. See Inner Portion of Runway Approach Surface Drawings, Approach Surface Profiles, Departure Surface Drawing for Obstacle Clearance Surfaces (OCS).

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
	SAME	ABANDONED PAVEMENT (To Be Removed)
		AIRPORT PROPERTY LINE/FENCE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		AVIGATION EASEMENT
	SAME	BUILDING ABANDONMENT (To Be Removed)
		BUILDING FACILITY
		PAVEMENT FACILITY
		FENCING (up to 5.9')
NONE	uPAPI	NAVIGATIONAL AID INSTALLATION (PAPI-4)
		RUNWAY THRESHOLD LIGHTS and REIL
RVZ	uRVZ	OBSTACLE FREE ZONE (OFZ)
	SAME	WIND INDICATOR/WINDSOCK (WS)
	SAME	SEGMENTED CIRCLE/WIND INDICATOR
950	SAME	TOPOGRAPHY (NAVD 88)
		HOLDING POSITION MARKING
	SAME	PARCELS
TSA	uTSA	TAXIWAY SAFETY AREA
TOFA	uTOFA	TAXIWAY OBJECT FREE AREA
Extd OFA	SAME	EXTENDED OBJECT FREE AREA
OFZ	uOFZ	OBSTACLE FREE ZONE (OFZ)
RSA	uRSA	RUNWAY SAFETY AREA (RSA)
OFA	uOFA	RUNWAY OBJECT FREE AREA (OFA)
AS	uAS	PART 77 APPROACH SURFACE
		RUNWAY PROTECTION ZONE (RPZ)
		TIE-DOWNS
	SAME	TREES
	SAME	LOCALIZER ANTENNA/LOC CRITICAL AREA
	NONE	VASI-4
BRL-35'		BUILDING RESTRICTION LINE (BRL)
		ROAD and PARKING

FAA APPROVAL STAMP

FOR APPROVAL BY

Airport Manager: Damion Pregitzer

DATE:

NO.	REVISIONS	DATE	BY	APP'D.
2	-	__	__	__
1	-	__	__	__

"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

AMES MUNICIPAL AIRPORT

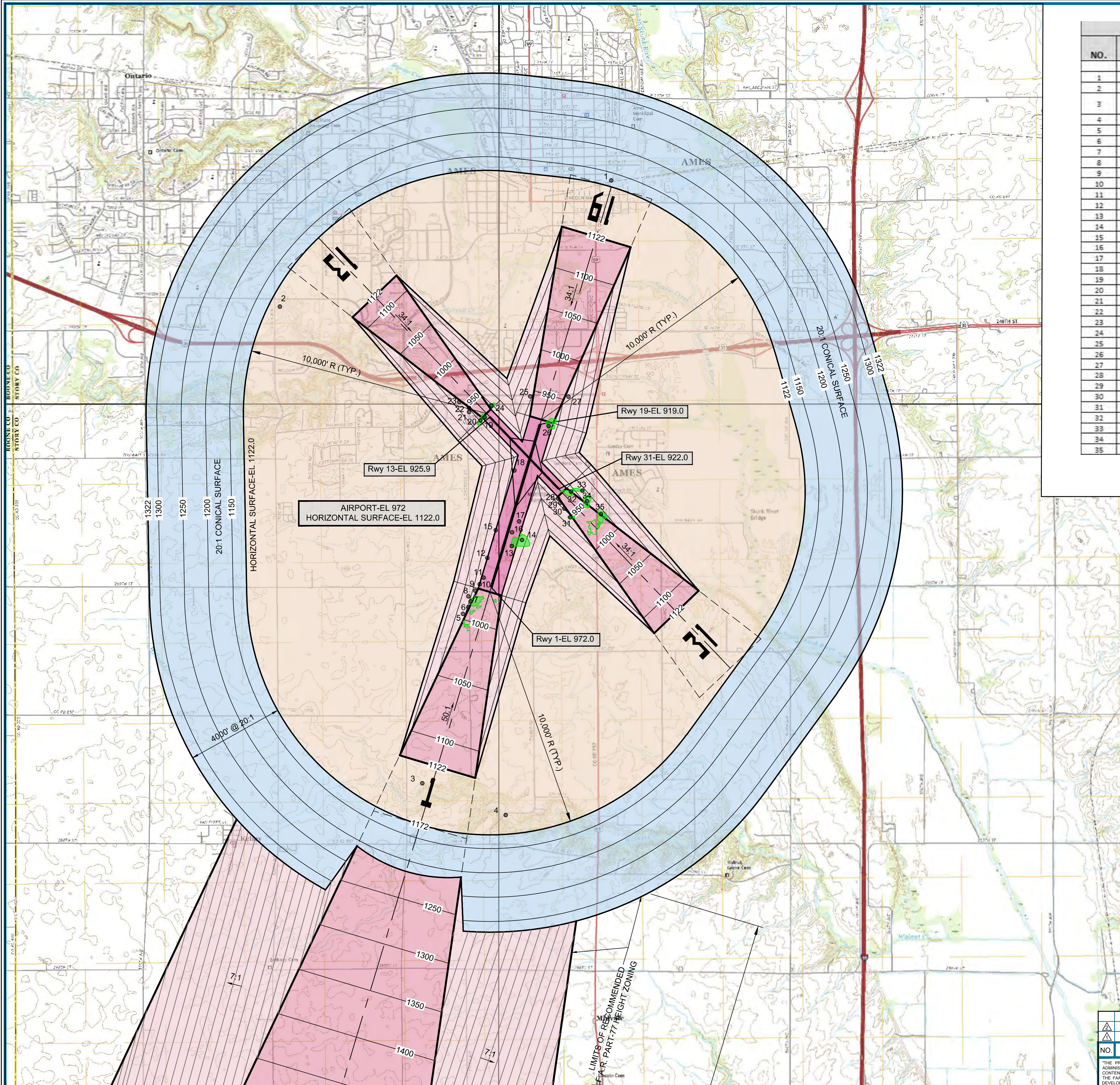
AIRPORT LAYOUT PLAN DRAWING

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

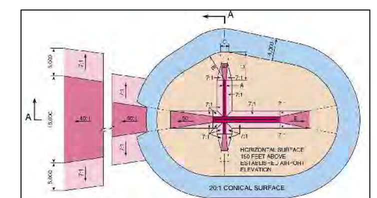
OCTOBER 2020 SHEET 3 OF 18

Coffman Associates Airport Consultants www.coffmanassociates.com



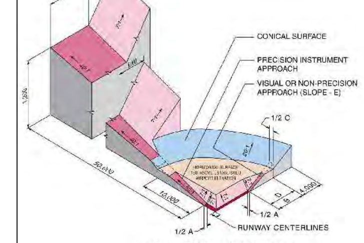
OBSTRUCTION TABLE

NO.	FeatID	Feature	Elevation (Top MSL)	Object AGL (Feet)	Ground Surface Elev	Part 77 Surfaces	Objects Penetration	Proposed Remediation
1	1	ANTENNA	1139.6	219.3	920.3	Conical	5.1	Verify or Add Obst. Lighting
2	2	WATER TOWER	1151.3	165.8	985.5	Horizontal	29.3	Verify or Add Obst. Lighting
3	862	TREETOP	1185.4	176.9	1008.4	Horizontal / Approach 50:1	Horizontal 63.4 / Approach 46.7	Remove Trees
4	863	BUILDING PEAK	1192.0	248.5	943.5	Horizontal	70.0	Verify or Add Obst. Lighting
5	1117	TREETOP	1033.2	55.6	977.5	Transitional	20.2	Remove Trees
6	1133	UTILITY POLE	1006.5	28.5	978.0	Transitional	11.7	Bury lines/ Remove Poles
7	1139	TREETOP	997.8	9.8	988.0	Transitional	6.8	Remove Trees
8	1116	UTILITY POLE	1024.3	30.0	994.3	Transitional	10.4	Bury lines/ Remove Poles
9	1112	GROUND	992.5	0.0	992.5	Transitional	8.0	Request Ground to be graded
10	583	GROUND	978.5	0.0	978.5	Primary	6.5	Future condition only, will be removed
11	565	BUILDING PEAK	979.6	9.6	970.0	Primary	7.6	Future condition only, will be removed
12	463	GROUND	958.2	0.0	958.2	Primary	3.0	Future condition only, will be removed
13	467	TREETOP	1017.2	75.3	942.0	Primary	66.0	Future condition only, will be removed
14	991	TREETOP	1010.7	83.2	927.6	Transitional	33.7	Remove Trees
15	449	GROUND	948.3	0.0	948.3	Primary	0.3	Future condition only, will be removed
16	447	BUILDING PEAK	953.6	9.8	943.8	Primary	6.2	Future condition only, will be removed
17	448	TREETOP	950.9	16.0	934.9	Primary	6.1	Future condition only, will be removed
18	65	GROUND	927.6	0.0	927.6	Primary	0.6	Future condition only, will be removed
19	62	TREETOP	935.4	15.4	920.0	Primary	9.9	Future condition only, will be removed
20	899	TREETOP	975.2	56.7	918.6	Transitional	31.0	Remove Trees
21	865	UTILITY POLE	963.6	33.6	930.0	Transitional	0.5	Bury lines/ Remove Poles
22	866	UTILITY POLE	961.1	29.9	931.2	Transitional	13.3	Bury lines/ Remove Poles
23	864	HVAC ON BLDG	979.8	47.1	932.7	Transitional	12.3	Verify or Add Obst. Lighting
24	869	TREETOP	959.3	45.3	914.0	Transitional	19.7	Remove Trees
25	867	TREETOP	950.7	30.1	920.5	Transitional	1.9	Remove Trees
26	44	TREETOP	926.8	18.3	908.5	Primary	8.1	Remove Trees
27	893	TREETOP	974.3	66.6	907.7	Transitional	3.0	Remove Trees
28	942	TREETOP	952.7	32.7	920.0	Transitional	54.8	Remove Trees
29	945	TREETOP	925.0	3.6	921.4	Transitional	5.7	Remove Trees
30	952	TREETOP	957.2	32.4	924.8	Transitional	16.1	Remove Trees
31	953	TREETOP	961.7	37.9	923.7	Transitional	1.5	Remove Trees
32	927	TREETOP	956.9	45.2	911.7	Transitional	26.7	Remove Trees
33	915	TREETOP	994.1	85.7	908.3	Transitional	9.5	Remove Trees
34	921	TREETOP	983.0	67.4	915.6	Transitional	17.3	Remove Trees
35	947	TREETOP	1009.4	90.0	919.4	Transitional	32.3	Remove Trees



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

A - UTILITY RUNWAYS
B - RUNWAYS LARGER THAN UTILITY
C - VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D - VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
* - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET



ISOMETRIC VIEW OF SECTION A-A

SOURCE: 14 CFR Part 77, Section 77.25, Civil Airport Imaginary Surfaces.

OBSTRUCTION LEGEND

- 35 • OBSTRUCTION
- 14 • GROUP of TREES

Date of Obstruction Survey: June 2020

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted.
2. Depiction of features and objects within the primary, transitional, horizontal, and conical surfaces, are illustrated on the AIRPORT AIRSPACE DRAWINGS.
3. Depiction of features and objects within the outer portion of the approach surfaces, are illustrated on the APPROACH SURFACE PROFILES.
4. Depiction of features and objects within the inner portion of the approach surfaces, are illustrated on the INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS.

Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

TRUE

0 2000 4000 6000
SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.
2	-	—	—	—
1	-	—	—	—

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AMES MUNICIPAL AIRPORT

AIRPORT AIRSPACE DRAWING I

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 4 OF 18

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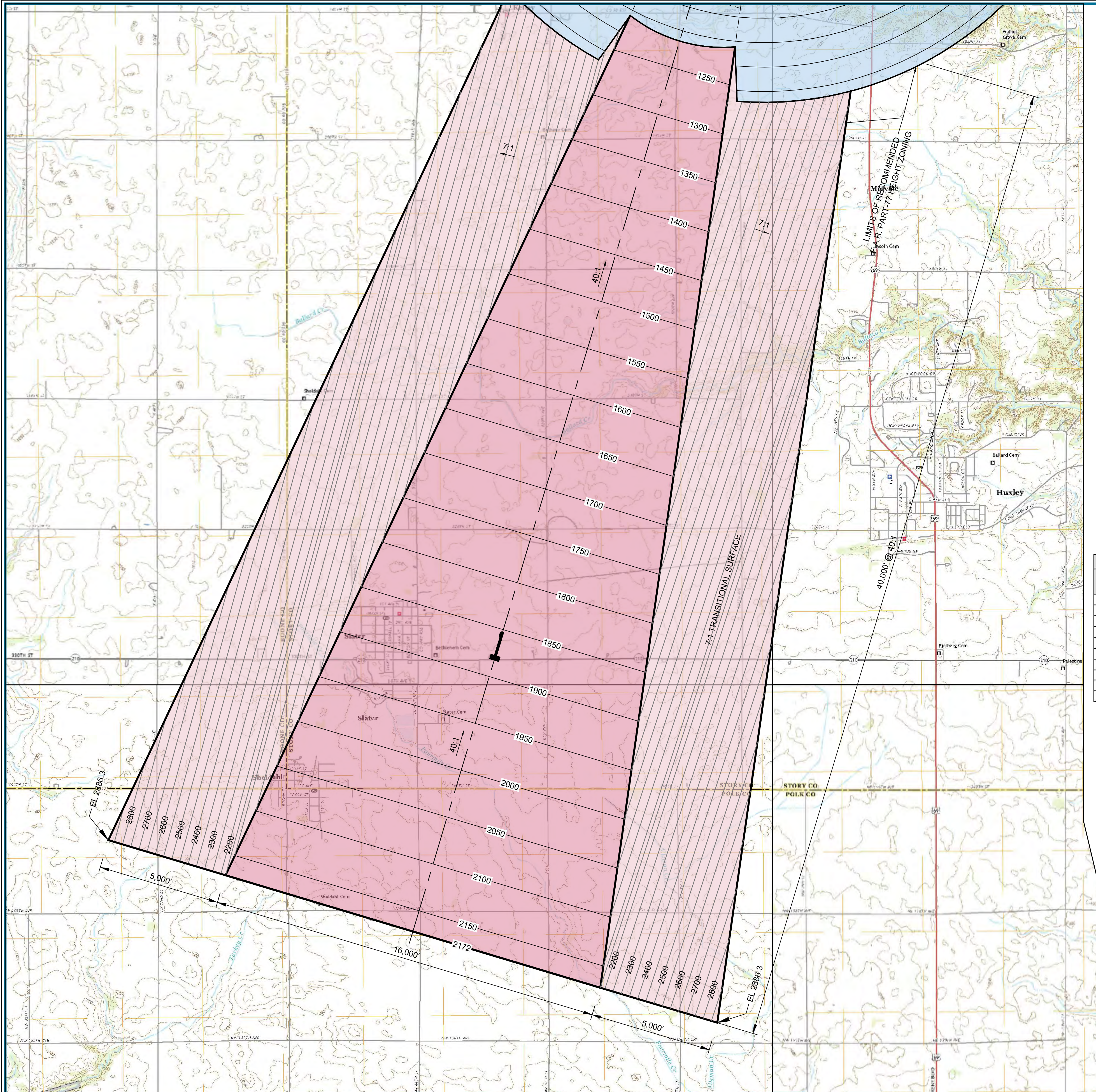

OBSTRUCTION LEGEND

35 ● OBSTRUCTION

14 ● GROUP of TREES

Date of Obstruction Survey: June 2020

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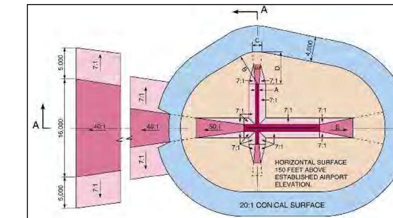
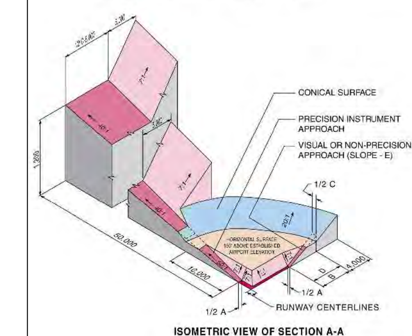


DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B: C	B: D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000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

A - UTILITY RUNWAYS
B - RUNWAYS LARGER THAN UTILITY
C - VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D - VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
* - PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET

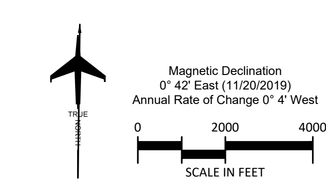


ISOMETRIC VIEW OF SECTION A-A

SOURCE: 14 CFR Part 77, Section 77.25, Civil Airport Imaginary Surfaces.

OBSTRUCTION TABLE

NO.	FeatID	Feature	Elevation (Top MSL)	Object AGL (Feet)	Ground Surface Elev	Part 77 Surfaces	Objects Penetration	Proposed Remediation
-	-	NONE	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-



Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

NO.	REVISIONS	DATE	BY	APP'D.
2	-	__	__	__
1	-	__	__	__

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AMES MUNICIPAL AIRPORT

AIRPORT AIRSPACE DRAWING II

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020

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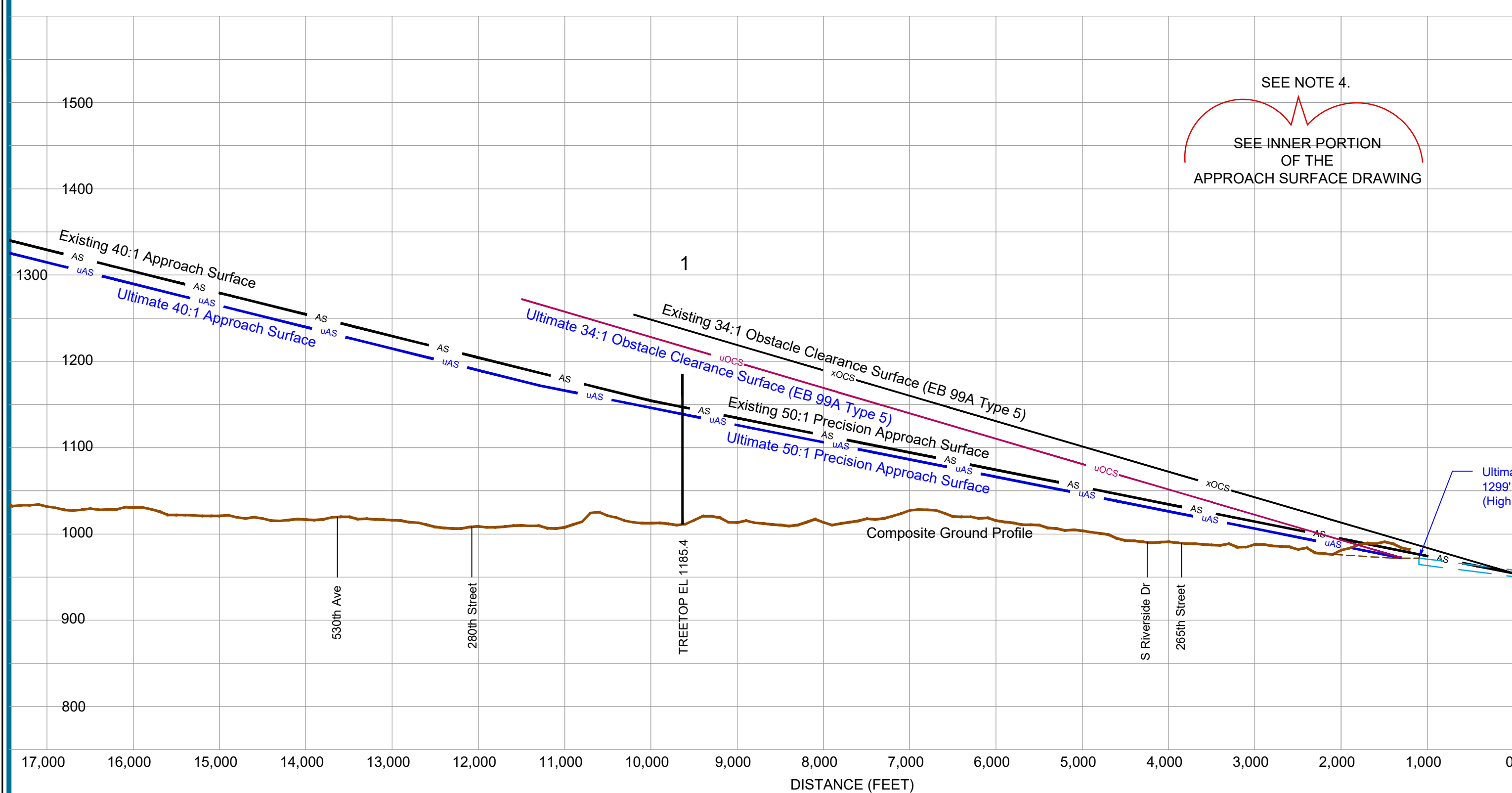
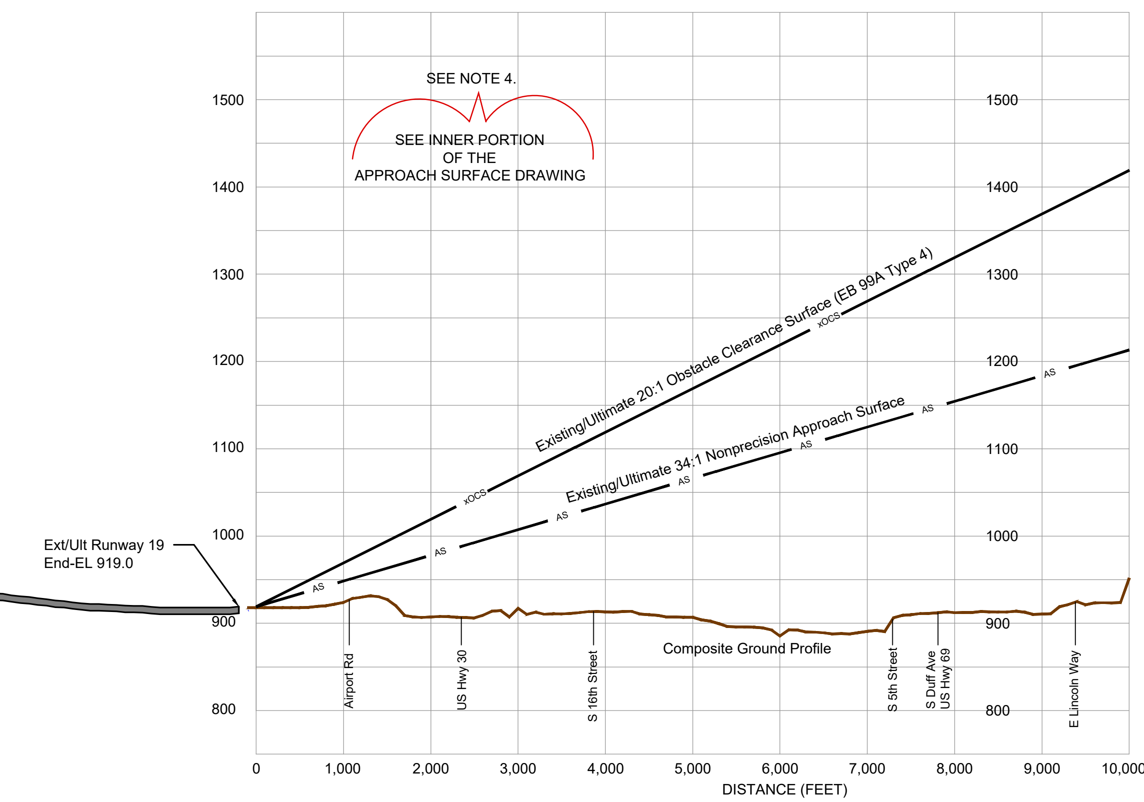
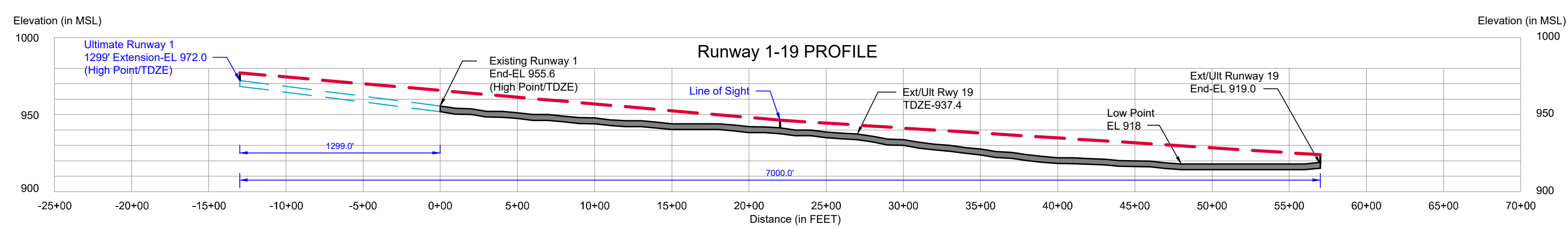
RUNWAY 1 APPROACH



RUNWAY 19 APPROACH

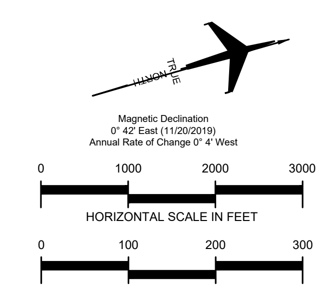


Runway 1-19 PROFILE



GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted.
2. Depiction of features and objects within the primary, transitional, horizontal, and conical surfaces, are illustrated on the AIRPORT AIRSPACE DRAWINGS.
3. Depiction of features and objects within the outer portion of the approach surfaces, are illustrated on the RUNWAY APPROACH SURFACE PROFILES.
4. Depiction of features and objects within the inner portion of the approach surfaces, are illustrated on the INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS.
5. Vertical Datum NAVD 88 and Horizontal Datum NAD 83.
6. FAA Memorandum July 24, 2020, All Airports Regional Division Managers, Engineering Brief No. 99A. This Engineering Brief (EB) provides the latest versions of Table 3-2 (Approach and Departure Standards) and Table 3-4 (Standards for Instrument Approach Procedures). Reference the tables in this EB until a new version of Advisory Circular (AC) 150/5300-13A Airport Design, is published.



Date of Obstruction Survey: June 2020

OUTER PORTION OF RUNWAY 1 APPROACH OBSTRUCTION TABLE

No.	Description	Elevation Top MSL	Existing 50:1 Penetration	Existing 34:1 OCS Penetration	Ultimate 50:1 Penetration	Ultimate 34:1 OCS Penetration	Proposed Remediation
1	TREETOP	1185.4	38.3	NONE	46.7	NONE	Remove Trees

OUTER PORTION OF RUNWAY 19 APPROACH OBSTRUCTION TABLE

No.	Description	Elevation Top MSL	Existing 34:1 Penetration	Existing 20:1 OCS Penetration	Ultimate 34:1 Penetration	Ultimate 20:1 OCS Penetration	Proposed Remediation
-	NONE	-	-	-	-	-	-

NO.	REVISIONS	DATE	BY	APP'D.
2	-	—	—	—
1	-	—	—	—

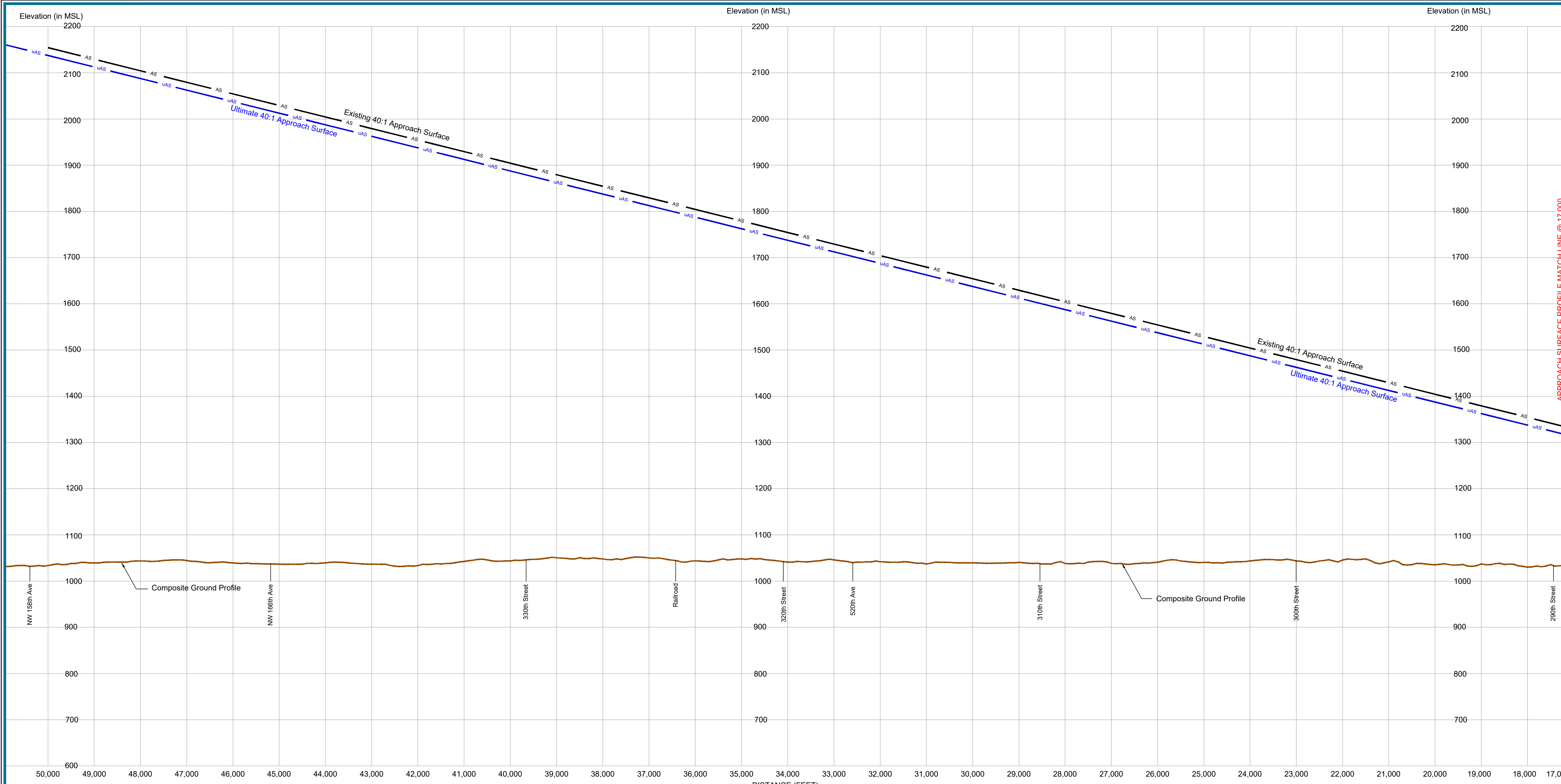
AMES MUNICIPAL AIRPORT

RUNWAY 1-19 APPROACH SURFACE PROFILES

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 6 OF 18



OUTER PORTION of RUNWAY 1 APPROACH

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted.
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4. Depiction of features and objects within the inner portion of the approach surfaces, are illustrated on the INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS.
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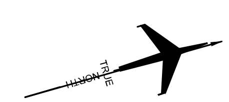
Date of Obstruction Survey: June 2020

OUTER PORTION OF RUNWAY 1 APPROACH OBSTRUCTION TABLE

No.	Description	Elevation Top MSL	Existing 50:1 Penetration	Existing 34:1 OCS Penetration	Ultimate 50:1 Penetration	Ultimate 34:1 OCS Penetration	Proposed Remediation
-	NONE	-	-	-	-	-	-



Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

0 1000 2000 3000
HORIZONTAL SCALE IN FEET

0 100 200 300
VERTICAL SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.
2	-			
1	-			

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AMES MUNICIPAL AIRPORT

RUNWAY 1
APPROACH SURFACE PROFILE II

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

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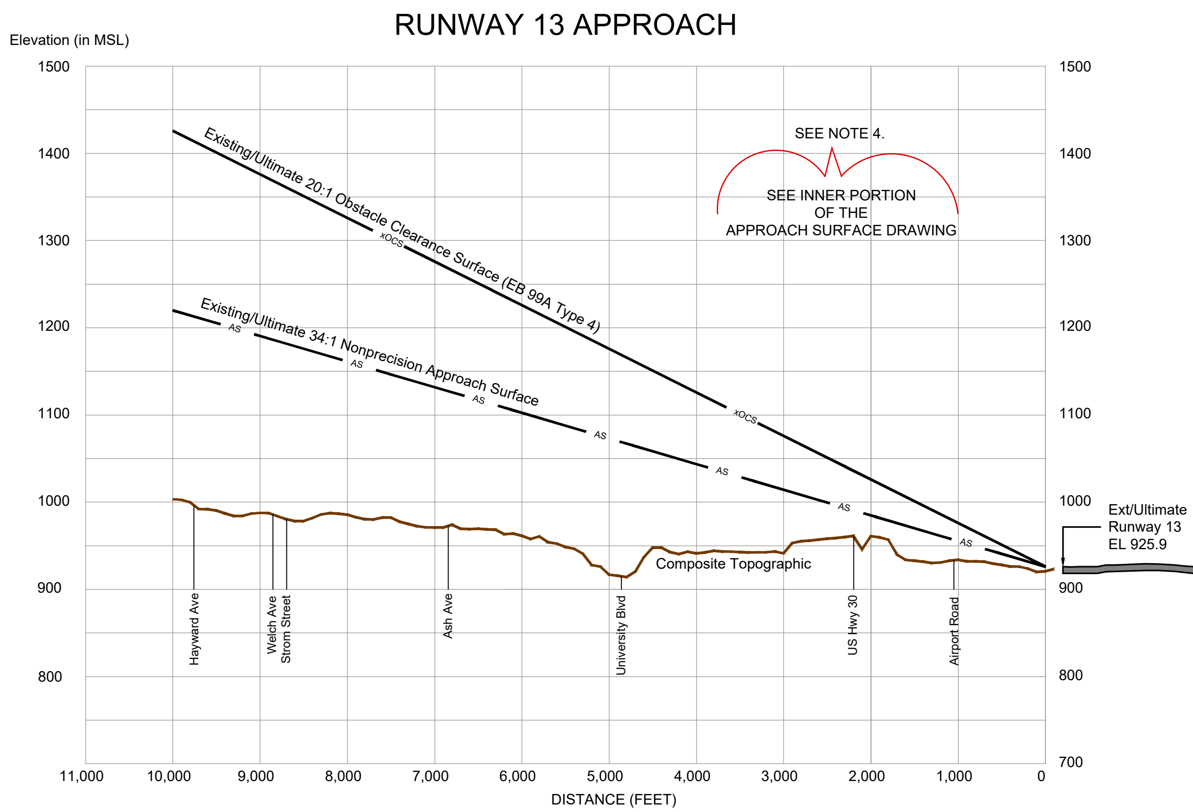
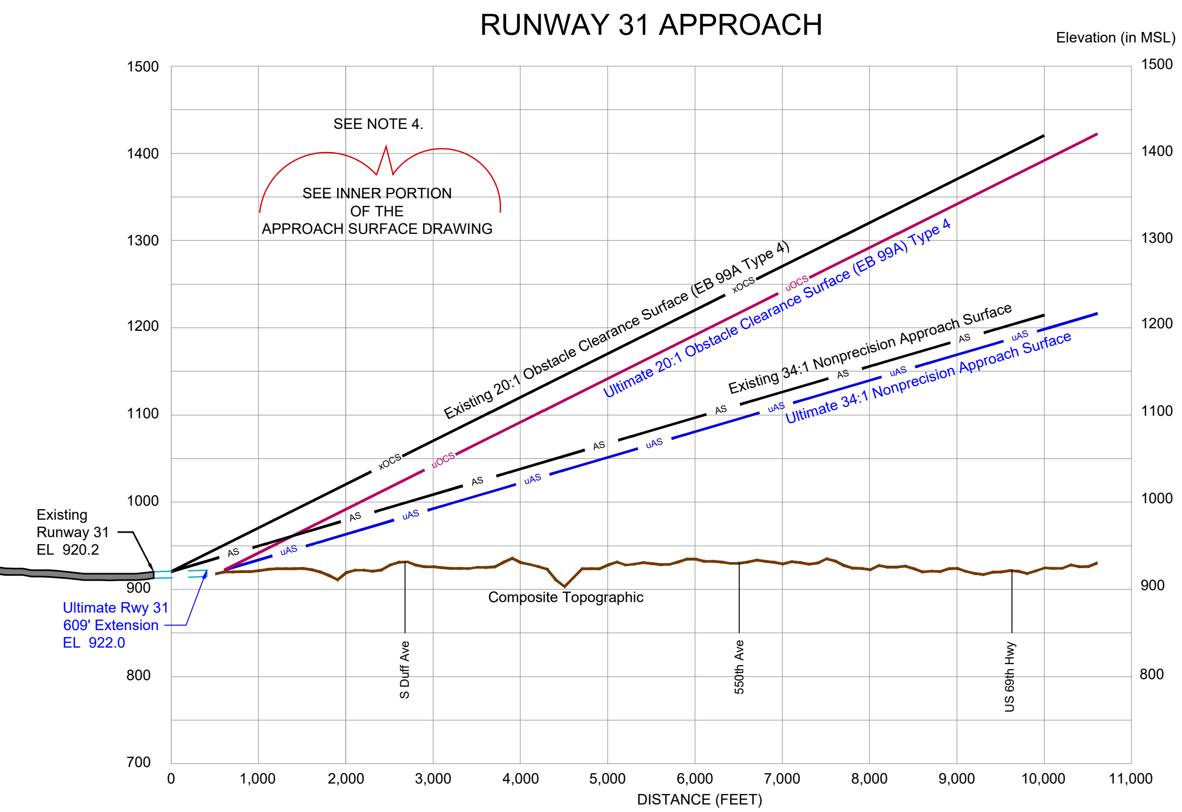
OCTOBER 2020 SHEET 7 OF 18

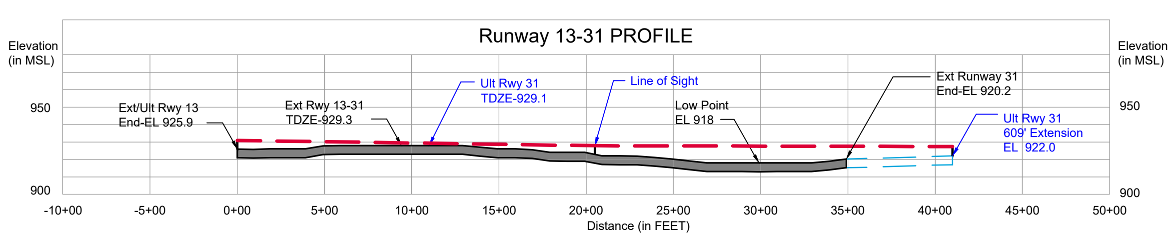
RUNWAY 13 APPROACH



RUNWAY 31 APPROACH



Runway 13-31 PROFILE



GENERAL NOTES:

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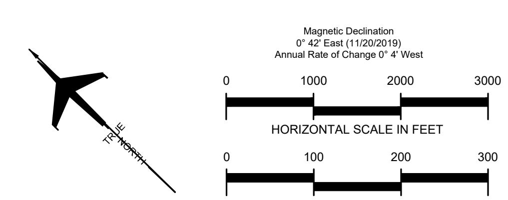
Date of Obstruction Survey: June 2020

OUTER PORTION OF RUNWAY 13 APPROACH OBSTRUCTION TABLE

No.	Description	Elevation Top MSL	Existing 34:1 Penetration	Existing 20:1 OCS Penetration	Ultimate 34:1 Penetration	Ultimate 20:1 OCS Penetration	Proposed Remediation
-	NONE	-	-	-	-	-	-

OUTER PORTION OF RUNWAY 31 APPROACH OBSTRUCTION TABLE

No.	Description	Elevation Top MSL	Existing 34:1 Penetration	Existing 20:1 OCS Penetration	Ultimate 34:1 Penetration	Ultimate 20:1 OCS Penetration	Proposed Remediation
-	NONE	-	-	-	-	-	-



NO.	REVISIONS	DATE	BY	APP'D.
2	-	___	___	___
1	-	___	___	___

AMES MUNICIPAL AIRPORT

Runway 13-31
APPROACH SURFACES PROFILES

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

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Coffman Associates
Airport Consultants
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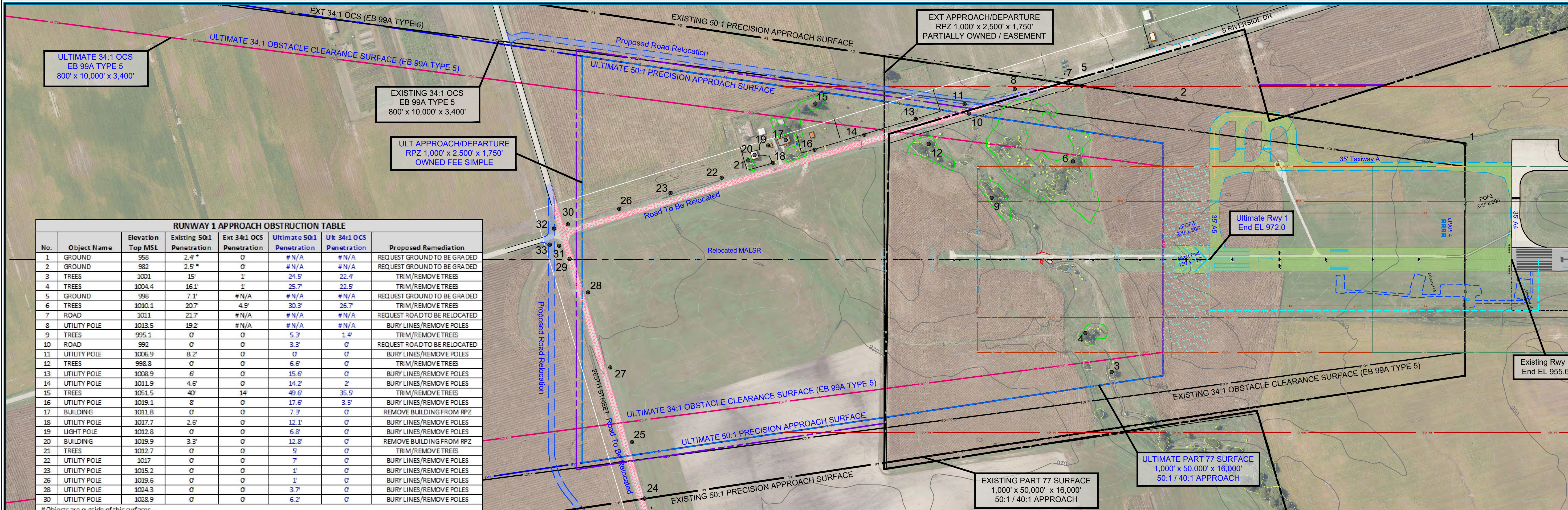
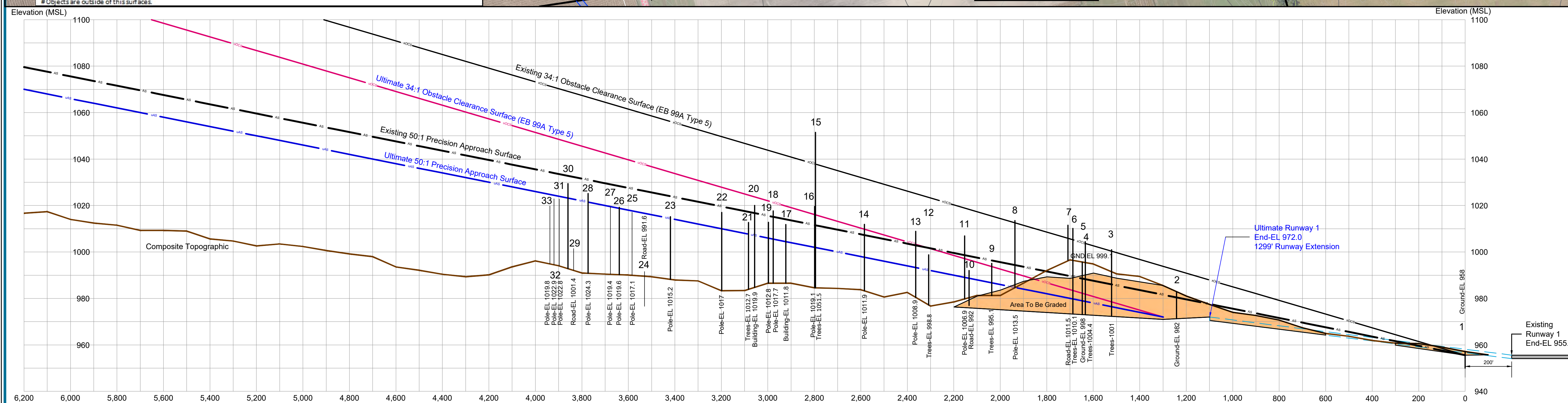


RUNWAY 1 APPROACH OBSTRUCTION TABLE

No.	Object Name	Elevation Top MSL	Existing 50:1 Penetration	Ext 34:1 OCS Penetration	Ultimate 50:1 Penetration	Ult 34:1 OCS Penetration	Proposed Remediation
1	GROUND	958	2.4' *	0'	#N/A	#N/A	REQUEST GROUND TO BE GRADED
2	GROUND	982	2.5' *	0'	#N/A	#N/A	REQUEST GROUND TO BE GRADED
3	TREES	1001	15'	1'	24.5'	22.4'	TRIM/REMOVE TREES
4	TREES	1004.4	16.1'	1'	25.7'	22.5'	TRIM/REMOVE TREES
5	GROUND	998	7.1'	#N/A	#N/A	#N/A	REQUEST GROUND TO BE GRADED
6	TREES	1010.1	20.7'	4.9'	30.3'	26.7'	TRIM/REMOVE TREES
7	ROAD	1011	21.7'	#N/A	#N/A	#N/A	REQUEST ROAD TO BE RELOCATED
8	UTILITY POLE	1013.5	19.2'	#N/A	#N/A	#N/A	BURY LINES/REMOVE POLES
9	TREES	995.1	0'	0'	5.3'	1.4'	TRIM/REMOVE TREES
10	ROAD	992	0'	0'	3.3'	0'	REQUEST ROAD TO BE RELOCATED
11	UTILITY POLE	1006.9	8.2'	0'	0'	0'	BURY LINES/REMOVE POLES
12	TREES	998.8	0'	0'	6.6'	0'	TRIM/REMOVE TREES
13	UTILITY POLE	1008.9	6'	0'	15.6'	0'	BURY LINES/REMOVE POLES
14	UTILITY POLE	1011.9	4.6'	0'	14.2'	2'	BURY LINES/REMOVE POLES
15	TREES	1051.5	40'	14'	49.6'	35.5'	TRIM/REMOVE TREES
16	UTILITY POLE	1019.1	8'	0'	17.6'	3.5'	BURY LINES/REMOVE POLES
17	BUILDING	1011.8	0'	0'	7.3'	0'	REMOVE BUILDING FROM RPZ
18	UTILITY POLE	1017.7	2.6'	0'	12.1'	0'	BURY LINES/REMOVE POLES
19	LIGHT POLE	1012.8	0'	0'	6.8'	0'	BURY LINES/REMOVE POLES
20	BUILDING	1019.9	3.3'	0'	12.8'	0'	REMOVE BUILDING FROM RPZ
21	TREES	1012.7	0'	0'	5'	0'	TRIM/REMOVE TREES
22	UTILITY POLE	1017	0'	0'	7'	0'	BURY LINES/REMOVE POLES
23	UTILITY POLE	1015.2	0'	0'	1'	0'	BURY LINES/REMOVE POLES
26	UTILITY POLE	1019.6	0'	0'	1'	0'	BURY LINES/REMOVE POLES
28	UTILITY POLE	1024.3	0'	0'	3.7'	0'	BURY LINES/REMOVE POLES
30	UTILITY POLE	1028.9	0'	0'	6.2'	0'	BURY LINES/REMOVE POLES

Objects are outside of this surfaces.



GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt Roads or private Roads, 15' for non-interstate Roads, 17' for interstate Roads, and 23' for railroad.
2. Depiction of features and objects within the primary, outer-approach, transitional, horizontal, and conical, Part 77 surfaces, are illustrated on the AIRPORT AIRSPACE DRAWING.
3. Vertical Datum NAVD 88 and Horizontal Datum NAD 83.
4. FAA Memorandum July 24, 2020, All Airports Regional Division Managers, Engineering Brief No. 99A. This Engineering Brief (EB) provides the latest versions of Table 3-2 (Approach and Departure Standards) and Table 3-4 (Standards for Instrument Approach Procedures). Reference the tables in this EB until a new version of Advisory Circular (AC) 150/5300-13A Airport Design, is published.

Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

HORIZONTAL SCALE IN FEET (0, 200, 400, 600)

VERTICAL SCALE IN FEET (0, 20, 40, 60)

Date of Obstruction Survey: June 2020

NO.	REVISIONS	DATE	BY	APP'D.

"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

AMES MUNICIPAL AIRPORT

INNER PORTION OF RUNWAY 1 APPROACH SURFACE DRAWING

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 | SHEET 9 OF 18

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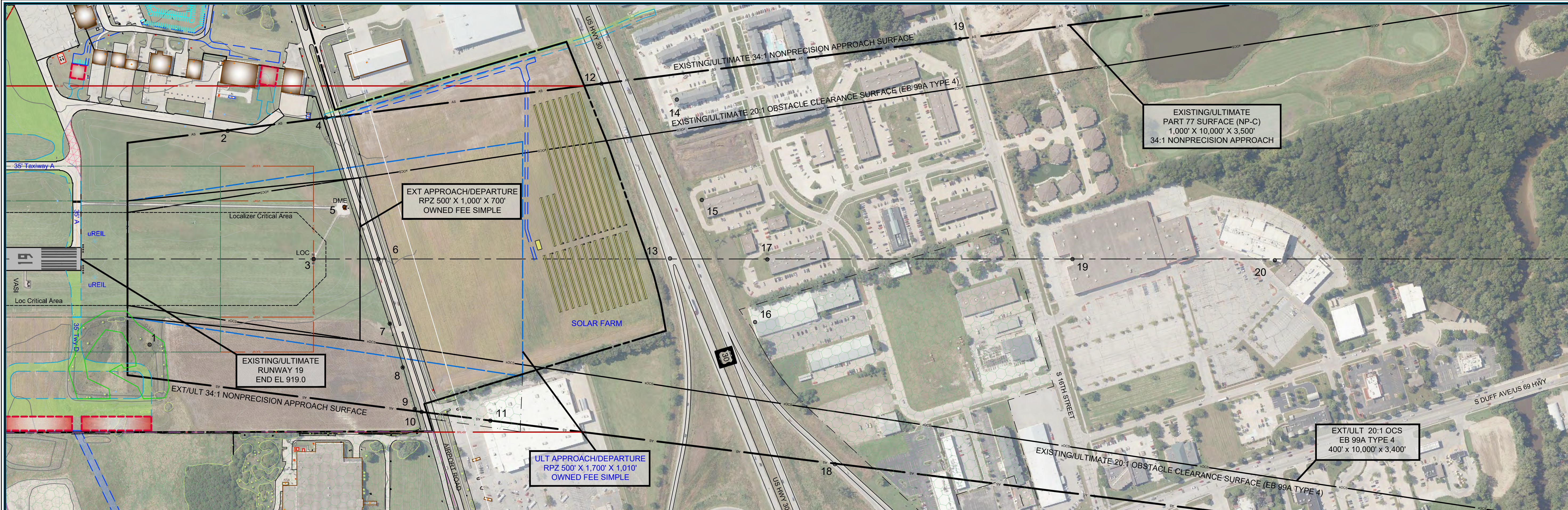

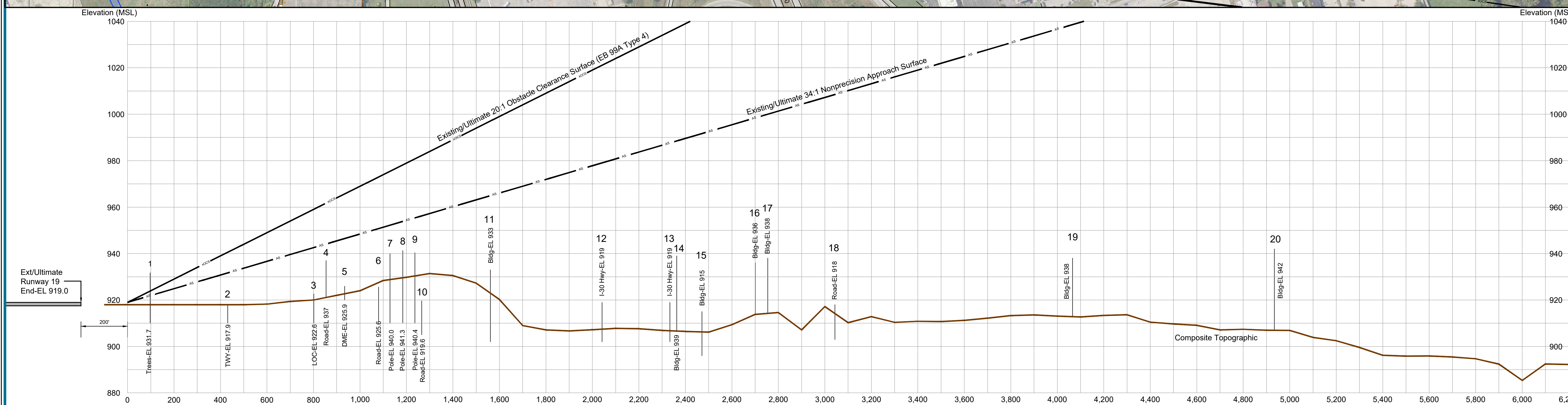

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt Roads or private Roads, 15' for non-interstate Roads, 17' for interstate Roads, and 23' for railroad.
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RUNWAY 19 APPROACH OBSTRUCTION TABLE

No.	Object Name	Elevation Top MSL	Existing 34:1 Penetration	Existing 20:1 OCS Penetration	Ultimate 34:1 Penetration	Ultimate 20:1 OCS Penetration	Proposed Remediation
1	TREES	931.7	9.8'	# N/A	SAME	SAME	TRIM/REMOVE TREES
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-

Objects are outside of this surfaces.

Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

TRUE NORTH

0 200 400 600
HORIZONTAL SCALE IN FEET

0 20 40 60
VERTICAL SCALE IN FEET

Date of Obstruction Survey: June 2020

NO.	REVISIONS	DATE	BY	APP'D.
2	-	__	__	__
1	-	__	__	__

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AMES MUNICIPAL AIRPORT

INNER PORTION OF RUNWAY 19 APPROACH SURFACE DRAWING

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 10 OF 18

RUNWAY 13 APPROACH OBSTRUCTION TABLE							
No.	Object Name	Elevation Top MSL	Existing 34:1 Penetration	Existing 20:1 OCS Penetration	Ultimate 34:1 Penetration	Ultimate 20:1 OCS Penetration	Proposed Remediation
1	TREES	933.2	5.8'	4.6' *	Same	Same	TRIM/REMOVE ALL TREES
2	TREES	934.4	4.7' *	2' *	Same	Same	TRIM/REMOVE ALL TREES
4	LIGHT POLE	956.9	10.5'	0'	Same	Same	BURY LINES/REMOVE POLES
6	LIGHT POLE	957.5	7.3'	0'	Same	Same	BURY LINES/REMOVE POLES
8	LIGHT POLE	954.1	3.1'	0'	Same	Same	BURY LINES/REMOVE POLES
11	LIGHT POLE	958	4.1'	0'	Same	Same	BURY LINES/REMOVE POLES
12	LIGHT POLE	959.2	3.7'	0'	Same	Same	BURY LINES/REMOVE POLES
13	LIGHT POLE	958.2	2'	0'	Same	Same	BURY LINES/REMOVE POLES
14	BUILDING	979.8	22'	0'	Same	Same	BURY LINES/REMOVE POLES
16	TREES	966.9	2.9'	0'	Same	Same	TRIM/REMOVE ALL TREES
17	TREES	965.3	0.5'	0'	Same	Same	TRIM/REMOVE ALL TREES
18	TREES	968.6	1.3'	0'	Same	Same	TRIM/REMOVE ALL TREES
29	TREES	1029.4	27.3'	0'	Same	Same	TRIM/REMOVE ALL TREES
31	TREES	1020.6	6.7'	0'	Same	Same	TRIM/REMOVE ALL TREES

* See Obstacle Action Plan included in Appendix D of the Ames Municipal Airport Master Plan.

GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt Roads or private Roads, 15' for non-interstate Roads, 17' for interstate Roads, and 23' for railroad.
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4. FAA Memorandum July 24, 2020, All Airports Regional Division Managers, Engineering Brief No. 99A. This Engineering Brief (EB) provides the latest versions of Table 3-2 (Approach and Departure Standards) and Table 3-4 (Standards for Instrument Approach Procedures). Reference the tables in this EB until a new version of Advisory Circular (AC) 150/5300-13A Airport Design, is published.

Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

0 200 400 600
HORIZONTAL SCALE IN FEET

0 20 40 60
VERTICAL SCALE IN FEET

Date of Obstruction Survey: June 2020

NO.	REVISIONS	DATE	BY	APP'D.
2	-	—	—	—
1	-	—	—	—

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AMES MUNICIPAL AIRPORT

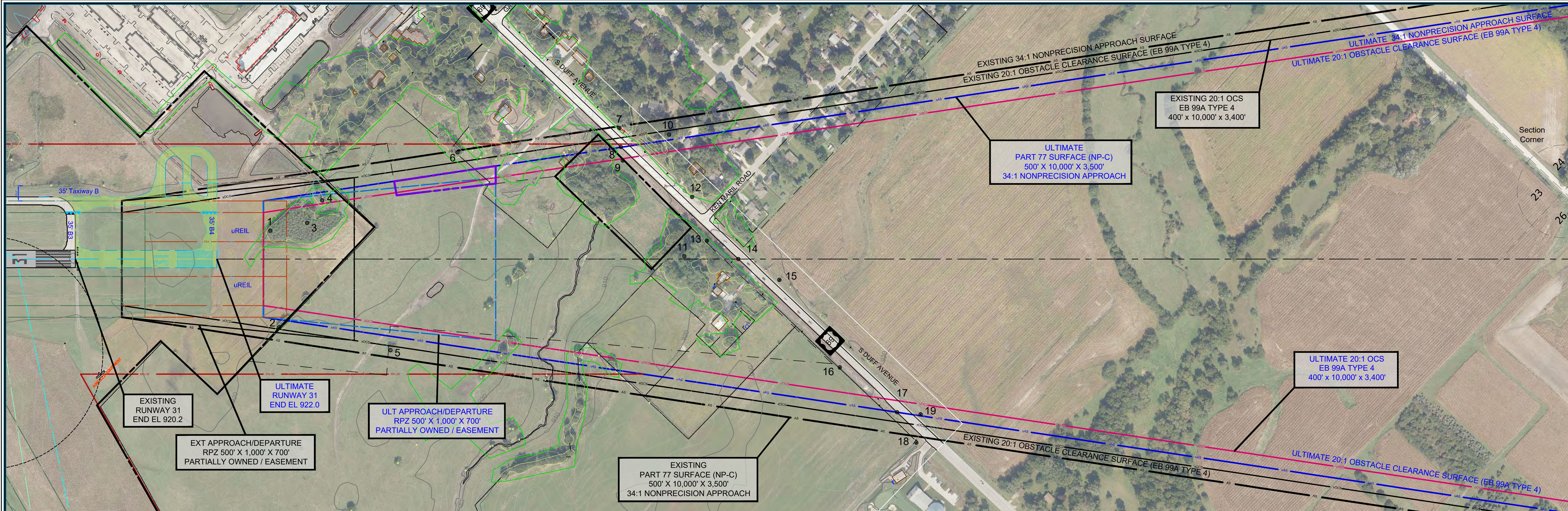
INNER PORTION OF RUNWAY 13 APPROACH SURFACE DRAWING

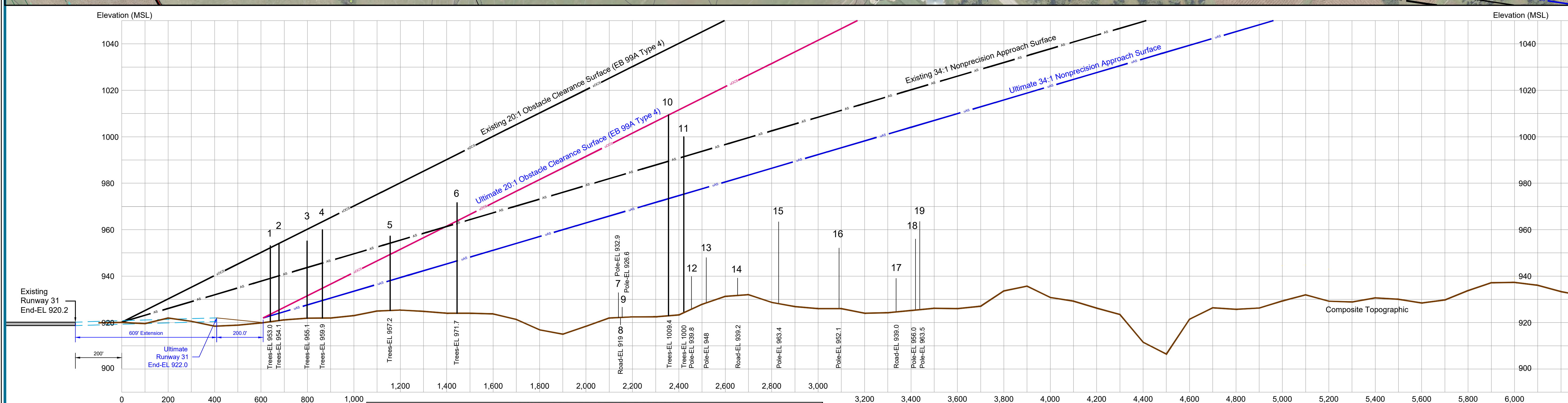
Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 11 OF 18

Coffman Associates
Airport Consultants
www.coffmanassociates.com





GENERAL NOTES:

1. Obstructions, clearances, and locations are calculated from ultimate runway end elevations and ultimate approach surfaces, unless otherwise noted. Road obstructions reflect a safety clearance of 10' for dirt Roads or private Roads, 15' for non-interstate Roads, 17' for interstate Roads, and 23' for railroad.
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RUNWAY 31 APPROACH OBSTRUCTION TABLE

No.	Object Name	Elevation Top MSL	Existing 34:1 Penetration	Existing 20:1 OCS Penetration	Ultimate 34:1 Penetration	Ultimate 20:1 OCS Penetration	Proposed Remediation
1	TREES	953.0	14.0'	.8' *	30.1'	29.5'	REMOVE ALL TREES
2	TREES	954.1	14'	.4' *	30.1'	28.7'	REMOVE ALL TREES
3	TREES	955.1	11.4'	0'	27.5'	23.4'	REMOVE ALL TREES
4	TREES	959.9	14.3'	0'	30.4'	25.1'	REMOVE ALL TREES
5	TREES	957.2	3'	0'	19.1'	7.8'	REMOVE ALL TREES
6	TREES	971.7	9'	0'	# N/A	# N/A	REMOVE ALL TREES
10	TREES	1009.4	19.9'	0'	# N/A	# N/A	TRIM/REMOVE TREES
11	TREES	1000.0	9.6'	0'	24.7'	0'	TRIM/REMOVE TREES

Objects are outside of this surfaces.
* See Obstacle Action Plan included in Appendix D of the Ames Municipal Airport Master Plan.

Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

0 200 400 600
HORIZONTAL SCALE IN FEET

0 20 40 60
VERTICAL SCALE IN FEET

Date of Obstruction Survey: June 2020

NO.	REVISIONS	DATE	BY	APP'D.
2	-	—	—	—
1	-	—	—	—

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AMES MUNICIPAL AIRPORT

INNER PORTION OF RUNWAY 31 APPROACH SURFACE DRAWING

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 12 OF 18

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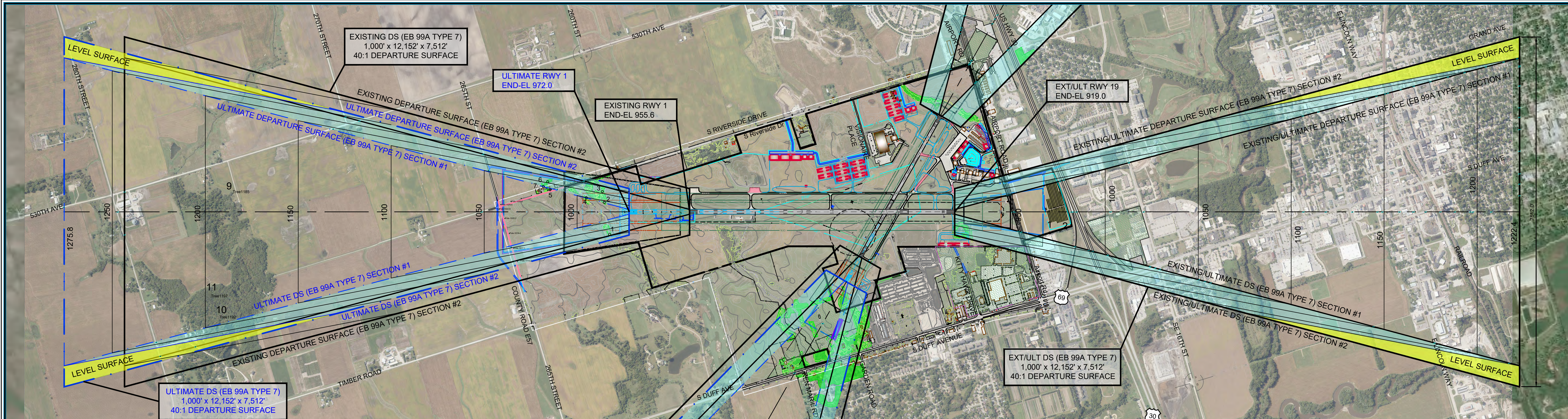
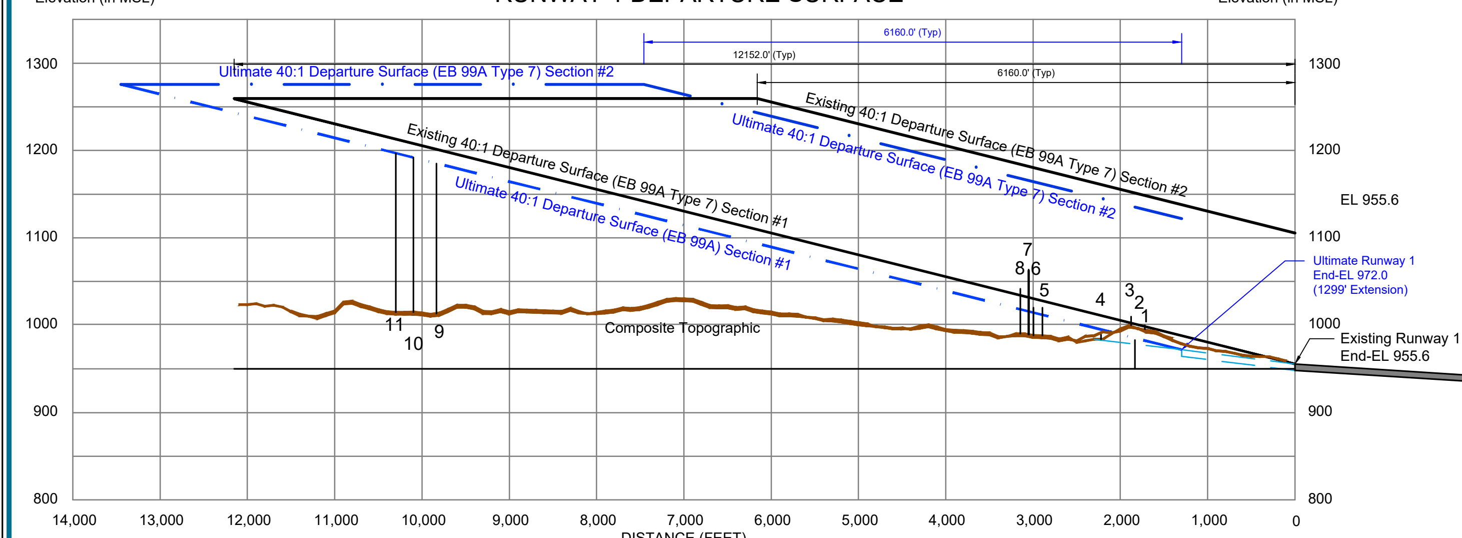
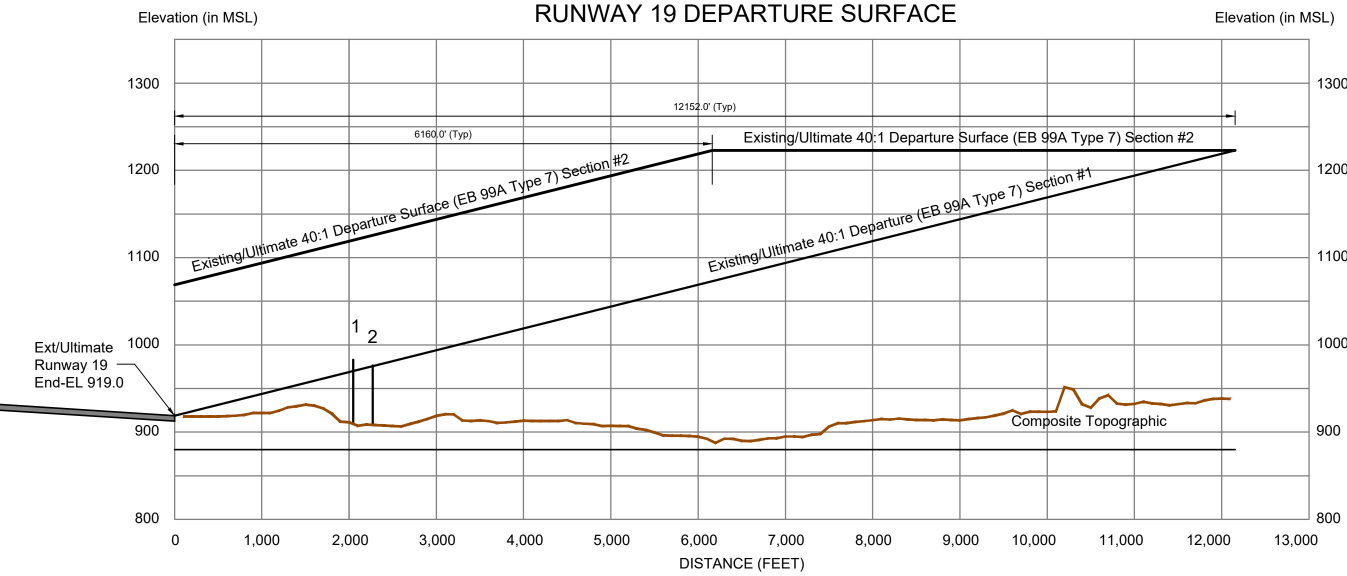


RUNWAY 1 DEPARTURE SURFACE



RUNWAY 19 DEPARTURE SURFACE



TREES

Date of Obstruction Survey: June 2020

Runway 1 OBSTRUCTION TABLE

NO.	OBJECT NAME	ELEVATION (Top MSL)	DEPARTURE SURFACE	PENETRATION (in Feet)	AGL	PROPOSED REMEDIATION
1	TREES	1001.0	EXT DEPARTURE	2.3' *	49.5'	TRIM/REMOVE ALL TREES
2	TREES	983.1	ULT DEPARTURE	11'	9.7'	TRIM/REMOVE ALL TREES
3	TREES	1009.0	EXT DEPARTURE	6.5' *	23.2'	TRIM/REMOVE ALL TREES
4	TREES	989.4	ULT DEPARTURE	10.4'	32.1'	TRIM/REMOVE ALL TREES
5	UTILITY POLE	1019.1	ULT DEPARTURE	4.6'	33.5'	BURY LINES/REMOVE POLES
6	TREES	1062.8	EXT DEPARTURE	30.9' *	81.6'	TRIM/REMOVE ALL TREES
7	TREES	1040.6	EXT DEPARTURE	6.3' *	55.1'	TRIM/REMOVE ALL TREES

* See Obstacle Action Plan included in Appendix D of the Ames Municipal Airport Master Plan.

Runway 19 OBSTRUCTION TABLE

NO.	OBJECT NAME	ELEVATION (Top MSL)	DEPARTURE SURFACE	PENETRATION (in Feet)	AGL	PROPOSED REMEDIATION
1	TREES	983.1	EXT/ULT DEPARTURE	12.9' *	78.4'	TRIM/REMOVE ALL TREES
2	TREES	976.6	EXT/ULT DEPARTURE	1' *	71.1'	TRIM/REMOVE ALL TREES

* See Obstacle Action Plan included in Appendix D of the Ames Municipal Airport Master Plan.

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TRUE NORTH

Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

0 1000 2000 3000
HORIZONTAL SCALE IN FEET

0 100 200 300
VERTICAL SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.
2	-	__	__	__
1	-	__	__	__

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AMES MUNICIPAL AIRPORT

RUNWAY 1-19 DEPARTURE SURFACE DRAWING

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

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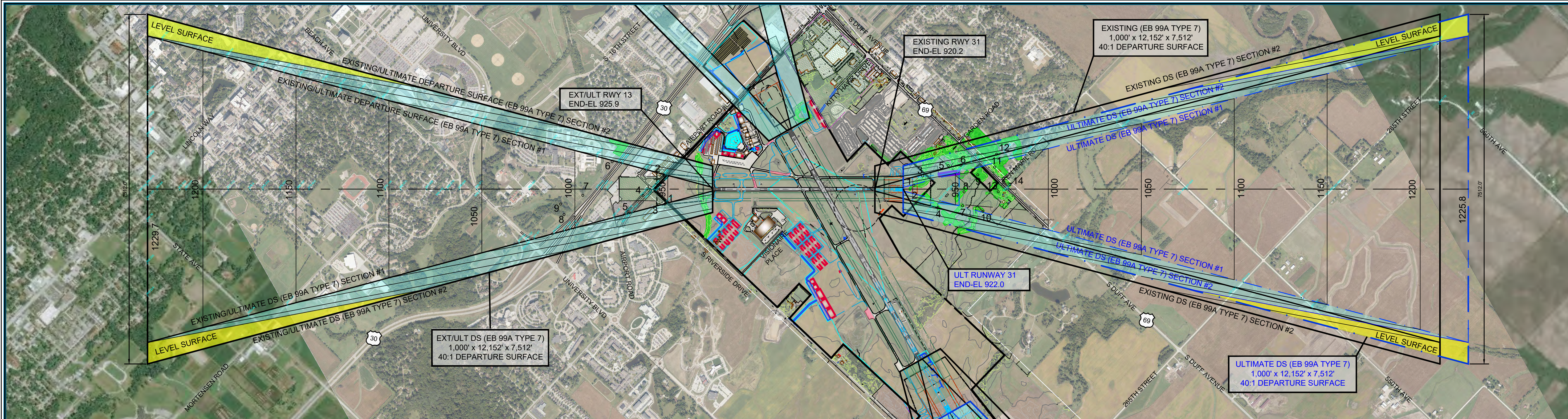
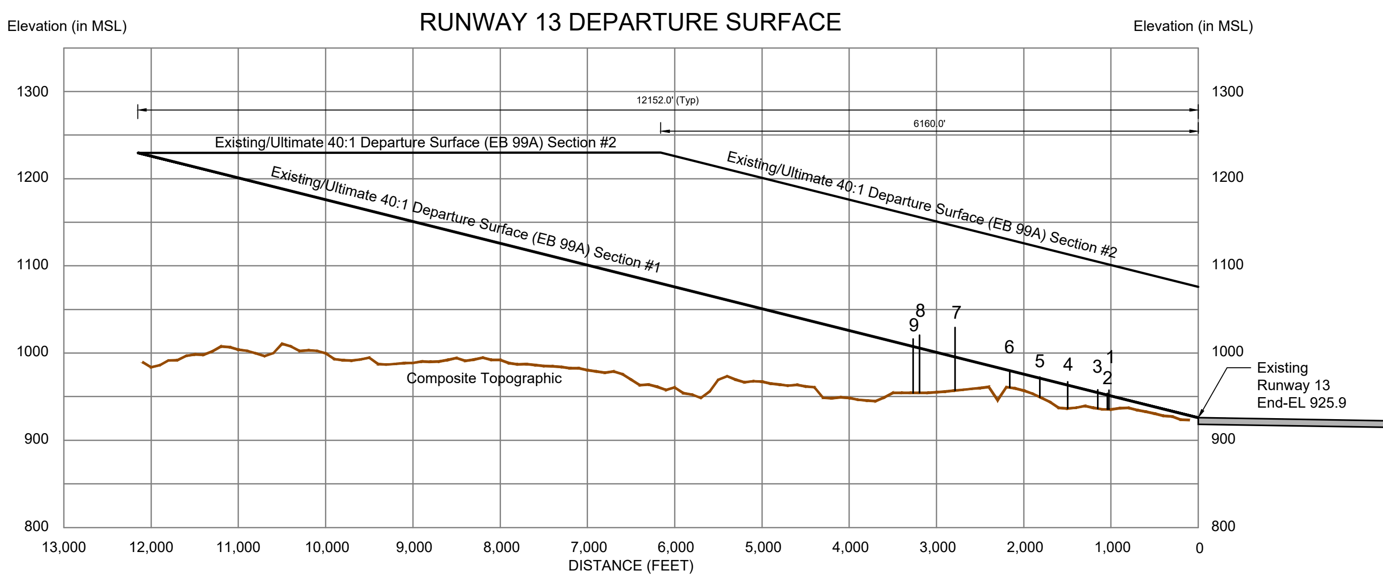
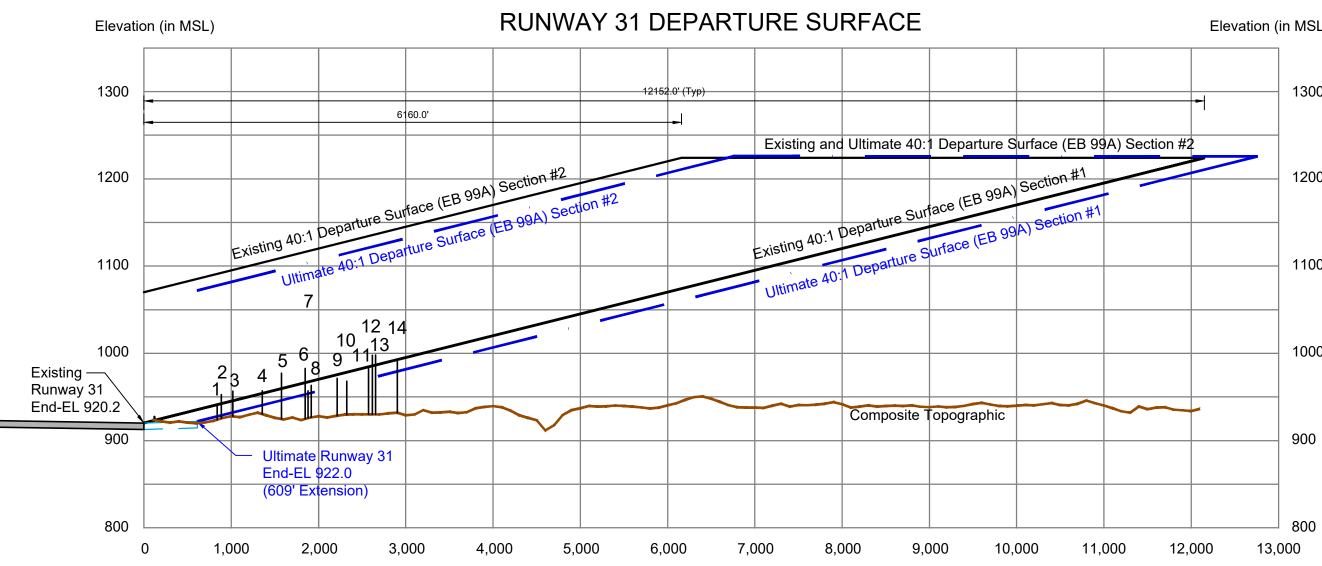
www.coffmanassociates.com







TREES

Date of Obstruction Survey: June 2020

Runway 13 OBSTRUCTION TABLE

NO.	OBJECT NAME	ELEVATION (Top MSL)	DEPARTURE SURFACE	PENETRATION (in Feet)	AGL	PROPOSED REMEDIATION
1	LIGHT POLE	957.5	EXT/ULT DEPARTURE	2' *	25.7'	BURY LINES/REMOVE POLES
2	LIGHT POLE	953.9	EXT/ULT DEPARTURE	2' *	29.5	BURY LINES/REMOVE POLES
3	LIGHT POLE	958.0	EXT/ULT DEPARTURE	3.3' *	25.4'	BURY LINES/REMOVE POLES
4	TREES	966.9	EXT/ULT DEPARTURE	3.6' *	39.2'	TRIM/REMOVE TREES
5	TREES	972.7	EXT/ULT DEPARTURE	1.2' *	40.1'	TRIM/REMOVE TREES
6	UTILITY POLE	980.1	EXT/ULT DEPARTURE	0.1' *	48.5'	BURY LINES/REMOVE POLES
7	TREES	1029.4	EXT/ULT DEPARTURE	33.7' *	94.6'	TRIM/REMOVE TREES
8	TREES	1020.6	EXT/ULT DEPARTURE	14.8' *	92.5'	TRIM/REMOVE TREES
9	TREES	1016.1	EXT/ULT DEPARTURE	8.6' *	78.6'	TRIM/REMOVE TREES

* See Obstacle Action Plan included in Appendix D of the Ames Municipal Airport Master Plan.

Runway 31 OBSTRUCTION TABLE

NO.	OBJECT NAME	ELEVATION (Top MSL)	DEPARTURE SURFACE	PENETRATION (in Feet)	AGL	PROPOSED REMEDIATION
1	TREES	940.1	EXT/ULT DEPARTURE	12.4' *	26.1'	TRIM/REMOVE TREES
2	TREES	952.7	EXT DEPARTURE	7.6' *	25.2'	TRIM/REMOVE TREES
3	TREES	956.9	EXT DEPARTURE	10.9' *	43.7'	TRIM/REMOVE TREES
4	TREES	957.2	ULT DEPARTURE	3.1'*	32.4'	TRIM/REMOVE TREES
5	TREES	977.3	EXT DEPARTURE	2.9' *	64.4'	TRIM/REMOVE TREES
6	TREES	982.9	ULT DEPARTURE	16.5' *	66.2'	TRIM/REMOVE TREES
7	TREES	957.2	ULT DEPARTURE	3.4' *	39.2'	TRIM/REMOVE TREES
8	TREES	963.4	ULT DEPARTURE	8.7' *	43.8'	TRIM/REMOVE TREES
9	TREES	971.4	ULT DEPARTURE	9.3' *	64.7'	TRIM/REMOVE TREES
10	TREES	968.3	ULT DEPARTURE	3.4' *	47.2'	TRIM/REMOVE TREES
11	TREES	982.6	ULT DEPARTURE	11.4' *	63.6'	TRIM/REMOVE TREES
12	TREES	997.9	ULT DEPARTURE	9' *	83.4'	TRIM/REMOVE TREES
13	TREES	998.3	EXT DEPARTURE	11.8' *	77.3'	TRIM/REMOVE TREES
14	TREES	991.8	ULT DEPARTURE	12.5' *	68.8'	TRIM/REMOVE TREES

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4. Depiction of features and objects within the inner portion of the approach surfaces, are illustrated on the INNER PORTION OF RUNWAY APPROACH SURFACE DRAWINGS.
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Magnetic Declination
0° 42' East (11/20/2019)
Annual Rate of Change 0° 4' West

0 1000 2000 3000
HORIZONTAL SCALE IN FEET

0 100 200 300
VERTICAL SCALE IN FEET

NO.	REVISIONS	DATE	BY	APP'D.
2	-	___	___	___
1	-	___	___	___

"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

AMES MUNICIPAL AIRPORT

RUNWAY 13-31 DEPARTURE SURFACE DRAWING

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

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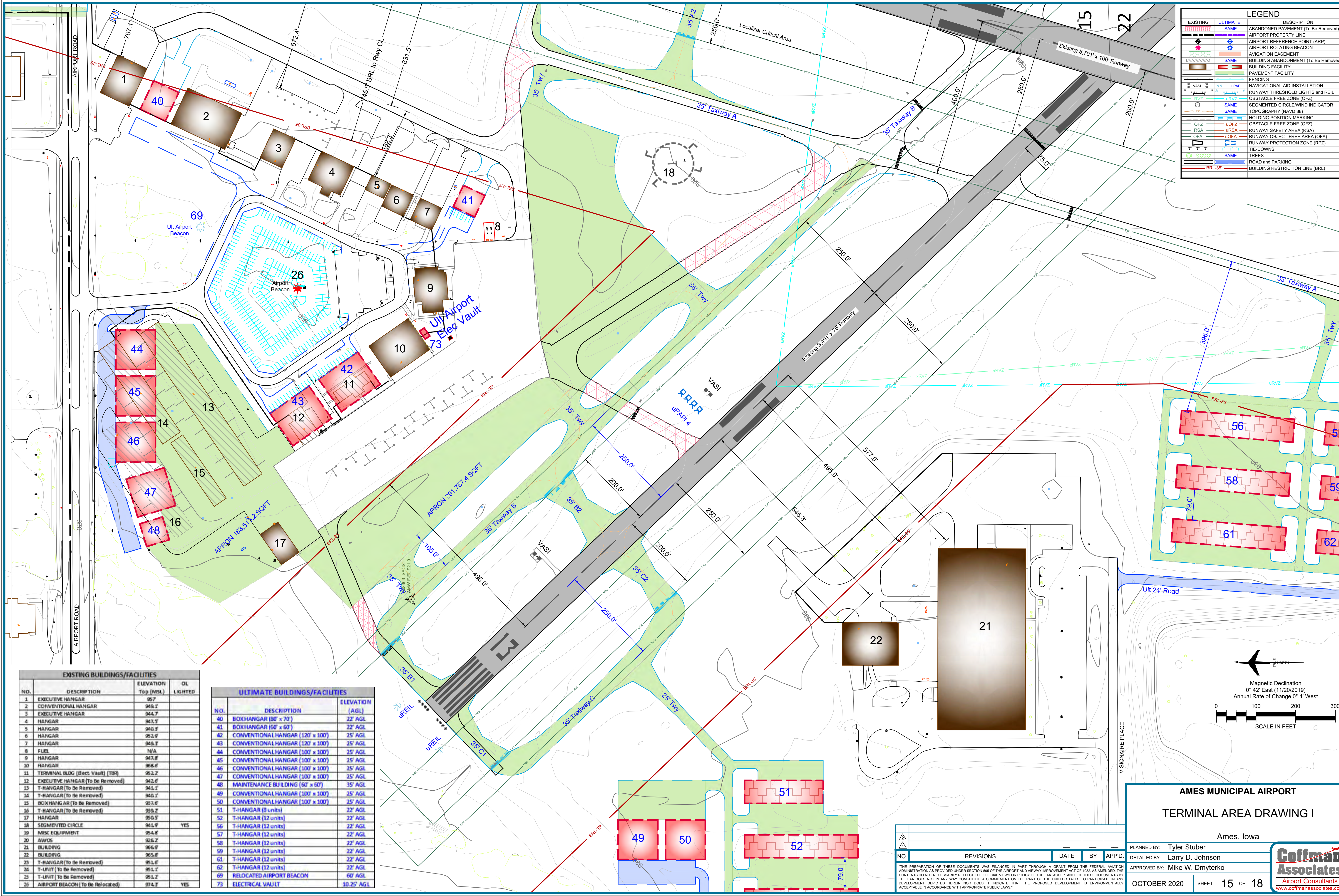

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
	SAME	ABANDONED PAVEMENT (To Be Removed)
		AIRPORT PROPERTY LINE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		AVIGATION EASEMENT
	SAME	BUILDING ABANDONMENT (To Be Removed)
		BUILDING FACILITY
		PAVEMENT FACILITY
		FENCING
VASI	uPAPI	NAVIGATIONAL AID INSTALLATION
		RUNWAY THRESHOLD LIGHTS and REIL
RVZ	uRVZ	OBSTACLE FREE ZONE (OFZ)
	SAME	SEGMENTED CIRCLE/WIND INDICATOR
950	SAME	TOPOGRAPHY (NAVD 88)
		HOLDING POSITION MARKING
OFZ	uOFZ	OBSTACLE FREE ZONE (OFZ)
RSA	uRSA	RUNWAY SAFETY AREA (RSA)
OFA	uOFA	RUNWAY OBJECT FREE AREA (OFA)
		RUNWAY PROTECTION ZONE (RPZ)
		TIE-DOWNS
	SAME	TREES
		ROAD and PARKING
BRL-35'		BUILDING RESTRICTION LINE (BRL)

EXISTING BUILDINGS/FACILITIES

NO.	DESCRIPTION	ELEVATION Top (MSL)	OL LIGHTED
1	EXECUTIVE HANGAR	957'	
2	CONVENTIONAL HANGAR	949.1'	
3	EXECUTIVE HANGAR	944.7'	
4	HANGAR	947.5'	
5	HANGAR	940.3'	
6	HANGAR	952.9'	
7	HANGAR	949.3'	
8	FUEL	N/A	
9	HANGAR	947.8'	
10	HANGAR	968.6'	
11	TERMINAL BLDG (Elect. Vault) (TBR)	952.2'	
12	EXECUTIVE HANGAR (To Be Removed)	942.6'	
13	T-HANGAR (To Be Removed)	941.1'	
14	T-HANGAR (To Be Removed)	940.1'	
15	BOX HANGAR (To Be Removed)	937.6'	
16	T-HANGAR (To Be Removed)	939.2'	
17	HANGAR	950.5'	
18	SEGMENTED CIRCLE	941.9'	YES
19	MISC EQUIPMENT	954.8'	
20	AWOS	926.2'	
21	BUILDING	966.9'	
22	BUILDING	965.8'	
23	T-HANGAR (To Be Removed)	951.6'	
24	T-UNIT (To Be Removed)	951.1'	
25	T-UNIT (To Be Removed)	951.2'	
26	AIRPORT BEACON (To Be Relocated)	974.3'	YES

ULTIMATE BUILDINGS/FACILITIES

NO.	DESCRIPTION	ELEVATION (AGL)
40	BOX HANGAR (80' x 70')	22' AGL
41	BOX HANGAR (60' x 60')	22' AGL
42	CONVENTIONAL HANGAR (120' x 100')	25' AGL
43	CONVENTIONAL HANGAR (120' x 100')	25' AGL
44	CONVENTIONAL HANGAR (100' x 100')	25' AGL
45	CONVENTIONAL HANGAR (100' x 100')	25' AGL
46	CONVENTIONAL HANGAR (100' x 100')	25' AGL
47	CONVENTIONAL HANGAR (100' x 100')	25' AGL
48	MAINTENANCE BUILDING (60' x 60')	35' AGL
49	CONVENTIONAL HANGAR (100' x 100')	25' AGL
50	CONVENTIONAL HANGAR (100' x 100')	25' AGL
51	T-HANGAR (8 units)	22' AGL
52	T-HANGAR (12 units)	22' AGL
56	T-HANGAR (12 units)	22' AGL
57	T-HANGAR (12 units)	22' AGL
58	T-HANGAR (12 units)	22' AGL
59	T-HANGAR (12 units)	22' AGL
61	T-HANGAR (12 units)	22' AGL
62	T-HANGAR (12 units)	22' AGL
69	RELOCATED AIRPORT BEACON	60' AGL
73	ELECTRICAL VAULT	10.25' AGL

NO.	REVISIONS	DATE	BY	APP'D.
2	-	__	__	__
1	-	__	__	__

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AMES MUNICIPAL AIRPORT

TERMINAL AREA DRAWING I

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 15 OF 18

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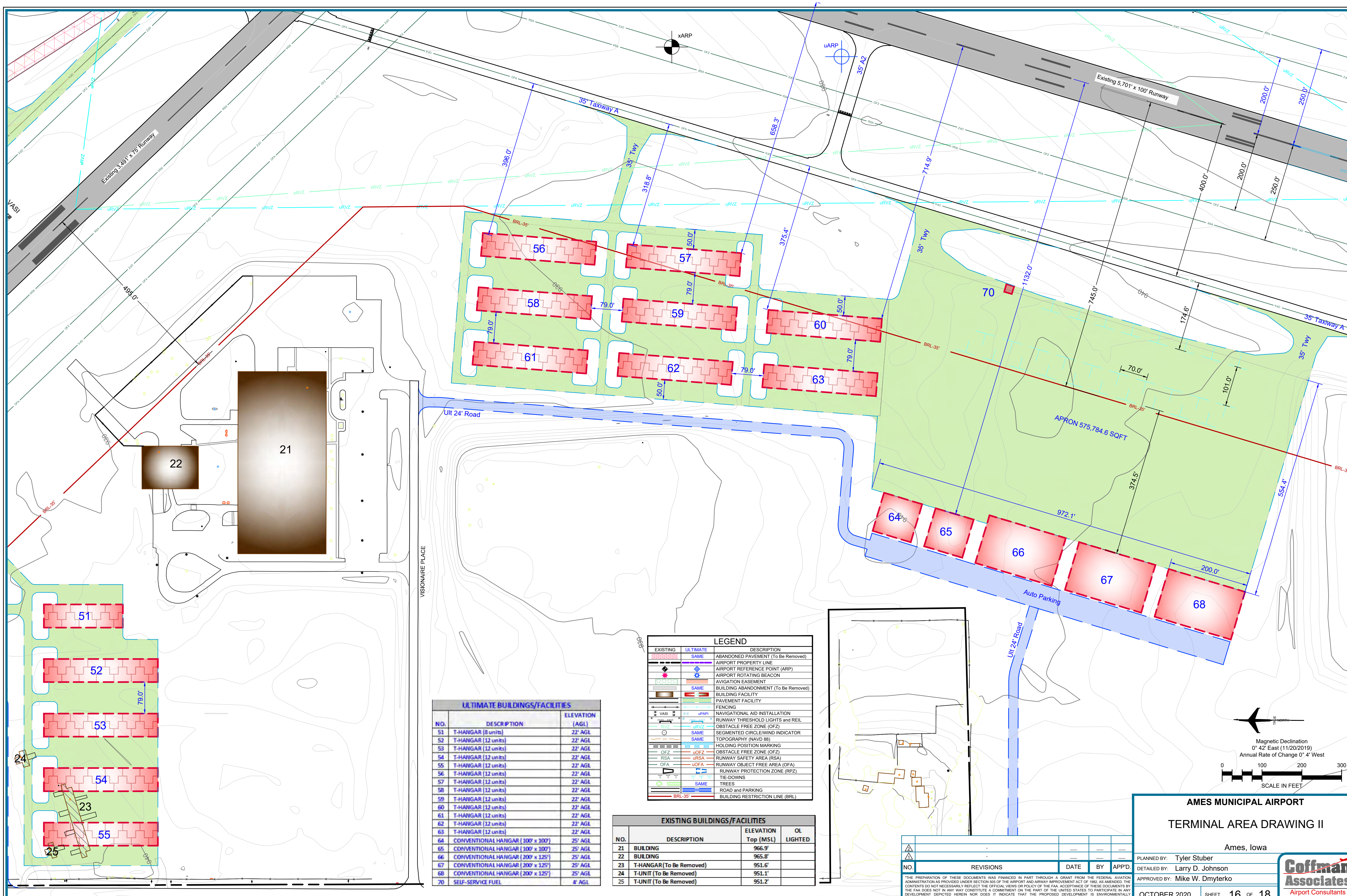

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
	SAME	ABANDONED PAVEMENT (To Be Removed)
		AIRPORT PROPERTY LINE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		AVIGATION EASEMENT
	SAME	BUILDING ABANDONMENT (To Be Removed)
		BUILDING FACILITY
		PAVEMENT FACILITY
		FENCING
VASI	uPAPI	NAVIGATIONAL AID INSTALLATION
		RUNWAY THRESHOLD LIGHTS and REIL
RVZ	uRVZ	OBSTACLE FREE ZONE (OFZ)
	SAME	SEGMENTED CIRCLE/WIND INDICATOR
950	SAME	TOPOGRAPHY (NAVD 88)
		HOLDING POSITION MARKING
OFZ	uOFZ	OBSTACLE FREE ZONE (OFZ)
RSA	uRSA	RUNWAY SAFETY AREA (RSA)
OFA	uOFA	RUNWAY OBJECT FREE AREA (OFA)
		RUNWAY PROTECTION ZONE (RPZ)
		TIE-DOWNS
	SAME	TREES
		ROAD and PARKING
BRL-35'		BUILDING RESTRICTION LINE (BRL)

ULTIMATE BUILDINGS/FACILITIES

NO.	DESCRIPTION	ELEVATION (AGL)
51	T-HANGAR (8 units)	22' AGL
52	T-HANGAR (12 units)	22' AGL
53	T-HANGAR (12 units)	22' AGL
54	T-HANGAR (12 units)	22' AGL
55	T-HANGAR (12 units)	22' AGL
56	T-HANGAR (12 units)	22' AGL
57	T-HANGAR (12 units)	22' AGL
58	T-HANGAR (12 units)	22' AGL
59	T-HANGAR (12 units)	22' AGL
60	T-HANGAR (12 units)	22' AGL
61	T-HANGAR (12 units)	22' AGL
62	T-HANGAR (12 units)	22' AGL
63	T-HANGAR (12 units)	22' AGL
64	CONVENTIONAL HANGAR (100' x 100')	25' AGL
65	CONVENTIONAL HANGAR (100' x 100')	25' AGL
66	CONVENTIONAL HANGAR (200' x 125')	25' AGL
67	CONVENTIONAL HANGAR (200' x 125')	25' AGL
68	CONVENTIONAL HANGAR (200' x 125')	25' AGL
70	SELF-SERVICE FUEL	4' AGL

EXISTING BUILDINGS/FACILITIES

NO.	DESCRIPTION	ELEVATION Top (MSL)	OL LIGHTED
21	BUILDING	966.9'	
22	BUILDING	965.8'	
23	T-HANGAR (To Be Removed)	951.6'	
24	T-UNIT (To Be Removed)	951.1'	
25	T-UNIT (To Be Removed)	951.2'	

NO.	REVISIONS	DATE	BY	APP'D.
2	-	—	—	—
1	-	—	—	—

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AMES MUNICIPAL AIRPORT

TERMINAL AREA DRAWING II

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 16 OF 18

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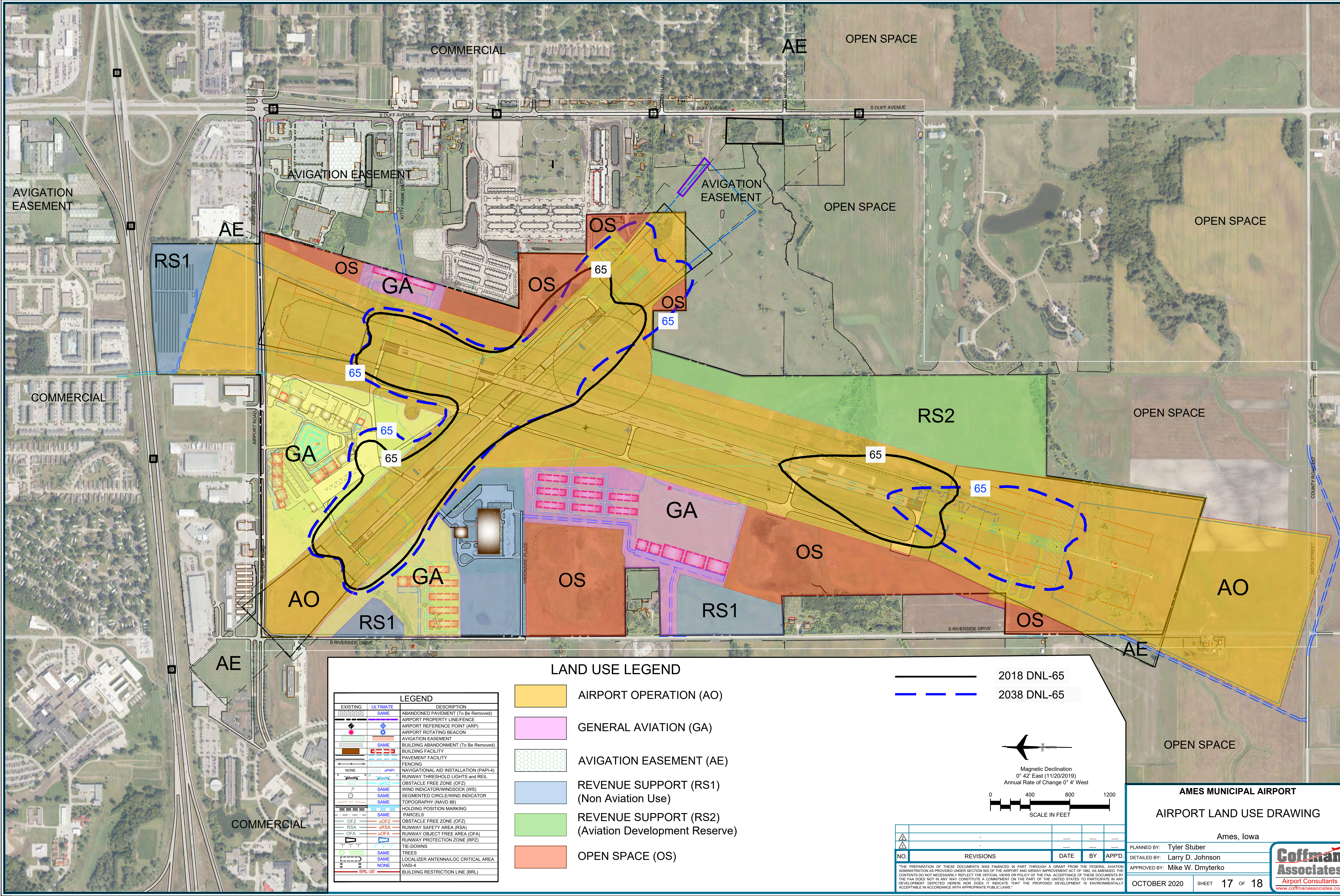

LEGEND

EXISTING	ULTIMATE	DESCRIPTION
	SAME	ABANDONED PAVEMENT (To Be Removed)
		AIRPORT PROPERTY LINE/FENCE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		AVIGATION EASEMENT
	SAME	BUILDING ABANDONMENT (To Be Removed)
		BUILDING FACILITY
		PAVEMENT FACILITY
		FENCING
NONE	uPAPI	NAVIGATIONAL AID INSTALLATION (PAPI-4)
		RUNWAY THRESHOLD LIGHTS and REIL
RVZ	uRVZ	OBSTACLE FREE ZONE (OFZ)
	SAME	WIND INDICATOR/WINDSOCK (WS)
	SAME	SEGMENTED CIRCLE/WIND INDICATOR
950	SAME	TOPOGRAPHY (NAVD 88)
		HOLDING POSITION MARKING
	SAME	PARCELS
OFZ	uOFZ	OBSTACLE FREE ZONE (OFZ)
RSA	uRSA	RUNWAY SAFETY AREA (RSA)
OFA	uOFA	RUNWAY OBJECT FREE AREA (OFA)
		RUNWAY PROTECTION ZONE (RPZ)
		TIE-DOWNS
	SAME	TREES
	SAME	LOCALIZER ANTENNA/LOC CRITICAL AREA
	NONE	VASI-4
BRL-35'		BUILDING RESTRICTION LINE (BRL)

NO.	REVISIONS	DATE	BY	APP'D.
2	-	—	—	—
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"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

AMES MUNICIPAL AIRPORT

AIRPORT LAND USE DRAWING

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 17 OF 18

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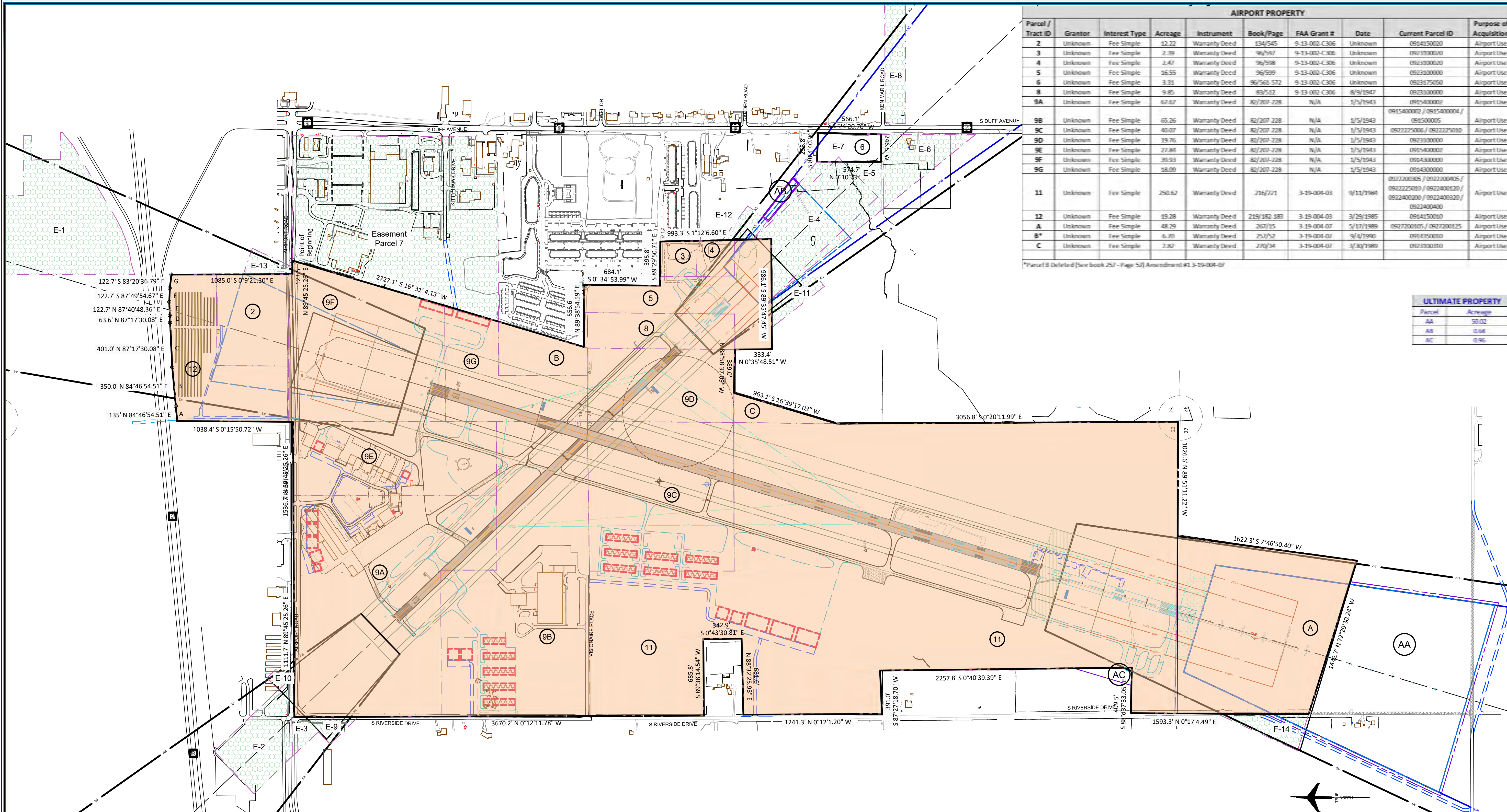

AIRPORT PROPERTY									
Parcel / Tract ID	Grantor	Interest Type	Acreage	Instrument	Book/Page	FAA Grant #	Date	Current Parcel ID	Purpose of Acquisition
2	Unknown	Fee Simple	12.22	Warranty Deed	134/545	9-13-002-C306	Unknown	0914150020	Airport Use
3	Unknown	Fee Simple	2.39	Warranty Deed	96/597	9-13-002-C306	Unknown	0923100020	Airport Use
4	Unknown	Fee Simple	2.47	Warranty Deed	96/598	9-13-002-C306	Unknown	0923100020	Airport Use
5	Unknown	Fee Simple	16.55	Warranty Deed	96/599	9-13-002-C306	Unknown	0923100000	Airport Use
6	Unknown	Fee Simple	3.31	Warranty Deed	96/561-572	9-13-002-C306	Unknown	0923175050	Airport Use
8	Unknown	Fee Simple	9.85	Warranty Deed	83/512	9-13-002-C306	8/9/1947	0923100000	Airport Use
9A	Unknown	Fee Simple	67.67	Warranty Deed	82/207-228	N/A	1/5/1943	0915400002	Airport Use
9B	Unknown	Fee Simple	65.26	Warranty Deed	82/207-228	N/A	1/5/1943	0915400002 / 0915400004 / 091500005	Airport Use
9C	Unknown	Fee Simple	40.07	Warranty Deed	82/207-228	N/A	1/5/1943	0922225006 / 0922225010	Airport Use
9D	Unknown	Fee Simple	19.76	Warranty Deed	82/207-228	N/A	1/5/1943	0923100000	Airport Use
9E	Unknown	Fee Simple	27.84	Warranty Deed	82/207-228	N/A	1/5/1943	0915400002	Airport Use
9F	Unknown	Fee Simple	39.93	Warranty Deed	82/207-228	N/A	1/5/1943	0914300000	Airport Use
9G	Unknown	Fee Simple	18.09	Warranty Deed	82/207-228	N/A	1/5/1943	0914300000	Airport Use
11	Unknown	Fee Simple	250.62	Warranty Deed	216/221	3-19-004-03	9/11/1984	0922200305 / 0922200405 / 0922225010 / 0922400120 / 0922400200 / 0922400320 / 0922400400	Airport Use
12	Unknown	Fee Simple	19.28	Warranty Deed	219/182-183	3-19-004-03	3/29/1985	0914150010	Airport Use
A	Unknown	Fee Simple	48.29	Warranty Deed	267/15	3-19-004-07	5/17/1989	0927200105 / 0927200125	Airport Use
B*	Unknown	Fee Simple	6.70	Warranty Deed	257/52	3-19-004-07	9/4/1990	0914350010	Airport Use
C	Unknown	Fee Simple	2.82	Warranty Deed	270/34	3-19-004-07	3/30/1989	0923100310	Airport Use

*Parcel B Deleted [See book 257 - Page 52] Amendment #1 3-19-004-07

ULTIMATE PROPERTY	
Parcel	Acreage
AA	50.02
AB	0.68
AC	0.96

AVIGATION EASEMENT								
Parcel / Tract ID	Grantor	Interest Type	Acreage	Instrument	Book/Page	FAA Grant #	Date	Purpose of Acquisition
7	Unknown	Avigation Easement	57.24	Unknown	126/468,4690	N/A	10/9/1964	Clearance
E-1	Unknown	Avigation Easement	23.07	Unknown	120/364	N/A	11/28/1972	Clearance
E-2	Unknown	Avigation Easement	8.73	Unknown	136/575	3-13-002-5704	11/21/1957	Clearance
E-3	Unknown	Avigation Easement	1.55	Unknown	136/570	N/A	1/28/1958	Clearance
E-4	Unknown	Avigation Easement	12.60	Unknown	82/307	3-13-002-5704	11/11/1957	Clearance
E-5	Unknown	Avigation Easement	4.28	Unknown	136/568	N/A	1/2/1964	Clearance
E-6	Unknown	Avigation Easement	6.63	Unknown	95/136,572	N/A	12/9/1963	Clearance
E-7	Unknown	Avigation Easement	0.04	Unknown	82/31	N/A	12/5/1957	Clearance
E-8	Unknown	Avigation Easement	5.39	Unknown	161/45	N/A	1/29/1989	Clearance
E-9	Unknown	Avigation Easement	0.95	Unknown	276/292	3-19-004-07	2/7/1989	Clearance
E-10	Unknown	Avigation Easement	0.89	Unknown	270/20	3-19-004-07	12/6/1988	Clearance
E-11	Unknown	Avigation Easement	2.46	Unknown	274/156	3-19-004-07	12/2/1988	Clearance
E-12	Unknown	Avigation Easement	1.52	Unknown	274/157	3-19-004-07	12/2/1988	Clearance
E-13	Unknown	Avigation Easement	1.46	Unknown	275/268	3-19-004-07	2/7/1989	Clearance
F-14	Unknown	Avigation Easement	3.10	Unknown	303/20-76	3-19-004-07	5/10/1989	Clearance

LEGEND		
EXISTING	ULTIMATE	DESCRIPTION
	SAME	ABANDONED PAVEMENT (To Be Removed)
		AIRPORT PROPERTY LINE/FENCE
		AIRPORT REFERENCE POINT (ARP)
		AIRPORT ROTATING BEACON
		AVIGATION EASEMENT
	SAME	BUILDING ABANDONMENT (To Be Removed)
		BUILDING FACILITY
		PAVEMENT FACILITY
		FENCING
NONE	uPAPI	NAVIGATIONAL AID INSTALLATION (PAPI-4)
		RUNWAY THRESHOLD LIGHTS and REIL
RVZ	uRVZ	OBSTACLE FREE ZONE (OFZ)
		HOLDING POSITION MARKING
	SAME	PARCELS
OFZ	uOFZ	OBSTACLE FREE ZONE (OFZ)
RSA	uRSA	RUNWAY SAFETY AREA (RSA)
OFA	uOFA	RUNWAY OBJECT FREE AREA (OFA)
AS	uAS	PART 77 APPROACH SURFACE
		RUNWAY PROTECTION ZONE (RPZ)
	SAME	LOCALIZER CRITICAL AREA
	NONE	VASI-4

FOR APPROVAL BY

Airport Manager: Damion Pregitzer

DATE:

NO.	REVISIONS	DATE	BY	APP'D.
2	-	__	__	__
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"THE PREPARATION OF THESE DOCUMENTS WAS FINANCED IN PART THROUGH A GRANT FROM THE FEDERAL AVIATION ADMINISTRATION AS PROVIDED UNDER SECTION 505 OF THE AIRPORT AND AIRWAY IMPROVEMENT ACT OF 1982, AS AMENDED. THE CONTENTS DO NOT NECESSARILY REFLECT THE OFFICIAL VIEWS OR POLICY OF THE FAA. ACCEPTANCE OF THESE DOCUMENTS BY THE FAA DOES NOT IN ANY WAY CONSTITUTE A COMMITMENT ON THE PART OF THE UNITED STATES TO PARTICIPATE IN ANY DEVELOPMENT DEPICTED HEREIN NOR DOES IT INDICATE THAT THE PROPOSED DEVELOPMENT IS ENVIRONMENTALLY ACCEPTABLE IN ACCORDANCE WITH APPROPRIATE PUBLIC LAWS."

AMES MUNICIPAL AIRPORT

EXHIBIT-A
AIRPORT PROPERTY INVENTORY MAP

Ames, Iowa

PLANNED BY: Tyler Stuber
DETAILED BY: Larry D. Johnson
APPROVED BY: Mike W. Dmyterko

OCTOBER 2020 SHEET 18 OF 18

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