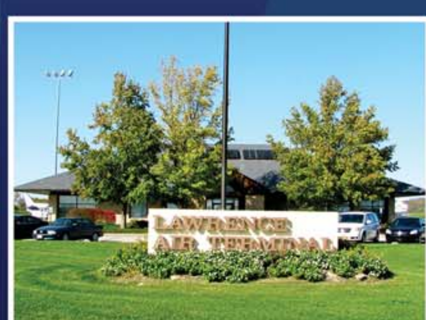
LAWRENCE MUNICIPAL AIRPORT

FINAL



AIRPORT MASTER PLAN

AIRPORT MASTER PLAN

for

LAWRENCE MUNICIPAL AIRPORT
Lawrence, Kansas

Prepared for

THE CITY OF LAWRENCE

by

Coffman Associates, Inc.

Approved by the Lawrence City Commission on November 15, 2011
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Introduction

LAWRENCE MUNICIPAL AIRPORT

Introduction

The Lawrence Municipal Airport (LWC) Master Plan was undertaken to evaluate the airport's capabilities and role, to forecast future aviation demand, and to plan for the timely development of new or expanded facilities that may be required to meet that demand. The ultimate goal of the master plan is to provide systematic guidelines for the airport's overall maintenance, development, and operation.

The City of Lawrence contracted with Coffman Associates, Inc., a national airport consulting firm specializing in airport planning studies. Olsson Associates will provide technical engineering assistance during the study, as needed.

The master plan is intended to be a proactive document which identifies and then plans for future facility needs well in advance of the actual need for the facilities. This is done to ensure that the City of Lawrence can coordinate project approvals, design, financing, and construction with local, State, and Federal agencies to avoid experiencing detrimental effects due to inadequate facilities.

An important outcome of the master plan is reserving sufficient areas for future facility needs. The recommended development plan protects identified areas for future development and ensures they will be readily available when required to meet future needs. The intended result is a detailed land use concept which outlines specific uses for all airport property.

The preparation of this master plan is evidence that the City of Lawrence recognizes the importance of air

AIRPORT MASTER PLAN

transportation to the community as well as the unique challenges operating an airport presents. The investment in an airport yields many benefits to the community and the region. With a sound and realistic master plan, the Lawrence Municipal Airport can maintain its important link to the national air transportation system for the community and maintain the existing public and private investments in its facilities.

STUDY COORDINATION

The study process included local participation through the formation of a Planning Advisory Committee (PAC). The PAC consisted of federal, state, and local agencies, airport tenants, and general public representatives. The airport sponsor determined the final makeup of the committee, with the assistance of the consultant.

The study schedule called out four points in the study process where the PAC convened to discuss draft working paper submittals. A kickoff meeting was held during the initial inventory process on August 11, 2010. Other meetings followed facility requirements (Phase 1), development alternatives (Phase 2), and the capital improvement program (Phase 3). Following the Phase 3 meeting with the PAC, an "open house" workshop for the general public was held on August 3rd, 2011, to present the preliminary findings and to solicit public comment. The study took 12 months to complete and was on time and on budget. The Federal Aviation Administration (FAA) reviewed the sponsor-approved airport layout plan drawings and approved then in February, 2012.

Draft Phase Reports were available online at www.Lawrence.airportstudy.com for the duration of the study. **Exhibit IA** presents the key study elements, meeting intervals, project schedule, and documentation.

MASTER PLAN OBJECTIVES

The overall objective of the Airport Master Plan Study is to provide the City with guidance for future development of the airport and meeting the needs of existing and future users, while also being compatible with the environment. The most recent master plan was completed in 1991. An Airport Layout Plan and Narrative Report for the airport were completed in 2001. The FAA-approved ALP is dated July 2003. This master plan identifies and provides justification for new priorities. The plan was closely coordinated with other existing or ongoing planning studies for the area, and with aviation plans developed by the state and FAA. Coordination between the Sponsor, Kansas Department of Transportation – Division of Aviation (KDOT), the FAA – Central Region, and other airport stakeholders were essential throughout the master planning process. Specific objectives of the study included:

- Research factors likely to affect air transportation demand in the Lawrence area over the next 20 years and develop new operational and basing forecasts.

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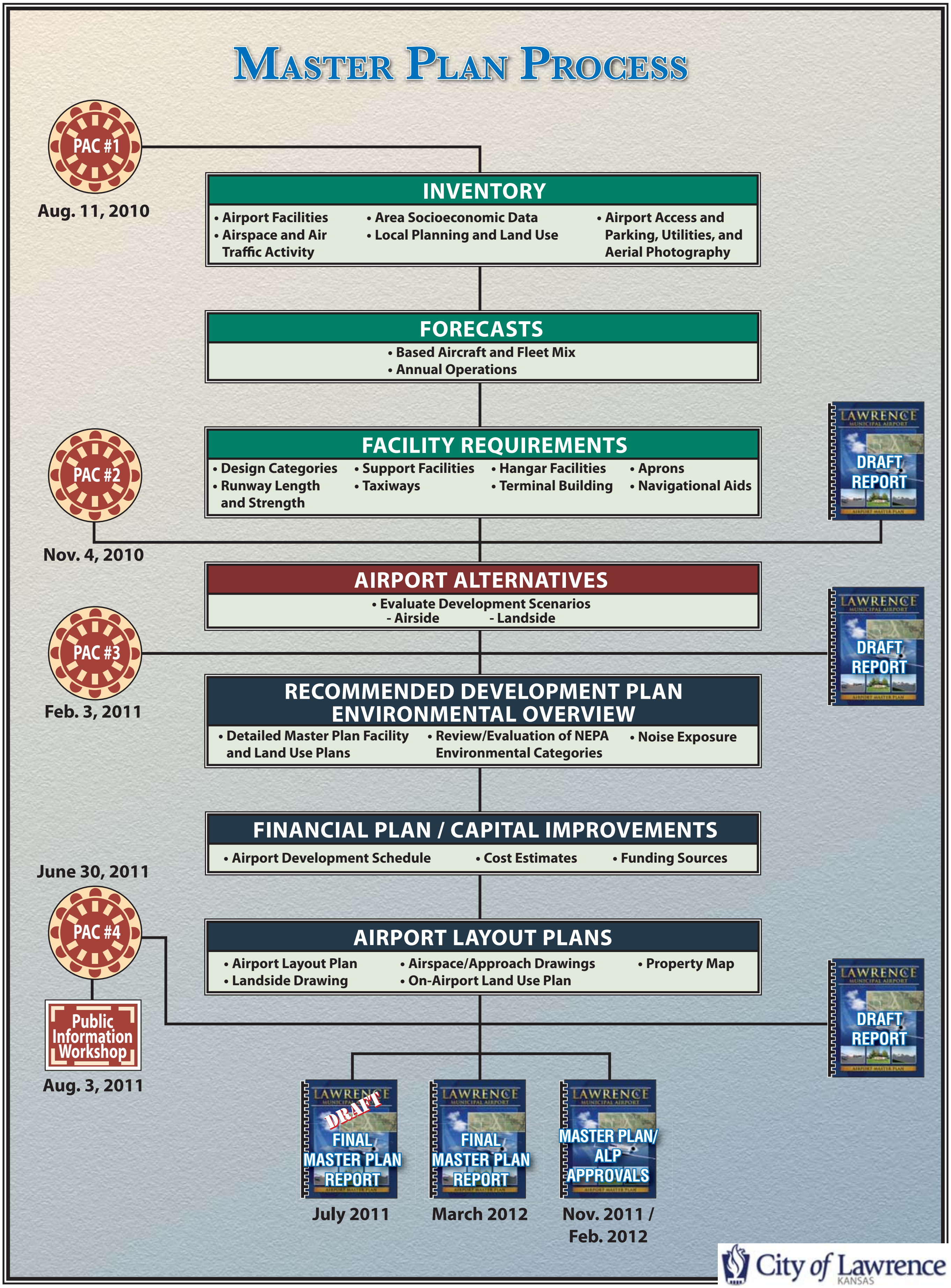

Exhibit IA
WORK FLOW

- Determine projected needs of airport users, taking into consideration recent changes to FAA design standards, global positioning (GPS) technology improvements, and shifting corporate and general aviation aircraft use trends.

- Recommend improvements which will enhance Lawrence Municipal Airport's ability to satisfy future aviation demand for the region, including areas such as: long term runway length needs, ultimate configuration of the terminal area, future hangar siting, and revenue enhancement opportunities.

- Establish a schedule of development priorities and associated capital improvement program. The financial plan will also include an analysis of potential capital improvement funding sources.

- Update airport mapping and airport layout plan drawings.

- Develop active and productive public involvement throughout the planning process.

MASTER PLAN ELEMENTS AND PROCESS

To achieve the objectives described above, the master plan is being prepared in a systematic fashion pursuant to the scope of services that has been coordinated with the sponsor and the FAA. The study has 12 elements:

1.0 **Study Initiation** - Development of the scope of services, budget, and schedule. A kickoff meeting with the PAC was held at the study's initiation to obtain a more comprehensive understanding of local issues. A dedicated project website was established.

2.0 **Inventory** - Inventory of facility and operational data, wind data, environmental inventory, population and economic data, airport financial data, and new aerial photography and mapping.

3.0 **Forecasts** - Forecasts for based aircraft, operations, and peaking characteristics for the airport over a 20-year period.

4.0 **Facility Requirements** - After establishing critical aircraft and physical planning criteria, facility needs assessments were developed for airside and landside facilities.

5.0 **Phase 1 Report** - The information and analysis developed in elements one through four was organized into a draft Phase 1 Report. The report was submitted for review by the PAC, FAA, and City officials.

6.0 **Airport Alternatives** - Potential airside and landside alternatives were developed (a maximum of three each) for meeting long-term needs. Each of the alternatives was subjected to engineering and environmental analysis.

7.0 **Phase 2 Report** - Upon completion of the work tasks in Element 6, a preliminary report was prepared to outline the analysis, methodologies, and findings of the airport alternatives chapter. The draft report was submitted for review by the PAC, FAA, and City of Lawrence officials.

8.0 **Recommended Master Plan Concept/Financial Program/ Environmental Overview** – Following input from the PAC, FAA, and City of Lawrence officials on the airside and landside alternatives prepared in the previous element, a detailed comparative evaluation and the supporting rationale to sufficiently describe the single recommended program for development and use of airport facilities was presented. The recommendations for the most prudent and feasible master plan concept become the basis for the final refinement of development costs and scheduling. A preliminary environmental overview was developed in order to identify any potential environmental impacts generated by the recommended master plan concept.

9.0 **Phase 3 Report** - Upon completion of the work tasks in Element 8, a draft report was prepared to outline the analysis, methodologies, and findings of the recommended concept, development schedules, cost estimates, and environmental overview. The draft report was submitted for review by the PAC, FAA, and City of Lawrence officials.

10.0 **Airport Plans and Drawings** - Airport layout plans were developed to depict existing and proposed facilities. The drawings set met the requirements of the FAA Central Region. In addition, noise exposure contours were developed for existing and future conditions to determine the extent of critical noise exposure in the airport vicinity.

11.0 **Draft Final Master Plan Report** - Upon completion of the work tasks in Elements 10, a draft report was prepared to outline the analysis, methodologies, and findings of the study efforts. This document incorporated appropriate comments and corrections received during previous reviews of the Phase I, II, and III reports. The draft ALP drawing set was also included. The report was submitted for review by the PAC, FAA, and City of Lawrence officials and was used for the necessary master plan approvals and reviews.

12.0 **Final Documentation/ Meetings/Public Workshops** - The final document incorporated the revisions to previous phase reports prepared under earlier elements into a usable master planning document. A total of four (4) meetings with the PAC were conducted, which included the initial kick-off meeting and a meeting to present each of the draft phase reports. A public workshop was held after the Phase III report was developed. An executive summary brochure has also been prepared.

Chapter One

Inventory

Chapter One

Inventory

The initial step in the preparation of the airport master plan update for Lawrence Municipal Airport is the collection of information that will provide a basis for the analysis to be completed in subsequent chapters. For the master plan, information is gathered regarding both the airport and the region it serves. This chapter will begin with an overview of the airport history, administration, location, competing airports, and typical weather conditions. This will be followed by a discussion of demographic and socioeconomic factors relevant to the region. A comprehensive overview of the national aviation system for general aviation airports and the role of Lawrence Municipal Airport in the national system are also presented. Finally, an inventory of the existing facilities at the airport will be discussed.

The information outlined in this chapter was obtained through on-site inspections of the airport, including interviews with the airport sponsors, management, tenants, and representatives of various government agencies. Information was also obtained from existing studies and various internet websites. A general list of document sources is provided at the end of this chapter.

BACKGROUND INFORMATION

It is important in any master plan to establish a baseline understanding of the airport setting, including its location, geography, access to other transportation modes, role in the national aviation system, climate, and admin-

istration. The following sections will outline these characteristics.

LOCATION AND ACCESS

The Lawrence Municipal Airport is located within the city limits of Lawrence, Kansas. All of airport property is surrounded by unincorporated Douglas County. The airport is physically situated north of the Kansas River and within Douglas County. The airport is 28 miles east of Topeka, the state capital, and 35 miles west of Kansas City, Missouri. The main access road to the airport extends from U.S. Highway 40/24 on the south side of the airport. Douglas County Road 9 provides access to the west terminal area. Approximately one mile to the west is U.S. Highway 24/59. Interstate 70 is the east/west interstate across Kansas and it passes approximately ½-mile to the south of the airport, with an interchange at U.S. Highway 59.

The airport encompasses approximately 445 acres and is situated at 832 feet above mean sea level (MSL). The location is within the traditional floodplain for the Kansas River. Just north of the airport is Mud Creek and an associated levee. A generalized location map is presented in **Exhibit 1A**.

AIRPORT HISTORY AND DEVELOPMENT

The Lawrence Municipal Airport was opened at its current location in 1929 on property owned by the University of Kansas. There were originally four turf runways with the longest being 2,600 feet in length. In 1936, the runways were improved with a cinder surface, boundary markers, and an aircraft apron. Two hangars were also constructed. In 1941, three of the four runways were extended, with the longest being 3,200 feet in length.

In 1958, the airport accepted federal grants from the Civil Aeronautics Administration, the predecessor to the Federal Aviation Administration (FAA), and a new 3,000-foot asphalt runway designated Runway 1-19 was constructed. Other improvements included the construction of a partial parallel taxiway, installation of runway lights, and a lighted rotating beacon. In the 1960s, several hangars were constructed and an aircraft tiedown apron was added as well. In 1977, the airport and the property were deeded to the City of Lawrence.

There have been several projects of noted significance in the last 10 years. Runway 15-33 has been extended from 5,002 feet to the current length of 5,700 feet. This project was primarily undertaken to extend the usefulness of the airport to an increasing number of medium and large business jet operators. Other improvements include the construction of a partial parallel taxiway to Runway 1-19. In the past year, the City of Lawrence has extended municipal water service to the airport and has plans to extend wastewater service in 2011. All of these projects position the airport for future growth. **Table 1A** presents a summary of the major airport capital improvements since the City of Lawrence took ownership of the airport property.

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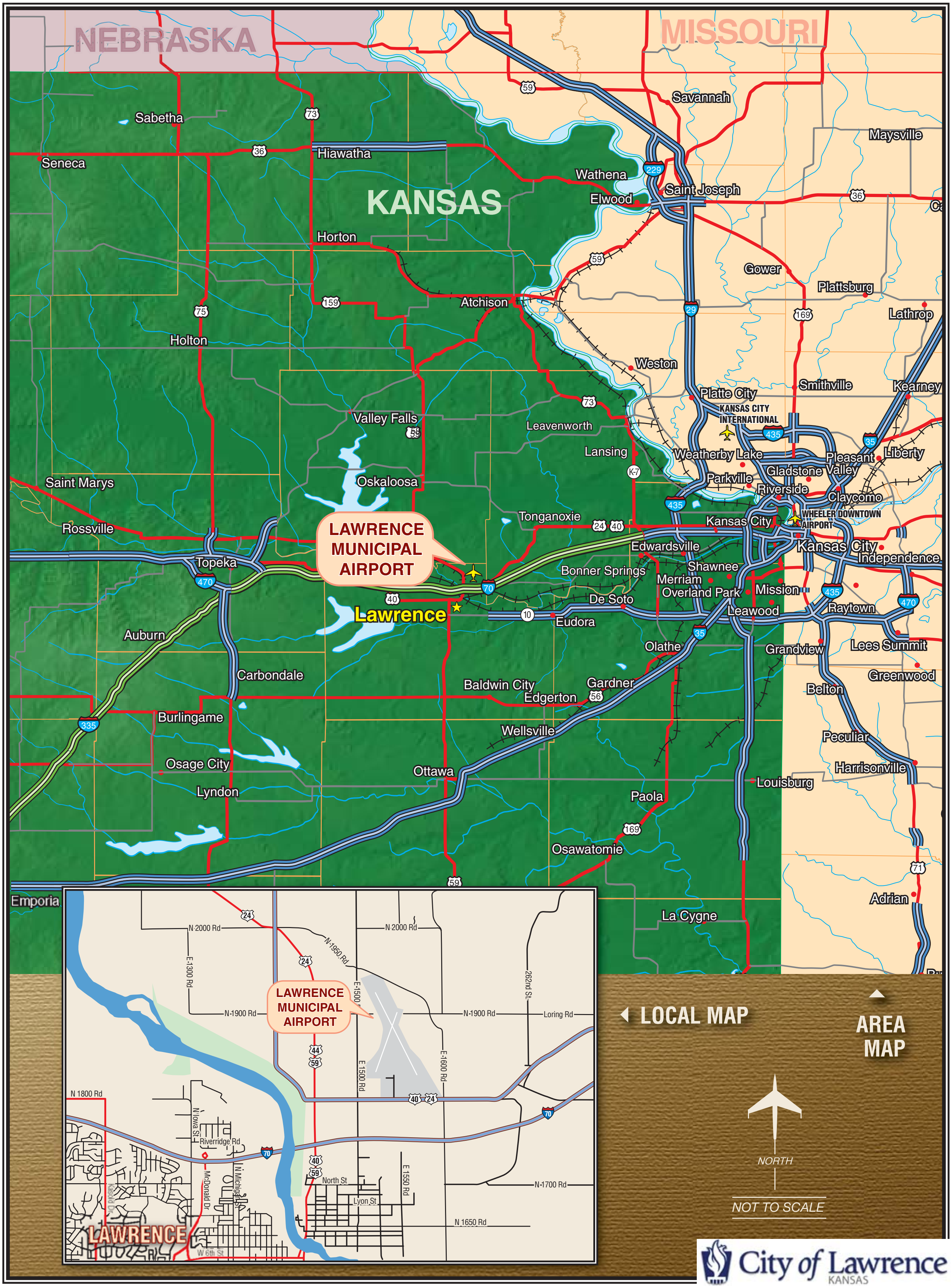


Exhibit 1A
LOCATION MAP

TABLE 1A
Historical Capital Improvement Projects
Lawrence Municipal Airport

Year	Projects
1977	Acquire land and easement overlay; widen mark and light connecting taxiway; construct segmented circle; install lighted wind sock; road barriers; modify underground pipelines; install fencing; various site preparation; obstruction removal
1978	Acquire land; reimbursement for land; adjust pipeline
1980	Acquire land; construct, mark, light Runway 14-32 (now 15-33); construct mark connecting taxiway from Runway 32 (33) to Runway 1; construct seal apron; grading, seeding, drainage
1981	Grade apron; construct access road to new terminal area; install lighted rotating beacon; drainage, seeding
1982	Expand terminal apron, marking, tie-downs; construct and mark parallel taxiway; grading and seeding
1983	Land reimbursement; light parallel taxiway (15-33), apron lighting
1990	Airport master plan
1991	Approach lights; land acquisition
1992	Pavement rehabilitation and marking
1994	Construct fuel farm.
1997	Apron rehabilitation
2001	Rehabilitate Runway 15-33; partial reconstruction of Taxiway A; rehabilitate and expand apron; install apron floodlighting
2001	Environmental Assessment; land acquisition
2002	Extend Runway 15-33 (298 feet north and 400 feet south); extend Taxiway A; new electrical vault; relocate MALSR, ASOS, ILS; install PAPI
2004	Rehabilitate Runway 1-19; construct taxiway connector and run up area
2004	Airfield lighting and visual aid updates
2005	Taxiway D construction for Runway 1-19
2007	Runway 15-33 safety area improvements
2009*	RPZ land acquisition for Runway 1-19
2010	Extension of municipal water to the airport
2011*	Extension of city wastewater service to the airport

*Project currently in progress (9-2010)

Source: Airport Layout Plan Update 2001; City of Lawrence records.

AIRPORT ADMINISTRATION

Lawrence Municipal Airport is owned and operated by the City of Lawrence. The airport falls under the responsibility of the Public Works Department, and the Director of Public Works is the primary airport contact. The City also employs a full-time operations specialist who is stationed at the airport on a daily basis. Customer interactions are handled by Hetrick Air Services, the fixed base operator (FBO). Hetrick is a full service FBO providing fuel, hangar rental, aircraft tie-down space, maintenance, annual inspections, catering services, pilots lounge, courtesy car, aircraft charters, aircraft sales, flight training, and supplies.

The city has created an Airport Advisory Board. The objectives of the Board include the following:

- promote general and commercial aviation activities and interests in Lawrence
- seek means of more fully utilizing and improving aviation facilities in Lawrence
- aid the City and users of the aviation facilities in Lawrence in obtaining and improving services subject to approval by the governing body
- receive and evaluate reports of poor or improper services by the contractual base operator, unsafe conditions, or failure of parties to observe airport rules.

The Airport Advisory Board consists of seven members, six of which are appointed from the public at large and one appointed from the University of Kansas. Board members serve three year terms and meet periodically, typically once a month, to discuss airport issues.

REGIONAL CLIMATE

Weather conditions must be considered in the planning and development of an airport, as daily operations are affected by local weather patterns. Temperature is a significant factor in determining runway length needs, while local wind patterns (both direction and speed) dictate the optimal orientation of the runways.

The climate in the region produces distinct seasonal changes. The winters range from cool to cold, while the summers are warm and humid. The average low temperatures range from 20 degrees Fahrenheit (F) in January to 70 degrees in July. The average high temperatures range from 39 degrees in January to 91 degrees in July. Lawrence averages nearly 40 inches of precipitation annually, including 18 inches of snowfall. Thunderstorms occur throughout the year, but are most frequent during the spring months. **Table 1B** presents a summary of climate data for Lawrence, Kansas.

TABLE 1B
Climate Summary
Lawrence, KS

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
High Temp. Avg.	39	46	57	68	77	85	91	89	81	70	54	42
Low Temp. Avg.	20	26	35	46	56	65	70	68	59	48	36	25
Precip. Avg.(in.)	1.25	1.19	2.74	3.54	5.30	5.63	4.01	3.81	4.54	3.40	2.57	1.80

Note: All temperatures in Fahrenheit degrees.
Source: Climatography of the United States No. 81 (30-years of data from 1971-2000)

AREA TRANSPORTATION MODES

Airports are a significant part of the national transportation infrastructure. Other modes of transportation can work in synergy with airports to promote access and economic development. The following discussion presents information related to the various transportation modes available in the Lawrence/Douglas County area.

Highways

Interstate 70 is situated just north of the Lawrence central business district, providing ready access to points east and west. U.S. Highways 40, 24, and 59 also provide surface transportation to points north and south of the city.

Rail

The Burlington Northern Santa Fe Railroad runs along the south side of the Kansas River. Several rail spurs feed to industrial sites to the east and west of the city. The Union Pacific Railroad runs along the north side of the Kansas River. Both of these are mainline railroad tracks.

Daily passenger rail service is available from AmTrak's Southwest Chief. The depot is located on 7th Street, east of Downtown Lawrence. Eastbound service is available to Kansas City and, ultimately, Chicago. Westbound service is available to Albuquerque and, ultimately, Los Angeles.

Public Transit Service

The City of Lawrence initiated the Lawrence Transit System, commonly referred to as the "T," in December 2000. When started, the "T" complimented a small paratransit system and the KU on Wheels system. Ridership has increased annually since its inception. Today, routes are coordinated between the "T" and KU on Wheels in order to maximize commuter efficiency. The Downtown to North Lawrence route operates daily and provides transit as far north as the I-70 business center located at the corner of I-70 and U.S. Highway 40/59, approximately 1½-miles from the airport.

AREA LAND USE

Land uses in the vicinity of the airport can have an impact on airport operations and growth potential. The following section identifies baseline information relating to both existing and future land uses in the vicinity of Lawrence Municipal Airport. By understanding the land use issues surrounding the airport, more appropriate recommendations can be made for the future of the airport.

COMPATIBLE LAND USE

As depicted on **Exhibit 1B**, land uses adjacent to the airport are primarily agricultural. Rural residential houses are located in the vicinity of the airport but not within the City of Lawrence. The closer residential and other noise-sensitive facilities are to an airport, the more difficult it can be to protect the primary function of the airport.

Any airport that accepts FAA grants is obligated to meet various grant assurances. Grant Assurance 21, *Compatible Land Use*, implementing Title 49 United States Code (U.S.C.) § 47107 (a) (10), requires, in part, that the sponsor:

> "…take appropriate action, to the extent reasonable, including the adoption of zoning laws, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft."

The City of Lawrence has limited ability to establish a zoning code that applies to property outside of the airport since the airport is effectively an island surrounded by unincorporated Douglas County. The airport itself is zoned for General Industrial, as shown on **Exhibit 1C**. Bordering on the east side of the airport is a small parcel zoned for limited industrial, and bordering on the west is a small parcel zoned for light industrial. Also shown on the exhibit is the current on-airport platting. In the terminal area, three large plats have been designated to the east of the terminal building. Several additional plats have been outlined to the south of the T-hangar access road, Bryant Way.

HEIGHT AND HAZARD REGULATIONS

Grant Assurance 20 relates to an airport sponsor's obligation for hazard removal and mitigation to address potential obstructions to the airspace around the airport. Grant Assurance 20 states that the airport sponsor will:

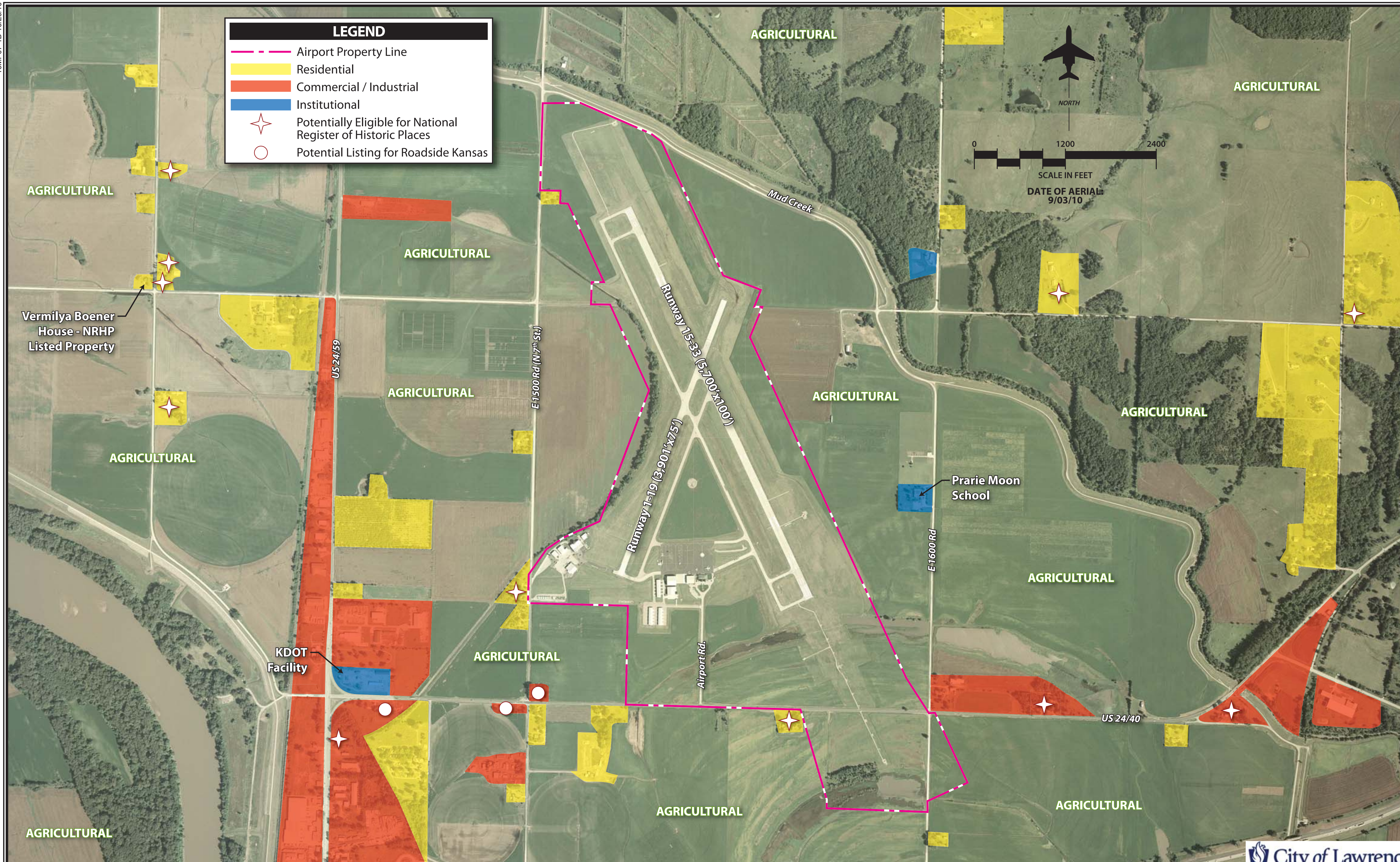
> "…take appropriate action to assure that such terminal airspace as is required to protect instrument and visual operations to the airport (including established minimum flight altitudes) will be adequately cleared and protected by removing, lowering, relocating, marking, or lighting or otherwise mitigating existing airport hazards and by preventing the establishment or creation of future airport hazards."

In addition to appropriate land use zoning, communities are responsible for protecting airports from obstruction to the airspace. Most communities develop height and hazard regulations surrounding airports.

The Development Code of the City of Lawrence, Kansas (Development Code) implements the Lawrence/Douglas County Comprehensive Land Use Plan. Section 20-302 of the Development Code defines the Airspace Overlay District. The purpose of the Airspace Overlay District is to:

1. Prevent the creation and establishment of hazards to life and property in the vicinity of any airport owned, controlled, or operated by the City of Lawrence;
2. Protect users of the airport; and
3. Prevent any unreasonable limitation or impairment on the use and expansion of the airport and the public investment therein.

The Airspace Overlay District is a zoning classification that establishes additional restrictions and standards on those uses permitted by the Base District (the underlying zoning classification). The Airport Overlay District



City of Lawrence KANSAS

Exhibit 1B
CURRENT LAND USE

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City of Lawrence KANSAS

Source: City of Lawrence

Exhibit 1C
AREA ZONING

regulations supersede the Base District regulations.

The Airspace Overlay District is compromised of several Airspace Zones. The Airspace Zones closely mirror the various imaginary surfaces surrounding airports as defined and described in Federal Aviation Regulations (FAR) Part 150. The Airspace Zones for the Lawrence Airport Overlay District are summarized as follows:

1. **Instrument Approach Zone**: The Instrument Approach Zone is established at each end of all runways used for instrument landings and takeoffs. The Instrument Approach Zones have a width of 1,000 feet at a distance of 200 feet beyond the end of each instrument runway, widening thereafter uniformly to a width of 16,000 feet at a distance of 50,200 feet beyond each end of the runway, its centerline being the continuation of the centerline of the runway.

   Height Limitation: One foot in height for each 50 feet in horizontal distance beginning 200 feet from the runway end and extending to a distance of 10,200 feet from the runway end; hence, one foot in height for each 40 feet in horizontal distance to a point 50,200 feet from the runway end.

2. **Non-Instrument Approach Zone**: The Non-Instrument Approach Zone is established at each end of all runways used for non-instrument landings and takeoffs. The Non-Instrument Approach Zone has a width of 500 feet at a distance of 200 feet beyond the end of each non-instrument runway, widening thereafter uniformly to a width of 2,500 feet at a distance of 10,200 feet beyond each end of the runway, its centerline being the continuation of the centerline of the runway.

   Height Limitation: One foot in height for each 20 feet in horizontal distance beginning 200 feet from the runway end and extending to a point 10,200 feet from the runway end.

3. **Transitional Zone**: The Transition Zone is established adjacent to each instrument and non-instrument runway and approach zone as indicated on the Official Zoning District Map. Transition Zones symmetrically located on either side of runways have variable widths as shown on the Official Zoning District Map. Transition Zones extend outward from a line of 250 feet on either side of the centerline of a non-instrument runway for the length of such runway plus 200 feet on each end; and 500 feet on either side of the centerline of an instrument runway for the length of such runway plus 200 feet on each end; and are parallel and level with such runway centerlines. The Transition Zones along such runways slope upward and outward one foot vertically for each seven feet hori-

zontally, to the point where they intersect the surface of the Horizontal Zone. Further, Transition Zones are established adjacent to both Instrument and Non-Instrument Approach Zones for the entire length of these Approach Zones. These Transition Zones have variable widths, as shown on the Official Zoning District Map. Such transition zones flare symmetrically with either side of the runway Approach Zones from the base of such zones and slope upward and outward at the rate of one foot vertically for each seven feet horizontally to the points where they intersect the surfaces of the Horizontal and Conical Zones. Additionally, Transition Zones are established adjacent to the Instrument Approach Zone where it projects through and beyond the limits of the Conical Zone, extending a distance of 5,000 feet measured horizontally from the edge of the Instrument Approach Zones at right angles to the continuation of the centerline of the runway.

Height Limitation: One foot in height for each seven feet in horizontal distance beginning at any point 125 feet from the centerline of non-instrument runways, and 500 feet from the centerline of instrument runways. The slope extends to an elevation of 150 feet.

4. **Horizontal Zone**: A Horizontal Zone is that area within a circle with its center at the Airport Reference Point and having a radius of 7,000 feet. The Horizontal Zone does not include the Instrument and Non-Instrument Approach Zones or the Transition Zones.

   Height Limitation: 150 feet above the airport elevation.

5. **Conical Zone**: A Conical Zone is the area that commences at the periphery of the Horizontal Zone and extends outward a distance of 5,000 feet. The Conical Zone does not include the Instrument Approach Zone and Transition Zones.

   Height Limitation: One foot in height for each 20 feet in horizontal distance beginning at the periphery of the Horizontal Zone, extending to a height 400 feet above the airport elevation.

The Lawrence/Douglas County Metropolitan Planning Commission is the Airport Zoning Commission for the City of Lawrence and has responsibility for administering and enforcing these regulations. The Airspace Overlay District defined above applies to the City of Lawrence and not to unincorporated county areas. **Exhibit 1D** presents the Airspace Overlay District for Lawrence Municipal Airport.

10MP07-1D-8/26/10

Airspace Overlay Zoning Districts At Lawrence Municipal Airport

0 485 970 1,940 2,910 3,880 Feet

1 inch = 2,000 feet

Source: City of Lawrence

Exhibit 1D

AIRSPACE OVERLAY DISTRICT

AIRPORT SYSTEM PLANNING ROLE

Airport planning exists on many levels: local, state, and national. Each level has a different emphasis and purpose. On the national level, the Lawrence Municipal Airport is included in the *National Plan of Integrated Airport Systems* (NPIAS). On the state level, the airport is included in *Kansas Airport System Plan* (2009) (KASP). The local planning document is the airport master plan and associated airport layout plan.

FEDERAL AIRPORT PLANNING

On the national level, the Lawrence Municipal Airport is included in the NPIAS. This federal plan identifies 3,356 existing airports which are considered significant to the national air transportation system. The NPIAS is published and used by the FAA in administering the Airport Improvement Program (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 2009-2013 NPIAS estimates $49.7 billion is needed for airport development 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 supports the FAA's strategic goals for safety, system efficiency, and environmental compatibility by identifying specific airport improvements. The current issue of the NPIAS identifies approximately $4.65 million in development needs over the next five years for Lawrence Municipal Airport. This figure is not a guarantee of federal funding; instead, this figure represents development needs as presented to the FAA by the City of Lawrence in the annual airport capital improvement program.

Airports that apply for and accept AIP grants must adhere to various grant assurances. These assurances include maintaining the airport facility safely and efficiently in accordance with specific conditions. The duration of the assurances depends on the type of airport, the useful life of the facility being developed, and other factors. Typically, the useful life for an airport development project is a minimum of 20 years. Thus, when an airport accepts AIP grants, they are obligated to maintain that facility in accordance with FAA standards for at least that long.

Of the $49.7 billion in airport development needs nationally, approximately 19 percent is designated for 2,564 general aviation airports, as shown in **Table 1C**. General aviation airports average 35 based aircraft and account for 41 percent of the nation's general aviation fleet. Lawrence Municipal Airport is designated as a general aviation airport.

TABLE 1C
NPIAS Distribution of Activity

Number of Airports	Airport Type	Percent of Enplanements	Percent of Based Aircraft	% NPIAS Costs
522	Commercial Service	99.9%	21%	71%
270	Relievers	0%	28%	10%
2,564	General Aviation	0%	41%	19%
3,356	Existing NPIAS Airports	99.9%	90%	100%
16,459	Non-NPIAS Airports	0.1%	10%	0%

Source: 2009-2013 National Plan of Integrated Airport Systems (NPIAS)

STATE AIRPORT PLANNING

The FAA primarily categorizes airports based on the presence of commercial passenger or cargo service. As such, airports are categorized as commercial service or general aviation, with a portion of the general aviation airports being further classified as general aviation reliever airports.

While these designations are useful to the FAA, it is left to the states to further define airports, especially general aviation airports. For the KASP, a set of goals were established (Preservation, Modernization, Accessibility, Economic Support, and Education) and are used to determine specific factors that relate to development of a successful aviation system for Kansas.

The *KASP 2009* identified five roles for Kansas airports which are defined as follows:

Commercial Service Airports: These airports accommodate scheduled major/national or regional/commuter commercial air service.

Regional Airports: Airports that accommodate regional economic activities, connect the state and national economies, and serve all types of general aviation aircraft.

Business Airports: Airports that accommodate local business activities and general aviation users.

Community Airports: These airports serve a supplemental role in local economies, primarily serving smaller business, recreational, and personal flying.

Basic Airports: Airports that serve a limited role in the local economy, primarily serving recreational and personal flying.

The Lawrence Municipal Airport is classified as a Regional Airport in the *KASP 2009*. The minimum facility and service requirements are listed in **Table 1D**.

TABLE 1D
Minimum Facility and Service Criteria
KASP Regional Airports

Airport Criteria	Minimum Objective
Runway Length	5,000 feet
Runway Width	100 feet
Taxiway	Full Parallel
Surface	Paved/All Weather Surface
Pavement Condition Index (PCI)	70 or Greater
Approach Capability	Near Precision
Visual Aids	Rotating Beacon, Lighted Wind Sock, REILS, VASI/PAPI
Lighting	MIRL/MITL
Approach Lighting System	ALS desired
Weather	AWOS, ASOS, ATCT
Planning documents	Security Plan, Snow Removal Plan
Services	Limited Service FBO, Restrooms, Links to Ground Transportation, AvGas and Jet A Fuel
Facilities	Terminal Building, Pilots' Lounge, Hangars for 100% of based aircraft, Apron 100' x 100', Auto Parking

REIL: Runway End Identification Lights
VASI: Visual Approach Slope Indicator
PAPI: Precision Approach Path Indicator
AWOS: Automated Weather Observation System
ASOS: Automated Surface Observation System
ATCT: Airport Traffic Control Tower
FBO: Fixed Base Operator

Source: Kansas Airport System Plan (2009)

LOCAL AIRPORT PLANNING

The airport master plan is the primary local planning document. The master plan is intended to provide a 20-year vision for airport development based on aviation demand forecasts. Forecasts beyond five years become less reliable. The most recent aviation forecasts were prepared in 2001 in conjunction with an Airport Layout Plan update. As a result, this is an appropriate time to update these forecasts and revisit the development assumptions from the previous planning study.

ECONOMIC IMPACT

In August 2010, the Kansas Department of Transportation – Division of Aviation published the commissioned report, *Kansas Aviation Economic Impact Study*. The report identifies 140 public use airports in the state, of which eight provide commercial service and the remaining 132 are general aviation airports. In 2009, the base year for the study, the system of 140 airports supported approximately 47,650 jobs, generated $2.3 billion in annual payroll, and produced $10.4 billion in annual economic activity.

Lawrence Municipal Airport is included in the study. It is estimated that the airport accounts for 96 jobs, $3.6 million in payroll, and $10.7 million in total economic output. **Table 1E** presents detailed information related to the economic impacts of Lawrence Municipal Airport.

TABLE 1E
Economic Impact Estimates
Lawrence Municipal Airport

Estimate of Annual Expenditures by General Aviation (GA) Visitors		
Estimated GA Visitors	Avg. Visitor Spending per Trip	Annual GA Visitor Expenditures
7,469	$85	$634,900
Estimate of On-Airport Employment		
First-Round Employment	Second Round Employment	Total On-Airport Employment
37	42	79
Estimate of Visitor Related Employment		
First-Round Employment	Second Round Employment	Total On-Airport Employment
13	4	17
Estimate of On-Airport Payroll		
First-Round Payroll	Second Round Payroll	Total On-Airport Payroll
$1,734,900	$1,423,000	$3,157,900
Estimate of GA Visitor-Related Payroll		
First-Round Payroll	Second Round Payroll	Total On-Airport Payroll
$256,400	$144,600	$401,000
Estimate of On-Airport Output		
First-Round Output	Second Round Output	Total On-Airport Output
$6,225,200	$3,465,000	$9,690,200
Estimate of GA Visitor-Related Output		
First-Round Output	Second Round Output	Total On-Airport Output
$634,900	$397,700	$1,032,600
Estimate of Total Economic Impact		
Total Employment	Total Payroll	Total Output
96	$3,558,900	$10,722,800

Source: Kansas Aviation Economic Impact Study 2010, prepared by Wilbur Smith Associates

The Kansas Aviation Economic Impact Study also characterizes many of the qualitative benefits provided by Lawrence Municipal Airport. The study identifies 22 potential benefit categories, of which 16 occur at the airport. The categories include personal flying, emergency medical transport, agricultural spraying, corporate/business activity, flight training, police/law enforcement, various community events, youth outreach, and aerial surveying.

Foreign Trade Zone

Douglas County, along with Miami, Johnson, Wyandotte, Shawnee, and Leavenworth counties comprise the Alternative Site Framework (ASF) for the Greater Kansas City Foreign Trade Zone (FTZ). Businesses that locate in any of these counties are eligible to apply to the County for the benefits that the FTZ offers.

The FTZ is designated to promote international trade and offer companies and importers a way to gain a financial edge in the global marketplace. The benefits of operating a business in an FTZ are primarily the reduction or elimination of duties or excise taxes on goods imported into the U.S. At a minimum, a U.S. importer could store a shipment in the FTZ and gradually import only what is needed, and thereby improve the company's cash flow by spreading the import duty over a longer period of time.

AIRSIDE FACILITIES

Airport facilities can be functionally classified into two broad categories: airside and landside. The airside category includes those facilities which are needed for the safe and efficient movement of aircraft, such as runways, taxiways, lighting, and navigational aids. The landside category includes those facilities necessary to provide a safe transition from surface to-air transportation, including aprons, hangars, terminal buildings, and various other support facilities.

Existing airside facilities are identified on **Exhibit 1E**. **Table 1F** summarizes airside facility data for Lawrence Municipal Airport.

RUNWAYS

Lawrence Municipal Airport is served by a two-runway system. The primary runway, Runway 15-33, is 5,700 feet long by 100 feet wide. Runway 15-33 intersects with the crosswind runway approximately 2,300 feet from the Runway 15 end and 900 feet from the Runway 19 end. The Runway 15 end has an elevation of 831 feet MSL and the Runway 33 end is 827 feet MSL. The runway has a longitudinal gradient of 0.07 percent. It is estimated that this runway accommodates approximately 70 percent of annual aircraft operations.

Runway 15-33 is strength rated at 40,000 pounds for single wheel loads (SWL) and 60,000 for dual wheel loads (DWL). The strength rating refers to the weight of aircraft with certain landing gear configurations. SWL refers to landing gear with a single wheel on each strut, while DWL refers to two wheels on the main landing gear. Runways can support infrequent operations by heavier aircraft.

Crosswind Runway 1-19 is 3,901 feet long and 75 feet wide. This runway is strength rated at 12,500 pounds SWL and 15,600 DWL. The Runway 1 end has an elevation of 833 feet MSL, and the Runway 19 end is 831 feet MSL. The runway has a longitudinal gradient of 0.05 percent. It is estimated that this runway accommodates 30 percent of annual aircraft operations.

TABLE 1F
Airside Facility Data
Lawrence Municipal Airport

	RUNWAY 15-33	**RUNWAY 1-19**
Runway Length	5,700'	3,901'
Runway Width	100'	75'
Runway Surface Material (Condition)	Asphalt (Good)	Concrete/Asphalt (Good)
Runway Markings (Condition)	Non-Precision (15): (Good)/ Precision (33): (Good)	Basic (Good)
Runway Lighting	Medium Intensity (MIRL)	Medium Intensity (MIRL)
Runway Load Bearing Strength (pounds)	40,000 SWL/ 60,000 DWL	12,500 SWL/ 15,600 DWL
Taxiway Lighting	Medium Intensity (MITL)	Reflectors
Taxiway, Taxilanes & Apron Lightning	Centerline marking, Tie-down area marking, Reflectors	
Traffic Pattern	Standard Left	Standard Left
Visual Approach Aids	PAPI-4L (15)/PAPI-4R(33) MALSR (33)	PAPI-2L REILS
Instrument Approach Aids	ILS (33) LOC (33) RNAV - GPS (33) RNAV - GPS (15) VOR/DME-A (Circling)	VOR/DME-A (Circling)
Weather and Navigational Aids	Automated Surface Observation System (ASOS) Lighted Wind Cone Segmented Circle Airport Beacon Localizer Topeka VOR/DME	

PAPI - Precision Approach Path Indicator
GPS - Global Positioning System
VOR - Very high frequency Omni-directional Range
REIL - Runway End Identification Lights
MALSR - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
SWL/DWL – Single Wheel Load/ Dual Wheel Load

Source: Airport/Facility Directory - Northwest U.S. (August 27, 2009); Airport records.

According to the airport master record (FAA Form 5010) as accessed from www.airnav.com, pilots should be aware of several potential obstructions in the vicinity of the airport. **Table 1G** summarizes these potential obstructions.

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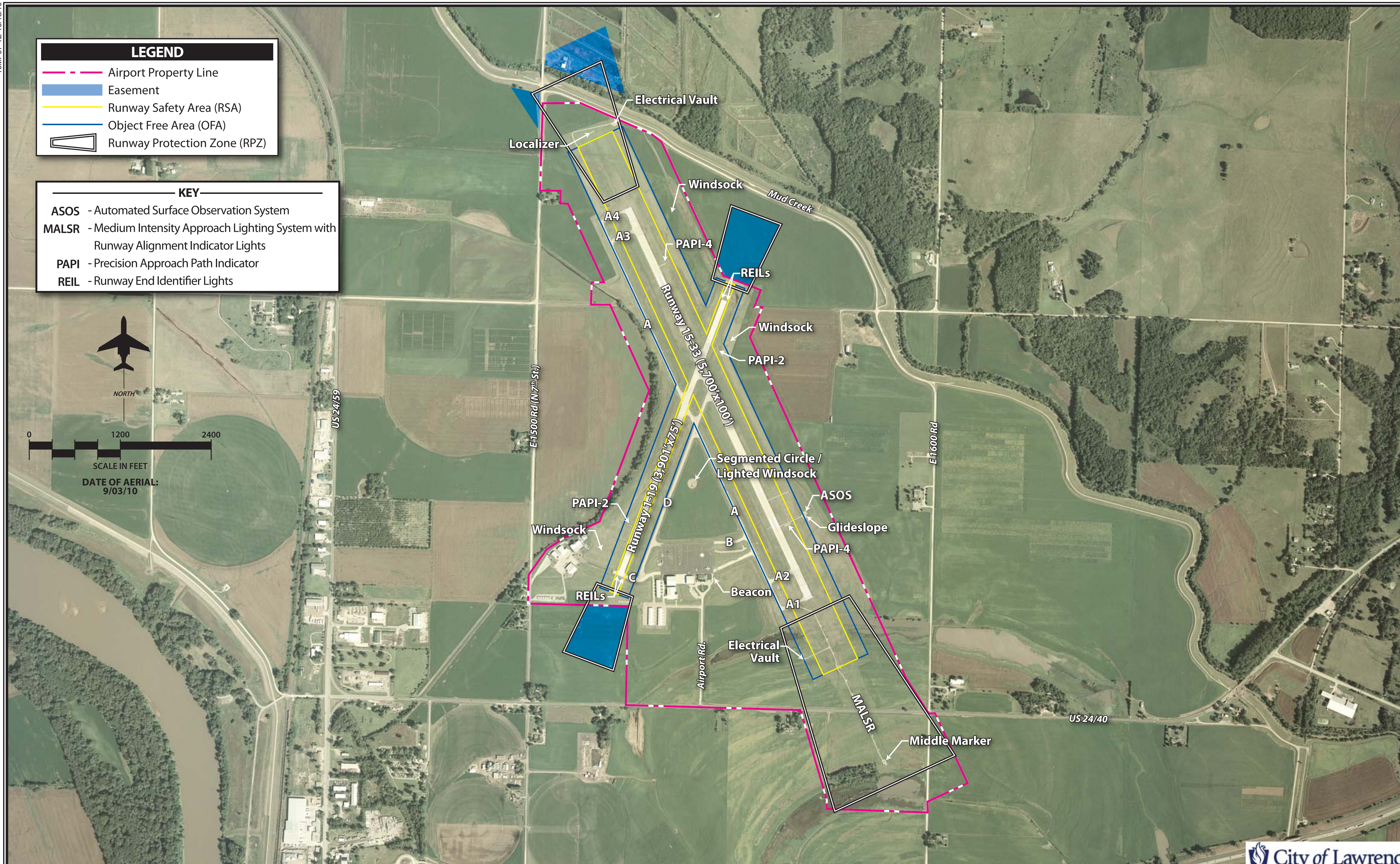

City of Lawrence KANSAS

Exhibit 1E
AIRSIDE FACILITIES

TABLE 1G Potential Runway Obstructions Lawrence Municipal Airport			
Obstruction	**Distance from Runway End**	**Distance Left or Right of Centerline**	**Slope to Clear**
Runway 15			
Trees (69 feet high)	1,908 feet	10 feet left	24:1
Runway 33			
Trees (77 feet high)	3,560 feet	250 feet right	43:1
Runway 1			
Trees (61 feet high)	1,870 feet	49 feet left	27:1
Runway 19			
Trees (72 feet high)	2,688 feet	47 feet right	34:1
Source: www.airnav.com			

PAVEMENT CONDITION

The FAA requires that sponsors monitor the condition of airfield pavements through Grant Assurance Number 11, which states that any airport requesting federal funds for pavement improvement projects must have implemented a pavement maintenance management program.

A common measurement of the existing pavement condition is the Pavement Condition Index (PCI). **Exhibit 1F** presents the current PCI map produced for the Lawrence Municipal Airport. The index ranges from 0 to 100, with values above 70 considered adequate and values below 70 indicating a need for repair or maintenance. The exhibit also shows current recommendations for pavement patching, crack sealing, surfacing and/or mill and overlay.

As can be seen on the exhibit, the vast majority of airfield pavements exceed the 70 PCI standards. The southeastern portion of Taxiway A has a PCI below 70. Pavement condition should be continually monitored and problems should be addressed promptly.

TAXIWAYS

All taxiways are 35 feet wide, except Taxiway C, which is 40 feet wide. Taxiway A is a full length parallel taxiway to Runway 15-33. Taxiway A1 is a right-angled threshold taxiway to Runway 33. Taxiway A2 is 400 feet from the Runway 33 end. Taxiway A3 is 300 feet from the Runway 15 end. Taxiway A4 is the Runway 15 threshold taxiway. Taxiway D was constructed in 2005 and serves as a partial parallel taxiway to Runway 1-19. This taxiway extends from the Runway 1 threshold, across Taxiway A, and terminates at Runway 15-33. Taxiway D can also be utilized as an exit from Runway 15-33.

Taxiway C extends from the main terminal area apron to the Runway 1 threshold then continues west to provide access to the west side development area. Taxiway B provides access from Taxiway A to the north edge of the main terminal area apron.

PAVEMENT MARKINGS

Pavement markings aid in the movement of aircraft along airport surfaces and identify closed or hazardous areas on the airport. Runway 33 has precision markings that include runway designations, threshold, fixed-distance aiming points, touchdown zone, edges, and centerline. Runway 15 has non-precision markings that include threshold, designation, centerline, and aiming point. Runway 1-19 provides basic markings which include the runway designations and runway centerline markings.

Taxiway and apron centerline markings assist pilots when moving on these surfaces. The taxiways have standard yellow centerline markings.

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. These lighting systems, categorized by function, are summarized as follows:

Identification Lighting: The location of the airport at night is universally identified by a beacon. The rotating beacon projects two beams of light, one white and one green, 180 degrees apart. The beacon at Lawrence Municipal Airport is situated on the top of a 60-foot tall steel lattice tower structure located approximately 125 feet to the east of the terminal building.

Runway and Taxiway Lighting: Runway 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.

Both runways are equipped with medium intensity runway lighting (MIRL). These are lights set atop poles that are approximately one foot above the ground. The light poles are frangible, meaning if one is struck by an object, such as an aircraft wheel, they can easily break away, thus limiting the potential damage to an aircraft. The last 2,000 feet of runway edge lights are yellow caution zone lights, and threshold lighting identifies each runway end.

Taxiways A, A1, A2, A3, A4, and B are equipped with medium intensity taxiway lighting (MITL). Taxiways D and C are equipped with reflective blue cans.

Visual Approach Lighting: Common visual approach aids include precision approach path indicator (PAPI) lights. These visual aids consist of either two or four-box light systems located to the side of the runway approximately 1,000 feet from the runway threshold. When interpreted by

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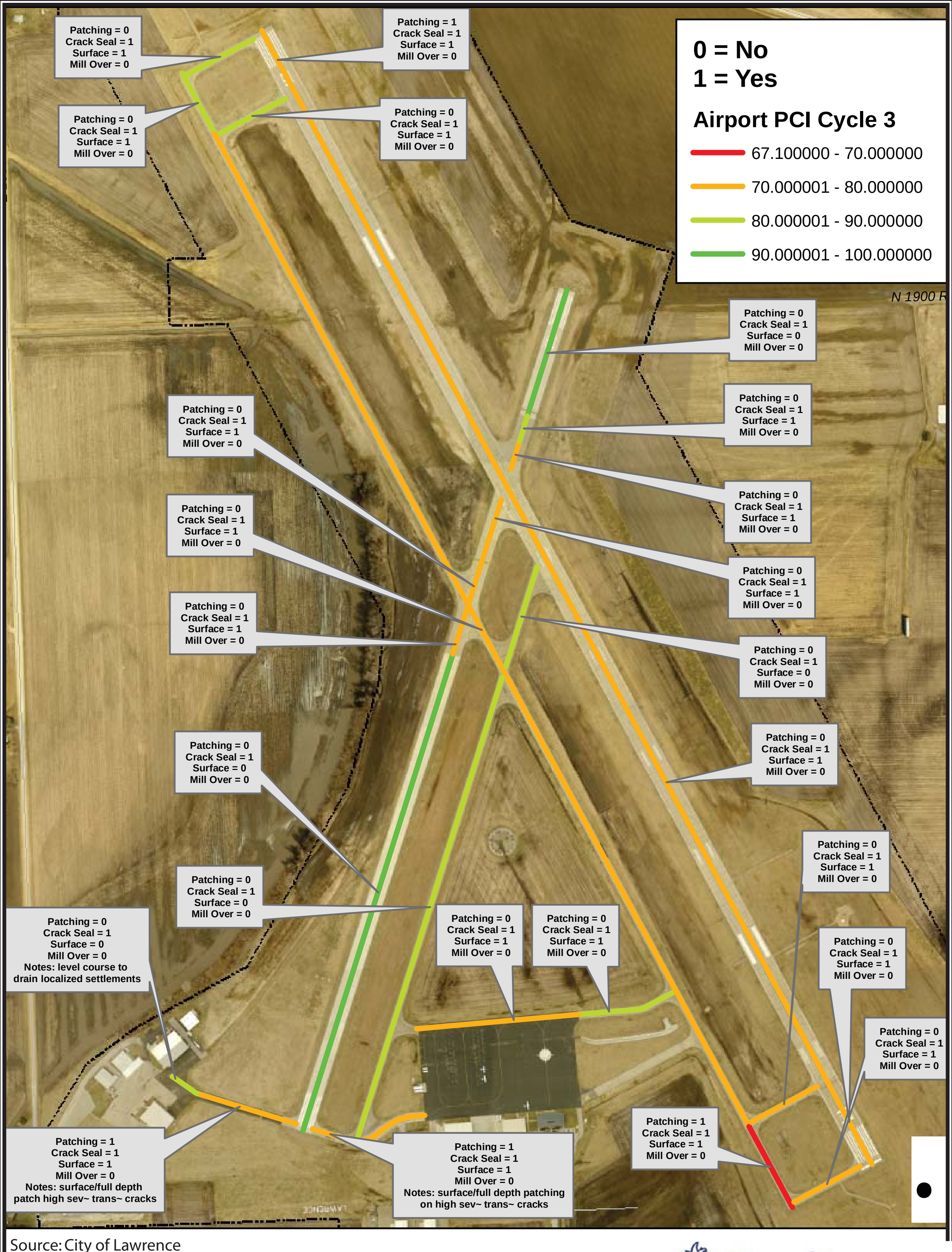

Source: City of Lawrence

City of Lawrence KANSAS

Exhibit 1F

PAVEMENT CONDITION INDEX

the pilot, PAPIs give them an indication of being above, below, or on the correct descent path to the runway. Two-box systems are common for runways serving small aircraft. Runways utilized by faster jet aircraft are typically equipped with four-box systems. The standard is for PAPIs to be set to the left side of the runway.

Both ends of Runway 15-33 are equipped with four-box PAPI units (PAPI-4). On the Runway 33 end, the PAPI-4 is set to the right side of the runway. Both ends of Runway 1-19 have two-box PAPIs set to the left of the runway. The FAA owns and maintains the PAPIs for Runway 33. The City owns and maintains the PAPIs for Runway 1-19 and Runway 15.

The approach to Runway 33 is equipped with a medium intensity approach lighting system with runway alignment indicator lights (MALSR). These lights extend approximately 2,400 feet from the Runway 33 threshold. This light system provides pilots rapid identification of the runway end and a visual lighted grid to align their aircraft for landing. The MALSR is owned and maintained by the FAA.

Runway End Identification Lighting: REILs provide a visual identification of the runway end for landing aircraft. The system consists of two flashing light assemblies located approximately 40 feet to either side of the runway landing threshold. These flashing lights can be seen day or night for up to 20 miles depending on visibility conditions. Both ends of Runway 1-19 are equipped with REILs. The REILs are owned and maintained by the FAA.

Airfield Signs: Airfield identification signs assist pilots in identifying their location on the airfield and directing them to their desired location. The airfield signs are located at various intersections at the airport. All airfield signs are lighted.

Pilot-Controlled Lighting: The airfield lights are turned off at nighttime. Pilots can utilize the pilot-controlled lighting system (PCL) to activate the airfield lights from their aircraft through a series of clicks of their radio transmitter utilizing the CTAF frequency (123.0 MHz). The lights for both runways, REILs, PAPIs (the Runway 33 PAPI is on continuously), and the MALSR are controllable through the system. Typically, the airfield lights will remain on for approximately 15 minutes.

WEATHER AND COMMUNICATION AIDS

Lawrence Municipal Airport has four windsocks. Windsocks provide information to pilots regarding wind conditions including direction and speed. The main lighted windsock is located within the segmented circle immediately north of the terminal area apron and between the two runways. There are three additional supplemental windsocks. One is located to the west of the Runway 1 threshold, and one is located to the east of the Runway 19 threshold. The third is located to the east of the Runway 15 threshold.

None of these are lit, other than an obstruction light set on top.

A segmented circle provides traffic pattern information to pilots. Lawrence Municipal Airport has a standard left hand traffic pattern for all runways. The segmented circle is centrally located to the north of the terminal area apron near the intersection of the two runways.

Lawrence Municipal Airport is equipped with an Automated Surface Observing System (ASOS). An ASOS will automatically record weather conditions such as wind speed, wind gust, wind direction, temperature, dew point, altimeter setting, visibility, fog/haze condition, precipitation, and cloud height. 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 (122.225 MHz). In addition, pilots and individuals can call a published telephone number and receive the information via an automated voice recording. The next closest automated weather broadcast is from the ASOS located 19 nautical miles to the southeast at New Century AirCenter (IXD) in Olathe, Kansas or 19 nautical miles to the west at Philip Billard Municipal Airport (TOP) in Topeka.

Lawrence Municipal Airport also utilizes the common traffic advisory frequency (CTAF). This radio frequency (123.0 MHz) is used by pilots in the vicinity of the airport to communicate with each other about approaches or take-offs from the airport. This frequency is also utilized to contact the airport FBO.

Approach and Departure Control services are available from the Kansas City Center Air Route Traffic Control Center via frequency 123.8 MHz. Radar coverage is available down to approximately 600 feet above the airport elevation. Clearance delivery is provided by Kansas City Center via frequency 121.825 MHz.

NAVIGATIONAL AIDS

Navigational aids are electronic devices that transmit radio frequencies, which pilots of properly equipped aircraft can translate into point-to-point guidance and position information. The types of electronic navigational aids available for aircraft flying in the vicinity of Lawrence Municipal Airport include a very high frequency omni-directional range (VOR) facility and the global positioning system (GPS).

The very high omni-directional range (VOR), in general, provides azimuth readings to pilots of properly equipped aircraft transmitting a radio signal at every degree to provide 360 individual navigational courses. Frequently, distance measuring equipment (DME) is combined with a VOR facility (VOR/DME) 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 Topeka VORTAC is located approximately 17 nautical miles (nm) to the west and is on frequency 117.80 MHz. The Johnson

County VOR/DME is located 25 nm to the southeast and is on frequency 113.00 MHz. The Kansas City VORTAC is 28 nm to the northeast and is on frequency 113.25 MHz. The Riverside VOR/DME is 30 nm to the east of Lawrence and is on frequency 111.40 MHz.

GPS is an additional navigational aid for pilots. GPS was initially developed by the United States Department of Defense for military navigation around the world. GPS differs from a VOR in that pilots are not required to navigate using a specific ground-based facility. GPS uses satellites placed in orbit around the earth that transmit electronic radio signals, which pilots of properly equipped aircraft use to determine altitude, speed, and other navigational information. With GPS, pilots can navigate directly to any airport in the country and are not required to navigate using a ground-based navigational facility.

The airport has several pieces of equipment on the airfield that assist pilots desiring to land at the airport. Runway 33 has an Instrument Landing System (ILS) that consists of a localizer and a glideslope antenna. The localizer antenna is located 1,000 feet north of the Runway 15 threshold. The glideslope is located adjacent the PAPI lights on the Runway 33 end.

AREA AIRSPACE

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 environment for civil, commercial, and military aviation. The NAS is defined as the common network of U.S. airspace, including air navigational facilities; airports and landing areas; aeronautical charts; associated rules, regulations, and procedures; technical information; and personnel and material. System components shared jointly with the military are also included as part of this system.

To ensure a safe and efficient airspace environment for all aspects of aviation, the FAA has established an airspace structure that regulates and establishes procedures for aircraft using the NAS. The U.S. airspace structure provides for categories of airspace, controlled and uncontrolled, and identifies them as Classes A, B, C, D, E, and G as described below. **Exhibit 1G** generally illustrates each airspace type in three-dimensional form.

- Class A airspace is controlled airspace and includes all airspace from 18,000 feet MSL to Flight Level 600 (approximately 60,000 feet MSL).

- Class B airspace is controlled airspace surrounding high-activity commercial service airports (i.e., Kansas City International Airport).

- Class C airspace is controlled airspace surrounding lower-activity commercial service (i.e., Wichita Mid-Continent Airport) and some military airports.

- Class D airspace is controlled airspace surrounding low-activity commercial service and general aviation airports with an ATCT, such as Forbes Field in Topeka.

All aircraft operating within Classes A, B, C, and D airspace must be in constant contact with the air traffic control facility responsible for that particular airspace sector.

- Class E airspace is controlled airspace surrounding an airport that encompasses all instrument approach procedures and low-altitude federal airways. Only aircraft conducting instrument flights 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 contact with air traffic control facilities, visual flight can only be conducted if minimum visibility and cloud ceilings exist.

- Class G airspace is uncontrolled airspace that does not require communication with an air traffic control facility.

Airspace within the vicinity of Lawrence Municipal Airport is depicted on **Exhibit 1H**. The airport operates in Class E airspace with a floor of 700 feet above ground level (AGL) and extending to 18,000 feet MSL. It should be noted that traditional transponder contact with air traffic control is not available below 600 feet in the airport vicinity.

Victor Airways

Victor Airways are designated navigational routes extending between VOR facilities. Victor Airways are identified on sectional charges with a "V" followed by a number. Victor Airways have a floor of 1,200 feet AGL and extend upward to an altitude of 18,000 feet MSL and are eight nautical miles wide. There are numerous Victor Airways in the vicinity due to the location of the Topeka VORTAC, Kansas City VORTAC, and the Johnson County VOR/DME. V-508 passes just north of the airport, and V-502 passes to the south.

Military Operations Areas (MOAs)

A Military Operations Area (MOA) is an area of airspace designated for military training use. This is not restricted airspace as civil pilots can use the airspace. However, they 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 elevations. The activity status of an MOA is advertised by a *Notice to Airmen* (NOTAM) and noted on Sectional Charts. The closest MOA to Lawrence Municipal Airport is the Riley MOA located approximately 70 statute miles

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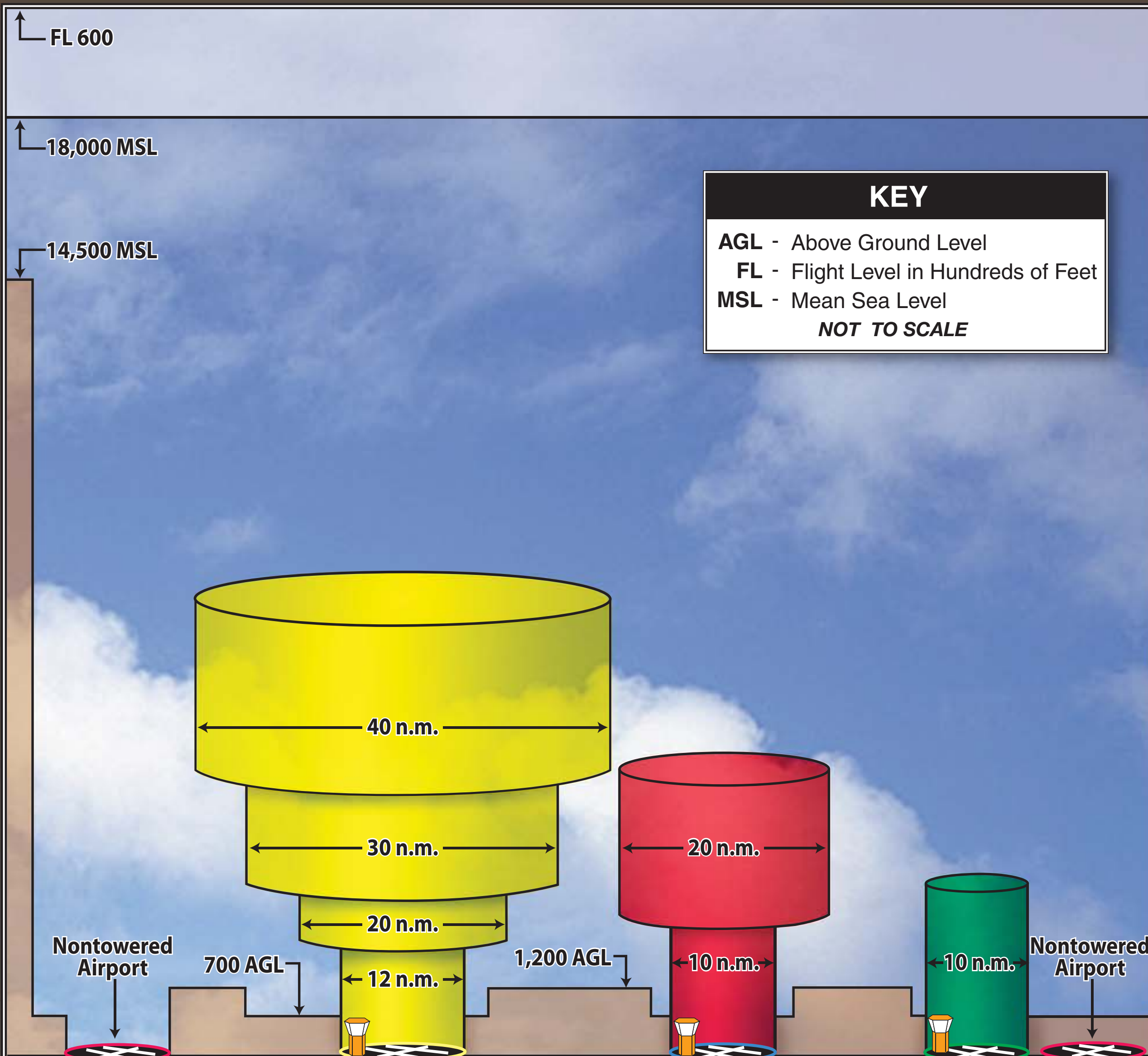


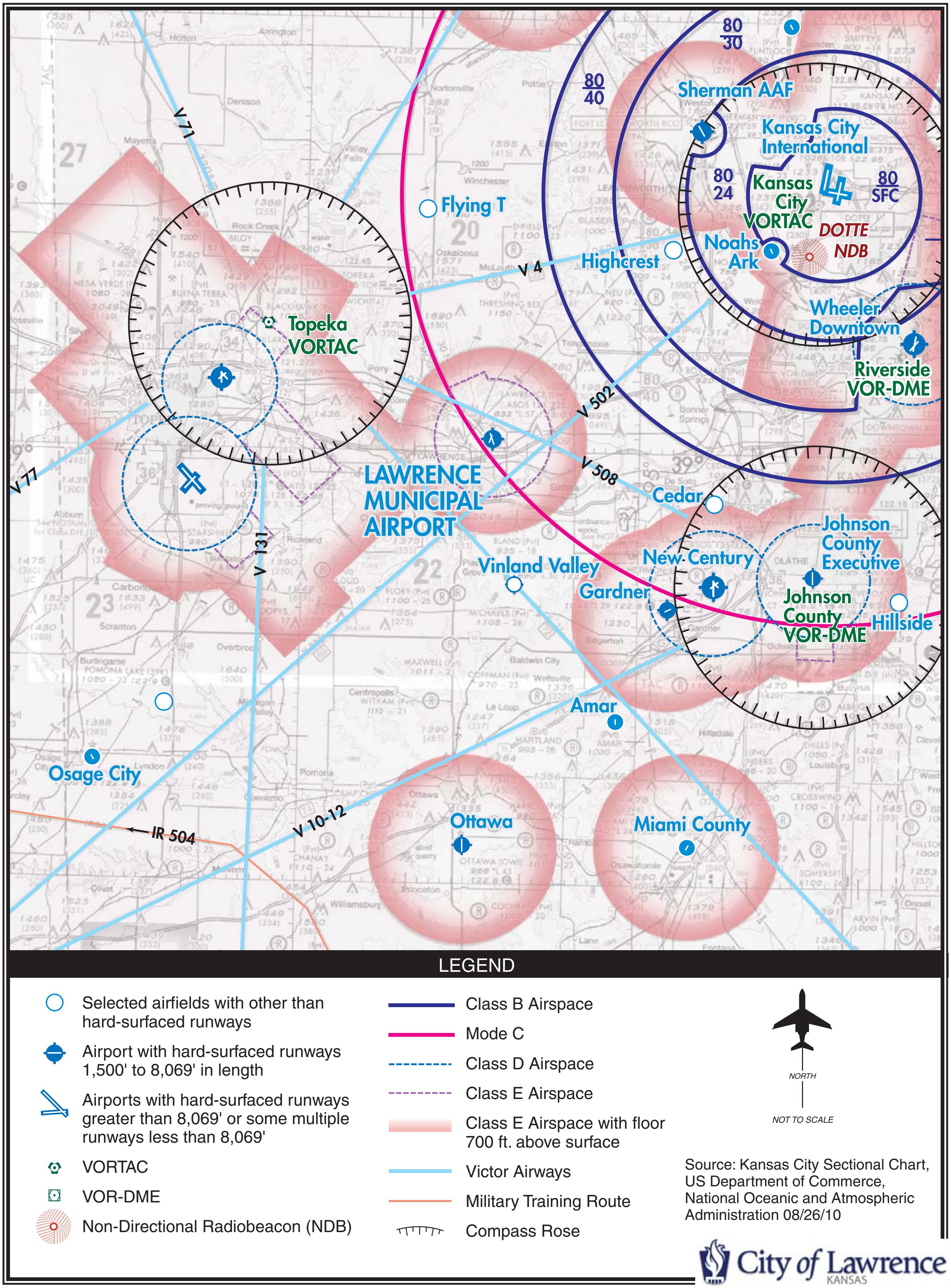
CLASSIFICATION	DEFINITION
CLASS A	Generally airspace above 18,000 feet MSL up to and including FL 600.
CLASS B	Generally multi-layered airspace from the surface up to 10,000 feet MSL surrounding the nation's busiest airports.
CLASS C	Generally airspace from the surface to 4,000 feet AGL surrounding towered 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.

Source: "Airspace Reclassification and Charting Changes for VFR Products," National Oceanic and Atmospheric Administration, National Ocean Service. Chart adapted by Coffman Associates from AOPA Pilot, January 1993.

City of Lawrence KANSAS

Exhibit 1G
AIRSPACE CLASSIFICATION

10MP07-1H-8/26/10



City of Lawrence KANSAS

Exhibit 1H
VICINITY AIRSPACE

to the west. The Truman A MOA is approximately 70 miles to the east, and the Eureka High MOA is approximately 90 miles to the southwest.

Military Training Routes

A Military Training Route, or MTR, is a specified training route for military pilot proficiency. Military aircraft operate on the MTR at speeds in excess of 250 knots and up to 10,000 feet MSL. Military training routes are designated on sectional charts with "IR" followed by a number. IR-504 passes approximately 40 miles to the southwest of Lawrence. General aviation pilots should be aware of the locations of the MTRs and exercise special caution if they need to cross them.

Mode C

Lawrence Municipal Airport falls within the Mode C ring that extends to a radius of 30 nautical miles from Kansas City International Airport. All aircraft operating within the Mode C ring are required to have an operable radio transponder. The Mode C requirements are typically found around busy commercial service airports in Class B airspace.

INSTRUMENT APPROACH PROCEDURES

Instrument approach procedures are a series of predetermined maneuvers established by the FAA using electronic navigational aids to assist pilots in locating and landing at an airport during low visibility and cloud ceiling conditions. The capability of an instrument approach 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 to complete the approach. Cloud ceilings define the lowest level a cloud layer (defined in feet above the ground) can be situated for a pilot to complete the approach. If the observed visibility or cloud ceiling is below the minimums prescribed for the approach, the pilot cannot complete the instrument approach. The available instrument approaches for Lawrence Municipal Airport are summarized in **Table 1H**.

The ILS to Runway 33 provides Category I (CAT I) approach minimums with 200-foot cloud ceiling heights and ½-mile visibility minimums. These are typically the lowest minimums available to a general aviation airport. When utilizing just the localizer antenna, the cloud ceilings are 429 feet and the visibility minimum remains at ½-mile. Pilots can also utilize the ILS to locate the airport then circle to the most appropriate runway depending on local wind conditions. This circling ILS approach has higher minimums.

Runway 33 has GPS approaches including an LPV (localizer performance with vertical guidance) approach that offers CAT I minimums. Stand-alone CAT I LPV approaches (an LPV approach without the presence of an existing ILS) is a goal for the FAA, but currently they are not being approved. The Runway 33 LNAV/VNAV GPS approach has ¾-mile visibility minimum, and cloud ceiling heights of 369 feet.

Runway 15 also offers GPS instrument approaches. The visibility minimum is one mile for most aircraft and 1½-mile for larger business jets (approach category C). A circling VOR/DME-A instrument approach is also available.

TABLE 1H
Instrument Approach Data
Lawrence Municipal Airport

	WEATHER MINIMUMS BY AIRCRAFT TYPE					
	Category A		Category B		Categories C	
	CH	VIS	CH	VIS	CH	VIS
ILS or LOC Rwy 33						
ILS 33	200	½-mile	200	½-mile	200	½-mile
Localizer 33	429	½-mile	429	½-mile	429	¾-mile
Circling	587	1 mile	587	1 mile	607	1¾-mile
RNAV (GPS) Rwy 33						
LPV	200	½-mile	200	½-mile	200	½-mile
LNAV/VNAV	369	¾-mile	369	¾-mile	369	¾-mile
LNAV MDA	389	½-mile	389	½-mile	389	½-mile
Circling	587	1 mile	587	1 mile	607	1¾-mile
RNAV (GPS) Rwy 15						
LNAV MDA	509	1 mile	509	1 mile	509	1½-mile
Circling	587	1 mile	587	1 mile	607	1¾-mile
VOR/DME-A						
Circling	647	1 mile	647	1 mile	647	1¾-mile

Aircraft Categories are based on 1.3 times the stall speed in landing configuration as follows:

Category A:	0-90 knots (e.g., Cessna 172)
Category B:	91-120 knots (e.g., Beechcraft KingAir)
Category C:	121-140 knots (e.g., Canadair Challenger)
Category D:	141-166 knots (e.g., Gulfstream IV)

Abbreviations:
CH - Cloud Height (in feet above ground level)
VIS - Visibility Minimums (in miles)
GPS - Global Positioning System
ILS - Instrument Landing System
LPV - Localizer Performance with Vertical Guidance
LNAV/VNAV - A technical variant of GPS

Source: U.S. Terminal Procedures, North Central Region(August 26, 2010)

RUNWAY USE AND TRAFFIC PATTERNS

Lawrence Municipal Airport is situated at 832 feet MSL. All runways have a standard left hand traffic pattern. Runway use is dictated by prevailing wind conditions. Ideally, it is desirable for aircraft to land directly into the wind. The prevailing wind is from the northwest to the southeast. Therefore, Runway 15-33 is the primary runway and experiences approximately 70 percent of annual aircraft operations. Runway 33 experiences approximately 45 percent of annual aircraft operations, while Runway 15 experiences approximately 25 percent. Runway 33 is considered the calm wind runway. Runway 1-19 accommodates approximately 30 percent of the remaining annual aircraft operations, with an even split between the two ends.

LANDSIDE FACILITIES

Landside elements are the ground-based facilities that support the aircraft and pilot/passenger handling functions. These facilities typically include the FBOs, aircraft storage hangars, aircraft maintenance hangars, aircraft parking aprons, and support facilities such as fuel storage, automobile parking, roadway access, and aircraft rescue and firefighting. Landside facilities are identified on **Exhibit 1J**.

AIRPORT BUSINESSES

The airport terminal building is centrally located, facing the main terminal area apron. The terminal building was constructed in 1986 and encompasses approximately 7,200 square feet of floor space. The terminal building includes a large open area lobby, FBO service counter and supply shop, flight planning stations, conference room, vending machines, restrooms, and a small kitchen.

Hetrick Air Services is the airport's only FBO. As a full service FBO, Hetrick offers fuel, ground support services, charters, aircraft rental, flight instruction, flight supplies, courtesy cars, aircraft maintenance, and hangar and tie-down rental. Hetrick Air Services leases space within the terminal building and occupies two conventional hangars to the west of the terminal building. In addition, they lease several individual T-hangar units and sub-let them or utilize them for overnight aircraft storage. Hetrick Air Services also leases the ground where the Port-A-Port hangars are located.

Stuber Research is a business owned by a private individual that leases a hangar adjacent to the airport FBO. Stuber Research specializes in homebuilt aircraft.

Life Star of Kansas: Life Star is an air ambulance service based at the Lawrence Municipal Airport. They operate on a near daily basis responding to emergencies that require helicopter transport. They also provide patient transport in emergencies.

Gut Works specializes in the physical design and fabrication of aircraft and aircraft systems. They provide aircraft repair, modification, and avionics installation. They also provide aircraft ferrying and exporting services.

Great Planes is a private company that owns a hangar on the west side of the airport. There are several smaller aircraft stored in the hangar.

Don's Diesel specializes in diesel engine kits for agricultural use. Don's Diesel has a combined hangar and warehouse at the airport. They utilize their aircraft for travel to rural agricultural areas to service diesel engines.

The University of Kansas maintains two hangars on the west side of the airport. The main hangar houses a Cessna Citation 550 business jet that is owned by the university. The University also has two single engine piston aircraft, a Cessna 172 and a Cessna 182. The Garrison Flight Research Center is part of this hangar. The airport facilities support Aerospace Engineering, the Mal Harned Propulsion Lab and the Vehicle Manufacturing Facility – Satellite Integration Lab.

AIRCRAFT HANGAR FACILITIES

It is important to identify the types, sizes, and availability of hangar space at the airport in order to ultimately determine the long term need for additional facilities. Hangars can be categorized as T-hangars, executive box hangars, or conventional hangars. T-hangar units are intended for storage of a single small aircraft. They are "T" shaped, thus their name. T-hangars are typically nested together to maximize space and to lower the cost of construction.

Port-A-Port is a brand name for a mobile type of T-hangar, of which there are six located on the west side of the airport.

Executive box hangars can be rectangular or square hangar spaces typically providing between 2,500 and 6,000 square feet of storage space. These hangars are often stand-alone structures, but they can be connected as well. Box hangars provide greater flexibility than T-hangars because they do not have a support structure that limits aircraft positioning. Box hangars are typically equipped with utilities such as water and sewer service.

Conventional hangars are large, clear-span hangars that typically house airport businesses or serve bulk storage needs. Operators of larger corporate aircraft may utilize these hangars as well.

Hetrick Air Services leases two hangars that front the main terminal apron. The hangar immediately adjacent to the terminal building has the FBO offices and three maintenance bays. The next hangar to the west is also leased by the FBO and is primarily used for aircraft storage. Stuber Research leases a conventional hangar on the taxilane extending from the west terminal apron, as depicted on **Exhibit 1J**.

The City of Lawrence owns three T-hangar structures, each of which has 10 individual aircraft storage spaces.

The airport's original terminal area was located on the west side of the airfield. There are several hangars on the west side that house various airport businesses. The largest hangar is owned by the University of Kansas. This hangar houses university aircraft and also provides several classrooms. **Table 1J** presents a summary of the buildings and hangars at Lawrence Municipal Airport.

10MP07-1J-10/18/10

City of Lawrence KANSAS

Exhibit 1J
LANDSIDE FACILITIES

TABLE 1J
Building Inventory
Lawrence Municipal Airport

No.	Building Type	Occupant	Total Aircraft Positions	Position Utilization	Available Positions	Aircraft Storage Space	Maintenance/ Office Space (sf²)
1	Terminal Building	City of Lawrence	NA	NA		NA	6,900
2	Conventional	FBO - Hetrick Air Services	4	4	0	0	10,000
3	Conventional	FBO - Hetrick Air Services	6	6	0	12,200	2,200
4	Conventional	Stuber Research	5	5	0	10,600	2,600
5	T-Hangars (A)	Individual Leases	10	7	3	11,500	NA
6	T-Hangars (B)	Individual Leases	10	10[1]	2	12,650	NA
7	T-Hangars (C)	Individual Leases	10	10[2]	(-1)	12,650	NA
8	Box Hangar	KU	1	0	0	3,200	400
9	Conventional	KU	3	3	0	13,100	2,300
10	Box Hangar	Great Planes	5	5	0	4,200	700
11	Box Hangar	Don's Diesel	1	1	0	4,100	700
12	Box Hangar	Life Star/ GUT Work's	2	2	0	6,800	4,000
13	Portable T-Hangars	Individual Owners	6	5	1	4,800	NA
TOTALS			63	58	5	**95,800**	**22,900**

[1]Two positions hold two aircraft each.

[2]One position holds two aircraft.

Note: Two aircraft tie-down on a permanent basis.

Source: Airport Records/FBO Records/Interviews

AIRCRAFT PARKING APRON

The terminal area apron encompasses approximately 30,000 square yards. Half of the apron is identified for transient aircraft and the other half is used for local aircraft. Taxilane centerlines marked on the apron occupy approximately 10,000 square yards (includes object free area). There are 10 marked transient positions and 26 marked local tie-down positions.

The concrete apron situated between the two FBO hangars is approximately 1,700 square yards in size. This apron is primarily used for circulation of aircraft although it is also used for aircraft parking.

The west terminal apron encompasses approximately 10,900 square yards of pavement. The pavement in this area is in poor condition and with no designated or marked tie-down positions.

AUTOMOBILE PARKING

The primary vehicle parking area is located adjacent to the terminal building and provides 30 parking spaces. There is a secondary terminal automobile parking lot to the west that has an additional 30 spaces. In the west terminal area, there are 25 vehicle parking spaces adjacent to the hangar facilities. Most local airport tenants park their vehicle in or adjacent their hangar.

EMERGENCY RESPONSE

As a general aviation facility that is not certified for scheduled commercial service, the airport is not required to have on-airport firefighting capability. The Lawrence-Douglas County Fire Medical Department is a division of the Lawrence City Government. The closest fire station is Fire Station No. 1, located at 746 Kentucky Street, approximately 3.5 miles from the airport terminal building. This location is south of the Kansas River in the central business district.

Fire Station No.1 houses three response vehicles, a Quint, a Tender, and an ambulance. The Quint has a 30-gallon capacity of aqueous film-forming foam (AFFF) and a 500-gallon water capacity. The Tender can hold 120 gallons of water. There are fire hydrants located around the airport as well.

AIRPORT MAINTENANCE

The airport does not have a dedicated maintenance storage shed. The City utilizes one space in T-Hangar "A" as well as the end cap and one of the portable hangars for equipment storage. Mowers and snow removal equipment are supplied by the City of Lawrence streets division as needed.

UTILITIES

In 2009, the City of Lawrence expanded the existing municipal water pipeline to the airport. The eight-inch line was replaced with a 12-inch line and a loop system was added. The upgrade to the water service positions the airport to more fully accommodate potential businesses. In addition, the water can be "flushed" more efficiently because of the loop system.

Currently (2010), the airport utilizes a traditional septic system for wastewater disposal. Construction is expected to begin in 2011 to extend the city sewer system to the airport. The planned system will utilize a gravity main from the airport to U.S. Highway 24/40, where a force main lift station would transmit wastewater. There are no plans to extend the municipal wastewater system to the west side of the airport.

Natural gas is available at the airport from Black Hills Energy. Natural gas can also be obtained from Magellan and Southern Star. Westar Energy provides electricity to the airport. Data and communication lines are available from several providers including AT&T, Sprint, and Sunflower.

FUEL FACILITIES

The airport owns the aboveground fuel farm located on the west side of the terminal area apron. The fuel farm consists of a 12,000-gallon Jet A tank, a 10,000-gallon Avgas tank, and a 500-gallon Mogas tank. The FBO owns four fuel delivery trucks: a 2,200-gallon Jet A truck, a 1,200-gallon Jet A truck, and two 1,200-gallon Avgas trucks. The total fuel storage capacity at the airport is 15,400 gallons for Jet A and 12,400 gallons for Avgas. **Table 1K** presents a summary of the fuel sales from 2008-2010.

TABLE 1K **Historic Fuel Sales (in gallons)** **Lawrence Municipal Airport**			
	Jet A	**100LL**	**Total**
2008	196,848	47,870	244,718
2009	152,710	40,031	192,741
2010*	162,638	42,210	204,848

* July-Dec is an average from the previous two years.
Source: Airport Records

FENCING

Perimeter fencing at the airport is limited. The terminal building and FBO hangars are fenced with three-foot high chain link fencing. There is no other perimeter fencing at the airport.

ADDITIONAL AIRPORT DOCUMENTATION

The airport maintains several procedural documents which provide guidance for airport management and tenants on airport issues. The Minimum Standards were established in November 2004 and are meant to encourage and ensure the provision of adequate services and facilities, economic health, and orderly development of aviation and related aeronautical activities at the airport. The Rules and Regulations were adopted in October 2006 as supplemental guidance to the Minimum Standards.

The City of Lawrence has adopted a snow removal plan that prioritizes airport surfaces to be plowed when snow events occur. The high priority surfaces are Runway 15-33, parallel Taxiway A, the transient terminal area apron, Taxiway C, and portions of the west terminal area apron. **Exhibit 1K** presents the snow removal plan.

HISTORICAL AIRPORT ACTIVITY

At general aviation airports, the number of based aircraft and the total annual operations (takeoffs and landings) are the primary indicators of aeronautical activity. These indicators will be used in subsequent analyses in this master plan to project future aeronautical activity and determine future facility needs.

ANNUAL OPERATIONS

Aircraft operations are classified as local or itinerant. Local operations consist mostly of aircraft training operations conducted within the airport traffic pattern and touch-and-go and stop-and-go operations. Itinerant operations are arriving or departing aircraft which have an origin or destination away from the airport.

Aircraft operations are further classified in three general categories: air taxi, general aviation, and military. Air taxi operations normally consist of the use of general aviation type aircraft for the "on-demand" commercial transport of persons and property in accordance with 14 CFR Part 135 and Subchapter K of 14 CFR Part 91. General aviation operations include a wide range of aircraft use ranging from personal to business and corporate uses. General aviation operations comprise the majority of operations at Lawrence Municipal Airport. Military use of the airport is limited.

Lawrence Municipal Airport does not have an ATCT and, therefore, exact operational figures are not available. Several sources do provide estimates of current operational levels. The FAA publishes the *Terminal Area Forecast* (TAF) which provides an estimate of annual operations. For Lawrence Municipal Airport, the FAA estimates 32,700 annual operations with 13,650 being local in nature and 19,050 being itinerant. The *Kansas Airport System Plan* shows 32,850 annual operations in the base year of 2007.

BASED AIRCRAFT

Identifying the current number of based aircraft is important to master plan analysis, yet it can be challenging because of the transient nature of aircraft storage. The City of Lawrence maintains a record of the aircraft utilizing space in the city owned T-hangars. The FBO maintains a list of all other based aircraft at the airport. There are currently 60 aircraft based at the airport. Of this total, one is a Cessna Citation 550 business jet, one is a Beech King Air 350 turboprop, one is the air ambulance helicopter, five are multi-engine piston powered, and the remaining 52 are single engine piston powered aircraft.

AIRPORT SERVICE AREA

The service area is loosely defined as a baseline geographical area from which future aviation demand (particularly based aircraft) is most likely to originate. The service area should relate to existing geographical areas, such as a county, or city boundary, in order to facilitate correlation with known socioeconomic data. With this relationship, forecasts of aviation demand can be made.

Many factors can contribute to the definition of an airport's service area. A primary factor is the proximity, capability, and level of services offered by other area airports. Another factor is the actual location where based aircraft owners live or work in proximity to the airport.

REGIONAL AIRPORTS

The proximity of other airports is largely the defining factor when describing an airport's service area. A review of public use airports in the region was made to identify and distinguish the types of air services provided in the region. Information pertaining to each airport was obtained from FAA Form 5010, *Airport Master Record*, as well as the web site www.airnav.com.

It is important to consider the capabilities and limitations of other airports when planning for future changes or

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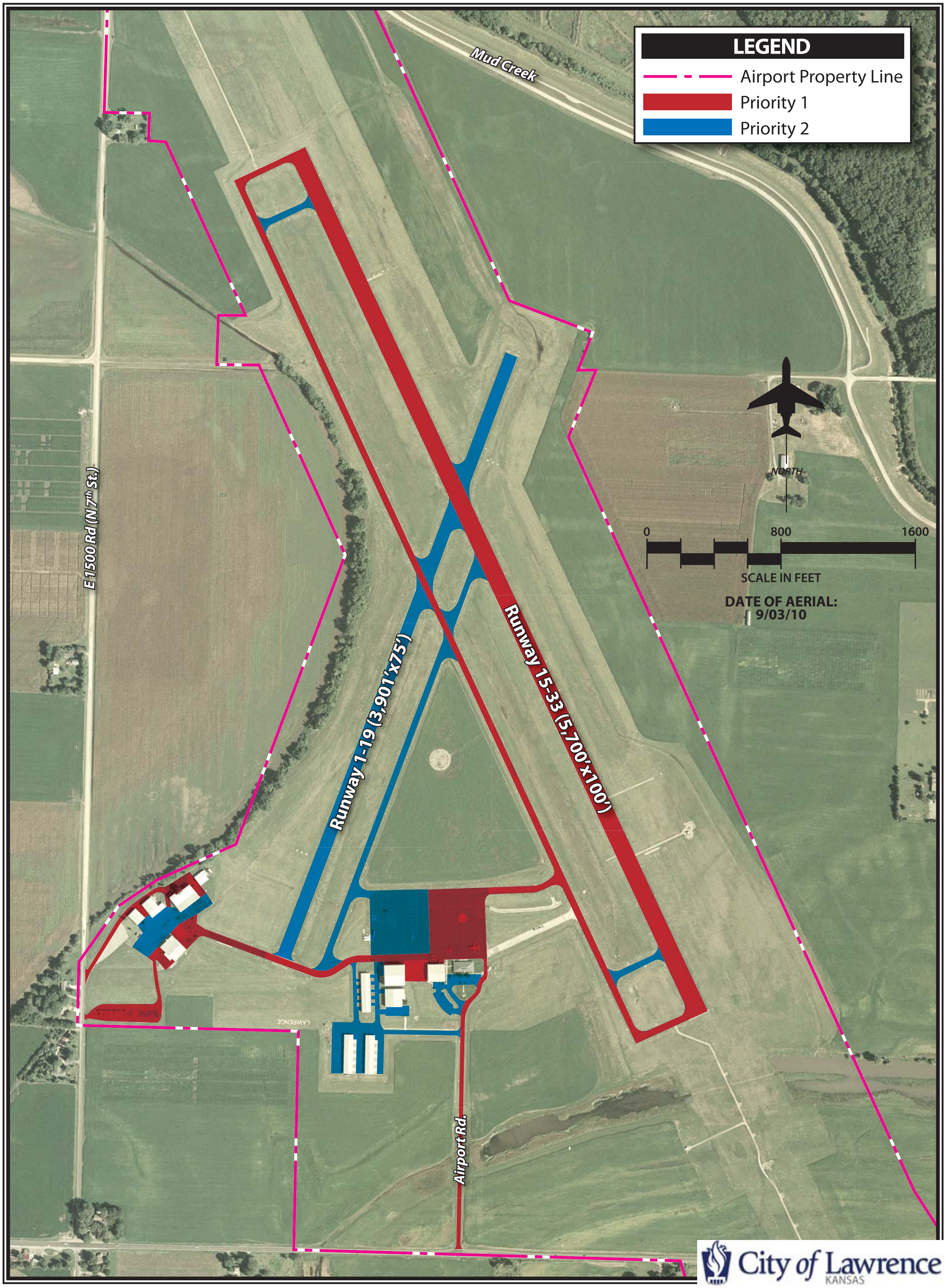


Exhibit 1K
SNOW REMOVAL PLAN

improvements at Lawrence Municipal Airport. The following are those public use airports with asphalt or concrete runways that can serve general aviation aircraft. These airports are listed by their proximity to Lawrence Municipal Airport. **Table 1L** identifies the major characteristics of each airport.

TABLE 1L
Public-Use Airports With Instrument Approaches Within 30 Miles of Lawrence

Airport Name (Identifier)	Distance/ Direction	FAA Type	Longest Paved Runway	Based Aircraft	Annual Ops	Services
Gardner Municipal Airport (K34)	20 SE	GA	2,960	78	26,000	Avgas, Flight School
New Century AirCenter (IXD)	22 SE	Reliever	7,339	148	45,000	Full Service
Philip Billard Municipal Airport (TOP)	22 W	GA	5,099	70	64,000	Full Service
Forbes Field Airport (FOE)	24 W	Commercial	12,802	57	32,000	Full Service
Johnson County Executive (OJC)	28 ESE	Reliever	4,098	143	53,000	Full Service
Sherman Army Airfield (FLV)	30 NNE	GA	5,905	31	20,000	Avgas, Jet A

Source: www.airnav.com as accessed on 8-17-10

Gardner Municipal Airport (K34) is located 20 miles to the southeast of Lawrence Municipal Airport. The airport supports three runways, with the only paved runway constructed of asphalt at 2,960 feet long. The airport's only instrument approach procedure is a circling NDB or GPS approach. It is estimated that there are 78 based aircraft, including several gliders and ultralights. This airport is intended to serve small recreational aircraft.

New Century AirCenter (IXD) is 22 miles to the southeast, near Gardner Municipal Airport. New Century is a reliever airport in the Kansas City region. It is estimated that there are nearly 150 based aircraft, including 27 multi-engine and eight jets. The airport has a control tower and experiences approximately 50,000 annual operations. Primary Runway 18-36 is 7,339 feet long, while crosswind Runway 4-22 is 5,132 feet long. The airport has two FBOs and several other aviation businesses. The U.S. Army Reserve bases approximately 12 Chinook Helicopters at the airport. The airport offers several instrument approaches to both ends of Runway 18-36 including a Category I ILS to Runway 36.

Philip Billard Municipal Airport (TOP) is located 22 miles to the west of Lawrence Municipal Airport. Three paved runways are available with Runway 13-31 being the longest at 5,099 feet. All runway ends have instrument approaches, including a CAT I ILS to Runway 13. There are 70 based aircraft, most of which are single engine piston powered aircraft.

There is a full service FBO and an airport café.

Forbes Field (FOE) is a primary commercial service airport serving the greater Topeka area. Primary Runway 13-31 is 12,802 feet long and offers instrument approaches, including a CAT I ILS to Runway 31. There are 57 based aircraft, including six business jets and 13 helicopters. In addition, the 190th Air Refueling Wing of the Kansas Air National Guard bases approximately 18 military aircraft at the airport, including the KC-135 Stratotanker.

Johnson County Executive Airport (OJC) is a general aviation reliever airport located approximately 28 miles to the east/southeast of Lawrence. The airport offers a single runway, Runway 18-36, that is 4,098 feet long. Instrument approaches are available to both ends of the runway. The airport supports 143 based aircraft, including two business jets, as well as two full service FBOs.

Sherman Army Airfield (FLV) is 30 miles to the north/northeast of Lawrence Municipal Airport. Runway 15-33 is 5,905 feet long. The airport is owned by the U.S. Army and is located on the Fort Leavenworth property. The U.S. Army leases a small portion of the airport to the City of Leavenworth for use by the public. There are 31 based general aviation aircraft. As of this writing (September 2010), Leavenworth County has completed an airport feasibility study and was planning to begin a site selection study for the development of a new airport.

BASED AIRCRAFT LOCATION

Most pilots who chose to base their aircraft at an airport do so because of the convenience of the airport to their residence or place of business. With that said, some aircraft owners will have other priorities such as runway length if they have a business jet, or hangar space availability.

The city and Hetrick Air Services maintain information related to the based aircraft at the airport. Analysis of the data indicated that there are 60 based aircraft as of September 2010. Of this total, 67 percent, or 40 of 60, are registered to zip codes in Douglas County. An additional 28 percent (17 of 60) are registered to addresses in adjacent counties, with Johnson County accounting for 11 based aircraft (5.5 percent). Three aircraft are registered out of state (5 percent). There are no based aircraft registered in Franklin, Osage, or Miami County. Therefore, 95 percent of the based aircraft at Lawrence Municipal Airport originate from Douglas County or one of the surrounding counties.

SERVICE AREA SUMMARY

Douglas County, Kansas represents the primary airport service area as nearly 70 percent of the aircraft based at the airport are registered to an owner or business in the county. The surrounding counties of Jefferson, Leavenworth, and Johnson represent the secondary service area. Shawnee County to the west also borders Douglas County; however, only one based aircraft is registered in Shawnee

County: the air ambulance helicopter. The corporate headquarters for the air ambulance company is in Topeka. Franklin County borders Douglas County to the south, but there are no aircraft based at Lawrence Municipal Airport that are registered in Franklin County. The location of the airport in the northeast corner of Douglas County effectively limits the secondary service area to Jefferson, southern Leavenworth, and north and western Johnson Counties. **Exhibit 1L** presents the airport service area. The map also includes the resident zip code for each of Lawrence's based aircraft (except for out of state owners).

HISTORIC SOCIOECONOMIC DATA

Socioeconomic information related to the approximate airport service area is an important consideration in the master planning process. The historic trend in elements such as population and employment provides insight into the long term socioeconomic condition of the region. **Table 1M** presents the historic population and employment trend for both the City of Lawrence and Douglas County as sourced from the *Horizon 2020 - The Comprehensive Plan for Lawrence and Unincorporated Douglas County.*

TABLE 1M
Historic Population and Employment data
Lawrence and Douglas County, Kansas

	POPULATION		**EMPLOYMENT**	
Year	**Lawrence**	**Douglas County**	**Lawrence**	**Douglas County**
1950	23,351	34,086	NA	NA
1960	32,858	43,720	NA	NA
1970	45,698	57,932	17,942	22,008
1980	52,738	67,640	25,279	31,584
1990	65,608	81,798	32,603	40,186
2000	80,098	99,962	NA	45,450
AAGR	2.50% (1950-2000)	2.18% (1950-2000)	3.03% (1970-1990)	2.45% (1970-2000)

AAGR: Average Annual Growth Rate
Source: Horizon 2020 (Lawrence/Douglas County MPO)

From 1950 to 2000, both the Lawrence and Douglas County populations have experienced steady and positive growth. The average annual growth rate for Lawrence was 2.5 percent, and for Douglas County it was 2.18 percent. Employment growth was more substantial with the City experiencing a growth rate above three percent annually and the County at 2.45 percent.

The Lawrence/Douglas County Metropolitan Planning Organization (MPO) presents a yearly update to population growth statistics. The estimates are based on a housing unit methodology developed by the U.S. Census Bureau. The overall population growth shows an average annual growth rate of 1.43 percent from 2000 to 2009, as shown in **Table 1N**. This is lower than the previous 50 years, but is still strong growth. This period does include two recent recessionary periods (2000-2001) and (2008-2010). **Exhibit 1M** graphically shows the growth of the City of Lawrence since 1940.

TABLE 1N
Population Growth, Year Over Year
City of Lawrence

Yearly Estimate - July 1st	Population	Change/Year	Percent Change
2000	80,508	NA	NA
2001	81,780	1,272	1.58%
2002	83,310	1,530	1.87%
2003	84,844	1,534	1.84%
2004	86,448	1,604	1.89%
2005	88,664	2,216	2.56%
2006	89,110	446	0.50%
2007	90,311	1,201	1.35%
2008	90,866	555	0.62%
2009	91,464	598	0.66%
AAGR 2000-2009		1,217	1.43%

Source: Lawrence/Douglas County MPO

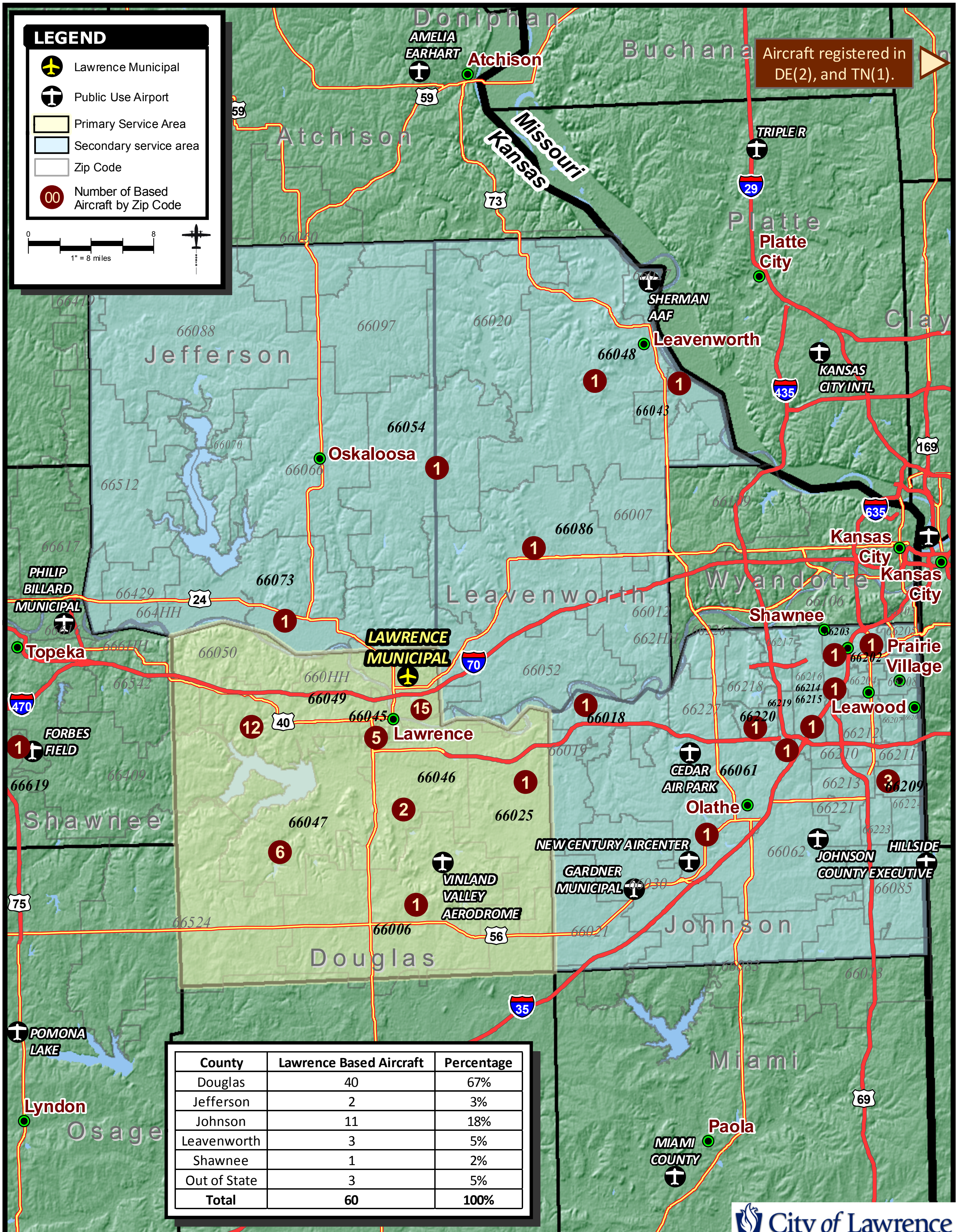
ENVIRONMENTAL INVENTORY

A review of the potential environmental impacts associated with proposed airport projects is an essential consideration in the airport master plan process. The intent of this inventory is to identify potential environmental sensitivities or resources that might affect future improvements at the airport. The information contained in this section was obtained from internet resources, agency maps, and existing literature.

Research was done for each of the 23 environmental impact categories described within the FAA's *Environmental Desk Reference for Airport Actions*. It was determined that the following resources are not present with the airport environs or cannot be inventoried:

- 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 – no wild and scenic rivers are located in within the State of Kansas.
- Resources that were not inventoried
  - Construction Impacts
  - Energy Supply and Natural Resources
  - Noise
  - Social Impacts

The following sections provide a discussion of the remaining resource categories.



County	Lawrence Based Aircraft	Percentage
Douglas	40	67%
Jefferson	2	3%
Johnson	11	18%
Leavenworth	3	5%
Shawnee	1	2%
Out of State	3	5%
Total	**60**	**100%**

Exhibit 1L
Airport Service Area

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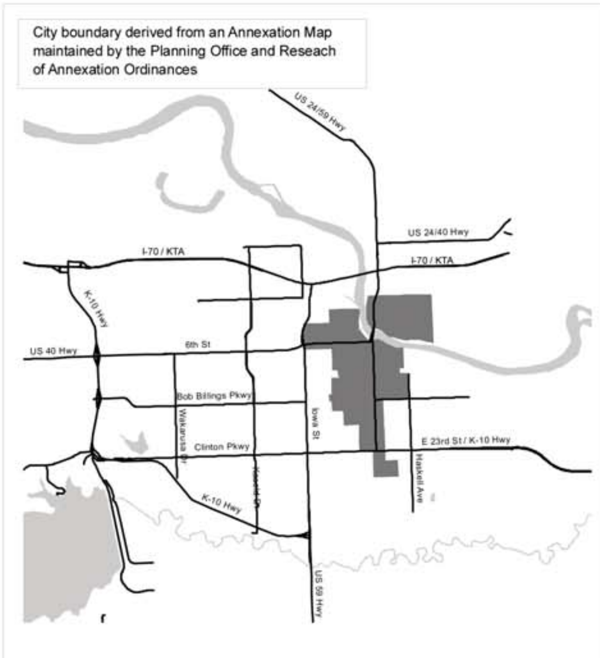
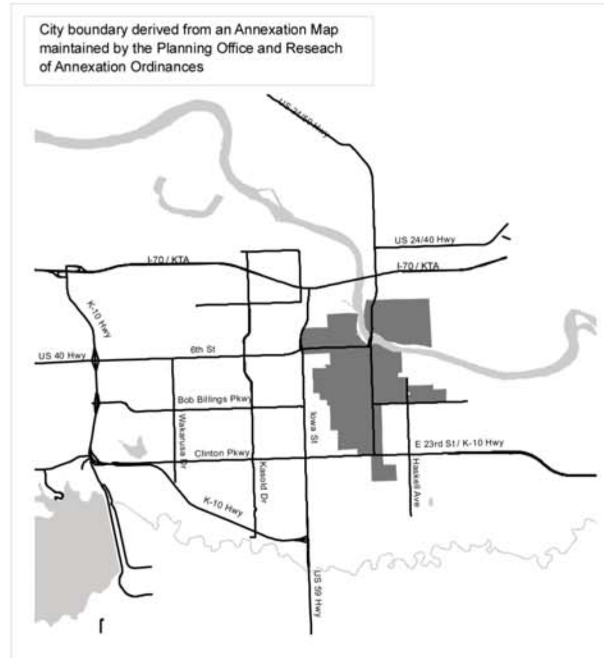
Historical Growth of Lawrence, Kansas

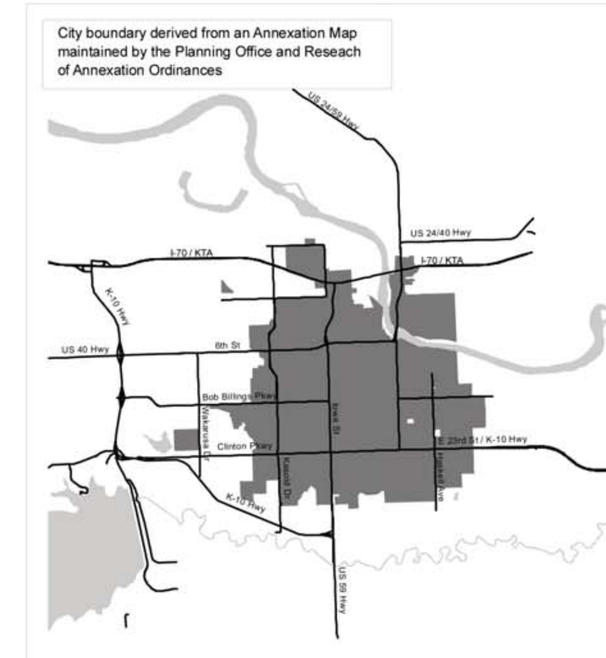


Lawrence Before 1940
Area: 2,610.576 acres (4.08 sq. miles)
1940 Census Population: 14,390
Population Density: 3,527 persons/sq. mile

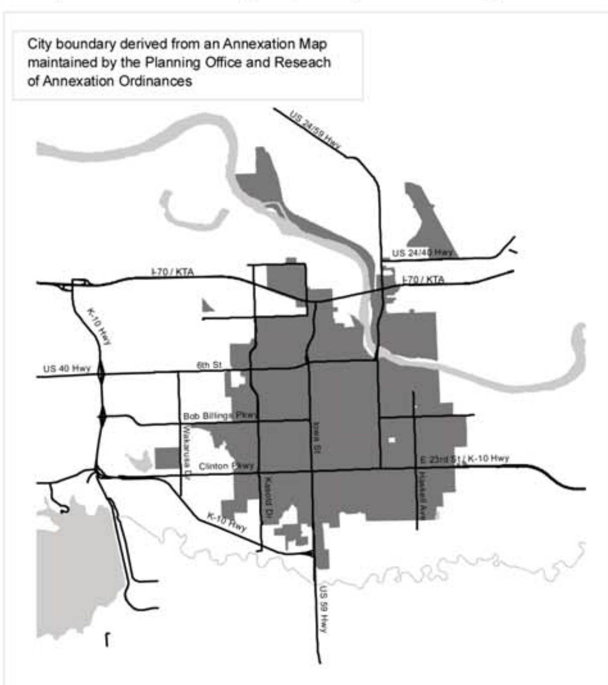


Lawrence Before 1950
Area: 3,025.398 acres (4.73 sq. miles)
1950 Census Population: 23,351
Population Density: 4,937 persons/sq. mile

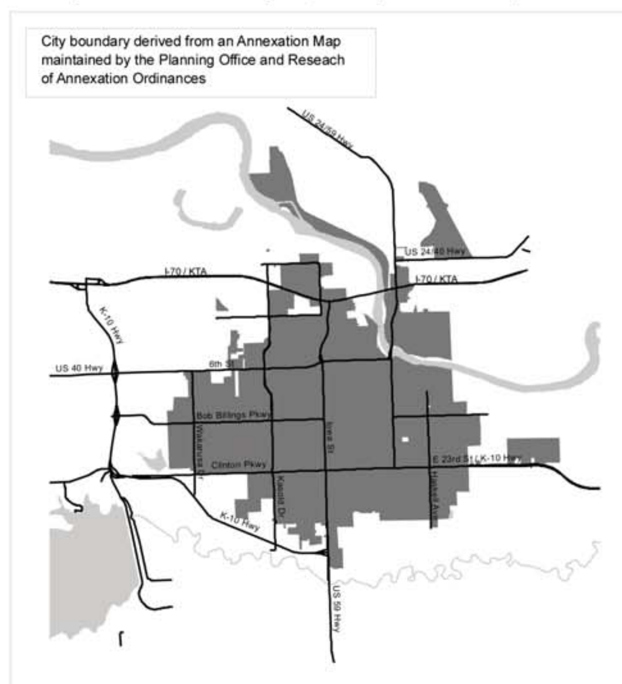
Lawrence Before 1960
Area: 5,156.96 acres (8.06 sq. miles)
1960 Census Population: 32,858
Population Density: 4,077 persons/sq. mile



Lawrence Before 1970
Area: 10,837.305 acres (16.93 sq. miles)
1970 Census Population: 45,698
Population Density: 2,699 persons/sq. mile

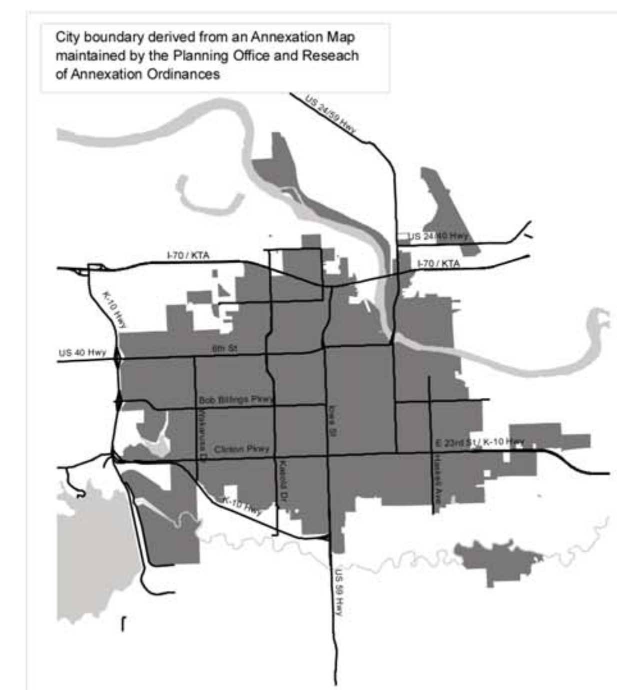


Lawrence Before 1980
Area: 12,484.872 acres (19.51 sq. miles)
1980 Census Population: 52,738
Population Density: 2,703 persons/sq. mile



Lawrence Before 1990
Area: 14,641.61 acres (22.88 sq. miles)
1990 Census Population: 65,608
Population Density: 2,867 persons/sq. mile

Lawrence Before 2000
Area: 17,932.595 acres (28.02 sq. miles)
2000 Census Population: 80,098
Population Density: 2,859 persons/sq. mile



Lawrence Today
Area: 20,882.98 acres (32.63 sq. miles)

Planning and Development Services Department
December 28, 2007

City of Lawrence
KANSAS

Exhibit 1M
HISTORICAL GROWTH OF
LAWRENCE KANSAS

AIR QUALITY

The U.S. Environmental Protection Agency (EPA) has adopted air quality 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), Particulate matter (PM_{10} and $PM_{2.5}$), and Lead (Pb). Various levels of review apply within both NEPA and permitting requirements. Potentially significant air quality impacts, associated with an FAA project or action, would be demonstrated by the project or action exceeding one or more of the NAAQS for any of the time periods analyzed.

According to the EPA's Greenbook, Douglas County, Kansas is an attainment area for all criteria pollutants.

COMPATIBLE LAND USE

The compatibility of existing and planned land uses in the vicinity of an airport is usually associated with the extent of the airport's noise impacts. Noise exposure contours will be prepared for Lawrence Municipal Airport based on the aviation forecasts outlined in Chapter Two.

Land immediately surrounding the airport is primarily used for agricultural operations. Father to the west of the airport, there are several commercial and industrial land uses along US-59. Additionally, there are several scattered residences within the vicinity of the airport.

Compatible land use also addresses nearby features that could pose a threat to safe aircraft operations by attracting wildlife (e.g., landfills and ponds). The Hamm Sanitary Landfill is located approximately two miles northwest of the airport. In addition to the previously discussed Kaw River and Mud Creek, there are also several manmade fishery ponds immediately north of the airport. As of this writing, the ponds were dry and the fishery was not operating commercially.

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.

Riverfront Park, located less than one mile west of the airport along the Kansas River is a potential Section 4(f) property.

FARMLAND

Under the *Farmland Protection Policy Act* (FPPA), federal agencies are directed to identify and take into account the adverse effects of federal programs on the preservation of farmland, to consider 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 indicates that the airport property includes six soil types, all of which are classified as prime farmland.

FISH, WILDLIFE, AND PLANTS

A number of regulations have been established to ensure that projects do not negatively impact protected plants, animals, or their designated habitat. Section 7 of the *Endangered Species Act* (ESA), as amended, applies to federal agency actions and sets forth requirements for consultation to determine if the proposed action may affect a federally endangered or threatened species.

According to the U.S. Fish and Wildlife Service (USFWS) and the Kansas Department of Wildlife and Parks, there are a number of federal and state species that have potential habitat in Douglas County. These species are listed in **Table 1P**.

It is unknown whether or not any of these species are present within the airport environs. However, several of these species, including the chestnut lamprey, flathead chub, hornyhead chub, pallid sturgeon, plains minnow, sicklefin chub, silver chub, sturgeon chub, Topeka shiner, and western silvery minnow are marine species whose habitat is not present at the airport. Additional field investigations would be required to determine the presence of the remaining species at the airport.

TABLE 1P Threatened or Endangered Species - Douglas County, Kansas			
Common Name	**Species**	**State Status**	**Federal Status**
American Burying Beetle	*Nicrophorus americanus*	Endangered	-
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	-
Chestnut Lamprey	*Ichthyomyzon castaneus*	Threatened	-
Eastern Spotted Skunk	*Spilogale putorius*	Threatened	-
Eskimo Curlew	Numenius borealis	Endangered	-
Flathead Chub	*Platygobio gracilis*	Threatened	-
Hornyhead Chub	*Nocomis biguttatus*	Threatened	-
Least Tern	*Sterna antillarum*	Endangered	-
Mead's Milkweed	Asclepias meadii	-	Threatened
Pallid Sturgeon	Scaphirhynchus albus	Endangered	Endangered
Peregrine Falcon	*Falco peregrinus*	Endangered	-
Piping Plover	*Charadrius melodus*	Threatened	-
Redbelly Snake	*Storeria occipitomaculata*	Threatened	-
Sicklefin Chub	*Macrhybopsis meeki*	Endangered	-
Silver Chub	*Macrhybopsis storeriana*	Endangered	-
Smooth Earth Snake	*Virginia valeriae*	Threatened	-
Snowy Plover	*Charadrius alexandrinus*	Threatened	-
Sturgeon Chub	*Macrhybopsis gelida*	Threatened	-
Topeka Shiner	*Notropis topeka*	Threatened	-
Western Prairie Fringed Orchid	Platanthera praeclara	-	Threatened
Western Silvery Minnow	*Hybognathus argyritis*	Threatened	-
Whooping Crane	*Grus americana*	Endangered	-
Source: USFWS, http://www.fws.gov/mountain-prairie/endspp/CountyLists/Kansas.pdf accessed June 2011. Kansas Department of Wildlife and Parks, County Lists, Threatened and Endangered Species, http://www.kdwp.state.ks.us/news/content/download/6530/31373/file/Douglas%20County.pdf, accessed June 2011,			

FLOODPLAINS

Executive Order 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.

A review of Douglas County, Kansas Flood Zone Map[1] information indicates that a portion of airport property south of US-40 is contained within the 100-year floodplain. Additionally, portions of the western and northern airport property line are adjacent to the 100-year floodplain. The floodplains are associated with tributaries to the Kansas River.

HAZARDOUS MATERIALS, POLLUTION, AND SOLID WASTE

Federal, state, and local laws regulate hazardous materials use, storage,

[1] Douglas County, Kansas Flood Zone Map, http://www.douglas-county.com/depts/em/preparedness/docs/pdf/floodzone_map.pdf

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.

The EPA's *Enviromapper for Envirofacts* was consulted regarding the presence of impaired waters or regulated hazardous sites. According to the EPA *Enviromapper*, there are no SUPERFUND sites within the vicinity of the airport. With regard to Clean Water Act Section 303(d) impaired waters, there are two within the vicinity of the airport: the Kansas River, located approximately one mile southwest of the airport, and Mud Creek located immediately north of the airport.

HISTORICAL, ARCHITECTURAL, AND CULTURAL RESOURCES

Determination of a project's environmental impact to historic and cultural resources is made under guidance in 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. In Kansas, the State Historic Preservation Officer has oversight on Kansas laws and regulations regarding historical, architectural, archeological and cultural resource laws and regulations.

A review of the National Register of Historic Places indicates that no registered sites are located in close proximity to the airport.

LIGHT EMISSIONS AND VISUAL IMPACTS

Airport lighting is characterized as either airfield lighting (i.e., runway, taxiway, approach and landing lights) or landside lighting (i.e., security lights, building interior lighting, parking lights, and signage). Generally, airport lighting does not result in significant impacts unless a high intensity strobe light, such as a Runway End Identifier Lighting (REIL), would produce glare on any adjoining site, particularly residential uses.

The existing light features of the airport are described in detail previously in this chapter.

ENVIRONMENTAL JUSTICE

Environmental justice can be defined as insuring that an action does not unfairly impact a minority race or families living under the poverty level. The EPA's *EJView*[2] was consulted regarding the presence of environmental justice areas within the airport environs. According to the tool, no areas of low income or minority population are located within the airport environs.

WATER QUALITY

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.

The Kansas River is located approximately one mile southwest of the airport, and Mud Creek is located immediately north of the airport. No streams or creeks are located on airport property. As previously discussed, the Kansas River and Mud Creek are listed as Section 303(d) impaired waters as they violate established water quality standards.

Congress has mandated (under the Clean Water Act) the National Pollutant Discharge Elimination System (NPDES). This program addresses non-agricultural storm water discharges. Through the use of NPDES permits, certain procedures are required to prevent contamination of water bodies from storm water runoff. The EPA can delegate this permit authority to individual states. The Kansas Department of Health and Environment administers the NPDES permit program for the State of Kansas. Lawrence Municipal Airport is eligible for coverage under the industrial activity general permit (S-ISWA-0507-1) issued September 1, 2006.

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 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

[2] EPA EJView, http://epamap14.epa.gov/ejmap/entry.html, accessed October 2010

conditions during the growing season (hydric).

A review of the National Wetland Inventory maps indicates the presence of potential wetlands on airport property. The potential wetlands are located within the area south of Runway 15-33 and north of US-40. Further analysis would be needed to determine if the wetlands would be considered jurisdictional by the U.S. Army Corps of Engineers.

SUMMARY

The information discussed in this inventory chapter provides a foundation upon which the remaining elements of the planning process will be constructed. Information on current airport facilities and utilization will serve as a basis, with additional analysis and data collection, for the development of forecasts of aviation activity and facility requirement determinations.

DOCUMENT SOURCES

As mentioned earlier, a variety of different sources were utilized in the inventory process. The following listing reflects a partial compilation of these sources. This does not include data provided by airport management as part of their records, nor does it include airport drawings and photographs which were referenced for information. On-site inventory and interviews with staff and tenants contributed to the inventory effort.

Airport/Facility Directory, North Central U.S., U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, August 26, 2010.

Kansas City Sectional Aeronautical Chart, U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, June 3, 2010.

National Plan of Integrated Airport Systems (NPIAS), U.S. Department of Transportation, Federal Aviation Administration, 2009-2013.

U.S. Terminal Procedures, Northwest, U.S. Department of Transportation, Federal Aviation Administration, National Aeronautical Charting Office, August 26, 2010.

Lawrence Municipal Airport Layout Plan Update (2001). Airport Development Group, Inc.

2010 Complete Economic and Demographic Data Source (CEDDS). Woods & Poole Economics, Washington, D.C.

Horizon 2020 – The Comprehensive Plan for Lawrence and Unincorporated Douglas County, as amended, December 2009. Prepared by the Lawrence/Douglas County Metropolitan Planning Organization.

Transportation 2030 – Lawrence/Douglas County, Long Range Transportation Plan. Prepared by the Lawrence/Douglas County Metropolitan Planning Organization.

Land Development Code – City of Lawrence 2006. Prepared by the City of Lawrence – Planning and Development Services.

Kansas Airport System Plan – 2009. Prepared by Wilbur Smith Associates. Available at: http://www.ksdot.org/divaviation

Kansas Aviation Economic Impact Study – 2010. Prepared by Wilbur Smith Associates. Available at: http://ktoc.net/group_file.aspx?fileid=371ea80d918647dbb3f97e14fc072cf8

A number of websites were also used to collect information for the inventory chapter. These include the following:

The City of Lawrence:
www.ci.lawrence.ks.us

Lawrence Kansas – Chamber of Commerce:
www.lawrencechamber.com

FAA 5010 Airport Master Record Data:
www.airnav.com

U.S. Census Bureau:
www.census.gov

Bureau of Economic Analysis, U.S. Department of Commerce:
http://www.bea.gov/bea/regional/data.htm

GCR and Associates.
http://www.airportiq.com/default.htm

Chapter Two

Forecasts

Chapter Two

Forecasts

An important factor when planning the future needs of an airport involves a definition of aviation demand that may reasonably be expected to occur in both the near term (five years) and long term (20 years). For a general aviation airport such as Lawrence Municipal Airport (LWC), forecasts of based aircraft and operations (takeoffs and landings) serve as the basis for facility planning.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. The FAA reviews such forecasts with the objective of comparing them to the FAA *Terminal Area Forecasts* (TAF) and the *National Plan of Integrated Airport Systems* (NPIAS). In addition, aviation activity forecasts are an important input to the benefit-cost analyses associated with some airport development projects.

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, dated December 4, 2004, says forecasts should be:

- Realistic
- Based on the latest available data
- Reflective of current conditions at the airport
- Supported by information in the study
- 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 depending upon the issues to be addressed and the level of effort required to develop the

forecast. 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 six standard steps involved in the forecast process, including:

1) Obtain existing FAA and other related forecasts for the area served by the airport.

2) Determine if there have been significant local conditions or changes in the forecast factors.

3) Make and document any adjustments to the aviation activity forecasts.

4) Where applicable, consider the effects of changes in uncertain factors affecting demand for airport services.

5) Evaluate the potential for peak loads within the overall forecasts of aviation activity.

6) Monitor actual activity levels over time to determine if adjustments are necessary in the forecasts.

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 following forecast analysis for Lawrence Municipal Airport was produced following these basic guidelines. 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 Lawrence Municipal Airport that will permit airport management to make planning adjustments as necessary to maintain a viable, efficient, and cost-effective facility.

SOCIOECONOMIC CHARACTERISTICS

A variety of historical and forecast socioeconomic data has been collected for use in various elements of this master plan. This data provides essential background information for use in determining aviation service level requirements. Aviation forecasts are related to socioeconomic indicators such as population, employment, and income, as well as the economic strength of the region; therefore, it is necessary to have an understanding of the socioeconomic outlook for the airport service area.

As discussed in the previous chapter, the primary service area for the airport is Douglas County, which accounts for approximately 67 percent of the based aircraft (40 of 60). Thirty-three percent of the current based aircraft have mailing addresses outside of Douglas County (20 of 60). The majority of those (16 of 20) are registered to addresses in Leavenworth, Jefferson, and Johnson Counties. Therefore, a secondary service area that includes these three adjacent counties will be considered.

Several sources were examined for demographic data, including the U.S. Census Bureau, the Kansas Water Office, the *Transportation 2030 – Lawrence/Douglas County Long Range Transportation Plan*, *Horizon 2020 – Comprehensive Plan for Lawrence and Unincorporated Douglas County,* and Woods & Poole Economics.

The socioeconomic data from the several local sources listed is somewhat dated. Both the *Transportation 2030* and *Horizon 2020* plans utilize demographic data from 2001, which included 2000 census data. The Kansas Water Office population data (analyzed but not presented) was developed in 1991. Demographic data available from Woods & Poole Economics, an independent firm specializ-ing in long term demographic projections for U.S. counties, is consistent with the positive population growth trends presented.

When preparing aviation forecasts, it is helpful to utilize consistent and comprehensive socioeconomic data. Woods & Poole publishes socioeconomic data annually, and they update the previous several years as necessary. They also provide both historical and forecast data, including yearly data through 2030.

Use of Woods & Poole data for airport forecasting is acceptable as the FAA has approved forecasts at other airports that utilize this data source. Therefore, the primary socioeconomic data sources for use in generating the aviation forecasts will be the Woods & Poole data sets for Douglas, Johnson, Leavenworth, and Jefferson Counties. **Table 2A** presents historical and forecast data for population, employment, and income for the four counties considered the primary and secondary service area for the Lawrence Municipal Airport. This data will be utilized in forecasting analysis later in the chapter.

AVIATION TRENDS

The forecasts developed for the airport must also consider national, regional, and local aviation trends. The following section describes the 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.

TABLE 2A **Demographic Trends and Forecast** **Airport Service Area**	HISTORIC		FORECAST				
	2000	**2005**	**2010**	**2015**	**2020**	**2030**	**AAGR 2010-2030**
Douglas County							
Population	100,281	111,519	117,423	124,241	131,271	145,623	2.18%
Employment	64,035	66,189	66,487	69,996	73,559	80,740	1.96%
Income (PCPI)	$26,195	$26,381	$27,912	$29,905	$32,111	$37,302	2.94%
Johnson County							
Population	454,605	505,329	558,517	620,084	682,642	809,337	3.78%
Employment	363,619	394,522	424,722	466,631	511,659	611,271	3.71%
Income (PCPI)	$47,874	$46,115	$48,473	$51,084	$54,133	$61,576	2.42%
Leavenworth County							
Population	68,922	71,756	75,736	79,470	83,343	91,272	1.88%
Employment	33,241	35,450	36,707	38,740	40,864	45,422	2.15%
Income (PCPI)	$26,651	$27,719	$29,509	$31,212	$33,040	$37,187	2.34%
Jefferson County							
Population	18,443	18,647	18,738	19,552	20,401	22,144	1.68%
Employment	5,799	6,155	6,425	6,676	6,923	7,392	1.41%
Income (PCPI)	$24,593	$25,688	$27,534	$29,032	$30,632	$34,228	2.20%

PCPI: Per capita personal income ($2004)
AAGR: Average annual growth rate
Source: Woods & Poole Economics (2010)

NATIONAL TRENDS

Each year, the FAA publishes its national aviation forecast. Included in this publication are forecasts for large air carriers, regional air carriers, general aviation, and FAA workload measures. The forecasts are prepared to meet budgeting and planning needs of the constituent units 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, FAA *Aerospace Forecasts - Fiscal Years 2010-2030*, has been utilized in the generation of the aviation demand forecasts to follow.

Historically, aviation activity has closely followed the national economic outlook. To quote from the FAA Forecasts, "each passing month of 2009, saw the light of consumer confidence dim as housing foreclosures climbed, credit tightened, and unemployment surged." This chain of events resulted in lower than expected demand for air travel and general aviation activity. Nonetheless, the FAA continues to forecast long term aviation growth.

The economic downturn led to sharp declines in general aviation products and services. Aircraft manufacturing declined for the second straight year in 2009, down 48.5 percent from 2008.

General aviation billings were down 32 percent in 2009 and operational activity at towered airports fell 11.7 percent.

General Aviation Trends

The passage of the *General Aviation Revitalization Act of 1994* (Act) (federal legislation which limits the liability on general aviation aircraft to 18 years from the date of manufacture) successfully infused new life into the general aviation industry after many years of decline. This legislation sparked an interest to renew the manufacturing of general aviation aircraft due to the reduction in product liability, as well as renewed optimism for the industry. After the passage of this legislation, annual shipments of new aircraft rose every year between 1994 and 2000. The industry then stagnated in the aftermath of 9/11, but recovered to new production highs from 2005 through 2007. The economic recession beginning in late 2007 has had an impact on production and the slow recovery has hit the industry hard. **Table 2B** presents historical data related to aircraft shipments.

TABLE 2B
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	1043	80	279	438	7,170
1998	2,457	1508	98	336	515	8,604
1999	2,808	1689	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	2,961	1,999	52	319	591	11,918
2005	3,590	2,326	139	375	750	15,156
2006	4,053	2,513	242	412	886	18,815
2007	4,270	2,417	258	459	1,136	21,826
2008	3,967	1,943	176	535	1,313	24,766
2009	2,276	895	70	441	870	19,466

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet
Source: General Aviation Manufacturers Association 2009 Statbook

Many capable general aviation airports have seen an upward trend in activity by business jets. There are numerous factors that have led to this trend, including the growth of fractional aircraft ownership and a desire by frequent travelers to save time by avoiding commercial service airports. **Table 2C** presents growth trends in fractional aircraft ownership.

TABLE 2C Fractional Aviation		
Year	Number of Shares	Number of Aircraft
1986	3	NA
1987	5	NA
1988	26	NA
1989	51	NA
1990	57	NA
1991	71	NA
1992	84	NA
1993	110	NA
1994	158	NA
1995	285	NA
1996	548	NA
1997	957	NA
1998	1,551	NA
1999	2,607	NA
2000	2,810	574
2001	3,601	689
2002	4,244	780
2003	4,516	826
2004	4,765	870
2005	4,828	945
2006	4,863	984
2007	5,168	1,030
2008	5,179	1,094
2009	4,881	1,037
Source: GAMA / JETNET LLC		

As with most sectors of general aviation, 2009 saw a decline in the number of fractional shares and aircraft in operation. At the same time, the table gives evidence that the concept of fractional ownership is popular and is likely to continue to grow as the economy improves.

ECONOMIC OUTLOOK

The FAA Aerospace Forecast uses economic forecasts developed by Global Insight, Inc. to project domestic aviation demand. Data suggest that the bottom of the recession was in June 2009, as both the third and fourth quarters of 2009 showed growth in gross domestic product (GDP). Nonetheless, overall GDP fell 2.9 percent in 2009. The pace of recovery is expected to be slow and not strong enough to halt the decline in jobs until later in 2010. "The recovery is not V-shaped, but instead is more W-shaped (FAA Forecasts)." In 2010, first quarter GDP grew by 3.7 percent and second quarter GDP grew by 1.6 percent, according to the Bureau of Economic Analysis.

There are a number of issues surrounding the economy that remain a concern, and how these are resolved will determine the future path of recovery. Among these are the size of the federal deficit and taxes, when the Federal Reserve will begin to raise interest rates, when housing prices will begin to recover, and how long consumers will continue to rein in spending. The FAA forecast assumes that there will be no additional fiscal stimulus and that the Federal Reserve will continue to keep interest rates at or near zero for much of 2010.

Global Insight's economic forecast projects a relatively weak recovery, as credit remains tight and consumer spending remains sluggish. Over the next several years, GDP is forecast to grow from 1.5 percent in 2010 to 3.4 percent in 2011 and to 3.6 percent in 2012. In the later years through 2030, GDP is forecast at an average of 2.6 percent annually.

FAA GENERAL AVIATION FORECASTS

The FAA forecasts of national general aviation activity assume that business use of general aviation aircraft will continue to expand at a more rapid pace than that for personal/sport use. Corporate use of fractional and charter aircraft continues to be a practical alternative to commercial travel due to time savings.

The active general aviation fleet is projected to increase at an average annual rate of 0.9 percent over the 21-year FAA forecast period, growing from 229,149 in 2009 to 278,723 in 2030. The more expensive and sophisticated business jet fleet is forecast to increase 4.2 percent a year. The results of the survey are not published until the following year; therefore, 2008 is the most recent statistical year, with 2009 being estimates. **Exhibit 2A** presents the FAA forecast for U.S. active general aviation aircraft.

ACTIVE AIRCRAFT FLEET MIX

The FAA forecasts the general aviation active fleet for piston powered aircraft, turboprops, business jets, helicopters, light sport aircraft, and others (experimental, gliders, and lighter than air). An active aircraft is one that is flown at least one hour during the year. The FAA primarily uses estimates from the General Aviation and Part 135 Activity Survey (GA Survey) as baseline figures upon which assumed growth rates are applied.

Piston-Powered Fixed-Wing Aircraft

The number of piston powered fixed-wing aircraft has realized an overall annual decline of 0.6 percent from 2000 to 2009. The FAA forecasts this trend to continue, with an annual decline of 0.1 percent until 2020. From 2020 to 2030, and annual growth of 0.6 percent is forecast. From 2009 through 2030, an overall average annual growth of 0.2 percent is forecast for single engine piston aircraft. This brings the total number of single engine piston powered aircraft from 144,745 in 2009 to 150,646 in 2030.

In 2009, it is estimated that there are 17,351 multi-engine piston powered aircraft. This is an annual decline of 2.1 percent from 2000 when there were 21,091 of these aircraft. By 2030, the FAA forecasts that there will be 14,597 multi-engine piston powered aircraft. This represents an average annual decline from 2009 through 2030 of 0.8 percent.

Turboprops

Turboprop aircraft have been showing steady historical growth. From 2000 to 2009, the turboprop fleet increased from 5,762 to 9,010, an average annual growth rate of 5.1 percent. By 2030, 12,023 turboprops are forecast for an average annual growth rate from 2009 through 2030 of 1.4 percent.

Business Jets

The use of business jets has led the growth in the general aviation industry. In 2000, there were just over 7,000 business jets in the fleet. In 2009, it is estimated that there were 11,418 business jets for an annual growth rate of 5.6 percent. As shown previously, fractional ownership programs became very popular during this period. Corporate safety/security concerns combined with increasing flight delays at some US airports have made these programs practical alternatives to commercial travel. In addition, new product offerings, the addition of very light jets, and increasing foreign demand has also contributed to this growth. By 2030, the FAA forecasts there will be 27,035 business jets in the fleet. This represents an annual growth rate of 4.2 percent from 2009 through 2030.

Very Light Jets

With the advent of relatively inexpensive very light jets (VLJ), many questions have arisen as to the future impact they may have. Several years ago, it was thought that the lower acquisition and operating cost could revolutionize the business jet market, particularly by being able to sustain a true on-demand air-taxi service. While initial FAA forecasts called for over 400 VLJs to be delivered annually, events such as the recession and eventual bankruptcy of Eclipse and DayJet have led to lower expectations. New entries such as the Embraer Phenom 100 have stabilized the VLJ market, but the continuing recession has led the FAA to forecast 216 new VLJs annually for the balance of the forecast.

Light Sport Aircraft

Starting in 2005, a new category of aircraft was created: "light sport" aircraft. At the end of 2009, a total of 7,311 light sport aircraft were estimated to be in this category. The FAA forecast assumes the fleet will increase by approximately 825 aircraft per year until 2013. Thereafter, the rate of increase in the fleet tapers considerably to about 335 per year. By 2030, a total of 16,311 light sport aircraft are projected to be in the fleet. The average annual growth from 2009 through 2030 is forecast at 5.9 percent for this category.

Helicopters

Helicopter usage has seen growth over the last 10 years. This category includes both piston powered and turbine helicopters, with the turbine representing more than 62 percent of the fleet. In 2000, the fleet consisted of 7,150 helicopters. By 2009, there were 10,206 helicopters, representing an average annual growth rate of 4.0 percent. This growth trend is forecast to continue with an average annual growth rate from 2009-2030 of 2.8 percent, bringing the total helicopter fleet to 18,195.

General Aviation Fleet Summary

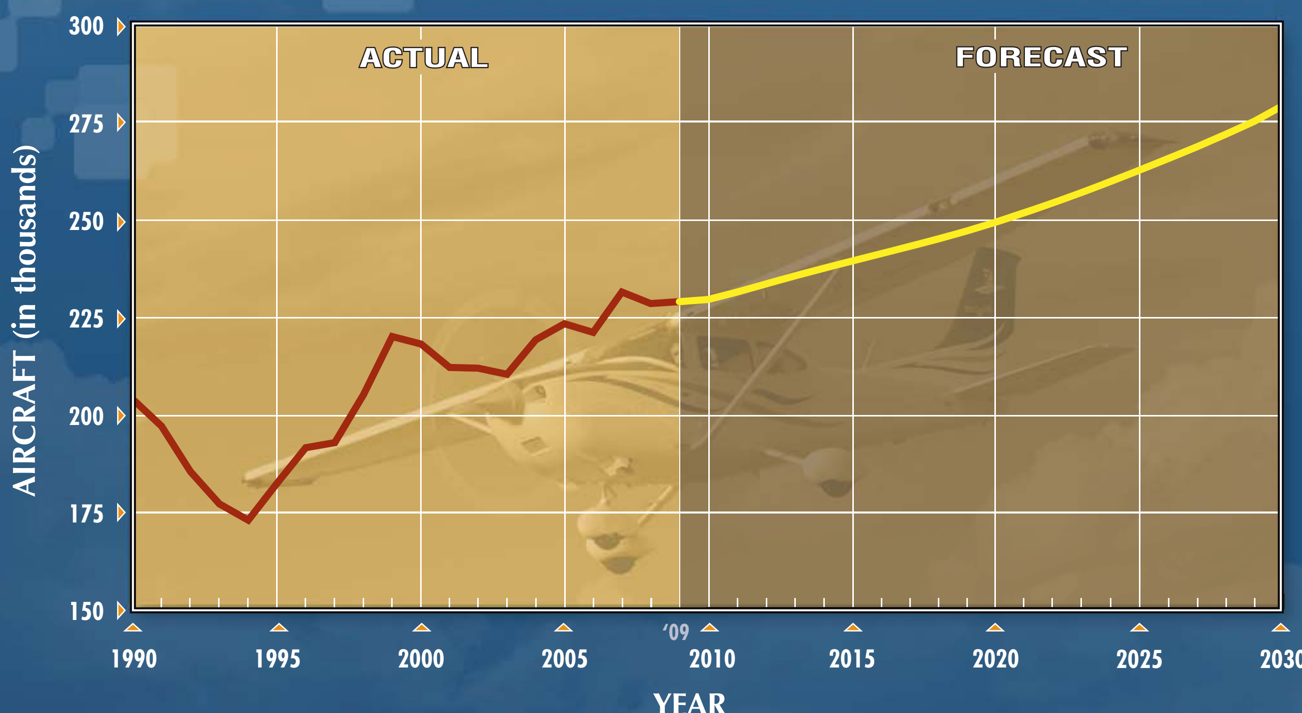
In 2009, the general aviation fleet consisted of 165,762 piston powered aircraft. In the short term, piston air-

10MP07-2A-10/01/10

U.S. ACTIVE GENERAL AVIATION AIRCRAFT

(in thousands)

	2009	2015	2020	2025	2030
FIXED WING					
PISTON					
Single Engine	144.7	141.9	142	145.3	150.6
Multi-Engine	17.3	16.5	15.8	15.2	14.6
TURBINE					
Turboprop	9	9.8	10.5	11.3	12
Turbojet	11.4	14.5	17.9	22.1	27
ROTORCRAFT					
Piston	3.7	4.7	5.6	6.5	7.4
Turbine	6.6	7.8	8.8	9.8	10.8
EXPERIMENTAL	23.4	27	29.8	32.2	34.4
SPORT AIRCRAFT	7.3	11.6	13.3	14.8	16.3
OTHER	5.7	5.7	5.7	5.6	5.6
TOTAL	229.1	239.5	249.4	262.8	278.7



Source: FAA Aerospace Forecasts, Fiscal Years 2010-2030.

Notes: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.

City of Lawrence KANSAS

Exhibit 2A
U.S. ACTIVE GENERAL AVIATION
AIRCRAFT FORECASTS

craft are forecast to decline in numbers until 2019, when a modest growth trend is forecast to begin. Overall, through the 21-year FAA forecast, piston powered aircraft are forecast to grow 0.2 percent annually, bringing the total number to 172,613 by 2030.

Turbine aircraft have been the stalwart category and are forecast to continue to grow from 26,968 in 2009 to 49,884 in 2030. This represents an average annual growth rate of 3.0 percent. While this growth rate is substantial, it does lag slightly behind the growth rate of 5.1 percent experienced from 2000-2009.

Overall, the FAA is forecasting the next few years will be ones of slow or stagnant growth, while the economy struggles to recover from the recession. Ultimately, the FAA is forecasting a return to a consistent growth pattern for general aviation aircraft.

OPERATIONS

The FAA forecasts operations for air carriers, air taxi/commuter, general aviation, and military. FAA forecasts of general aviation operations (takeoffs and landings) are categorized as local and itinerant with local operations being those within the traffic pattern airspace of an airport, and itinerant being those by aircraft with a destination away from the airport. General aviation activity at FAA air traffic facilities (including FAA contract towers) has been consistently on the decline across all categories since 2000.

In 2009, there were 15.55 million itinerant general aviation operations. This represented an average annual decline of 4.2 percent since 2000, when there were 22.84 million itinerant operations. Growth is forecast to return in 2011, and by 2030 19.43 million itinerant operations are forecast. This is an average annual growth rate of 1.1 percent from 2009 through 2030.

Local operations have followed a similar trend, declining by 3.4 percent annually from 2000-2009. Growth is forecast to return in 2010, and through 2030 the annual growth rate is forecast at 1.1 percent. In 2000, there were 17.03 million local operations and by 2030, it is forecast there will be 15.63 million operations.

Air taxi operations have also seen a decline from 2000, when there were 10.76 million. In 2009, this figure was estimated at 9.32 million. The number of air taxi operations is forecast to reverse trend in 2010, exceeding year 2000 levels in 2023 and ultimately reaching 12.51 million in 2030.

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.

Beyond five years, the predictive reliability of the forecasts can diminish. 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 preview, since it often takes several years to complete a major facility development program. However, it is important to use forecasts which do not overestimate revenue-generating capabilities or understate demand for facilities needed to meet public (user) needs.

A wide range of factors are known to influence the aviation industry and can have significant impacts on the extent and nature of activity occurring in both the local and national markets. Technological advances in aviation have historically altered and will continue to change the growth rates in aviation demand over time. A recent example is the substantial growth in the production and delivery of business jet aircraft, which resulted in a growth rate that far exceeded expectations. Such changes are difficult to predict, but over time, reasonable growth trends can be identified. Using a broad spectrum of demographic, economic, and industry data, forecasts for Lawrence Municipal Airport have been developed. Several standard statistical methods have been employed to generate various projections of aviation demand.

Trend series 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.

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

Regression analysis measures the statistical relationship between dependent and independent variables yielding a "correlation coefficient." The correlation coefficient (Pearson's "r") measures the association between changes in a dependent variable and independent variable(s). If the r-squared (r^2) value (coefficient determination) is greater than 0.90, it indicates good predictive reliability. A value below 0.90 may be used with the understanding that the predictive reliability is lower.

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

Market share analysis involves a historical review of airport 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.

Utilizing these statistical methods, available existing forecasts, and analyst expertise, forecasts of aviation demand for Lawrence Municipal Airport have been developed. The remainder of this chapter presents the aviation demand forecasts and includes activity in two broad categories: based aircraft and annual operations.

GENERAL AVIATION FORECASTS

Several aviation demand indicators must be forecast to determine the future needs of the airport. As a general aviation airport, the most important demand indicators are based aircraft and operations. The following sections will present forecasts of these and other demand indicators following guidelines from the FAA and accepted statistical methods. It should be noted that for many of the demand indicators, several forecasting methods are utilized in order to create a planning envelope. From there, a single forecast is selected based on the reliability of the statistical method employed and upon the judgment of the forecast analyst.

HISTORICAL AIRCRAFT OWNERSHIP

The number of based aircraft is the most basic indicator of general aviation. One method of forecasting based aircraft at an airport is to first examine local aircraft ownership, or aircraft registrations in the airport's service area. The primary service area for aircraft basing at Lawrence Municipal Airport is Douglas County, and the secondary service area includes Johnson, Leavenworth, and Jefferson Counties.

Any serviceable aircraft is required to be registered with the FAA, and an N-number is assigned. The FAA maintains a database of registered aircraft which includes the resident location by county for each certificated aircraft in the United States. An initial analysis of the history of registered aircraft in Douglas County and the three adjacent counties of Johnson, Leavenworth, and Jefferson, was conducted to obtain an understanding of local aviation ownership trends. **Table 2D** presents the history of registered aircraft in these four counties.

TABLE 2D
Four-County Registered Aircraft

Year	Douglas	Johnson	Leavenworth	Jefferson	TOTAL
2000	86	672	79	19	856
2001	82	672	82	22	858
2002	82	677	80	21	860
2003	83	678	82	23	866
2004	85	689	77	21	872
2005	90	692	81	19	882
2006	91	698	81	20	890
2007	100	701	86	25	912
2008	103	703	87	25	918
2009	102	707	82	25	916
2010	109	709	86	26	930
AAGR	2.18%	0.49%	0.77%	2.89%	0.76%

AAGR: Average Annual Growth Rate
Source: FAA Aircraft Registry Database; FAA Census of U.S. Civil Aircraft

Johnson County has the most registered aircraft in the airport service area, with 709 in 2010. Douglas County had the second most registered aircraft, with 109 in 2010. Each of the four counties has showed positive growth in the number of registered aircraft over the last 10 years.

REGISTERED AIRCRAFT FORECASTS

Now that the history of aircraft ownership in both the primary and secondary service area has been established, projections of future ownership, as defined by registered aircraft, can be made. A multitude of statistical methods have been employed to forecast registered aircraft growth.

Regression Analysis

Two regression techniques were utilized to develop forecasts of registered aircraft. These include a simple time-series analysis as well as regression analyses comparing service area registered aircraft with associated socioeconomic factors. The results of these methods are presented in **Table 2E**.

The first statistical measure presented is the time-series analysis. A time-series is a sequence of data points measured at successive times spaced at uniform time intervals. Time-series forecasting is the use of a statistical model to forecast future events based on known past events: to predict data points before they are measured. The time-series presented in the table considers the yearly aircraft registrations for the four-county area from 2000 to 2010. The plotted line is then continued into the future; in this case, to the year 2030. This analysis results in registered aircraft increasing from 930 in 2010 to 968 in 2015, 1,008 in 2020, and 1,089 in 2030.

TABLE 2E Four-County Service Area Analytical Analysis Time-Series and Regression		**FORECAST**		
	r^2	**2015**	**2020**	**2030**
TIME SERIES				
Year - Time Series	0.95	968	1,008	1,089
REGRESSION VARIABLES				
Year, Active Aircraft, Population, Employment, PCPI	0.989	961	996	1,078
Year, Active Aircraft, Population, PCPI	0.989	980	996	1,078
Year, Population, Employment, PCPI	0.986	959	992	1,062
Year, Population, PCPI	0.986	958	989	1,057
Year, Active Aircraft, Employment, PCPI	0.986	980	1,035	1,162
Year, Active Aircraft, PCPI	0.986	979	1,034	1,160
Active Aircraft, Population, Employment, PCPI	0.985	984	1,044	1,182
Active Aircraft, Population, PCPI	0.985	1,011	1,043	1,180
Year, Employment, PCPI	0.983	980	1,035	1,155
Year, PCPI	0.983	1,007	1,032	1,149
Population, Employment, PCPI	0.982	1,012	1,044	1,176
Year, Active Aircraft, Population, Employment	0.981	943	961	1,002
Population, PCPI	0.981	984	1,043	1,172
Year, Active Aircraft, Population	0.980	936	946	970
Year, Population, Employment	0.978	941	955	981
Year, Population	0.976	929	930	926
Active Aircraft, Population, Employment	0.976	1,006	1,050	1,201
Year, Active Aircraft, Employment	0.971	978	1,031	1,154
Employment, PCPI	0.971	1,009	1,051	1,196
Active Aircraft, Population, Employment	0.969	981	1,038	1,170
Year, Employment	0.965	978	1,031	1,143
Active Aircraft, Employment	0.964	983	1,043	1,186
Year, Active Aircraft	0.963	971	1,017	1,123
Population, Employment	0.963	982	1,039	1,161
Active Aircraft, Population	0.957	976	1,027	1,148
Employment	0.957	984	1,045	1,178
Active Aircraft, PCPI	0.954	983	1,047	1,212
Population	0.940	975	1,022	1,118
PCPI	0.910	984	1,050	1,204
Active Aircraft	0.881	969	1,022	1,179
Average	**0.969**	**977**	**1,020**	**1,129**

Source: Coffman Associates Analysis

PCPI: Per Capita Personal Income

A measure of the statistical reliability of the forecast is Pearson's "r." When $r^2 = 0.90$ or higher, the statistical reliability is high. The time series projection results in an r^2 value of 0.95.

Next, a series of single and multiple variable correlation analyses were run to examine the relationship between the historic four-county registered aircraft and up to four independent variables. The independent variables considered were U.S. active general aviation aircraft, population, employment, and income (as measured by per capita personal income). All of the regression analyses resulted in an r^2 value above 0.90 percent except one. In fact, 27 of the 30 regressions had r^2 values above 0.95. Overall, the statistical reliability of the analytical techniques employed is very high.

Historical Growth Projection

From 2000 to 2010, registered aircraft in the four-county region grew from 856 to 930, for an average annual growth rate of 0.76 percent. By extrapolating this growth through 2030, a forecast can be made. The result is 966 registered aircraft in 2015, 1,003 in 2020, and 1,081 in 2030.

Market Share Projections

Two market share projections have been developed, one that compares historical population to registered aircraft and one that compares U.S. active general aviation aircraft fleet to historical registered aircraft, both utilizing the four-county airport service area. Utilizing population, two forecasts were developed. The first considers the ratio of registered aircraft to every 1,000 people in the four counties. As of 2010, there were 1.2071 aircraft per 1,000 people. By maintaining this ratio as a constant, by 2030, 1,290 registered aircraft are forecast, as shown in **Exhibit 2B**. (The exhibit also shows the historic growth forecast and the average of the regression forecasts.)

Typically, the ratio of population to U.S. active aircraft declines as population increases, meaning there is not typically a one-to-one correlation between population growth and registered aircraft. This phenomenon is common across the country and is evident in the historical data for the Lawrence service area; therefore, this forecast likely represents the higher end of the planning envelope.

The next market share forecast utilizing population and registered aircraft considers a more common declining market share. From 2000 to 2010, the ratio declined from 1.3328 to 1.2071 registered aircraft per 1,000 people. By extrapolating the difference over the 20-year planning horizon, a forecast is developed. This results in a 2030 forecast of 1,046 registered aircraft.

The second set of market share forecasts considers the relationship between historic registered aircraft and the U.S. active general aviation fleet. The first considers the four-county region maintaining a constant market share (0.4049 percent) of U.S. active aircraft. Historically, the region has held constant in this regard. This forecast results in 1,128 registered aircraft by 2030.

The next market share forecast utilizing U.S. active aircraft considers an

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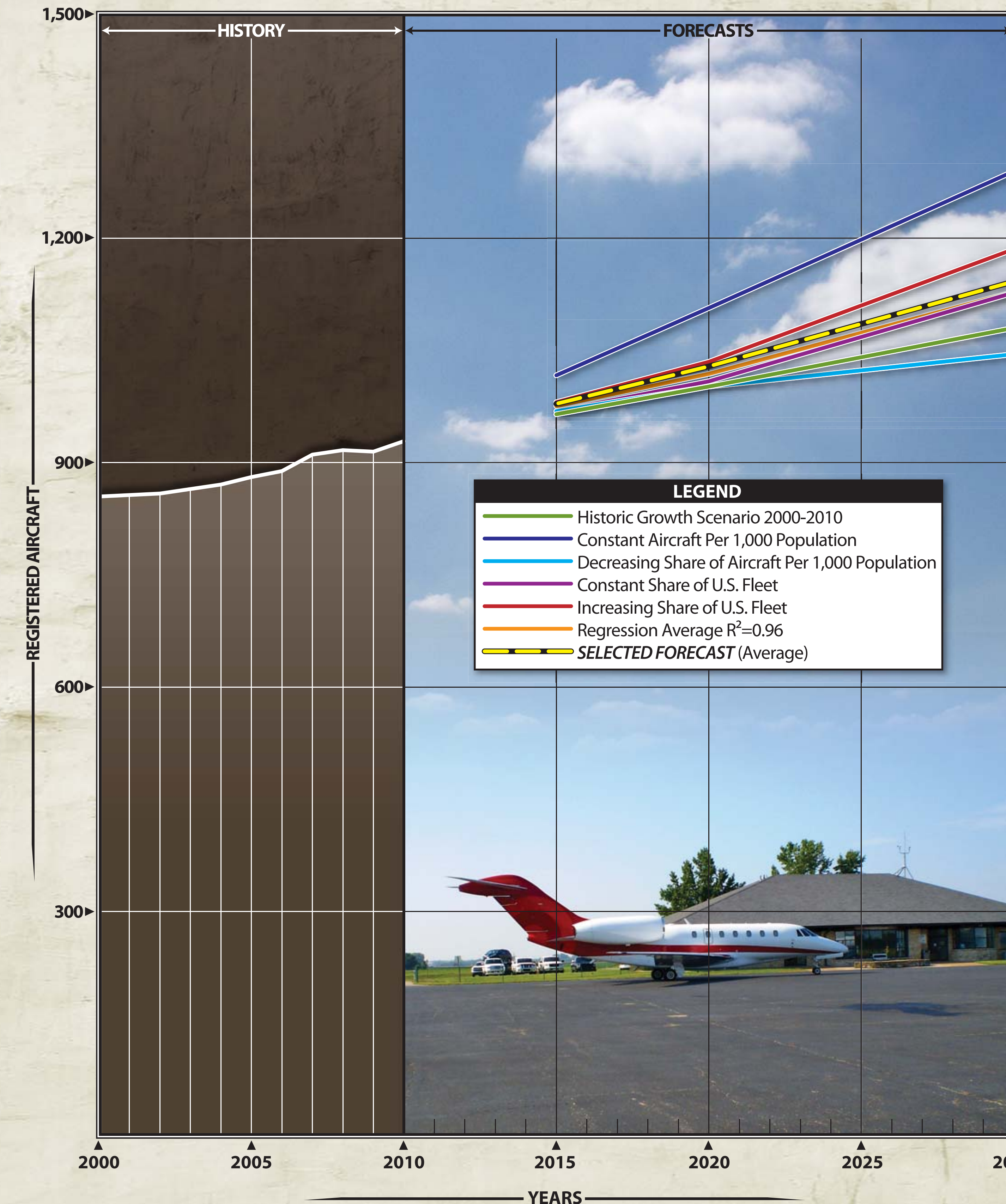
Year	Four County Registrations[1]	U.S. Active Aircraft[2]	Percent of U.S. Active Aircraft	Four-County Population[3]	Aircraft Per 1,000 Population
2000	856	217,533	0.3935%	642,251	1.3328
2001	858	218,880	0.3920%	654,464	1.3110
2002	860	220,235	0.3905%	669,466	1.2846
2003	866	221,598	0.3908%	682,182	1.2695
2004	872	222,970	0.3911%	694,681	1.2553
2005	882	224,350	0.3931%	707,251	1.2471
2006	890	221,939	0.4010%	718,793	1.2382
2007	812	231,606	0.3938%	730,144	1.2491
2008	918	228,668	0.4015%	741,538	1.2380
2009	916	229,149	0.3997%	755,954	1.2117
2010	930	229,699	0.4049%	770,414	1.2071
Historic Growth Scenario 2000-2010 (AAGR = 0.76%)					
2015	966	239,522	0.4032%	843,347	1.1451
2020	1,003	249,440	0.4020%	917,657	1.0928
2030	1,081	278,723	0.3880%	1,068,376	1.0121
Constant Aircraft Per 1,000 Population (AAGR = 1.65%)					
2015	1,018	239,522	0.4250%	843,347	1.2071
2020	1,108	249,440	0.4441%	917,657	1.2071
2030	1,290	278,723	0.4627%	1,068,376	1.2071
Decreasing Share of Aircraft Per 1,000 Population (AAGR = 1.18%)					
2015	970	239,522	0.4049%	843,347	1.1500
2020	1,003	249,440	0.4021%	917,657	1.0929
2030	1,046	278,723	0.3751%	1,068,376	0.9787
Constant Share of U.S. Fleet (AAGR = 0.97%)					
2015	970	239,522	0.4049%	843,347	1.1499
2020	1,003	249,440	0.4049%	917,657	1.1005
2030	1,046	278,723	0.4049%	1,068,376	1.0563
Increasing Share of U.S. Fleet (AAGR = 1.22%)					
2015	982	239,522	0.4100%	843,347	1.1646
2020	1,036	249,440	0.4125%	917,657	1.1287
2030	1,186	278,723	0.4256%	1,068,376	1.1102
Regression Average R^2=0.96 (AAGR = 0.97%)					
2015	977	239,522	0.4078%	843,347	1.1582
2020	1,020	249,440	0.4088%	917,657	1.1111
2030	1,129	278,723	0.4055%	1,068,376	1.0565
Selected Forecast (Average) (AAGR = 1.04%)					
2015	980	239,522	0.4093%	843,347	1.1625
2020	1,030	249,440	0.4128%	917,657	1.1222
2030	1,143	278,723	0.4102%	1,068,376	1.0701

[1] FAA Aircraft Registration Database
[2] FAA Aerospace Forecast for Fiscal Years 2010-2030
[3] Woods & Poole Economics 2010

Source: Coffman Associates analysis.



City of Lawrence KANSAS

Exhibit 2B
REGISTERED AIRCRAFT FORECAST

increasing share. Once again, the increase in market share from 2000 to 2010 was extrapolated to the 20-year planning horizon. This results in a 2030 forecast of 1,086 registered aircraft.

Selected Registered Aircraft Forecast

The forecasts of registered aircraft presented consider the major factors that can influence aircraft ownership in the four-county region. Local socioeconomic measures such as population, employment, and income are utilized. Additional population measures are analyzed in the market share forecasts. Time-series and historical growth trends have been considered, and national aircraft ownership is also considered based on the FAA forecasts.

The selected forecast represents an average of the 35 different forecasts generated for this analysis. By 2015, it is forecast there will be 980 registered aircraft in the four-county region. In 2020, there are 1,030 registered aircraft forecast and by 2030, it is forecast that there will be 1,143 registered aircraft. With an established registered aircraft forecast, a forecast of future based aircraft at Lawrence Municipal Airport can be made.

BASED AIRCRAFT FORECAST

It is known from airport records that 56 of the 60 based aircraft owners have mailing addresses in the primary and secondary service areas represented by Douglas, Johnson, Leavenworth, and Jefferson Counties. Of the remaining four aircraft, one owner has a mailing address in Shawnee County (Life Star), and three are out of state. It is further noted that 40 of the 60 based aircraft owners have mailing addresses in Douglas County. Therefore, there is a significant portion of the based aircraft at Lawrence Municipal Airport that is not from Douglas County. It is imperative that the based aircraft forecast be reflective of the airport's ability to draw aircraft from the secondary service area.

The based aircraft forecast for Lawrence Municipal Airport is a function of the registered aircraft forecast completed in the previous section. In the registered aircraft forecast, socioeconomic elements such as population, employment, income, and national aircraft forecasts from the FAA were utilized to arrive at a 20-year projection. Two market share forecasts for based aircraft have been developed and are presented in **Table 2F**.

The first market share forecast considers the airport maintaining its 2010 share of the four-county registered aircraft (6.452 percent). This forecast results in 63 based aircraft in 2015, 66 in 2020, and 74 in 2030. This percent is nearly an average of the previous 10-years market share for the airport. This forecast then results in the addition of only 14 new based aircraft over the next 20 years.

There are several factors that led to a need to consider an increasing market share forecast. First, the airport has a hangar waiting list of 38 aircraft owners. The list itself is regularly updated and owners have been waiting for up to four years for an appropriate hangar to become available. In addition, it has been more than 10 years since any bulk hangar storage facilities, such as T-hangars, box hangars, or even conventional hangars, have been built; therefore, there is pent up demand.

TABLE 2F
Based Aircraft Forecasts
Lawrence Municipal Airport

Year	Four County Registered Aircraft	Percent Based at LWC	Number Based at LWC*
2000	856	6.425%	55
2001	858	6.410%	55
2002	860	6.512%	56
2003	866	6.467%	56
2004	872	6.537%	57
2005	882	6.463%	57
2006	890	6.517%	58
2007	912	6.360%	58
2008	918	6.427%	59
2009	916	6.441%	59
2010	930	6.452%	60
Average Annual Growth Rate 2000-2010:			*0.44%*
Constant Share Forecast			
2015	980	6.452%	63
2020	1,030	6.452%	66
2030	1,143	6.452%	74
Average Annual Growth Rate 20010-2030:			*1.03%*
Increasing Share Forecast			
2015	980	6.961%	68
2020	1,030	7.471%	77
2030	1,143	8.491%	97
Average Annual Growth Rate 2010-2030:			*2.43%*
Selected Forecast			
2015	980	6.63%	65
2020	1,030	7.28%	75
2030	1,143	7.87%	90
Average Annual Growth Rate 2010-2030:			*2.05%*

*Historical based aircraft from FAA TAF; 2010 figure is actual count.
Source: Coffman Associates Analysis

Second, Lawrence Municipal Airport serves a significant university town. Generally, airports serving major universities are attractive to aircraft owners (often alumni). This phenomenon is easily seen in Exhibit 1L, where there are several based aircraft owners with mailing addresses that would be closer to equally serviceable general aviation airports. For example, 10 of the 11 based aircraft from Johnson County are closer to Johnson County Executive (OJC) or New Century AirCenter (IXD).

Third, the based aircraft forecast needs to be reflective of the fact that Douglas County has been adding the largest number of registered aircraft, as a percentage of the four-county area. As shown in **Table 2G**, Douglas County added 23 registered aircraft between 2000 and 2010, for a growth rate of 1.67 percent. Johnson County, while adding 37 registered aircraft, saw a decline of 2.27 percent, as a percentage of all service area aircraft. Both Leavenworth and Jefferson County added seven registered aircraft and showed a small increase in their percentage of the whole.

TABLE 2G
Registered Aircraft Distribution
Lawrence Municipal Airport Service Area

Year/%	Douglas	Johnson	Leavenworth	Jefferson	Total
HISTORIC DISTRIBUTION					
2000	86	672	79	19	856
Percent	10.05%	78.50%	9.23%	2.22%	100.00%
2010	109	709	86	26	930
Percent	11.72%	76.24%	9.25%	2.80%	100.00%
Total Change (2000-2010)	23	37	7	7	74
Total Change (2000-2010)	1.67%	-2.27%	0.02%	0.58%	NA
FORECAST DISTRIBUTION					
2015	122	737	91	30	980
Percent	12.48%	75.21%	9.26%	3.06%	100.00%
2020	136	764	95	34	1,030
Percent	13.24%	74.17%	9.26%	3.32%	100.00%
2030	169	824	106	44	1,143
Percent	14.76%	72.10%	9.29%	3.84%	100.00%
Total Change (2010-2030)	60	115	20	18	213
Total Change (2010-2030)	3.04%	-4.13%	0.04%	1.05%	0.00%

Source: Coffman Associates analysis

Based on these observations, an increasing market share forecast is presented. The increasing market share utilizes 67 percent the registered aircraft forecast growth for Douglas County, and extrapolates that growth rate over the 20 year forecast. In mathematical terms: 3.04% * 0.67 = 2.0368%. This results in a forecast of 68 based aircraft in 2015, 77 aircraft in 2020, and 97 aircraft in 2030.

The selected forecast takes into consideration the reality of today's economic environment. The recent recession and slow recovery has had a negative impact on the aviation industry. Nationally, aircraft production is down, new student pilot numbers are down, and operations are down. In addition, the cost of constructing hangars, whether by the airport sponsor or by private developers, has made it difficult to obtain a return on that investment within a typical 20-year amortization schedule. Nonetheless, the local history and outlook for based aircraft is positive and the airport should plan for growth. The subsequent chapters of this master plan will utilize the selected forecast of 65 based aircraft by 2015, 75 based aircraft by 2020, and 90 based aircraft by 2030.

Comparative Based Aircraft Forecasts

There are several forecasts of based aircraft for Lawrence Municipal Airport that were completed in previous studies and reports. For any master plan, the FAA will compare the master plan forecasts to the TAF. Sometimes, the TAF for lower activity general aviation airports is not regularly updated. Such is the case at Lawrence Municipal Airport where the TAF shows a flat-line based aircraft figure of 57 for every year through 2030. This and other comparative forecasts are presented in **Table 2H**.

TABLE 2H
Based Aircraft Forecast Summary
Lawrence Municipal Airport

	2010 (Base Year)	2015	2020	2030	AAGR 2010-2030
Comparison Projections*					
2010 FAA TAF	56	57	57	57	0.09%
2001 ALP Report	79	85	92	107	1.53%
2009 KASP	68	75	82	97	1.79%
U.S. GA Fleet Growth Rate	60	63	66	72	0.90%
Registered Aircraft Growth - Douglas County	60	67	74	92	2.18%
SELECTED FORECAST	**60**	**65**	**75**	**90**	**2.05%**

TAF: Terminal Area Forecast
ALP: Airport Layout Plan
KASP: Kansas Aviation System Plan
* Figures interpolated and extrapolated to plan years.

Source: Coffman Associates analysis

The most recent set of forecasts approved by the FAA for the airport were from the 2001 Airport Layout Plan (ALP) report. The report utilized the year 2000 as the base year and identified 55 based aircraft then. An annual average growth rate of 1.53 percent was planned that led to a forecast of 92 based aircraft in 2020.

The *Kansas Airport System Plan* (KASP) also provides a set of based aircraft forecasts for Lawrence Municipal Airport. The base year was 2007, when 66 based aircraft were identified. The KASP then applied a growth rate of 1.79 percent annually to arrive at a 2027 based aircraft figure of 92.

As shown in the table, the 2001 ALP report and the 2009 KASP figures have been interpolated and extrapolated to the plan years of this master plan.

Two additional historical growth scenarios are presented in the table. The first considers the FAA national forecast for the growth rate in general aviation aircraft of 0.90 percent annually. This results in a 2030 forecast of 72 based aircraft. A final comparative forecast applies the forecast growth rate for population in Douglas County (2.18 percent). This results in 92 based aircraft by 2030.

Based Aircraft Summary

As shown previously, Douglas County can realize the addition of more than two new registered aircraft in a given year. In 2000, there were 86 registered aircraft, and in 2010 there were 109; the growth potential is there. Certainly, not all of these registered aircraft will be based at the airport, but historically, most do. The availability of hangars will factor significantly on how many aircraft base at the airport. The based aircraft forecast presented here assumes that additional facilities will be made available to accommodate growth. If facilities are not available, the airport could continue to experience limited growth.

The master plan will consider the need for facilities to accommodate the addition of 30 based aircraft over the next 20 years. **Exhibit 2C** shows the based aircraft forecast scenarios and the selected forecast.

BASED AIRCRAFT FLEET MIX PROJECTIONS

Forecasting the aircraft fleet mix expected to utilize the airport is necessary to properly plan facilities that will best serve the level and type of activity occurring at the airport. As detailed previously, the growth areas in the general aviation fleet nationally is in turboprop and jet aircraft, as well as helicopters. Single engine piston-powered aircraft are forecast to grow slightly, while multi-engine piston aircraft are forecast to decrease slightly. Growth within each based aircraft category at the airport has been determined, in part, by comparison with national projections and consideration of local economic conditions.

There are 60 aircraft based at the airport in 2010. Of this total, 52 are single engine piston powered aircraft, five are multi-engine piston aircraft, one is a turboprop, one is a helicopter, and one is a business jet. The turboprop is a Super King Air 350, and the business jet is a Cessna Citation 550.

Table 2J presents the forecast fleet mix for the 20-year planning horizon of the master plan. Single engine piston-powered aircraft will continue to account for the vast majority of based aircraft at the airport. Multi-engine piston aircraft are forecast to remain fairly steady with five through 2020, increasing to six by 2030. Turboprops are forecast to increase from one to four by 2030. By 2030, business jets and helicopters are both forecast to increase from one each to three each.

TABLE 2J
Based Aircraft Fleet Mix
Lawrence Municipal Airport

Aircraft Type	2010	Percent	2015	Percent	2020	Percent	2030	Percent
Single Engine Piston	52	86.67%	54	83.08%	63	84.00%	74	82.22%
Multi-Engine Piston	5	8.33%	5	7.69%	5	6.67%	6	6.67%
Turboprop	1	1.67%	2	3.08%	3	4.00%	4	4.44%
Jet	1	1.67%	2	3.08%	2	2.67%	3	3.33%
Helicopters	1	1.67%	2	3.08%	2	2.67%	3	3.33%
Total	**60**	**100.00%**	**65**	**100.00%**	**75**	**100.00%**	**90**	**100.00%**

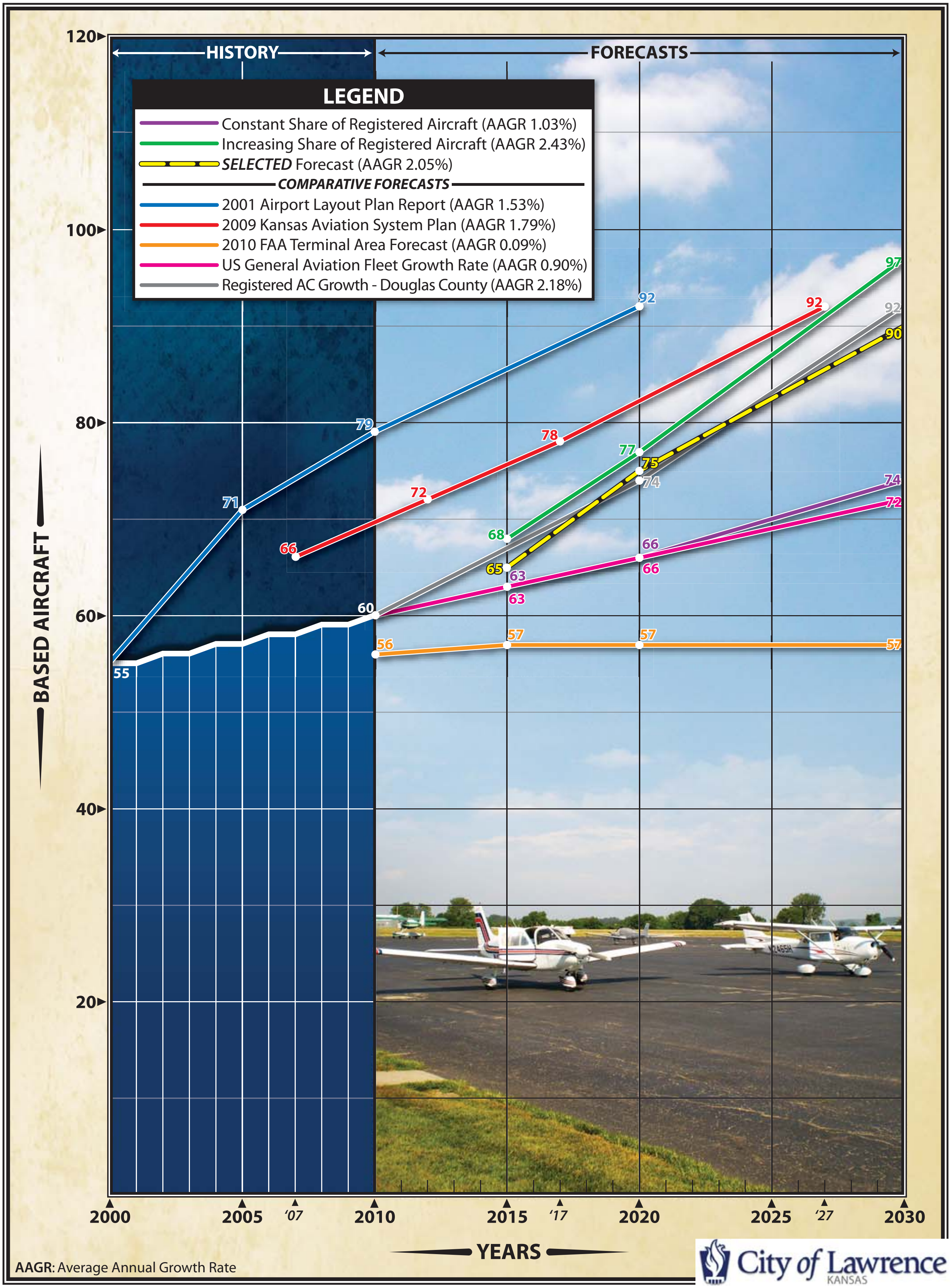
Source: Coffman Associates analysis of FAA Registered Aircraft Database

ANNUAL OPERATIONS

Airport operations can be characterized as local or itinerant. A local operation is a takeoff 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. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Generally, local operations are characterized by training operations.

Operations at an airport are further classified as general aviation, air taxi, air carrier, or military. Air taxi is generally considered on-demand service that includes charter and fractional activity. This is considered itinerant in nature. Air carrier activity is scheduled passenger operations, which is not currently or forecast to be available at Lawrence Municipal Airport. Military activity is not unusual at general aviation airports and can include both local and itinerant. Military activity at Lawrence Municipal Airport is minimal as documented by the airport fixed base operator (FBO). Typically, itinerant operations increase with business and commercial use as business aircraft are used primarily to transport people from one location to another. The FAA estimates that 60 percent of the activity at the airport is itinerant in nature.

Lawrence Municipal Airport is a non-towered facility. This means that actual operations counts are not available. Therefore, estimates must be made based on interviews with airport operators and management and from historical documentation and studies. Five operations estimates are presented in **Table 2K**.



City of Lawrence KANSAS

Exhibit 2C
BASED AIRCRAFT FORECAST

TABLE 2K
Existing Total Operations Forecasts
Lawrence Municipal Airport

Year	2001 ALP*	2009 KASP[1]	2010 TAF	FAA National Growth	NPIAS Formula	Equation[2]	Selected Forecast
2010	43,450	34,534	32,700	32,700	24,000	26,789	32,700
2015	46,900	37,534	32,700	34,538	26,000	28,082	35,500
2020	50,600	40,794	32,700	36,480	30,000	30,445	38,600
2030	58,955	48,189	32,700	40,698	36,000	34,031	45,600
AAGR 2010-2030	1.54%	1.68%	0.00%	1.10%	2.05%	1.20%	1.68%

KASP: Kansas Aviation System Plan
NPIAS Formula: 400 operations per based aircraft
TAF: Terminal Area Forecast
AAGR: Average Annual Growth Rate
[1]Interpolated and extrapolated to plan years.
[2]Model for Estimating General Aviation Operations at Non-Towered Airports (FAA 2001)
*Extrapolated

Source: Coffman Associates analysis

The most recent FAA approved forecasts developed for the airport were contained in the 2001 Airport Layout Plan report. As they are ten years old as of this writing, their reliability is low, but they are included as a point of reference. The base year for the ALP operations forecast was 2000, with an estimate operations total of 43,450. An average annual growth rate of 1.54 percent was then applied.

The KASP was published in 2009 and utilized a base year of 2007. The KASP operations forecast for Lawrence Municipal Airport considered an average annual growth rate of 1.68 percent through 2027. As shown in the table, 2030 was extrapolated to the long term plan year of this master plan.

The FAA TAF does not present a dynamic forecast for the airport. A total of 32,700 annual operations are estimated through 2030. This is a zero growth scenario and does not take into account various growth factors.

The FAA Aerospace Forecasts – Fiscal Years 2010-2030 presents a forecast for general aviation operations which results in an average annual growth rate of 1.10 percent. Utilizing the 2010 TAF operations forecast for Lawrence Municipal Airport as the starting point and applying this growth rate, a forecast is presented.

The *Field Formulation of the National Plan of Integrated Airport Systems* provides a general formula for estimating operations at non-towered general aviation airports. For a general aviation airport with some itinerant traffic such as Lawrence Municipal Airport, an estimate of 400 operations per based aircraft can be used as a guideline. This would result in a current year operations estimate of 24,000. By applying this factor to the forecast of based aircraft, a long term estimate of operations is 36,000. The average annual growth rate is 2.05 percent.

The last forecast utilizes a statistical regression model approved by the FAA to estimate total operations at non-towered airports. The research paper entitled, *Model for Estimating General Aviation Operations at Non-Towered Airports Using Towered and Non-Towered Airport Date (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 GA airports and incorporates a dummy variable to distinguish the two airport types. Specifically, the model utilizes the following variables:

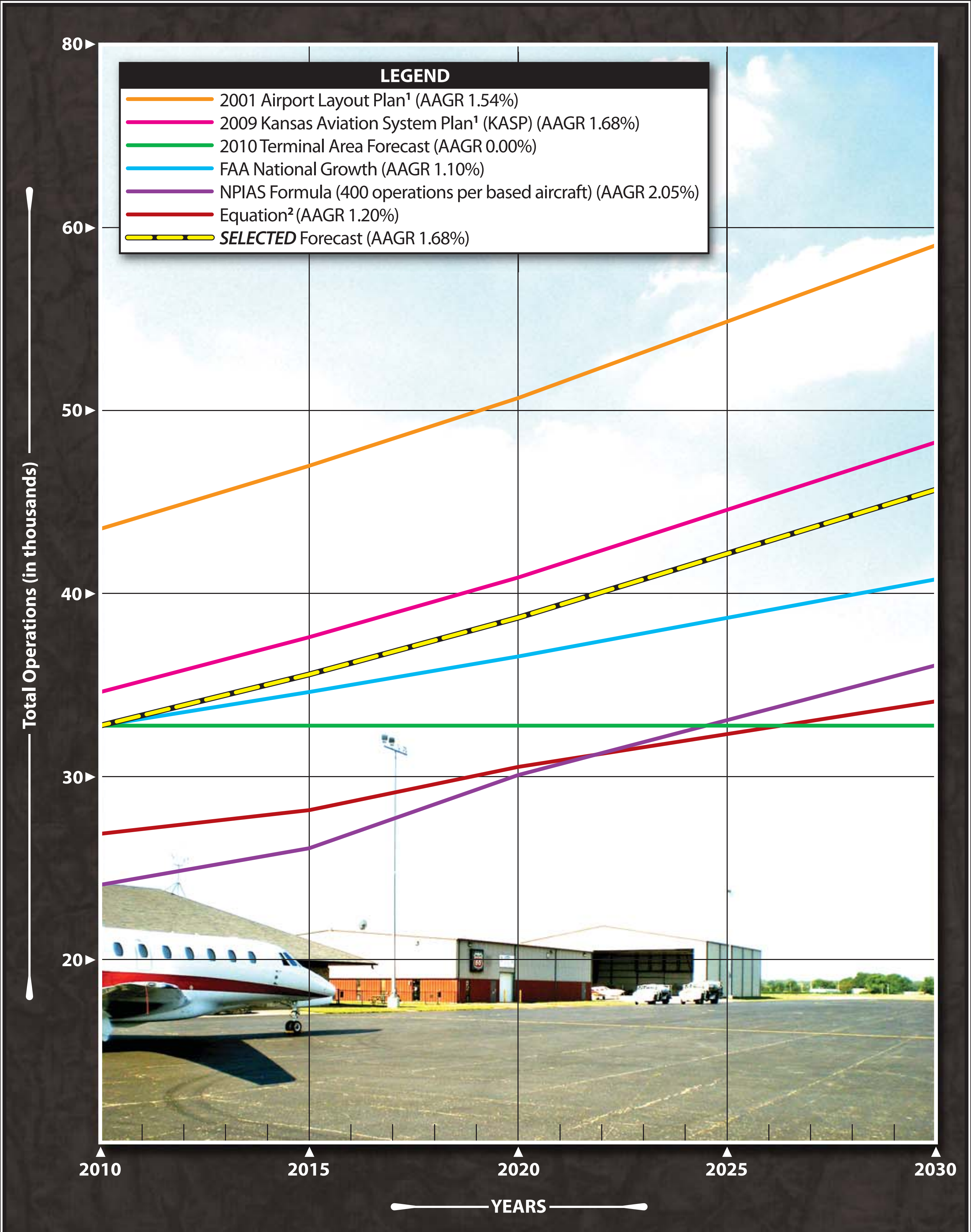
- Based aircraft;
- Percent of aircraft based at the subject airport among general aviation airports within 100 miles;
- Number of FAR 141 flight training schools at the airport;
- Population within 100 miles;
- Ratio of population within 25 miles and within 100 miles.

The model factors each of these variables so that both local and national factors are considered when estimating operations. When applying the model to Lawrence Municipal Airport, one of the most dynamic variables is the presence of an FAR 141 certified flight school. While the FBO does operate a flight school, it is certified under FAR Part 61 rather than FAR 141. The only difference is the structure of the ground school component, and it is not reflective of the number of students or training operations. For Lawrence Municipal Airport, an assumption has been made that a certified flight school will be present at the airport. The results of the model show an annual growth rate of 1.20 percent.

The selected operational forecast utilizes the FAA TAF for the base year and applies the KASP growth rate. Forecast operations generally are utilized to determine capacity needs for the airport. For a two runway general aviation airport, until operations reach 60 percent of capacity (which can be as high as 230,000 annual operations), or 138,000, then there is little airfield impact. For planning purposes, this operations forecast is considered reasonable and within the range of other existing forecasts. The forecast operations are presented in **Exhibit 2D**.

Air Taxi Operations

The air taxi category includes aircraft involved in on-demand passenger (charter and fractional), small parcel transport (cargo), and air ambulance activity. This category of operations is regulated under FAR Part 135. Life Star air ambulance bases a helicopter at Lawrence Municipal Airport and



[1]Interpolated and extrapolated to plan years.
[2]Model for Estimating General Aviation Operations at Non-Towered Airports (FAA 2001)
AAGR: Average Annual Growth
Source: Coffman Associates Analysis

City of Lawrence KANSAS

Exhibit 2D
OPERATIONS FORECAST

they operate under a FAR Part 135 certificate.

The FAA surveys general aviation and air taxi activity on an annual basis. The information obtained from the survey enables the FAA to monitor the general aviation fleet so that it can:

- Anticipate and meet demand for National Airspace facilities and services;
- Evaluate the impact of safety initiatives and regulatory changes;
- Build more accurate measures of the safety of the general aviation community.

The data collected are also used by other government agencies, the general aviation industry, trade associations, and private businesses to pinpoint safety problems and to form the basis for critical research and analysis of general aviation issues. This data is consolidated in the annual FAA Aerospace Forecasts. For air taxi operations, the FAA forecasts an annual growth rate of 1.3 percent between 2009 and 2030.

The FAA TAF estimates 2,100 annual air taxi operations at Lawrence Municipal Airport for each year through 2030 (flat-line forecast). Life Star accounts for approximately 1,400 annual air taxi operations at the airport. **Table 2L** presents the air taxi operations forecast. The air taxi operations forecast were developed utilizing the same annual growth rate as applied to overall operations (1.68 percent).

TABLE 2L
Air Taxi Forecasts
Lawrence Municipal Airport

Year	Other/Air Taxi Operations	LWC Itinerant Operations	U.S. Air Taxi/Commuter Operations	Percent
2010	2,100	19,050	9,326,000	0.0225%
FORECAST (AAGR = 1.68%)				
2015	2,280	20,681	9,727,000	0.0234%
2020	2,479	22,487	10,327,800	0.0240%
2030	2,928	26,565	12,514,700	0.0234%

AGR = Annual Growth Rate
Sources: FAA TAF; FAA Aerospace Forecasts FY 2010-2030

Military Operations

At some general aviation airports, military operations can be common. Lawrence Municipal Airport does not experience regular military operations. The FAA TAF forecasts 150 itinerant military operations annually from 2010 through 2030. Forecasting military operations is complicated by the lack of actual operational data (primarily for national security reasons), and the fact that the mission for local military posts can change quickly. Therefore, for planning purposes, this master plan will include 150 military itinerant operations for each of the plan years.

Operations Fleet Mix

Estimating the number of operations by aircraft type helps to identify facility requirements and various environmental impacts. Operations by multi-engine, turboprop, and business jet aircraft are generally considered itinerant in nature.

Table 2M presents the forecast operations activity by aircraft type. General assumptions based on typical aircraft utilization have been made and are applied to the fleet mix at Lawrence Municipal Airport. Multi-engine piston activity is estimated at 250 operations per based aircraft, turboprop at 275 operations per based aircraft, jet activity at 300 operations per based aircraft, and helicopters at 400 operations per based aircraft. An adjustment has been made to account for the 1,400 annual air taxi operations conducted by the Life Star helicopter. These operations estimates account for all activity by that aircraft type and are not estimates of the actual number of operations attributable to a particular based aircraft.

TABLE 2M
Fleet Mix Operations Forecast
Lawrence Municipal Airport

	2010	2015	2020	2030
Local Operations				
Piston	13,550	14,669	15,913	18,635
Helicopter	100	150	200	400
Total Local	13,650	14,819	16,113	19,035
Itinerant Operations				
Single Piston	15,265	15,727	16,549	18,842
Multi-Piston	1,250	1,250	1,250	1,500
Turboprop	415	726	1,041	1,406
Jet	650	1,240	1,739	2,464
Helicopters	1,470	1,738	1,908	2,353
Total Itinerant	19,050	20,681	22,487	26,565
Total Operations	32,700	35,500	38,600	45,600

Source: Coffman Associates analysis

Peaking Operations

Many aspects of facility planning relate to levels of peaking activity – times when the airport is busiest. For example, the appropriate size of a terminal building can be estimated by determining the number of people that could reasonably be expected to use the facility at a given time. The following planning definitions apply to the peak periods:

- **Peak Month** -- The calendar month when peak aircraft operations occur.
- **Design Day** -- The average day in the peak month.
- **Busy Day** -- The busy day of a typical week in the peak month.
- **Design Hour** -- The peak hour within the design day.

It is important to note that only the peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. The peak period forecasts represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

Without the availability of records from a tower, peak periods must be estimated. The forecast of peak month operations assumes approximately 12 percent of annual operations. This is typical for a general aviation airport that may have some seasonal changes to activity levels, such as winter snow events that occur in Kansas.

The design day was then calculated by dividing the peak month operations by 30. The busy day has been estimated at 40 percent higher than the average day in the peak month and was calculated by multiplying the design day by 1.4. Design hour operations were calculated at 17.5 percent of design day operations. **Table 2N** summarizes the general aviation peak activity forecasts.

TABLE 2N
Peak Operations Forecast
Lawrence Municipal Airport

	2010	2015	2020	2030
Annual Operations	32,700	35,500	38,600	45,600
Peak Month (12%)	3,924	4,260	4,632	5,472
Busy Day	183	199	216	255
Design Day	131	142	154	182
Design Hour (17.5%)	23	25	27	32

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 percent of itinerant operations regardless of the frequency of poor weather conditions. An estimate of two percent of itinerant operations is utilized to forecast AIAs at Lawrence Municipal Airport, as presented in **Table 2P**.

TABLE 2P
Annual Instrument Approach (AIAs) Projections
Lawrence Municipal Airport

	AIAs	Itinerant Operations	Ratio
2015	414	20,681	2.00%
2020	450	22,487	2.00%
2030	531	26,565	2.00%

Source: Coffman Associates analysis

In the future, Lawrence Municipal Airport will be increasingly utilized by more sophisticated turboprop and jet aircraft (as is the trend nationally). Also, the increased availability of low-cost navigational equipment could allow for smaller and less sophisticated aircraft to utilize instrument approaches. National trends indicate an increasing percentage of instrument approaches given the greater availability of approaches at airports with GPS and the availability of more cost-effective equipment.

SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the next 20 years for the Lawrence Municipal Airport. **Exhibit 2E** presents a summary of the aviation demand forecasts. The baseline year for forecast data is 2010. The forecasting effort extends 20 years to the year 2030.

Lawrence Municipal Airport is a general aviation airport that experienced an estimated 32,700 operations in 2009. The primary runway, Runway 15-33, is 5,700 feet long and the crosswind runway, Runway 1-19, is 3,901 feet long. The airport provides several sophisticated instrument approaches, including an instrument landing system (ILS) that allows pilots to land even in poor visibility conditions.

General aviation activity often trends with national and local economies. The country has been in a recessionary period since December 2007, and activity at both commercial service airports and general aviation airports has been down. The Lawrence Municipal Airport has, to date, weathered the economic downturn fairly well. The number of based aircraft and fuel sales has remained steady.

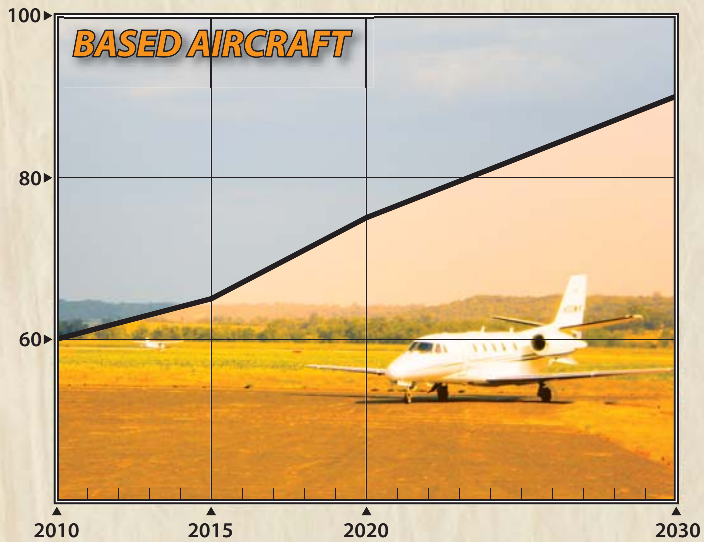
Forecasts of aviation activity, including based aircraft and operations, is key to determining future facility requirements. There are currently 60 aircraft based at the airport, and this is forecast to grow to 90 aircraft by 2030. It is estimated that the airport currently experiences approximately 32,700 annual operations. This is forecast to grow to approximately 45,600 operations annually by 2030.

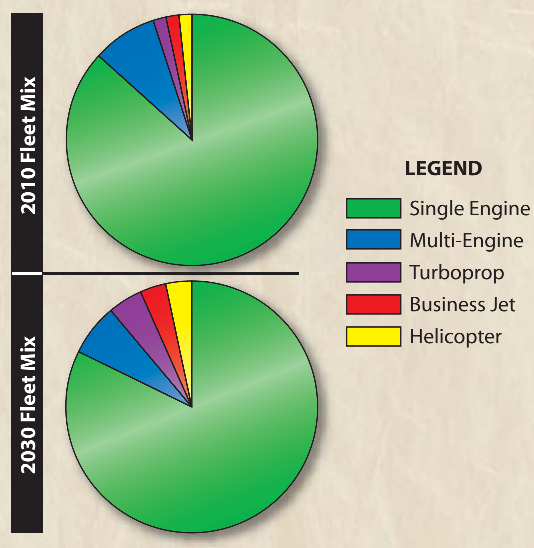
The fleet mix operations, or type and frequency of aircraft use, is important in determining facility requirements and environmental impacts. While single engine piston powered aircraft are expected to represent the majority of based aircraft, the long term forecast considers the possibility of additional turboprop aircraft and up to three business jets.

The next step in the master plan process is to use the forecasts to deter-

10MP07-2E-9/16/10

	ESTIMATE	FORECAST		
	2010	2015	2020	2030
ANNUAL OPERATIONS				
General Aviation				
Itinerant	16,800	18,251	19,858	23,487
local	13,650	14,819	16,113	19,035
Military				
Itinerant	150	150	150	150
local	0	0	0	0
Air Taxi (itinerant)	2,100	2,280	2,479	2,928
Total Itinerant	***19,050***	***20,681***	***22,487***	***26,565***
Total Local	***13,650***	***14,819***	***16,113***	***19,035***
Total Operations	***32,700***	***35,500***	***38,600***	***45,600***
BASED AIRCRAFT				
Single Engine	52	54	63	74
Multi-Engine	5	5	5	6
Turboprop	1	2	3	4
Business Jet	1	2	2	3
Helicopter	1	2	2	3
Total Based Aircraft	***60***	***65***	***75***	***90***
Instrument Approaches (AIAs)	NA	414	450	531





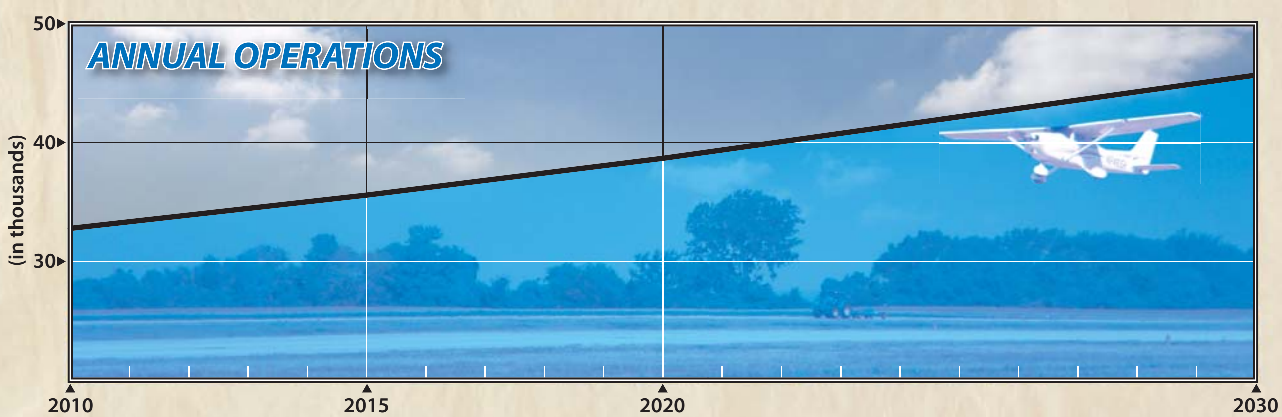


Exhibit 2E
FORECAST SUMMARY

mine development needs for the airport through 2030. Chapter Three – Facility Requirements will address airside elements, such as safety areas, runway, taxiways, lighting, and navigational aids, as well as landside requirements, including hangars, aircraft aprons, and support services. As a general observation, the Lawrence Municipal Airport is well-positioned for growth into the future. The local economy is forecast to emerge from the recession soon. The remaining portions of the master plan will lay out how that growth can be accommodated in an orderly, efficient, and cost-effective manner.

Chapter Three

Airport Facility Requirements

LAWRENCE MUNICIPAL AIRPORT

Chapter Three

Airport Facility Requirements

To properly plan for the future of Lawrence Municipal Airport, it is necessary to translate forecast aviation demand into the specific types and quantities of facilities that can adequately serve this identified demand. This chapter uses the results of the forecasts presented in Chapter Two, as well as established planning criteria, to determine the airfield (i.e., runways, taxiways, navigational aids, marking and lighting) and landside (i.e., hangars, aircraft parking apron, and automobile parking) facility requirements.

The objective of this effort is to identify, in general terms, the adequacy of the 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 Chapter Four - Alternatives to determine the most cost-effective and efficient means for implementation.

PLANNING HORIZONS

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

AIRPORT MASTER PLAN

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 have been established that take into consideration the reasonable range of aviation demand projections. The planning horizons are the Short Term (approximately years 1-5), the Intermediate Term (years 6-10), and the Long Term (years 11-20).

It is important to consider that the actual activity at the airport may 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. It is important for the plan to accommodate these changes so that airport officials can respond to unexpected changes in a timely fashion.

The most important reason for utilizing milestones is it allows airport management to make decisions and develop facilities according to need generated by actual demand levels. 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 officials with a financially responsible and needs-based program.

CRITICAL AIRCRAFT

The selection of appropriate Federal Aviation Administration (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 the airport. The critical design aircraft is used to define the design parameters for the airport. The critical design aircraft is defined as the most demanding category of aircraft, or family of aircraft, which conducts at least 500 operations per year at the airport. Planning for future aircraft use is of particular 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 long range potential needs of the airport.

The FAA has established a coding system to relate airport design criteria to the operational and physical characteristics of aircraft expected to use the airport. This airport reference code (ARC) has two components. The first component, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed (operational characteristic). The second component, depicted by a Roman numeral, is the airplane design group (ADG) and relates to aircraft wingspan or tail height (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while airplane wingspan primarily relates to separation criteria involving taxiways, taxilanes, and landside facilities.

According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at that aircraft's maximum certificated weight. The ADG is based upon either the aircraft's wingspan or tail height, whichever is greater. For example, an aircraft may fall in ADG II for wingspan, but ADG III for tail height. This aircraft would be classified under ADG-III. **Table 3A** presents the components of the airport reference code.

TABLE 3A
Airport Reference Code

Aircraft Approach Category		
Category	*Speed*	
A	< 91 Knots	
B	91- < 121 Knots	
C	121- < 141 Knots	
D	141- <166 Knots	
E	> 166 Knots	
Airplane Design Group[1]		
Group	*Tail Height (ft)*	*Wingspan (ft)*
I	< 20	< 49
II	20- < 30	49- < 79
III	30- < 45	70- < 118
IV	45- < 60	118- < 171
V	60- < 66	171- < 214
VI	66- < 80	214- < 262

[1] Utilize the most demanding category.
Source: FAA AC 150/5300-13, Airport Design

Exhibit 3A summarizes representative aircraft by ARC. As shown on the exhibit, the airport does not currently, nor is it expected to, regularly serve aircraft in ARCs C-IV, D-IV, or D-V. These large transport aircraft are used by commercial carriers which do not currently use, nor are they expected to use, the airport through the planning period. Some of the largest business jets, such as the Gulfstream V, fall in ARC D-III, and are capable of operating at the airport under certain conditions.

In order to determine airfield design requirements, the critical aircraft and critical ARC should first be determined before appropriate airport design criteria can be applied. This begins with a review of aircraft currently using the airport and those expected to use the airport through the 20-year planning period.

CURRENT CRITICAL AIRCRAFT

The critical design aircraft is defined as the most demanding category of aircraft which conduct 500 or more itinerant operations at the airport each year. In some cases, more than one specific make and model of aircraft comprises the airport's critical design aircraft. One category of aircraft may be the most critical in terms of approach speed, while another is most critical in terms of wingspan and/or tail height, which affects runway/taxiway width and separation design standards.

General aviation aircraft using the airport include a variety of single and multi-engine piston-powered aircraft, turboprops, business jets, and helicopters. While the airport is used by helicopters (particularly the based Life Star helicopter), they are not included in this determination as they are not assigned an ARC.

The majority of the based aircraft are single and multi-engine piston-powered aircraft which fall within approach categories A and B and ADG I. To determine if the current ARC for the airport is larger than A/B-I, an analysis of both based and transient activity by larger turboprops and business jets was undertaken.

There is one based turboprop, a King Air 350, which falls in ARC B-II. There is also a based business jet, a Cessna Citation Bravo 550, which also falls in ARC B-II. These aircraft types typically have higher utilization rates than smaller aircraft and rarely perform local operations. The combination of operations by these aircraft would justify, at a minimum, ARC B-II. The next step in determining the current critical aircraft is to examine activity by aircraft that are in the faster approach categories of C and D which are business jets.

Jet Operations

Jet operations are typically those that will influence required airport facilities as the critical design aircraft. In order to discern the number and type of jet aircraft operations at Lawrence Municipal Airport, data was obtained from the *Enhanced Traffic Management System Counts* (ETMSC), an FAA database. Information is added to the ETMSC 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, ETMSC data cannot account for all aircraft activity at an airport. Therefore, it is likely that there are more jet operations at the airport than are captured by this methodology. Nonetheless, this information provides a reasonable estimate of business jet operations.

It should be noted that two other sources of business jet activity were also consulted. The first is available from an online subscription service (www.AirportIQ.com) that tracks flight plans opened and closed on the ground. While this source showed fewer jet operations than the ETMSC, valuable information such as aircraft owner, aircraft type, N-number, origin, destination, date, and time-of-day are provided. **Table 3B** presents a sampling of the business jet types that are known to operate at the airport. As can be seen, a wide variety of businesses, including the largest fractional share operators, utilize the airport. Aircraft as large as the Gulfstream V (D-III) were identified in the database. More common business jet activity is seen from those in ARC C-II and below.

The second source of business jet operations is a manual count maintained for 2009 and 2010 by the airport fixed base operator (FBO). This source showed far fewer jet operations than either the ETMSC or AirportIQ.

Exhibit 3B presents the ETMSC jet activity at Lawrence Municipal Airport from 2000 through September 2010. As can be seen, most types and sizes of business jets can and do operate at the airport. From 2000 through 2009, the airport has averaged 893 annual business jet operations. The range of operations has been fairly

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A-I

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

B-I less than 12,500 lbs.

- Beech Baron 58
- Beech King Air 100
- Cessna 402
- **Cessna 421**
- Piper Navajo
- Piper Cheyenne
- Swearingen Metroliner
- Cessna Citation I

B-II less than 12,500 lbs.

- **Super King Air 200**
- Cessna 441
- DHC Twin Otter

B-I, B-II over 12,500 lbs.

- Super King Air 350
- Beech 1900
- Jetstream 31
- Falcon 10, 20, 50
- Falcon 200, 900
- **Citation II**, III, IV, V
- Saab 340
- Embraer 120

A-III, B-III

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

C-I, D-I

- Beech 400
- **Lear 25, 31, 35, 45, 55, 60**
- Israeli Westwind
- HS 125-400, 700

C-II, D-II

- Cessna Citation III, VI, VIII, X
- **Gulfstream II, III, IV**
- Canadair 600
- ERJ-135, 140, 145
- CRJ-200/700
- Embraer Regional Jet
- Lockheed JetStar

C-III, D-III

- ERJ-170, 190
- CRJ 700, 900
- Boeing Business Jet
- **B 737-300 Series**
- MD-80, DC-9
- Fokker 70, 100
- A319, A320
- Gulfstream V
- Global Express

C-IV, D-IV

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

D-V

- **B-747** Series
- B-777

Note: Aircraft pictured is identified in bold type.

City of Lawrence KANSAS

Exhibit 3A
AIRPORT REFERENCE CODES

10MP07-3B-10/20/10

JET OPERATIONS BY AIRPORT REFERENCE CODE (MINIMUM)

ARC	Aircraft Type	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010*
B-I	Eclipse 500	0	0	0	0	0	0	0	0	8	18	2
	Premier 390	0	0	0	2	10	14	2	8	2	12	4
	Beechjet 400	24	60	22	42	42	76	116	128	162	66	42
	Cessna 500	4	6	4	12	6	4	2	14	2	18	0
	Cessna 501	16	14	6	4	6	0	2	0	0	16	0
	Cessna Mustang 510	0	0	0	0	0	0	0	0	0	0	4
	Cessna 525 (CJ I)	130	196	166	130	110	90	68	34	22	16	12
	Embraer Phenom 100	0	0	0	0	0	0	0	0	0	12	28
	Falcon 10	4	26	50	12	6	8	12	4	6	0	2
	Mitsubishi MU-300	4	10	4	2	8	18	12	6	14	9	0
	Rockwell Saber 40/60	12	36	36	78	62	5	8	4	0	0	0
TOTAL B-I		***194***	***348***	***288***	***282***	***250***	***215***	***222***	***198***	***216***	***167***	***94***
B-II	Cessna 525A (CJ II)	0	0	14	16	26	24	42	18	14	6	4
	Cessna 525B (CJ III)	0	0	0	0	0	10	2	10	20	40	24
	Cessna Citation Bravo 550	351	336	275	288	268	230	211	244	199	166	91
	Cessna 551	0	0	0	0	0	0	0	2	0	0	0
	Cessna Citation V/Ultra/Encore 560	92	68	108	50	42	32	32	40	56	38	32
	Cessna 560 XLS	2	6	24	32	14	40	52	78	74	38	54
	Cessna Citation III/VI/VII 650	6	10	8	6	8	20	24	38	12	14	2
	Cessna Citation Sovereign 680	0	0	0	0	0	0	10	6	18	10	0
	Falcon 20	22	10	18	6	16	8	10	18	6	14	0
	Falcon 50	14	8	2	14	6	10	14	10	16	10	8
	Falcon 900	4	4	8	16	14	10	12	2	12	4	2
	Falcon 2000	2	0	6	14	4	10	10	16	6	22	14
	Dornier 328 Jet	0	0	2	0	10	0	6	24	26	34	8
TOTAL B-II		***493***	***442***	***465***	***442***	***408***	***394***	***425***	***506***	***459***	***396***	***239***
C-I	Hawker Siddeley HS 125-600	2	4	10	10	8	0	0	6	6	0	0
	Hawker Siddeley HS 125-800	22	18	14	22	32	44	40	44	42	42	14
	Learjet 24	10	2	14	6	14	2	10	4	4	0	2
	Learjet 25	6	4	6	12	14	10	4	8	2	2	0
	Learjet 31	16	10	14	14	14	8	12	4	14	6	4
	Learjet 40	0	0	0	0	0	0	6	4	8	12	2
	Learjet 55	6	4	6	2	0	8	2	2	10	0	2
	IAI Westwind	14	4	0	16	14	8	10	14	10	20	0
TOTAL C-I		***76***	***46***	***64***	***82***	***96***	***80***	***84***	***86***	***96***	***82***	***24***
C-II	IAI Astra	4	4	6	4	0	2	4	0	2	0	2
	IAA Galaxy	0	0	0	0	0	4	4	2	12	4	14
	Cessna Citation 750 (X)	16	20	16	14	32	32	40	28	20	22	24
	Challenger 300	0	0	0	0	0	2	0	2	2	7	6
	Challenger 600/604	14	24	4	12	16	24	12	28	44	10	6
	Embraer ERJ 135	0	0	0	0	2	0	2	8	2	8	0
	Gulfstream III	0	0	2	0	6	0	4	0	8	2	4
	Hawker 800XP, 1000, 4000	2	8	0	2	0	0	0	0	4	2	0
	Falcon 900EX & F-Series	0	0	0	0	0	0	0	0	0	0	0
TOTAL C-II		***36***	***56***	***28***	***32***	***56***	***64***	***66***	***68***	***94***	***55***	***56***
C-III	Global Express/5000	0	0	0	0	0	0	2	8	6	4	0
TOTAL C-III		***0***	***0***	***0***	***0***	***0***	***0***	***2***	***8***	***6***	***4***	***0***
D-I	Learjet 35/36	40	16	16	16	26	60	50	24	41	90	24
	Learjet 45	0	6	8	6	10	24	32	32	29	18	22
	Learjet 60	6	8	4	12	4	4	22	6	6	14	10
TOTAL D-I		***46***	***30***	***28***	***34***	***40***	***88***	***104***	***62***	***76***	***122***	***56***
D-II	Gulfstream G150	0	0	0	0	0	0	0	0	2	0	0
	Gulfstream II	2	0	4	0	4	6	6	2	2	2	2
	Gulfstream IV	2	12	4	14	10	14	2	6	8	6	2
TOTAL D-II		***4***	***12***	***8***	***14***	***14***	***20***	***8***	***8***	***12***	***8***	***4***
D-III	Gulfstream V	0	0	0	0	0	0	0	4	6	4	8
TOTAL D-III		***0***	***0***	***0***	***0***	***0***	***0***	***0***	***4***	***6***	***4***	***8***
TOTAL JET ACTIVITY		**849**	**934**	**881**	**886**	**864**	**861**	**911**	**940**	**965**	**838**	**481**

TOTAL JET OPERATIONS BY APPROACH CATEGORY & AIRPLANE DESIGN GROUP

Approach Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010*
B	687	790	753	724	658	609	647	704	675	563	333
C	112	102	92	114	152	144	152	162	196	141	80
D	50	42	36	48	54	108	112	74	94	134	68
Airplane Design Group											
I	316	424	380	398	386	383	410	346	388	371	174
II	533	510	501	488	478	478	499	582	565	459	299
III	0	0	0	0	0	0	2	12	12	8	8

ARC - Airport Reference Code
*Through September 2010
Source: Enhanced Traffic Management System Counts (ETMSC) - FAA activity database.

City of Lawrence KANSAS

Exhibit 3B
JET OPERATIONS

narrow with a low of 838 operations in 2009 and a high of 965 operations in 2008. As far back as 2001, there were 934 business jet operations documented.

TABLE 3B
Business Jet Activity
Lawrence Municipal Airport

Owner/Operator	Aircraft Model	Aircraft ARC
KU	Cessna 550	B-II
Bank of America	Cessna 560	B-II
Citation LLC	Beech 400A	B-I
DRC Transportation LLC	Beech 400A	B-I
Fortney Companies, Inc	Cessna 525	B-I
HyVee, Inc	Cessna 525	B-I
Kroger Co, Inc	Lear 35A	D-I
Mac-Tech, Inc	Cessna 525A	B-II
MBO Aviation LLC	Cessna 650	B-II
Stanley Bank	Cessna 525	B-I
Tulsair Beechcraft Inc	BAe 125-800A	B-II
Capital Aircraft Group	Gulfstream II (G-1159)	D-II
CFS Air, LLC	Hawker 800XP	C-II
Cessna Finance Corp.	Cessna 750	C-II
Target Corp	Cessna 750	C-II
Ford Motor Company	Gulfstream V	D-III
Citation Shares	Various	B-II, C-I, C-II
Executive Jet	Various	B-II, C-I, C-II
Flight Options	Various	B-II, C-I, C-II
Bombardier Business Jets	Various	C-I, C-II, D-I

Source: www.airportiq.com

The exhibit also shows the breakout of these business jets by approach category and airplane design group. Over the 10 year sample period, 76 percent of the business jet activity was by aircraft in approach category B, 15 percent in approach category C, and eight percent in approach category D. In 2009, there were 275 documented operations by aircraft in approach category C and D.

The number of business jet operations presented does not represent all jet operations at the airport. Some flight plans are not credited to the airport because they are opened or closed in the air or because radar coverage is lost. Lawrence Municipal Airport is outside of the Class B airspace surrounding Kansas City International, and radar coverage is not available below 600 feet around the airport. It is reasonable to assume that some flight plans are closed or opened in the air. Therefore, the level of activity by aircraft in approach category C and D may exceed the 500 operations threshold.

In addition, the Lawrence Municipal Airport has been planned and designed to C standards for more than a decade. Unless there is a general trend showing that airport activity is decreasing to a point where the existing design standard is encumbering, the FAA typically will support maintaining the existing design standard. **Therefore, this master plan will consider an existing ARC of C-II for the airport.**

FUTURE CRITICAL AIRCRAFT

The table clearly shows that, while total business jet activity has been relatively constant, a trend has emerged where medium and large business jet (approach categories C and D) activity is increasing over time. This is not unexpected as medium and large business jets are representing a greater percentage of business jet deliveries for the last 10 years.

The aviation demand forecasts indicate the potential for continued growth in business jet activity at the airport. This includes the forecast addition of two more based business jets by the long term planning horizon. The type and size of the business jet activity in the future is difficult to precisely identify. 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.

The type and size of business jets based at or operating from the airport is important to determining the future critical aircraft. Over the past 10 years, approximately 53 percent of business jets manufactured have been in approach category C or larger as shown in **Table 3C**. Thus, the trend in business jet usage is toward larger aircraft. This trend provides an indication that the airport should at least maintain ARC C-II design standards through the long term planning period.

TABLE 3C
Business Jet Deliveries by ARC from 1999-2009

ARC	Number of Business Jets	Percent
B-I	1,644	18%
B-II	2,561	29%
Total B-II and Smaller	**4,205**	**47%**
C-I	179	2%
C-II	2,585	29%
C-III	550	6%
D-I	698	8%
D-II	623	7%
D-III	132	1%
Total C-I and Larger	**4,767**	**53%**
TOTAL	**8,972**	**100%**

Source: General Aviation Manufacturers Association

Because of the trend toward larger business jets, some consideration is given to the possibility of a transition from ARC C-II to ARC D-II or D-III at Lawrence Municipal Airport. While these aircraft account for approximately eight percent of the business jet deliveries in the last 10 years, they operate at Lawrence Municipal Airport infrequently.

Table 3D presents a forecast estimate of future business jet operations at Lawrence Municipal Airport. The trend over the last ten years (2000-2009) has been that approach category B jets operations have decreased as a percentage of the whole, while approach category C and D have increased. The future forecast continues these trends, but in a more gradual manner.

TABLE 3D
Jet Operations Forecast By Design Category
Lawrence Municipal Airport

	HISTORICAL JET OPERATIONS				FORECAST JET OPERATIONS			
Design Categories	**2000**	**Percent**	**2009**	**Percent**	**2015**	**2020**	**2030**	**2030 Percent**
Approach Category B	687	81%	563	67%	769	1,009	1,281	52%
Approach Category C	112	13%	141	17%	236	365	567	23%
Approach Category D	50	6%	134	16%	236	365	616	25%
Total	**849**	**100%**	**838**	**100%**	**1,240**	**1,739**	**2,464**	**100%**
Airplane Design Group I	316	37%	371	44%	558	800	1,158	47%
Airplane Design Group II	533	63%	459	55%	657	887	1,183	48%
Airplane Design Group III	0	0%	8	1%	25	52	123	5%
Total	**849**	**100%**	**838**	**100%**	**1,240**	**1,739**	**2,464**	**100%**

Source: Enhanced Traffic Management System Counts (ETMSC) – FAA activity database

By the end of the short term planning period, operations by approach category C and D business jets are forecast to reach 472. By the intermediate planning period, the combined C and D operations are 730. By the long term planning period, nearly 1,200 approach categories C and D business jet operations are forecast, with D category representing 616 annual operations.

Long term planning for Lawrence Municipal Airport will consider the potential for a transition from ARC C-II to ARC D-II. The previous airport layout plan (ALP) also identified a future design standard in ARC D-II. **Therefore, the future critical design aircraft considered for this planning effort will remain in ARC D-II.**

CRITICAL AIRCRAFT SUMMARY

At airports without an airport traffic control tower (ATCT), precise operations counts can be difficult to determine. It is even more difficult to categorize operations by ARC. The determination of the current and future critical design aircraft has relied on the ETMSC FAA database of flight activity to and from Lawrence Municipal Airport. It is known that the data relied upon represents a minimum number of operations because not all activity is captured.

Because of the potential range of additional business jet operations, the critical aircraft determination has utilized only the raw baseline data for each year. What has been determined is that business jets are critical for airport design and they account for more than 500 annual operations on average. The trend at the airport has been for larger business jets, those in approach categories C and D to account for a larger percentage of the overall business jet activity. Therefore, the current critical design aircraft is ARC C-II. The future critical design aircraft is planned to be represented by those business jets that fall in ARC D-II.

A final consideration is how the airport has been planned and constructed in the past. The current ALP on record with the FAA identifies a critical aircraft in ARC D-II. The runway environment has been planned to meet these design requirements in most cases. **Therefore, this master plan will utilize design standards associated with ARC C/D-II for both the current and future design standard.**

AIRFIELD CAPACITY

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. Aircraft delay is the total delay incurred by aircraft using the airfield during a given timeframe. FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, provides a methodology for examining the operational capacity of an airfield for planning purposes. The airfield capacity discussion takes into account specific factors about the airfield which are presented on **Exhibit 3C**.

- **Runway Configuration** –Runway 15-33 is 5,700 feet long and 100 feet wide. Runway 1-19, the crosswind runway, is 3,901 feet in long and 75 feet wide. The runway intersection is approximately 2,300 feet from the Runway 15 end and 900 feet from the Runway 19 end.

- **Runway Use** – Runway use will be controlled by wind and/or airspace conditions. The direction of takeoffs and landings are generally determined by the speed and direction of the wind. It is generally safest for aircraft to take-off and land into the wind, avoiding a crosswind (wind that is blowing perpendicular to the travel of the aircraft) or tailwind components during these operations.

  Runway 15-33 is the primary runway and utilized the most. This runway also provides the only instrument approaches so it is utilized exclusively in instrument flight rule (IFR) conditions.

- **Exit Taxiways** – Exit taxiways have a significant impact on airfield capacity since the number and location of exits directly determines the occupancy time of an aircraft on the runway. For Lawrence Municipal Airport, those taxiway exits (located between 2,000 and 4,000 feet from the runway threshold) count in the capacity determination. There is one exit from both directions that counts in the capacity analysis.

Exhibit 3C
AIRFIELD CAPACITY FACTORS

- **Weather Conditions** – The airport operates under visual flight rules (VFR) 92.21 percent of the time. When cloud ceilings are between 500 and 1,000 feet and visibility is between one and three miles, IFR conditions apply, which is approximately 5.02 percent of the year. Poor visibility conditions (PVC) apply when cloud ceilings are below 500 feet and visibility is below one mile. PVC conditions occur 2.77 percent of the year. **Table 3E** summarizes the weather conditions between 2000 and 2010.

TABLE 3E
Annual Weather Conditions
Lawrence Municipal Airport

Condition	Cloud Ceiling	Visibility	Observations	Percent
Visual (VFR)	>1,000'	> 3 mi.	77,293	92.21%
Instrument (IFR)	≤ 1,000' and > 500'	≤ 3 mi. and Vis > 1 mi.	4,211	5.02%
Poor Visibility (PVC)	≤ 500'	≤ 1 mi.	2,318	2.77%
		TOTAL	**83,822**	**100.00%**

Source: National Oceanic and Atmospheric Administration (NOAA). Data from the on-airport ASOS

- **Aircraft Mix** – Aircraft mix for the capacity analysis is defined in terms of four aircraft classes. Classes A and B consist of small and medium-sized propeller and some jet aircraft, 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, which include most business jets and some turboprop aircraft. Class D aircraft consists of large aircraft weighing more than 300,000 pounds. The airport does not experience operations by Class D aircraft; however, Class C operations are estimated to be 3.6 percent of total annual operations. This is forecast to grow to 6.69 percent by the long term planning period. The remaining are operations by Class A and Class B aircraft.

- **Percent Arrivals** – Percent arrivals generally follow the typical 50/50 percent split.

- **Touch-and-Go Activity** – Ninety percent of local operations are considered touch-and-go in nature, which is approximately 41 percent of general aviation operations. This figure will likely remain relatively constant over the planning period.

- **Peak Period Operations** – For the airfield capacity analysis, average daily operations and average peak hour operations during the peak month, as calculated in the previous chapter, are utilized. Typical operations activity is important in the calculation of an airport's annual service volume 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.

Given the factors outlined above, the airfield ASV is estimated at 141,000. 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. The current operation level estimated for Lawrence Municipal Airport represents 23.2 percent of the airfield's ASV. By the end of the planning period, total annual operations are expected to represent 33.3 percent of the airfield's ASV. **Table 3F** summarizes the capacity analysis for Lawrence Municipal Airport.

TABLE 3F
Airfield Demand/Capacity Summary
Lawrence Municipal Airport

	PLANNING HORIZON			
	Current	**Short Term**	**Intermediate Term**	**Long Term**
Operational Demand				
Annual	32,700	35,500	38,600	45,600
Design Hour	23	25	27	32
Capacity				
Annual Service Volume	141,000	140,000	139,000	136,000
Percent Capacity	23.16%	25.39%	27.81%	33.42%
Weighted Hourly Capacity	99	98	97	96
Delay				
Per Operation (Minutes)	0.10	0.15	0.20	0.25
Total Annual (Hours)	55	89	129	190

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 under construction/development. Based on current and projected operations developed for this study, improvements specifically designed to enhance capacity are not necessary during the 20-year scope of this master plan.

AIRFIELD REQUIREMENTS

As indicated earlier, airport facilities include both airfield and landside components. Airfield facilities include those facilities that are related to the arrival, departure, and ground movement of aircraft. These components include:

- Runway Configuration
- Safety Area Design Standards
- Runways
- Taxiways
- Navigational Approach Aids
- Lighting, Marking, and Signage

RUNWAY CONFIGURATION

The airport is served by two intersecting runways. Primary Runway 15-33 is orientated in a northwest to southeast manner, intersecting crosswind Runway 1-19 approximately 2,300 feet from the Runway 15 end and 900 feet from the Runway 19 end. Runway 1-19 is oriented in a north to south manner.

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.

FAA Advisory Circular 150/5300-13, *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 computed on the basis of the crosswind component not exceeding 10.5 knots (12 mph) for ARCs A-I and B-I, 13 knots (15 mph) for ARCs A-II and B-II, and 16 knots (18 mph) for ARC C-I through D-II.

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 automated surface observation system (ASOS) over a continuous 10-year period from 2000 to 2010. A total of 83,822 observations of wind direction and other data points were made.

Runway 15-33 provides 93.58 percent wind coverage for 10.5 knot crosswinds, 96.87 percent coverage at 13 knots, and 98.13 percent at 16 knots. Runway 1-19 provides for 89.81 percent wind coverage at 10.5 knots, 94.4 percent at 13 knots, and 98.11 percent at 16 knots. The combined wind coverage at 10.5 knots is 97.69 percent. **Exhibit 3D** presents a wind rose of the data developed following FAA guidance.

At a minimum, the airport should maintain the two-runway system. Runway 15-33 provides the greatest length, which is necessary when considering the current usage of the airport by larger aircraft needing more runway length. Runway 15-33 also provides the only instrument approach capability at the airport (other than the circling VOR/DME approach). A crosswind runway is necessary to provide the required combined wind coverage that exceeds 95 percent. At a minimum, the crosswind runway should meet the design standards for aircraft in ARC B-I.

There will be times when the primary runway is closed for extended periods of time. Most commonly, this occurs when a full runway rehabilitation/reconstruction is necessary. Lawrence Municipal Airport receives frequent activity by aircraft that are unable to safely utilize crosswind Runway 1-19. As a major university town with a population of nearly 100,000 and a significant business/economic base, the loss of operational capability by larger aircraft would have a detrimental economic impact. The alternatives chapter will consider options for maintaining operational capability for the largest percentage of aircraft, including the possibility of upgrading Runway 1-19 to ARC B-II standards. The applicable improvements, including additional runway length and expanded safety areas, would allow the airport to continue to accommodate all turboprops and smaller aircraft as well as a significant portion of the business jet fleet.

SAFETY AREA DESIGN STANDARDS

The FAA has established several imaginary surfaces to protect aircraft operational areas and keep them free from obstructions that could affect their safe operation. These include the runway safety area (RSA), object free area (OFA), obstacle free zone (OFZ), and runway protection zone (RPZ).

The entire RSA, OFA, and OFZ 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. The RPZ 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 safety areas were previously presented on Exhibit 1E.

Dimensional standards for the various safety areas associated with the runways are a function of the type of aircraft (ARC) expected to use the runways as well as the instrument approach capability. Runway 33 provides an instrument approach with ½-mile visibility minimums and 200-foot cloud ceiling heights. Runway 15 provides for 1-mile visibility minimums and 509-foot cloud ceiling heights. There are no straight-in instrument approaches for Runway 1-19. **Table 3G** presents the FAA design standards as they apply to the runways at Lawrence Municipal Airport.

Runway Safety Area (RSA)

The RSA is defined in FAA Advisory Circular (AC) 150/5300-13, *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 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.

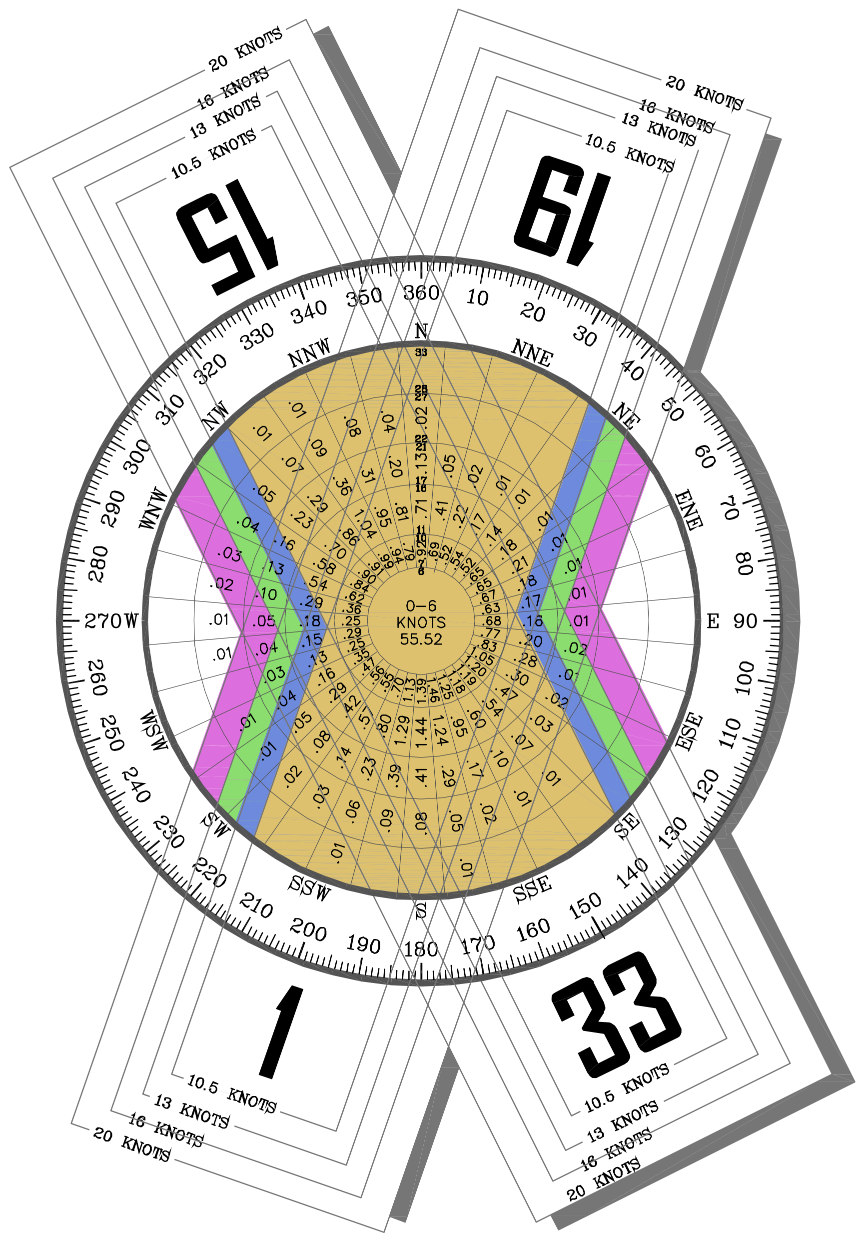
The FAA has placed a higher significance on maintaining adequate RSA at all airports. Under Order 5200.8, effective October 1, 1999, the FAA established the *Runway Safety Area Program.* The Order states, "The objective of the Runway Safety Area Program is that all RSAs at federally-obligated airports…shall conform to the standards contained in Advisory Circular 150/5300-13, *Airport Design*, to the extent practicable." Each Regional Airports Division of the FAA is

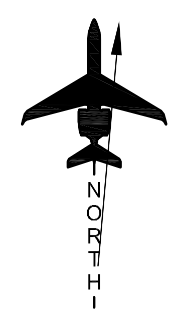
ALL WEATHER WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 1-19	*89.81%*	*94.40%*	*98.11%*	*99.50%*
Runway 15-33	*93.58%*	*96.87%*	*98.13%*	*99.80%*
Combined	*97.69%*	*99.10%*	*99.74%*	*99.95%*

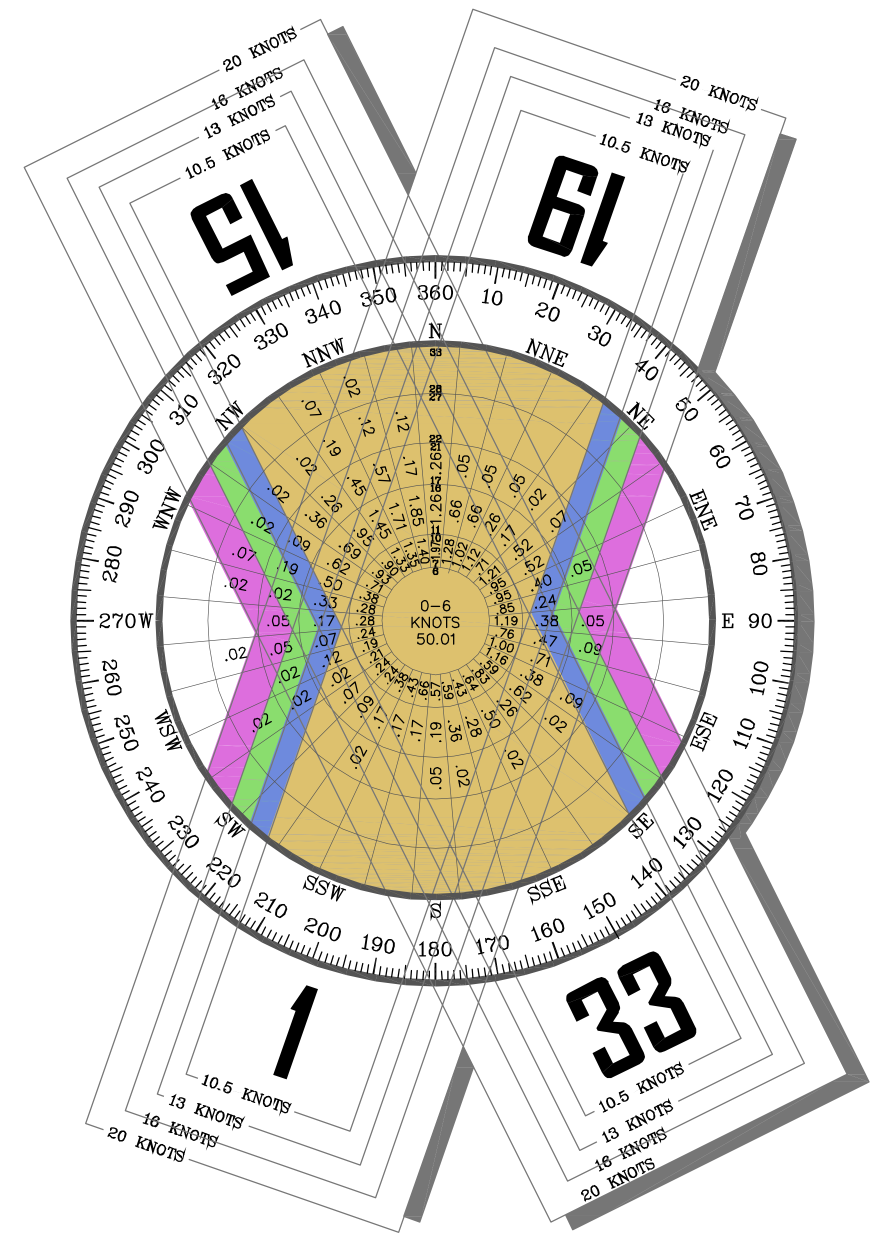
IFR WIND COVERAGE

Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 1-19	*87.27%*	*92.94%*	*97.64%*	*99.41%*
Runway 15-33	*93.71%*	*96.91%*	*98.18%*	*99.78%*
Combined	*97.70%*	*98.77%*	*99.65%*	*99.93%*





Magnetic Declination
02° 51' East (September 2010)
Annual Rate of Change
00° 07' West (September 2010)



SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Lawrence Municipal Airport
Lawrence, Kansas

OBSERVATIONS:
83,822 All Weather Observations
2000-2010

SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Lawrence Municipal Airport
Lawrence, Kansas

OBSERVATIONS:
4,211 IFR Observations
2000-2010

City of Lawrence KANSAS

Exhibit 3D
WINDROSE

obligated to collect and maintain data on the RSA for each runway at the airport and perform airport inspections.

TABLE 3G **Runway Design Standards** **Lawrence Municipal Airport**	**Runway 15-33**	**Runway 1-19**	**Upgraded Runway 1-19**
Design Standard	**C/D-II**	**B-I**	**B-II**
Applicable Approach	**½ Mile**	**1 Mile/Visual**	**1 Mile/visual**
RUNWAYS			
Runway Width	100	60	75
Runway Shoulder Width	10	10	10
Runway Safety Area			
Width	500	120	150
Length Beyond End	1,000	240	300
Length Prior to Landing	600	240	300
Runway Object Free Area			
Width	800	400	500
Length Beyond End	1,000	240	300
Runway Obstacle Free Zone			
Width	400	250	400
Length Beyond End	200	200	200
Runway Centerline to:			
Holding Position	250/259	200	200
Parallel Taxiway	400	225	240
Aircraft Parking Area	500	200	250

Note: All dimensions in feet
Source: FAA AC 150/5300-13, Airport Design

The RSA for Runway 15-33 should be 500 feet wide and extend 1,000 feet beyond the runway ends. The RSA for Runway 1-19 is 120 feet wide and extends 240 feet beyond the runway ends. Both runways meet RSA standard. The B-II RSA for a potentially improved Runway 1-19 is 150 feet wide and it extends 300 feet beyond the runway ends.

Object Free Area (OFA)

The runway OFA 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 OFA does not have to be graded and level like the RSA; instead, the primary requirement for the OFA is that no object in the OFA penetrates the lateral elevation of the RSA. The runway OFA is centered on the runway, extending out in accordance to the critical aircraft design category utilizing the runway.

For Runway 15-33, the OFA is 800 feet wide and extends 1,000 feet beyond the end of the runway. Therefore, the OFA ends at the same distance as the RSA. For Runway 1-19, the OFA is 400 feet wide and extends

240 feet beyond the ends of the runway. Runway 1-19 meets the RSA design standard. The ARC B-II OFA for an improved Runway 1-19 is 500 feet wide and 300 feet beyond the runway ends.

Obstacle Free Zone (OFZ)

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

For Runway 15-33, the OFZ is 400 feet wide, centered on the runway, and extends 200 feet beyond the runway pavement ends. The OFZ for Runway 1-19 also extends 200 feet beyond the runway ends and 250 feet wide. The ARC B-II for a potentially upgraded Runway 1-19 is 400 feet wide and 200 feet beyond the runway ends. The OFZ for both runway ends is unobstructed.

A precision obstacle free zone (POFZ) is further defined for runway ends with a precision approach, such as the ILS approach to Runway 33. The POFZ is 800 feet wide and extends from the runway threshold to a distance of 200 feet. The POFZ is in effect when the following conditions are met:

a) The runway supports a vertically guided approach.
b) Reported ceiling is below 250 feet and/or visibility is less than ¾-mile.
c) An aircraft is on final approach within two miles of the runway threshold.

When the POFZ is in effect, a wing of an aircraft holding on a taxiway may penetrate the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ.

Runway Protection Zones (RPZ)

The RPZ is a trapezoidal area centered on the runway, typically 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 dimensions of the RPZ vary according to the visibility minimums serving the runway and the type of aircraft (design aircraft) operating on the runway.

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 OFA. Only objects necessary to aid air navigation, such as approach lights, are allowed in this portion of the RPZ. Wildlife attractants, fuel farms, places of public assembly, and residences are prohibited from the RPZs. The remaining portions of the RPZ, the controlled activity areas, have strict land use limitations. FAA AC 150/5300-13, *Airport Design*, specifically allows surface parking facilities, but they are discouraged. All other uses are prohibited.

There are portions of the RPZs associated with Runways 15, 1, and 19 that extend beyond airport property. Avigation easements fully cover these RPZs. The Runway 33 RPZ is on airport property. Ultimately, the airport should acquire any RPZ area that is not on airport property.

Runway/Taxiway Separation

The design standards for the separation between runways and parallel taxiways are a function of the critical aircraft and the instrument approach visibility minimum. The separation standard for ARC C-II design with ½-mile visibility minimums is 400 feet from the runway centerline to the parallel taxiway centerline. Taxiway A is located 400 feet from the runway and meets FAA standards. Taxiway D, the partial parallel taxiway to Runway 1-19, is 240 feet from the runway which meets the design standard. As a runway designed to ARC B-I standards, the separation only needs to be 225 feet. The 240-foot separation would meet the next design category from ARC B-II.

According to FAA AC 150/5300-13, *Airport Design*, Change 17, the hold line separation standard for runways in approach category D are adjusted one foot for each 100 feet above sea level. With an airport elevation of 833 feet above sea level, the hold lines should be located at a distance of 259 feet from the runway centerline. The airport currently meets this standard.

Agricultural Separation Standards

The FAA has developed separation standards between agricultural activities that occur on or adjacent to airport property and certain airport features including runways, taxiways and aprons. **Table 3H** presents these standards. To meet standard for an ARC C-II runway with ½-mile visibility minimums, the crop line can be no closer than 575 feet to the runway centerline. From the runway end, the distance must be at least 1,000 feet.

TABLE 3H
Agriculture Crop Separation Standards

ARC	Distance from Runway Centerline to Crop ≥ ¾-mile	Distance from Runway Centerline to Crop < ¾-mile	Distance From Runway End to Crop ≥ ¾-mile	Distance From Runway End to Crop < ¾-mile	Distance from Taxiway Centerline to Crop	Distance from Apron to Crop
Category A and B Aircraft						
Group I	200'	400'	300'	600'	45'	40'
Group II	250'	400'	400'	600'	66'	58'
Category C and D Aircraft						
Group I	530'	575'	1,000'	1,000'	45'	40'
Group II	530'	575'	1,000'	1,000'	66'	58'
Group III	530'	575'	1,000'	1,000'	93'	81'

Source: AC 150/5300-13, Airport Design

RUNWAYS

The adequacy of the existing runway system at Lawrence Municipal Airport has been analyzed from a number of perspectives, including runway orientation, runway length, pavement strength, width, and adherence to safety area standards. From this information, requirements for runway improvements were determined for the airport.

Runway Length

Runway 15-33 is the primary runway and is 5,700 feet in length. Runway 1-19 is the crosswind runway measuring 3,901 feet in length. The determination of runway length requirements for the airport is based on five primary factors:

- Mean maximum temperature of the hottest month
- Airport elevation
- Runway gradient
- Critical aircraft type expected to use the airport
- Stage length of the longest nonstop destination (specific to larger aircraft)

The mean maximum daily temperature of the hottest month for Lawrence Municipal Airport is 91 degrees Fahrenheit (F). The airport elevation is 833 feet above mean sea level (MSL). The runway elevation difference is four feet for Runway 15-33 and two feet for Runway 1-19. Both runways have a longitudinal gradient of 0.07 percent or less, which conforms to FAA design standards. For aircraft in approach categories A and B, the runway longitudinal gradient cannot exceed two percent. For aircraft in approach categories C and D, the maximum allowable longitudinal runway gradient is 1.5 percent.

The first step in evaluating runway length is to determine general runway length requirements for the majority of aircraft operating at the airport. The majority of operations at Lawrence Municipal Airport consist of small aircraft weighing less than 12,500 pounds. Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance for determining runway length needs. To accommodate 95 percent of small aircraft with less than 10 passenger seats, a runway length of 3,400 feet is recommended. To accommodate 100 percent of these small aircraft, a runway length of 4,000 feet is recommended. Small aircraft with 10 or more passenger seats require a runway length of 4,400 feet.

Runway length requirements for business jets weighing less than 60,000 pounds have also been calculated. These calculations take into consideration the runway gradient and landing length requirements for contaminated runways (wet). 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 determination for business jets 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. **Table 3J** presents a partial list of common aircraft in each aircraft grouping. A third group considers business jets weighing more than 60,000 pounds. Runway length determination for these aircraft must be based on the performance characteristics of the individual aircraft.

TABLE 3J
Business Jet Categories for Runway Length Determination

75 percent of the national fleet	MTOW	75-100 percent of the national fleet	MTOW	Greater than 60,000 pounds	MTOW
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 3K presents the results of the runway length analysis developed following the guidance provided in FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*. 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 4,800 feet that is adjusted, as recommended, for runway gradient and consideration of landing length needs on a contaminated runway (wet and slippery). Dry runways would require approximately 4,900 feet, while 5,500 feet is needed to accommodate business jets landing in wet conditions. To accommodate 100 percent of the business jet fleet at 60 percent useful load, a runway length of 5,800 feet is recommended.

Utilization of the 90 percent category for runway length determination is generally not considered by the FAA unless there is a demonstrated need at the airport. This could be documented activity by a cargo carrier or by a business jet operator that flies out frequently with heavy loads. To accommodate 75 percent of the business jet fleet at 90 percent useful load, a runway length of 7,000 feet is recommended.

The runway length recommended to accommodate business jets weighing more than 60,000 pounds is approximately 6,300 feet. These aircraft are generally newer and are outfitted with more efficient engines. If there are 500 operations by aircraft weighing more than 60,000 pounds (e.g., Gulf stream II, IV, V), then the future runway length would be determined utilizing the operations manual specific to that aircraft.

TABLE 3K Runway Length Analysis Lawrence Municipal Airport	
AIRPORT AND RUNWAY DATA	
Airport Elevation	832 feet
Mean daily maximum temperature	91° F
Maximum difference in runway centerline elevation	6 feet
Length of haul length for airplanes of more than 60,000 pounds	1,000 miles
Wet and Slippery Runways:	Yes
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with less than 10 passenger seats	
95 percent of these small airplanes	3,400 feet
100 percent of these small airplanes	4,000 feet
Small airplanes with 10 or more passenger seats	4,400 feet
Large airplanes of 60,000 pounds or less	
75 percent at 60 percent useful load	5,500 feet
75 percent at 90 percent useful load	7,000 feet
100 percent at 60 percent useful load	5,800 feet
100 percent at 90 percent useful load	8,900 feet
Airplanes of more than 60,000 pounds	approximately 6,300 feet
Reference: FAA AC 150/5325-4B, Runway Length Requirements for Airport Design	

The 2001 ALP report recommended extending the runway to an ultimate length of 7,000 feet in order to accommodate a design aircraft represented by the Gulfstream-II (ARC D-II). Further analysis indicated that the airport site is restricted by U.S. Highway 24/40 on the south and the Mud Creek levee on the north. Therefore, the maximum runway length the site can accommodate is 6,100 feet without significant and costly road relocation.

In an effort to go beyond the general runway length requirements that result from the FAA procedure, individual aircraft operating manuals were consulted to determine actual runway length needs for a sampling of business jets that are known to operate at the airport. **Table 3L** shows the runway length results for the individual aircraft under maximum loading conditions. As can be seen, several of the aircraft would require a runway length that exceeds both the current length of 5,700 feet and the currently considered length of 6,100 feet.

The alternatives chapter will assess the maximum runway length that the airport site can accommodate up to 6,300 feet in the short term. Even if this length is possible, there will still be some aircraft that would be weight restricted on certain hot days. Nonetheless, a runway length of 6,300 feet would open up opportunities for many aircraft in the 100 percent category. The feasibility of a 7,000-foot long runway will be considered for the long term.

TABLE 3L
Select Business Jet Takeoff Length Requirements
Lawrence Municipal Airport

Assumptions:
Mean Maximum Temp of Hottest Month: 91 degrees
Runway Gradient: 4-foot runway elevation difference
Airport Elevation: 833 feet

Aircraft	75% or 100% Category of National Fleet	ARC	MTOW	Takeoff Length
Challenger 600/604	100% Category	C-II	47,450	6,800
Gulfstream IV	Greater Than 60,000 pounds	D-II	74,600	7,200
Gulfstream V	Greater Than 60,000 pounds	D-III	90,500	7,000
Cessna 750	100% Category	C-II	36,100	6,200
Beechjet 400	75% Category	B-I	16,100	6,100
Cessna 550	75% Category	B-II	16,830	4,600
Cessna 680	100% Category	B-II	30,300	4,100
Hawker 800XP*	100% Category	C-II	26,000	5,500
Lear 45	75% Category	D-I	21,500	5,600
Lear 60	100% Category	D-I	23,500	7,200
Cessna 525	75% Category	B-I	10,700	4,700

ARC: Airport Reference Code
MTOW: Maximum Certified Takeoff Weight
*Temp too high for MTOW of 28,000 pounds
Source: Aircraft Flight Planning Manuals

Runway 1-19 Length

Runway 1-19 should meet the design standards associated with ARC B-I. The minimum runway length that should be considered is 3,400 feet, which would accommodate 95 percent of small aircraft. To accommodate 100 percent of small planes, a runway length of 4,000 feet is recommended. To additionally accommodate small aircraft with 10 or more seats, a runway length of 4,400 feet is recommended. At 3,901 feet in length, Runway 1-19 currently provides for the minimum recommended runway length. The existing length should be maintained through the planning period.

As previously discussed, there may be times when the primary runway is closed for an extended period of time. In order to preserve and protect the economic viability of the airport, consideration should be given to improving Runway 1-19 to ARC B-II standards. A runway length of 4,400 feet would meet this desire and will be considered in the alternatives chapter.

Runway Width

Runway 15-33 is 100 feet wide. This meets the design standard and should be maintained. Runway 1-19 is 75 feet wide, which exceeds the ARC B-I standard of 60 feet. Reducing the runway length should not be considered as the existing width provides an additional safety margin. In addition, the recent construction of parallel Taxiway D was at a separation distance of

240 feet (exceeding the standard of 225 feet and meeting the ARC B-II standard).

Runway Strength

An important feature of airfield pavement is its ability to withstand repeated use by aircraft. The FAA Airport/Facility Directory places the pavement strength for Runway 15-33 at 40,000 pounds single wheel loading (SWL) and 60,000 pounds dual wheel loading (DWL). 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 for Runway 15-33 is adequate and should be maintained in the short and intermediate term. In the long term, in conjunction with a 7,000-foot long runway, a strength rating of 75,000 pounds SWL and 90,000 pounds DWL, will be considered.

Runway 1-19 is strength rated at 12,500 pounds SWL and 15,600 DWL. There are very few ARC B-I or smaller aircraft weighing more than 12,500 pounds; therefore, the current pavement strength should be maintained. If the runway is improved to ARC B-II design standards, the strength should be increased to 30,000 pounds SWL and DWL.

TAXIWAYS

The taxiway width standard is based primarily on the wingspan of the critical design aircraft. For a critical aircraft in ADG II, the taxiway width standard is 35 feet. The critical design aircraft currently and into the future is anticipated to remain in ADG II; therefore, taxiways should be at least 35 feet wide.

All of the taxiways at Lawrence Municipal Airport are 35 feet wide except Taxiway C, which is 40 feet wide. If this taxiway were ever reconstructed or replaced, the width could be reduced to 35 feet. Until such a reconstruction (or redesign/layout) is necessary, the existing taxiway width should be maintained.

INSTRUMENT NAVIGATIONAL AIDS

The airport has a sophisticated ILS (CAT-I) instrument approach to Runway 33. This approach provides for visibility minimums as low as ½-mile and cloud ceilings down to 200 feet. Runway 33 also provides a standalone LPV (Localizer Performance with Vertical Guidance) approach with the same minimums. LPV approaches do not require the extensive ground based systems such as the localizer antenna and glide slope antenna, instead utilizing the GPS constellation of satellites to provide vertical and horizontal guidance. These approaches should be maintained in the future.

Runway 15 provides a GPS approach with 1 mile visibility minimums and 600-foot cloud ceiling heights. The potential to add an LPV approach with CAT-I minimums will be explored in the alternatives section of this master plan.

Runway 1-19 is currently a visual runway not being served by a published instrument approach procedure. As a crosswind runway that is needed to meet FAA standard for wind coverage, if possible, an instrument approach should be made available. The alternatives chapter will also explore the possibility of implementing GPS approaches with not lower than 1 mile visibility minimums.

VISUAL NAVIGATION AIDS

The airport beacon is located approximately 125 feet to the east of the terminal building. The beacon provides for rapid identification of the airport with a rotating light that is green on one side and white on the opposite. The beacon should be maintained through the planning period.

As discussed in Chapter One – Inventory, Runway 15-33 has 4-box precision approach path indicator (PAPI) lights serving both ends of the runway. Runway 1-19 has 2-box PAPIs serving both ends of the runway. These units serve the same purpose of indicating to a pilot if they are on the correct glide path to the runway touchdown point. These should be maintained through the planning period.

Runway end identification lights (REIL) are strobe lights set to either side of the runway. These lights provide rapid identification of the runway threshold. REILs should be installed at runway ends not currently providing an approach lighting system but supporting instrument operations. Both ends of Runway 1-19 are equipped with REILs. A REIL system should be planned for Runway 15, unless an approach lighting system is planned.

Runway 33 has a medium intensity approach lighting system with runway alignment indicator lights (MALSR). This system is required as part of the ILS approach and allows for the visibility minimums to be ½-mile. This system should be maintained on the Runway 33 end. To achieve CAT-I minimums on the Runway 15 end, an approach lighting system would be required. If ¾ mile minimums are to be obtained, a MALS (or similar) is generally required. A summary of the airside needs at Lawrence Municipal Airport is presented on **Exhibit 3E**.

LANDSIDE 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 element was examined in relation to projected demand to identify future landside facility needs. This includes components for general aviation needs such as:

- Aircraft Hangars
- Aircraft Parking Aprons
- Terminal Building
- Auto Parking and Access
- Airport Support Facilities

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 tie-downs.

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. However, hangar development should be based upon actual demand trends and financial investment conditions.

While a majority of aircraft owners prefer enclosed aircraft storage, a number of based aircraft owners will still tie-down outside (due to the 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 Lawrence Municipal Airport, it is estimated that 97 percent of the based aircraft are currently stored in hangars (two tie-down on apron space). If facilities are available, it is estimated that this ratio can be maintained through the planning period.

There are three general types of aircraft storage hangars: T-hangars, executive box hangars, and conventional hangars. T-hangars are similar in size and will typically house a single engine piston powered aircraft. Some multi-engine aircraft owners may elect to utilize these facilities as well. There are typically many T-hangar units "nested" within a single structure. There are 36 T-hangar units at the airport. For determining future aircraft storage needs, a planning standard of 1,200 square feet per based aircraft is utilized for T-hangars.

Executive box hangars are open-space facilities with no interfering supporting structure. Executive box hangars can vary in size and can either be attached to others or be standalone hangars. Typically, executive box hangars will house larger multi-engine, turboprop, or jet aircraft. For future planning, a standard of 2,500 square feet per aircraft is utilized for box hangars.

Conventional hangars are the familiar large hangars with open floor plans that can store several aircraft. At Lawrence Municipal Airport, there are four conventional hangars: two occupied by Hetrick Air Services, one by Stuber Research, and one by the University of Kansas. For future planning needs, 2,500 square feet per aircraft is utilized for conventional hangars.

The City owns three sets of T-hangars, each of which has 10 individual storage spaces. T-hangar facility "A" has seven occupied positions and three available for lease (one of the three the City currently maintains for equipment storage). T-Hangar "B" has two units available for lease, while two of the units currently store two planes each. T-Hangar "C" is fully occupied, including one unit with two aircraft. Five of the six Port-a-Ports are occupied with the City, utilizing the sixth for storage. It is estimated that there are 63 possible enclosed aircraft storage spaces with 58 of those spaces currently occupied. Table 1J previously showed the current hangar occupancy levels. Therefore, there are three readily available T-hangar units available at the airport.

10MP07-3E-10/01/10




AVAILABLE	SHORT TERM	LONG TERM
	RUNWAYS	
Runway 15-33	**Runway 15-33**	**Runway 15-33**
ARC C-II	ARC C-II	D-II
5,700' x 100'	Up to 6,300' x 100'	7,000' x 100' if possible
40,000# SWL	Maintain	75,000# SWL
60,000# DWL	Maintain	90,000# DWL
Standard RSA, OFA, OFZ, POFZ	Maintain	Maintain
Standard RPZ (33)/ RPZ (15) Easements	Purchase Rwy 15 RPZ	Maintain
Precision marking (33)	Maintain	Maintain
Non-precision marking (15)	Precision Marking (with improved approach)	Maintain
MIRL	Maintain	Maintain
Runway 1-19	**Runway 1-19**	**Runway 1-19**
ARC B-I	Maintain	ARC B-II (potential)
3,901' x 75'	Maintain	4,400' x 75'
12,500# SWL	Maintain	30,000# SWL
15,600# DWL	Maintain	40,000# DWL
Standard RSA, OFA, OFZ	Maintain	Maintain
RPZ Easements	Purchase RPZ's	Maintain
Basic Marking	Maintain	Non-precision marking (with improved approach)
MIRL	Maintain	Maintain
	TAXIWAYS	
Centerline marking	Maintain	Maintain
35' wide (Taxiway C 40' wide)	Maintain	Uniform 35' wide
Taxiway A Full Parallel	Maintain	Maintain
Taxiway D Partial Parallel	Taxiway D Full Parallel	Maintain
MITL (Reflectors on Taxiway D)	Full MITL	Maintain
	NAVIGATIONAL AIDS	
ASOS, Segmented Circle, 1 lighted and 2 supplemental windcones	2 additional supplemental windcones	Maintain
Runway 15-33	**Runway 15-33**	**Runway 15-33**
CAT I ILS Rwy 33	Maintain	Maintain
LPV GPS Rwy 33	Maintain	Maintain
LNAV GPS Rwy 15 (1 mi. visibility/509'ceilings)	Consider LPV Approach, if feasible	Maintain
Runway 1-19	**Runway 1-19**	**Runway 1-19**
VOR/DME-A circling (1 mile visibility / 647'ceiling)	GPS Straight-In, if feasible	Maintain
	VISUAL AIDS	
Rotating Beacon	Maintain	Maintain
Runway 15-33	**Runway 15-33**	**Runway 15-33**
PAPI-4L (Rwy 15)	Maintain	Maintain
PAPI-4R (Rwy 33)	Maintain	Maintain
MALSR (33)	Maintain	Maintain
REIL (NA)	REIL (Runway 15)	Maintain
Runway 1-19	**Runway 1-19**	**Runway 1-19**
PAPI-2L	Maintain	Maintain
REIL	Maintain	Maintain

KEY

- **RSA** - Runway safety area
- **OFA** - Object free area
- **OFZ/POFZ** - Obstacle free zone/presicion obstacle free zone
- **RPZ** - Runway protection zone
- **PAPI** - Precision Approach Path Indicator
- **GPS** - Global Positioning System
- **DME** - Direction Measuring Equipment
- **VOR** - Very-High Frequency Omni-Directional Radar
- **REIL** - Runway End Identification Lights
- **MIRL** - Medium Intensity Runway Lighting
- **MITL** - Medium Intensity Taxiway Lighting
- **ASOS** - Automated Surface Observation System
- **MALSR** - Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
- **ARC** - Airport Reference Code
- **SWL** - Single Wheel Loading

City of Lawrence KANSAS

Exhibit 3E
AIRFIELD REQUIREMENTS

Table 3M presents the aircraft storage needs based on the demand forecasts. Assumptions have been made on owner preferences for a storage type based on trends at general aviation airports. For example, as more individual hangars become available, it is presumed that owners currently storing their aircraft in a bulk storage conventional hangar may transition to their own hangar. It is also assumed that helicopters, jets, and turboprops will be stored in conventional or box hangars. Tie-down aircraft are assumed to be single engine piston powered.

TABLE 3M
Hangar Needs
Lawrence Municipal Airport

	Currently Available	Short Term	Intermediate Term	Long Term	Total Need Less Current Supply
Based Aircraft	60	65	75	90	
Aircraft to be Hangared	58	63	73	87	29
T-Hangar Positions	36	45	52	61	25
Box Hangar Positions	9	9	11	13	4
Conventional Hangar Positions	18	9	10	13	0
Hangar Area Requirements					
T-Hangar Area	41,600	54,000	62,000	73,000	31,400
Box Hangar Area	18,300	23,000	27,000	33,000	14,700
Conventional Hangar Area	35,900	22,000	25,000	32,000	0
Total Storage Area (s.f.)	**95,800**	**99,000**	**114,000**	**138,000**	**46,100**
Maintenance Area	22,900	11,000	13,000	16,000	0

Source: Coffman Associates analysis.

A portion of executive box and conventional hangars often are utilized for maintenance activities or for office space. A planning standard of 175 square feet per based aircraft is considered for these purposes and is considered in addition to the aircraft storage needs.

It is estimated that there is 95,800 square feet of hangar storage space available currently. In the short term, there is a forecast need for an additional 12,400 square feet of T-hangar space and at least nine T-hangar positions. By the long term planning period, a total of an additional 31,400 square feet of T-hangar space is forecast as needed. Approximately 4,700 feet of additional executive box hangar space is needed in the short term and 14,700 square feet by the long term. The long term need for conventional hangar space is forecast to decline due to the natural transition of aircraft from bulk conventional hangar storage to individual units, as they become available.

It should be noted that the hangar requirements are general in nature and are based on standard hangar size estimates. If a private developer constructs a large hangar to house one plane, any extra space in that hangar may not be available for other aircraft. The actual hangar area needs will be dependent on the usage within each hangar.

AIRCRAFT PARKING APRON

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. 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 hangars and at other locations around the airport. The apron layout at Lawrence Municipal Airport follows this typical pattern.

The apron to the north of the terminal building is approximately 30,000 square yards in size. Approximately 10,000 square yards is designated for aircraft circulation and the remaining portions are divided evenly between local tie-down and transient spaces. There are 26 tie-down positions for locally based small aircraft. There are ten transient positions designated for use by small and large aircraft. A small apron is located between the two FBO hangars which encompasses approximately 1,700 square yards of pavement. Most of this is used for transport of aircraft into and out of the hangars, but the edge can be used for small aircraft parking. The west apron encompasses approximately 10,900 square yards of pavement. This pavement is in poor condition and exclusively serves the private hangars located in the area.

FAA Advisory Circular 150/5300-13, *Airport Design*, suggests a methodology by which transient apron requirements can be determined from knowledge of busy-day operations. At Lawrence Municipal Airport, the number of itinerant spaces required is estimated at 13 percent of the busy-day itinerant operations (107 x 0.13). This results in a current need for 14 itinerant aircraft parking spaces. Of these, 12 should be for small aircraft and two should be for turboprops and business jets. By the long term planning period, 20 spaces are estimated to be needed, with 16 identified for small aircraft and four for larger planes.

A planning criterion of 800 square yards per aircraft was applied to determine future transient apron area requirements for single and multi-engine aircraft. For turboprops and business jets (which can be much larger), a planning criterion of 1,600 square yards per aircraft position was used. The current need for transient apron area is 12,800 square yards. By the long term planning period, approximately 19,200 square yards is necessary.

For planning purposes, 80 percent of transient spaces are estimated to be needed for non-jet aircraft, which is in line with airport activity levels. This results in a current need for three designated large aircraft spaces. By the long term planning period, there is a need for a total of four large aircraft spaces.

An aircraft parking apron should provide space for the number of locally based aircraft that are not stored in hangars, transient aircraft, and for maintenance activity. For local tie-down needs, an additional ten spaces are identified for maintenance activity. Maintenance activity would include the movement of aircraft into and out of hangar facilities and temporary storage of aircraft on the ramp. Currently, a total of 12 local positions are needed (two based plus ten additional). Total apron parking requirements are presented in **Table 3N**.

TABLE 3N
Aircraft Apron Requirements
Lawrence Municipal Airport

			FORECAST		
	Currently Available (2010)	Calculated Need (2010)	Short Term	Intermediate Term	Long Term
Local Apron Positions	26	12	12	12	13
Local Apron Area (s.y.)	11,700	8,000	8,000	8,000	8,000
Transient Apron Positions	10	14	15	16	20
Piston Transient Positions	5	11	12	13	16
Turbine Transient Positions	5	3	3	3	4
Transient Apron Area (s.y.)	10,000	13,300	14,500	15,700	19,200
Central Circulation Apron	10,000	10,000	10,000	10,000	10,000
Total Apron Area (s.y)	31,700	31,300	32,500	33,700	37,200

Note: The west area apron encompasses 10,900 s.y but is not included in these calculations.

The portion of the apron designated for local tie-down is approximately twice as large as it needs to be through the long term planning period. The transient apron is half as large as it needs to be. By the long term planning period, an additional 5,500 square yards of terminal area apron pavement is needed to meet forecast demand.

Event Driven Apron Needs

The airport experiences periodic spikes in aircraft parking needs. The most prominent of these times is the annual NASCAR race weekend in October at the Kansas Speedway. The airport FBO indicated that on race weekends, the existing ramp can be full and overflow aircraft are parked on the west ramp or on the closed taxiway. NASCAR has announced that the Kansas Speedway will host a second annual race weekend in June beginning in 2011. In addition, construction is currently underway on a Hollywood branded casino that will overlook turn two of the race track. This could increase transient activity on a year-round basis.

At times, the airport experiences overflow aircraft parking needs associated with KU athletic events as well.

There are two potential businesses considering establishing a significant presence at the airport. The first is an airframe manufacturer of aircraft prototypes that is a designated aircraft representative (DAR). A DAR is an individual or company that is certified by the FAA to perform certain FAA functions, particularly related to experimental aircraft. Common functions are:

- Issue airworthiness certificates for Experimental Amateur-Built (EAB) aircraft.
- Issue airworthiness certificates for Experimental Light-Sport aircraft (ELSA).
- Issue airworthiness certificates and production flight-test permits for Special Light-Sport Aircraft (SLSA) and;
- Perform FAA conformity inspections for prototype parts used in FAA design approval programs, including type certification (TC), supplemental type certification (STC), parts manufacturer approval (PMA), and technical standard orders (TSO).

Preliminary discussions with the DAR representatives have indicated a desire to construct a 40,000 square foot hangar. The hangar would be located to the southeast of the terminal building. An apron and access taxilane would need to be constructed to be constructed as well. The DAR representatives have also indicated a desire to build "green" by generating their own electricity with a wind turbine and through other "green" building techniques. The DAR plans to utilize the tax benefits of the newly created Foreign Trade Zone (FTZ).

The second business considering locating at Lawrence Municipal Airport is a transmission/power line inspection company. The company has three helicopters and seven fixed wing aircraft that would be based at the airport. They are considering constructing a 20,000 square-foot hangar in the same general southeast location as the DAR. Again, an apron and taxilane would need to be constructed.

TERMINAL BUILDING FACILITIES

General aviation terminal facilities have several functions. Space is required for a pilots' lounge, flight planning, concessions, management, and storage. More advanced airports will have leasable space in the terminal building for such features as a restaurant, FBO line services, and other needs. This space is not necessarily limited to a single, separate terminal building, but can include space offered by FBOs in their hangars for these functions and services.

The methodology used in estimating general aviation terminal facility needs is based on the number of airport users expected to utilize general aviation facilities during the design hour. General aviation space requirements were then based upon providing 120 square feet per design hour itinerant passenger. Design hour itinerant passengers are determined by multiplying design hour itinerant operations by the number of passengers on the aircraft (multiplier). An increasing passenger count (from 1.9 to 2.3) is used to account for the likely increase in the number of passengers utilizing general aviation services. **Table 3P** outlines the general aviation terminal facility space requirements for Lawrence Municipal Airport.

TABLE 3P
General Aviation Terminal Area Facilities
Lawrence Municipal Airport

	Existing	Short Term	Intermediate Term	Long Term
Design Hour Operations	23	25	27	32
Design Hour Itinerant Operations	13	14	16	19
Multiplier	1.9	2.0	2.1	2.3
Total Design Hour Itinerant Passengers	25	29	33	43
General Aviation Building Space (s.f.)	9,000	3,000	4,000	5,000

The terminal building at Lawrence Municipal Airport, constructed in 1986, provides approximately 9,000 square feet of space. This includes space leased by the FBO for line services and pilot supplies. The facility itself is adequate through the long term planning period.

Interviews with the FBO indicated a desire to connect the terminal building (and line services) to the FBO hangar and offices. Currently, customers must walk outside in order to get to the FBO hangar. The FBO would like to cover the walkway in some fashion.

The airport terminal building is the entrance to the community for most air passengers utilizing the airport. It should be assumed that these passengers include decision-makers who may be considering investment in the community. Therefore, it is recommended that the airport sponsor be cognizant of the appearance of the airport and the terminal building in particular.

SUPPORT REQUIREMENTS

Various facilities that do not logically fall within classifications of airside or landside facilities have also been identified. These other areas provide certain functions related to the overall operation of the airport.

AUTOMOBILE PARKING

Planning for adequate automobile parking is a necessary element for any airport. Parking needs can effectively be divided between transient airport users and locally based users. Transient users include those employed at the airport and visitors, while locally based users primarily include those attending to their based aircraft. A planning standard of 1.9 times the design hour passenger count provides the minimum number of vehicle spaces needed for transient users. Locally based parking spaces are calculated as one-half the number of based aircraft.

At Lawrence Municipal Airport, there are approximately 60 vehicle parking spaces available near the terminal building. There are approximately 25 parking spaces in the west terminal area. Each of the airport business hangars has vehicle parking available.

A planning standard of 315 square feet per space is utilized to determine total vehicle parking area necessary, which includes area needed for circulation and handicap clearances. Parking requirements for the airport are summarized in **Table 3Q**.

TABLE 3Q
GA Vehicle Parking Requirements
Lawrence Municipal Airport

	Existing	Short Term	Intermediate Term	Long Term
Design Hour Itinerant Passengers	25	29	33	43
GA Itinerant Spaces	60	52	60	77
GA Based Spaces	25	33	38	45
Itinerant Parking Area (s.f.)	16,500	16,000	19,000	24,000
GA Based Parking Area (s.f.)	14,000	10,000	12,000	14,000
Total GA Parking Area (s.f.)	30,500	26,000	31,000	38,000
Total Parking Spaces	85	85	97	122

There appears to be enough designated vehicle parking through the short term planning period. By the intermediate and long term planning period, additional spaces are needed. Parking should be made available in close proximity to the terminal building and airport businesses. In an effort to limit the level of vehicle traffic on the aircraft movement areas, many general aviation airports are providing separate parking in support of facilities with multiple aircraft parking positions, such as T-hangars. Vehicle parking spaces will be considered in conjunction with additional facility needs in the alternatives chapter.

AIRCRAFT RESCUE AND FIREFIGHTING (ARFF) FACILITIES

Only those airports that are certificated under Title 14 Code of Federal Regulations (CFR), Part 139, are required to have on-site firefighting capabilities. Lawrence Municipal Airport is not a Part 139 airport and, therefore, is not required to have onsite firefighting capabilities. Instead, the local fire department responds to airport emergencies. The closest fire station is south of the Kansas River near the central business district.

FUEL STORAGE

The airport has two aboveground fuel storage tanks. A 12,000-gallon tank is dedicated to Jet A fuel and a 10,000-gallon tank is dedicated to AvGas. In addition, the FBO has truck storage capability of 3,400 gallons of Jet A and 2,400 gallons of AvGas. In total, the airport has a 15,400-gallon Jet A capacity and a 12,400-gallon AvGas capacity.

Additional fuel storage capacity should be planned when the airport is unable to maintain an adequate supply and reserve. While each airport (or FBO) determines their own desired reserve, a 14-day reserve is common for general aviation airports. When additional capacity is needed, it should be planned in 10,000 to 12,000 gallon increments. Common fuel tanker trucks have an 8,000-gallon capacity.

Table 3R presents the forecast of fuel demand through the planning period. Jet A fuel needs were forecast based on an average of 40 gallons purchased per air taxi operations. An additional 10 gallons per itinerant general aviation operations was assumed. For AvGas, five gallons per local operations was assumed.

TABLE 3R
Fuel Storage Requirements
Lawrence Municipal Airport

			Planning Horizon		
	Current Capacity	**Current Consumption (2009)**	**Short Term**	**Intermediate Term**	**Long Term**
Jet A Requirements	15,400				
Annual Usage (gal.)		152,710	275,210	299,240	353,490
Daily Usage (gal.)		418	754	820	968
14-Day Storage (gal.)		5,857	10,556	11,478	13,559
AvGas Requirements	12,400				
Annual Usage (gal.)		40,031	74,095	80,565	95,175
Daily Usage (gal.)		110	203	221	261
14-Day Storage (gal.)		1,535	2,842	3,090	3,651

Assumptions:
Jet A — 40 gallons per air taxi operation.
10 gallons per itinerant general aviation operation.
AvGas — 5 gallons per general aviation local operation.

Source: FBO fuel sales; Coffman Associates analysis

While the current capacity appears to be adequate to meet the operational needs of the airport, future operational activity levels could necessitate additional capacity needs. A summary of landside and support needs is presented on **Exhibit 3F**.

SUMMARY

The intent of this chapter has been to outline the facilities required to meet potential aviation demand projected for Lawrence Municipal Airport for the next 20 years. In an effort to provide a more flexible master plan, the yearly forecasts from Chapter Two have been converted to planning horizon levels. The short term roughly corresponds to a five-year time frame, 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.

The airport has been planned and designed to meet FAA design standards associated with ARC C-II. This includes most small and medium size business jets such as the Cessna Citation X, Dassault Falcon 900EX, and Bombardier Challenger 604. Operational trends at the airport indicate that a larger percentage of business jet activity is by larger aircraft. As a result, a future design standard associated with ARC D-II will be considered. Aircraft contributing to this design standard would be Lear models 45 and 60, Gulfstream IIs and IVs.

At 5,700 feet in length, Runway 15-33 meets the needs of 75 percent of the national business jet fleet at 60 percent useful load. Some aircraft within the critical aircraft family may require up to 7,000 feet when operating with heavy loads in hot conditions. The existing ALP shows a 400-foot extension to the south and indicates that barriers to the north and south limit any additional length. The alternatives chapter will examine the possibility of an ultimate runway length of 6,300 feet and determine what additional length could be accommodated. Ultimately, a need by one or several business jet operators for more runway length will be necessary to justify any runway extension.

Runway 1-19, at 3,901 feet in length meets the needs for a crosswind runway. There may be times when a backup runway could be beneficial for the airport. The alternatives chapter will consider improvements to Runway 1-19 that would accommodate ARC B-II aircraft. The potential for a runway length of 4,400 feet will be examined in this context.

On the landside, planning calculations show a need for additional hangars. Specifically, there is a need for T-hangars and executive box hangars. The airport actively maintains a hangar wait list, on which there are 38 aircraft owners.

The next chapter, Alternatives, will examine potential improvements to the airfield system. Most of the alternatives discussion will focus on those capital improvements that would require federal grant funds. Other projects of local concern will also be presented. On the landside, several facility layouts that meet the forecast demands over the next 20 years will be presented. Ultimately, an overall airport layout vision that is well beyond the 20-year scope of the master plan will be developed.

10MP07-3F-10/04/10

	Base Year (2010)	Short Term	Intermediate Term	Long Term
Based Aircraft	60	65	75	90
Aircraft to be tied down	2	2	2	3
AIRCRAFT TO BE HANGARED				
Single Engine	50	53	62	72
Multi-Engine	5	5	5	6
Turboprop	1	2	3	4
Jet	1	2	2	3
Rotor	1	1	1	2
Total to be Hangared	***58***	***63***	***73***	***87***
HANGAR POSITIONS				
T-Hangars Positions	36	45	52	61
Box Hangar Positions	9	9	11	13
Conventional Hangar Positions	18	9	10	13
HANGAR AREA				
T-Hangars (s.f.)	41,600	54,000	62,000	73,000
Box Hangar (s.f.)	18,300	23,000	27,000	33,000
Conventional Hangar (s.f.)	35,900	22,000	25,000	32,000
Maintenance Area (s.f.)	22,900	11,000	13,000	16,000
AIRCRAFT PARKING				
Local Apron Positions	26	12	12	13
Local Apron Area (s.y.)	11,700	8,000	8,000	8,000
Transient Apron Positions	10	15	16	20
Piston Transient Positions	5	12	13	16
Turbine Transient Positions	5	3	3	4
Transient Apron Area (s.y.)	10,000	14,500	15,700	19,200
Circulation Apron	10,000	10,000	10,000	10,000
Total Apron Area (s.y)	***31,700***	***32,500***	***33,700***	***37,200***
AUTO PARKING				
Spaces	85	85	97	122
Area (s.f.)	30,500	26,000	29,000	37,000
TERMINAL BUILDING				
Area (s.f.)	9,000	3,000	4,000	5,000

***Source**: Coffman Associates Analysis*

City of Lawrence KANSAS

Exhibit 3F
LANDSIDE REQUIREMENTS

Chapter Four

Alternatives

LAWRENCE MUNICIPAL AIRPORT

Chapter Four

Alternatives

In the previous chapter, airside and landside 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. There can be numerous combinations of design alternatives, but the alternatives presented here are those with the perceived greatest potential for implementation based on potential justification within the 20-year scope of this master plan.

Any development proposed for a master plan is evolved from an analysis of projected needs for a set period of time. Though the needs were determined by utilizing industry accepted statistical methodologies, unforeseen future events could impact the timing of the needs identified. The master planning process attempts to develop a viable concept for meeting the needs caused by projected demands for the next 20 years. However, no plan of action should be developed which may be inconsistent with the future goals and objectives of the City of Lawrence and its citizens, who have a vested interest in the development and operation of the airport.

The development alternatives for Lawrence Municipal Airport can be categorized into two functional areas: the airside (runways, taxiways, navigational aids, etc.) and landside (hangars, apron, and terminal area). 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 development and well-

AIRPORT MASTER PLAN

being of the region must be considered.

Each functional area interrelates and affects the development potential of the others. Therefore, all areas are examined individually and then coordinated as a whole to ensure the final plan is functional, efficient, and cost-effective. The total impact of all these factors on the existing airport must be evaluated to determine if the investment in Lawrence Municipal Airport will meet the needs of the community, both during and beyond the 20-year planning period.

The alternatives considered are compared using environmental, economic, and aviation factors to determine which of the alternatives will best fulfill the local aviation needs. With this information, as well as input from various airport stakeholders, a final airport concept can evolve into a realistic development plan.

AIRPORT DEVELOPMENT OBJECTIVES

Prior to identifying objectives specifically associated with development of Lawrence Municipal Airport, non-development alternatives are briefly considered. Non-development alternatives include a "no-build" alternative, the transfer of services to another existing airport, or the development of a new airport at a new location.

The Lawrence Municipal Airport plays a critical role in the economic development of the region and plays an important role in the continuity of the national aviation network. There is significant public and private investment at the airport. Pursuit of a non-development alternative would slowly devalue these investments, lead to infrastructure deterioration, and potentially lead to the loss of significant levels of federal funding for airport improvements. Ultimately, the safety of aircraft, pilots, and persons on the ground could be jeopardized. Therefore, the non-development alternatives are not further considered.

It is the goal of this effort to produce a balanced airside and an appropriate landside aircraft storage mix to best serve forecast aviation demands. However, before defining and evaluating specific alternatives, airport development objectives should be considered. As owner and operator, the City of Lawrence 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. With this in mind, the following development objectives have been defined for this planning effort:

- To preserve and protect public and private investments in existing airport facilities.
- To develop a safe, attractive, and efficient aviation facility in accordance with applicable federal, state, and local regulations.
- To develop a balanced facility that is responsive to the current and long term needs of all general aviation users.

- To be reflective and supportive of the long term planning efforts currently applicable to the region.

- To develop a facility with a focus on self-sufficiency in both operational and developmental cost recovery.

- To ensure that future development is environmentally compatible.

REVIEW OF PREVIOUS AIRPORT PLAN

The most recent set of aviation demand forecasts was developed for the airport in 2001. As discussed in the Forecast chapter of this master plan, there were 55 based aircraft in 2000. There were an estimated 31,350 operations in that same year. The Airport Layout Plan (ALP) was updated in late 2005 to reflect an extension of the primary runway and the construction of a parallel taxiway, Taxiway D, to Runway 1-19.

On the airside, the 2005 ALP considered a 400-foot extension to Runway 33 which would bring the total available runway length to 6,100 feet. The 2005 ALP also planned for the completion of parallel Taxiway D to the Runway 19 threshold. An additional exit taxiway was also planned between Taxiway A and Runway 15-33, approximately 1,900 feet from the current Runway 33 end.

On the landside, the 2005 ALP considered an expansion of the apron to the east that would parallel Runway 15-33. Facing this new apron are two large conventional hangars and two medium sized executive box hangars. Between the executive box hangars is an extension of the planned apron that would accommodate an additional six executive box hangars. Approximately 100,000 square feet of hangar space is shown. Additional T-hangar space was not shown on the ALP. The plan also provided space for potential expansion of the KU Aerospace Engineering hangar located in the west terminal area.

The 2005 ALP also identified areas of future property acquisition. This includes a portion of the future runway protection zone (RPZ) associated with Runway 33, once the runway is extended. The other areas of land acquisition are the current RPZs associated with both ends of Runway 1-19, for which the airport currently owns avigation easements. **Exhibit 4A** presents the 2005 ALP for the airport which will be updated based on the findings of this master plan.

AIRSIDE PLANNING CONSIDERATIONS

Generally, airside issues relate to those airport elements that contribute to the safe and efficient transition of aircraft and passengers from air transportation to the landside facilities at the airport. This includes the established design standard for the airport, the instrument approach capability, the capacity of the airfield, the length and strength of the runways, and the layout of the taxiways.

Each of these elements was introduced in the previous chapters. This chapter will examine airside issues specific to Lawrence Municipal Airport. These will then be presented in several airside development alternatives. **Exhibit 4B** presents a summary of the primary airside and landside elements to be considered in this alternatives analysis.

RUNWAY LENGTH

Runway 15-33 is 5,700 feet long and 100 feet wide. This length meets the Federal Aviation Administration (FAA) minimum recommended length of 5,500 feet to accommodate 75 percent of business jets at 60 percent useful load. As discussed in Chapter Three – Facility Requirements, additional runway length would be recommended if activity levels by certain types of business jets were to increase beyond the FAA threshold of 500 annual operations. For example, a runway length of 5,800 feet is recommended to accommodate 100 percent of business jets at 60 percent useful load. To accommodate 75 percent of business jets at 90 percent useful load, a runway length of 7,000 feet is recommended. Finally, an approximate runway length of 6,300 feet is recommended to accommodate business jets weighing more than 60,000 pounds. **Table 4A** presents a summary of the runway length demand indicators.

TABLE 4A
Runway Length Indicators
Lawrence Municipal Airport

Runway Length	FAA Demand Criteria*	Threshold	Example Aircraft Types
5,500'	75% of business jet fleet at 60% useful load	500 annual operations	Cessna 550, 560, 650; Beechjet 400; Falcon 50
5,800'	100% of business jet fleet at 60% useful load	500 annual operations	Cessna 750; Challenger 604; Hawker 800XP
6,300'	Business jets greater than 60,000 pounds	500 annual operations	Gulfstream II, IV, V; Global Express
7,000'	75% of business jet fleet at 90% useful load	500 annual operations	Cessna 550, 560, 650; Beechjet 400; Falcon 50

*FAA demand criteria must be documented to justify runway length.
Source: Coffman Associates analysis.

While the airport should plan for any reasonable increase in activity that would impact runway length, ultimately justification will be required before the airport would be eligible for FAA grant assistance for a runway extension. Planning for an extension of the runway will allow the airport sponsor to request a grant, should justification materialize, by having the extension on the approved ALP with the FAA. In addition, the airport sponsor will be able to more positively protect the long term viability of the airport by implementing appropriate land use controls based on the future airport configuration.

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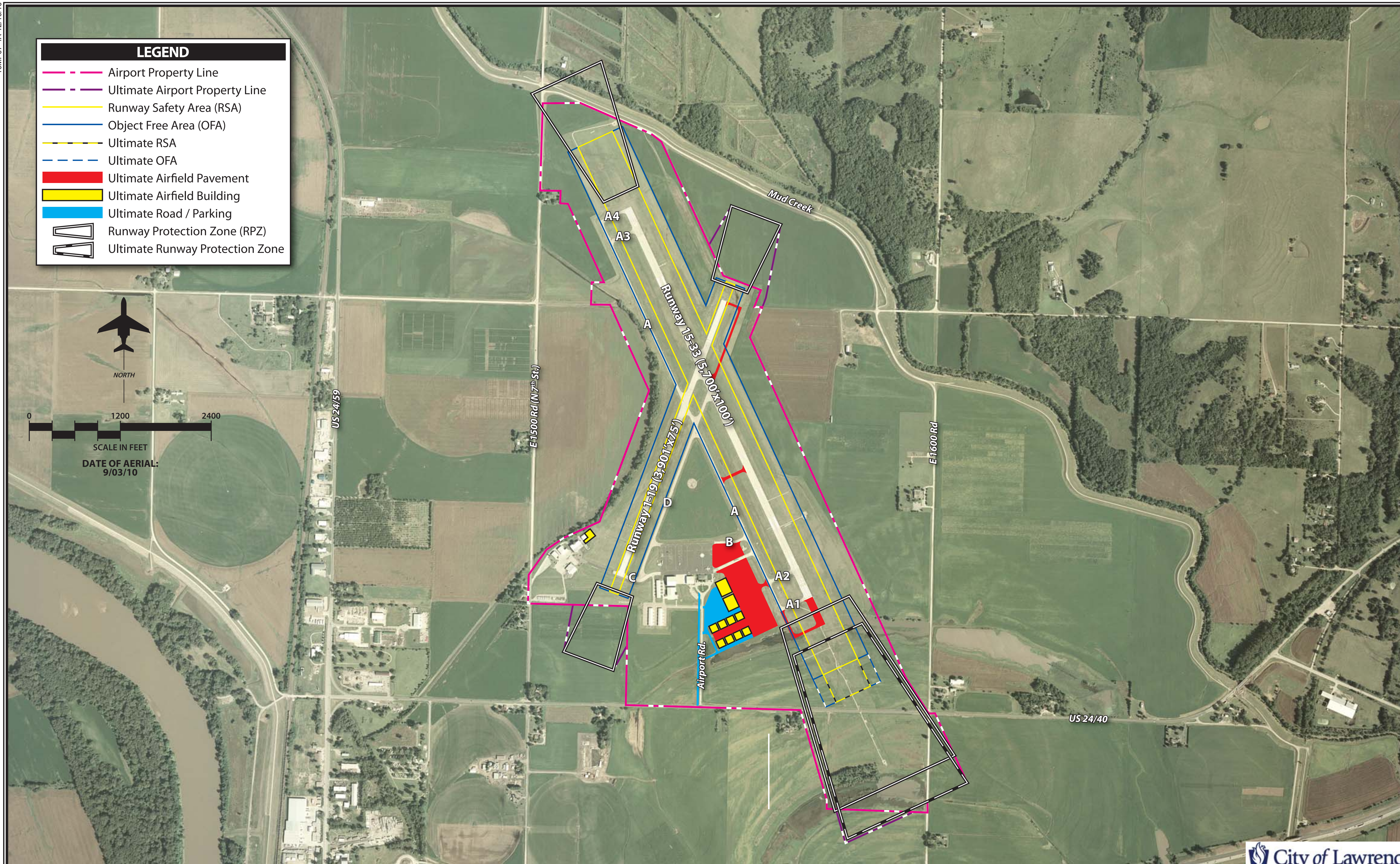

Exhibit 4A
2005 AIRPORT LAYOUT PLAN

10MP07-4B-11/30/10

AIRSIDE PLANNING CONSIDERATIONS

- Primary Runway Length: Examine impacts of increasing Runway 15-33 from 5,700′ up to 7,000′.
- Crosswind Runway Length: Examine impacts of increasing Runway 1-19 from 3,901′ up to 4,400′.
- Runway Safety Areas: Maintain adequate Runway Safety Area (RSA), Object Free Area (OFA), Obstacle Free Zone (OFZ), and Runway Protection Zones (RPZ).
- Taxiway Layout: Examine need for additional taxiways to improve safety and efficiency.
- Navigational Aids: Explore instrument approach improvements and navigational aid needs.

LANDSIDE PLANNING CONSIDERATIONS

- Separation of Activity Levels: Group planned facilities so that similar activity levels are logically grouped together.
- Facility Layout: Maximize airport property for aviation related development.
- Airport Land Uses: Identify areas of airport property to reserve for aviation and non-aviation development.
- Strategic Land Acquisition: Identify parcels necessary to support long term growth and protection of the airport.
- Surface Transportation Impacts: Potential need to shift U.S. Highway 24/40 to accomodate runway extension.

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Exhibit 4B
PLANNING CONSIDERATIONS

Runway 1-19 serves as the crosswind runway which is utilized approximately 30 percent of time. This runway is required to meet the FAA standard for providing at least 95 percent crosswind coverage at 10.5 knots for small aircraft in airport reference codes (ARC) A-I and B-I. At 3,901 feet in length, Runway 1-19 currently meets this requirement for 95 percent of these small aircraft. To accommodate 100 percent of small aircraft, a runway length of 4,000 feet is recommended.

As discussed in Chapter Three – Facility Requirements, there may be occasions when the primary runway is closed for an extended period of time. Typically, closure may occur due to runway rehabilitation or reconstruction. In an effort to limit the potentially negative economic consequences of closing the primary runway, a reasonable alternative is to consider a crosswind runway length that can accommodate a larger portion of airport traffic. A runway length of 4,400 feet would meet this potential need.

INSTRUMENT APPROACHES

Lawrence Municipal Airport has straight-in instrument approaches to both ends of Runway 15-33. Runway 33 has a CAT-I Instrument Landing System (ILS) approach that provides for visibility minimums as low as ½-mile and cloud ceilings as low as 200 feet. This is considered an all weather instrument approach. Associated with the ILS approach is a localizer approach with ½-mile visibility minimums and 429-foot cloud ceilings.

The ground-based equipment necessary for an ILS approach is significant and includes an approach lighting system, the localizer antenna, and a glide slope antenna. At Lawrence Municipal Airport, this equipment was installed and is maintained by the Facilities and Equipment (F&E) division of the FAA. With the advent of global positioning system (GPS) satellite navigation, F&E rarely funds new installations of ILS approaches.

What is more common is the development of GPS based instrument approaches that rely on the constellation of GPS satellites and not on expensive ground-based systems. The most sophisticated GPS approaches are LPV (localizer performance with vertical guidance) approaches. Lawrence Municipal Airport has a stand-alone LPV approach to Runway 33 that provides CAT-I minimums.

Runway 15 has a GPS instrument approach that provides visibility minimums of 1-mile and cloud ceilings of 509 feet. If feasible, a CAT-I LPV approach should be planned to the Runway 15 end.

The current instrument approaches to Lawrence Municipal Airport are approved for use by aircraft in approach categories A, B, and C, but not large business jets in approach category D. This category includes several Lear and Gulfstream jet models. These aircraft types do currently operate at the airport, presumably in visual conditions. Instrument approaches that include approach category D should be requested of the FAA by the airport sponsor.

Runway 1-19 is a visual runway meaning visibility must be above three miles and cloud ceilings must be above 1,000 feet for aircraft to operate to the runway. With advancements in avionics, it is common today for even small aircraft to have GPS capability. GPS instrument approaches with visibility minimums of 1-mile will be planned to both ends of Runway 1-19 whether this runway is maintained for small aircraft (ARC A-I and B-I) or if it is ultimately planned to accommodate ARC B-II aircraft as well.

AIRSIDE DEVELOPMENT ALTERNATIVES

The following section presents development alternatives for the runway and taxiway environment. Each runway is considered individually and any recommendations will be combined into a single master plan concept to be presented in Chapter Five.

RUNWAY 15-33 ALTERNATIVES

The primary airside consideration for Runway 15-33 is related to a runway extension. The Lawrence Municipal Airport receives activity from the full range of business jets, including some of the largest and heaviest in the national fleet. Justification for any runway extension must be documented by evidence of at least 500 annual operations by critical aircraft or critical family of aircraft. Currently, the airport does have documentation of 500 annual operations by business jets in the zero to 75 percent category, thereby justifying the current runway length.

Any planned extension of Runway 15-33 will likely have to be considered on the Runway 33 end only. An extension of Runway 15 would place the object free area (OFA) and runway safety area (RSA) (depending on extension length) over the Mud Creek levee. In order to meet the design standards for the OFA and RSA surrounding an extension, the levee would have to be shifted. An extension to the north would also make an improved instrument approach more problematic as the terrain could become a penetration to the approach surfaces. Therefore, planning for an extension will be considered for the Runway 33 end.

The first extension to be considered is adding 100 feet to the runway for a total length of 5,800 feet. This length would meet the recommended length to accommodate 100 percent of business jets at 60 percent useful load. While there is adequate space to add 100 feet to the Runway 15 end before the RSA encroaches upon the localizer antenna, the OFA would extend into the levee. Under certain conditions, the FAA will allow a non-standard OFA (but not RSA), but they would not support building into such a condition. Shifting the levee to accommodate a 100-foot extension would likely not meet a benefit-cost analysis. Therefore, even this modest extension of Runway 15 is not considered further.

A 100-foot extension of Runway 33 is more feasible as the RSA and OFA would still meet design standard. The runway and taxiway extension could also be accomplished with minimal physical impact. The impacts that could outweigh the benefits of a 100-foot extension would be the potential wetland impact, cost to relocate the approach lighting system, and the cost and time to develop new instrument approaches. The benefit of an additional 100 feet on the Runway 33 end is likely minimal when compared to the cost of construction.

Exhibit 4C presents three potential extensions of Runway 33. Option One considers the maximum extension possible without impacting U.S. Highway 24/40. A 400-foot extension would provide a total length of 6,100 feet while maintaining the RSA and OFA to standard. The wetland would be impacted by the extension of Taxiway A to the new runway end. The approach lighting system would need to be shifted and new approaches would need to be developed. An additional 400 feet is more likely to meet a benefit-cost analysis than a 100-foot extension.

A 400-foot extension would push the RPZ further to the south by 400 feet. The southwest corner of the RPZ, approximately six acres, would then extend off airport property. This property would need to be acquired.

Option Two on the exhibit considers a 600-foot extension of Runway 33. This extension would meet the recommended length of 6,300 feet to accommodate business jets weighing more than 60,000 pounds. The RSA and OFA would extend over U.S. Highway 24/40, necessitating relocation of this road. As shown on the exhibit, the road is planned to then be shifted slightly to the south in order to remain outside the RSA and OFA. An extension of 600 feet would also impact the wetland and the approach lighting system would need to be relocated and new instrument approaches developed.

Option Three examines the impacts of extending Runway 33 by 1,300 feet for a total length of 7,000 feet, which is recommended to accommodate 75 percent of business jets at 90 percent useful load. As discussed previously, planning runway length around the 90 percent useful load category would require justification, such as regular cargo operations or frequent international flights. Neither of these scenarios are anticipated; nonetheless, the potential impacts are presented for informational purposes.

Approximately 4,800 feet of U.S. Highway 24/40 would need to be relocated outside the RSA and OFA. The road shift may need to be even greater as an oxbow pond would be impacted and possibly a designated wetland. One farmhouse would fall under the RPZ and the RPZ would extend slightly over Interstate 70. As with the other extension alternatives, the on-airport wetland would be impacted by the extension of Taxiway A.

RUNWAY 1-19 ALTERNATIVES

Runway 1-19 currently meets the design standards (ARC B-I), including runway length and safety areas for a crosswind runway. This alternatives analysis presents the possibility of improving the crosswind runway to a length of 4,400 feet, which is intended to accommodate aircraft in ARC B-II. Planning to ARC B-II standards would allow this runway to serve a greater percentage of aircraft, including some business jets, during those times when the primary runway is closed.

Option One on **Exhibit 4D** shows a 500-foot extension of Runway 1. The extension would extend onto property not owned by the airport, necessitating acquisition of the property. Threshold taxiways are then planned to each side of the new runway end. The RSA surrounding the runway would increase from 120 feet wide to 150 feet wide, and the length beyond the runway ends would increase from 240 feet to 300 feet.

Option Two considers placing the 500-foot runway extension on the north end of the runway. Initial analysis indicates that the approach surface leading the new runway end would clear any potential obstructions, including the Mud Creek levee.

Taxiway D is the partial parallel taxiway to Runway 1-19, extending from the Runway 1 threshold and terminating at the intersection with Runway 15-33. Approximately 900 feet of Runway 19 is accessible only by back-taxiing. Back-taxiing, or utilizing the runway for taxiing purposes, is discouraged as aircraft remain on the active runway for a longer period of time, thereby increasing the potential for runway incursions. The remaining 1,000 feet of Taxiway D is planned to be constructed to alleviate this potential safety issue.

AIRSIDE SUMMARY

The airside alternatives presented are those that could possibly be justified within the 20-year planning scope of this master plan. At a minimum, the airport should plan for an extension of Runway 15-33 to the southeast. An extension of 400 feet would maintain the RSA and OFA on airport property and would not impact U.S. Highway 24/40. Approximately six acres of RPZ property would need to be acquired.

Any extension beyond 400 feet would require U.S. Highway 24/40 to be shifted. A 600-foot extension was considered, but would only be justified if the critical design aircraft transitioned to a business jet weighing more than 60,000 pounds. These types of aircraft do currently operate at the airport, but on a very infrequent basis.

Runway 1-19 currently meets design standards for a crosswind runway. The alternatives considered improvements to this runway, including a 500-foot extension to accommodate a larger percentage of aircraft, including some smaller business jets. This improvement may be desired in order to lessen the economic impacts of the primary runway being closed for a period of time, typically due to reconstruction. This runway would still be intended for aircraft weighing less than 12,500 pounds.

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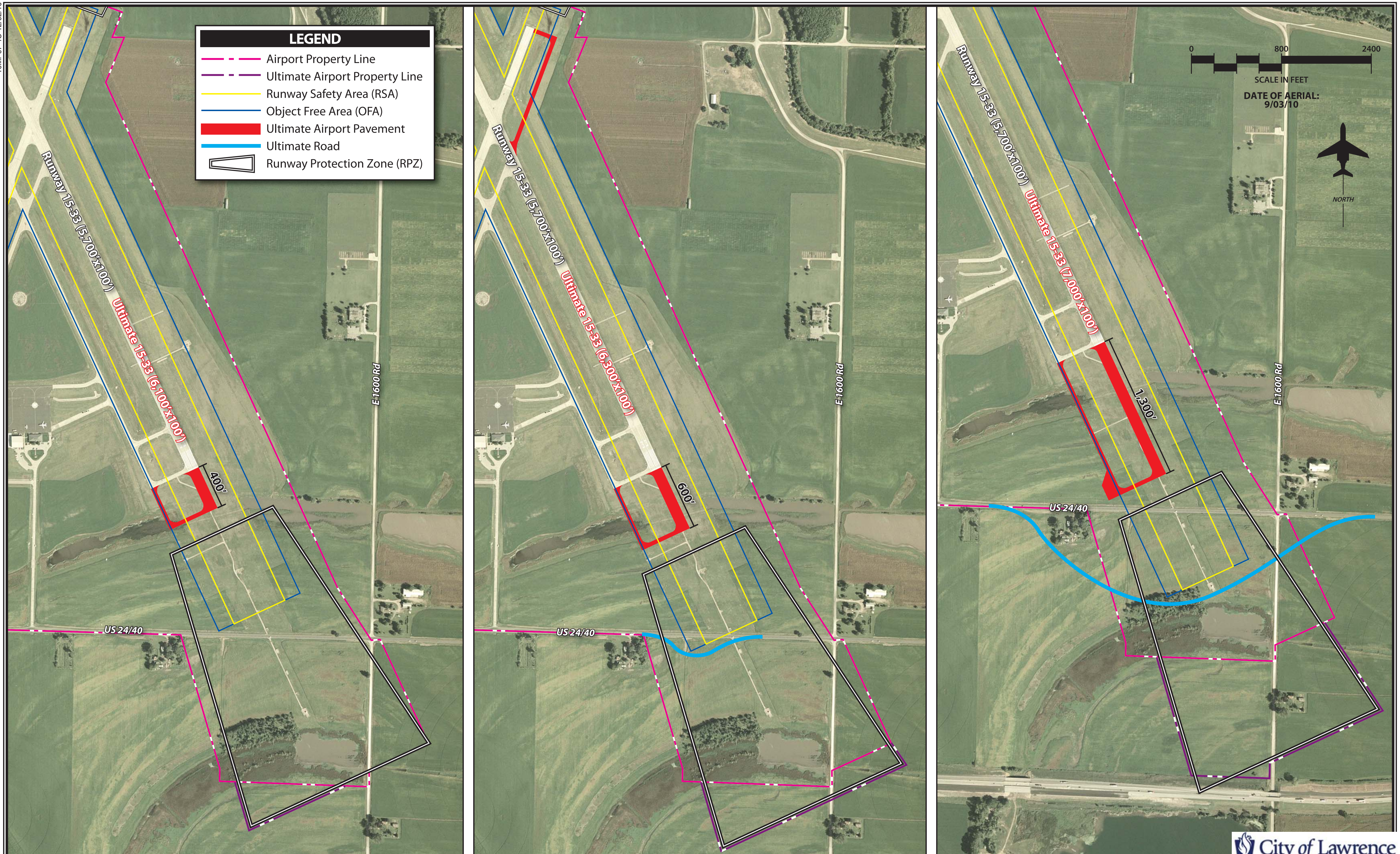
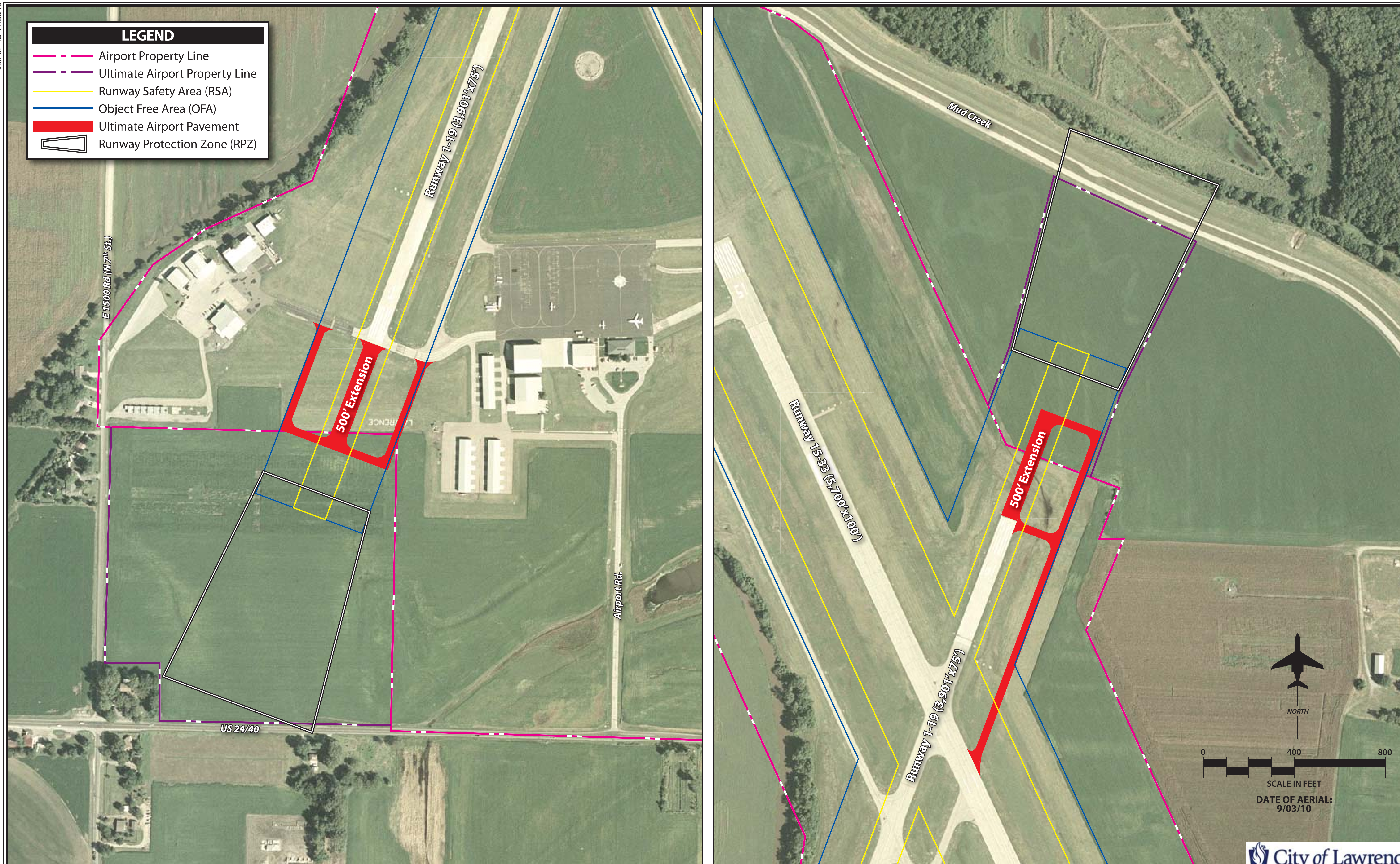


City of Lawrence KANSAS

Exhibit 4C
AIRSIDE ALTERNATIVES I

10MP07-4D-11/30/10



City of Lawrence KANSAS

Exhibit 4D
AIRSIDE ALTERNATIVES II

LANDSIDE PLANNING CONSIDERATIONS

Generally, landside issues relate to those airport facilities necessary, or desired, for the safe and efficient parking and storage of aircraft, movement of passengers and pilots to and from aircraft, airport land use, and overall revenue support functions. In addition, elements such as fueling capability, availability of services, and emergency response are also considered in the landside functions.

Landside planning issues, summarized on **Exhibit 4B**, will focus on facility locating strategies following a philosophy of separating activity levels. To maximize airport efficiency, it is important to locate facilities intended to serve similar functions. For example, it makes sense to plan T-hangar structures in a designated area rather than haphazardly building them as needed on the next available spot at the airport. It is also important to plan for facilities that are desired and to group those facilities together, whether they be T-hangars, executive box hangars, or 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 the 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.

Activity in the terminal area should be divided into three categories at an airport. The high-activity area should be planned and developed as the area providing aviation services on the airport. An example of a high-activity area is the aircraft parking apron, which provides outside storage and circulation of aircraft. In addition, large conventional hangars housing fixed base operators (FBOs), other airport businesses, or that used for aircraft storage would be considered high-activity uses. A conventional hangar structure in the high-activity area should be a minimum of 6,400 square feet (80 feet by 80 feet). If space is available, it is more common to plan these hangars for up to 200 feet by 200 feet. The best location for high-activity areas is along the flight line near midfield, for ease of access to all areas of the airfield.

The medium-activity category defines the next level of airport use and primarily includes corporate aircraft operators that may desire their own executive or conventional hangar storage on the airport. A hangar in the medium-activity use area should be at least 50 feet by 50 feet, or a minimum of 2,500 square feet. The best location for medium-activity use is set back from the immediate flight line, but still with ready access to the runway/taxiway system. Typically, these areas will be adjacent to the high-activity areas. 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 twin-engine aircraft. Low-activity users are personal or small business aircraft owners who prefer individual space in T-hangars or small executive box hangars. Low-activity areas should be located in less conspicuous areas or to the ends of the flight line. This use category will require electricity, but may not require water or sewer utilities.

In addition to the functional compatibility of the terminal area, the proposed development concept should provide a first-class appearance for Lawrence Municipal Airport. Consideration to aesthetics should be given high priority in all public areas, as the airport can many times serve as the first impression a visitor may have of the community.

The existing terminal area at Lawrence Municipal Airport has, for the most part, followed the separation of activity levels philosophy. The terminal building faces a central ramp area with hangar areas located to the sides. Larger, high-activity hangars are immediately adjacent to the main apron, and lower-activity executive box and T-hangars are set farther to the sides.

Ideally, terminal area facilities at general aviation airports should follow a linear configuration parallel to the runways. The linear configuration allows for maximizing available space, while providing ease of access to terminal facilities from the airfield. Each landside alternative will address development issues, such as the separation of activity levels and efficiency of layout. Each of the landside alternatives will address the forecast needs from the previous chapter of this plan.

VEHICULAR ACCESS AND PARKING

A planning consideration for any airport master plan is the segregation of vehicles from aircraft operational areas (AOA). This is both a safety and security consideration for the airport. Aircraft safety is reduced and accident potential increased when vehicles and aircraft share the same pavement surfaces. Vehicles contribute to the accumulation of debris on aircraft operational surfaces, which increases the potential for foreign object debris (FOD) damage, especially for turbine-powered aircraft. The potential for runway incursions is increased, as vehicles may inadvertently access active runway or taxiway areas if they become disoriented. The greatest concern is for public vehicles, such as delivery vehicles and visitors, which may not fully understand the operational characteristics of aircraft and the markings in place to control vehicle access. The best solution is to provide dedicated vehicle access roads to each landside facility that is separated from the aircraft operational areas with security fencing.

The segregation of vehicle and aircraft operational areas is supported by FAA guidance established in June 2002 and amended in March 2008. FAA AC 150/5210-20, *Ground Vehicle Operations on Airports*, states, "The control of vehicular activity on the airside of an airport is of the highest importance." The AC further states, "An airport operator should limit vehicle operations on the movement areas of the airport to only those vehicles necessary to support the operational activity of the airport."

The landside alternatives for Lawrence Municipal Airport have been developed to reduce the need for vehicles to cross apron or taxiway areas. Dedicated vehicle parking areas, which are outside the airport fence line, are considered for all potential hangars. Nested T-hangars, which do not traditionally have dedicated vehicle parking, should, at a minimum, be planned with dedicated and secure vehicle access points to reduce the potential for a vehicle to be diverted onto the aprons or runway/taxiway system.

BUILDING RESTRICTION LINE

The building restriction line (BRL) identifies suitable building areas on the airport. The BRL encompasses the RPZs, the OFA, the runway visibility zone, navigational aid critical areas, areas required for terminal instrument procedures, and other areas necessary for meeting airport line-of-sight requirements.

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. As a general aviation airport supporting business jet operations, Runway 15-33 is classified as "other-than-utility," while Runway 1-19 is a utility runway intended for aircraft weighing less than 12,500 pounds. The instrument approach provides for CAT-I visibility minimums for Runway 15-33 and visual approaches for Runway 1-19.

The BRL is the product of F.A.R. Part 77 transitional surface clearance requirements. These requirements stipulate that no object be located in the primary surface, defined as being no closer than 250 feet from a visual runway and no closer than 500 feet to a runway served by a non-precision or precision instrument approach. From the primary surface, the transitional surface extends outward at a slope of one vertical foot to every seven horizontal feet. Traditionally, the BRL is set at a point where the transitional surface is 35 feet above runway elevation. For a visual runway or utility runway with non-precision instrument approaches, this distance is 495 feet from the centerline. For a non-precision and precision instrument runway, this dimension is 745 feet from the runway centerline. It should be noted that structures can be located between the BRL and the primary surface as long as the highest point of the structure is not a penetration to the 7:1 transitional surface.

TERMINAL BUILDING

The existing terminal building is a significant asset for the airport. The facility is ideally located facing the transient aircraft apron. The FBO leases the service counter and office space in the terminal building providing visitors with quick and immediate access to airport services. The terminal building is in excellent condition, as the City has made continuous maintenance investments since the building's construction in 1986.

The Facility Requirements chapter of this master plan indicated that the terminal building meets the minimum standard for square footage. A large atrium area provides plenty of natural light and lounge space. There does not appear to be a need to redesign the layout of the interior of the facility.

The main FBO offices and hangar are located to the immediate west of the terminal building. Aircraft operators doing business with the FBO will often walk outside between the two buildings. An amenity that might be considered is the construction of a covered walkway or enclosed hallway to connect the two facilities.

Some communities are able to support additional services, such as a restaurant within terminal buildings. When successful, an airport restaurant can drive additional transient aviation traffic and can become a destination for community residents. Goodwill with the community tends to develop as people who might not otherwise have a reason to come to the airport begin to visit more often.

The existing terminal building is not designed to accommodate a modern restaurant facility. A logical location for expansion would be to the east. An expansion of the terminal building (or construction of any non-aviation business at the airport) cannot occupy space that is necessary for aviation related purposes. Expansion of the terminal building to the east for a restaurant must be compatible with the planned location of future aviation facilities. Basically, the airport sponsor cannot construct a non-aviation related facility on property reserved for aviation purposes.

EQUIPMENT STORAGE

By their very nature, airports encompass large areas of property that must be properly maintained in order to promote safety. Grass must be mowed in order to maintain visibility and to reduce the potential to attract wildlife. In the winter, the airport operations area needs to be plowed to allow the airport to remain open.

Currently, equipment used to maintain the airport is stored in several aircraft hangars at the airport. These hangars should be made available for lease if possible. Construction of dedicated maintenance buildings is eligible for grant funding from the FAA. Such a facility will be planned in the alternatives for the airport.

EMERGENCY RESPONSE

As discussed in Chapter One – Inventory, the closest fire station is located near downtown Lawrence south of the Kansas River, a distance of approximately 3.5 miles. If a new north Lawrence fire station is planned, a location on or near the airport would allow this firehouse to serve both the community and the airport. If an on-airport location is considered, it should have ready access to both the runway/taxiway system as well as the street network.

LANDSIDE DEVELOPMENT ALTERNATIVES

As presented in Chapter Three – Facility Requirements, additional aircraft hangar storage area is recommended to accommodate forecast growth in based aircraft. An additional 46,100 square feet of space is recommended for T-hangars and executive box hangars. Conventional hangar space appears adequate to meet the needs of the airport, but a change in functional use of conventional hangars could indicate an additional need here as well. For example, if aircraft maintenance increases, then additional conventional hangar space could be needed for this purpose. Specialty hangars could also be needed to satisfy the needs of new airport businesses.

Each of the landside alternatives will present a future facility layout that may exceed the total hangar storage necessary to meet forecast demand over the next 20 years. This is important in order to allow maximum flexibility within the master plan to allow the airport to adjust to unforeseen growth. In fact, the airport is currently in negotiations with two aviation businesses to locate at the airport in the short term. Between these two businesses, a total of 10 new aircraft (three helicopters and seven fixed wing) could be based at the airport. In addition, the airport board is planning to present a business plan to the Lawrence City Council in early 2011 to justify the construction of up to 20 additional T-hangar units.

EXISTING FACILITY LAYOUT

The existing facility layout provides easy access to the surface transportation system with an airport access road connecting to U.S. Highway 24/40. It also provides quick airside access to Runways 33 and 1. The airside access to Runways 19 and 15 requires pilots to taxi the length of the airfield. With the terminal area located between Runway 33 and Runway 1, the potential areas of development are limited. Nonetheless, the forecast growth of the airport (based aircraft and operations) indicated that the available undeveloped land in the terminal area can accommodate planned growth.

There are two primary development areas available in the terminal area; the first is to the west of Airport Road and the second is east of the road. The east side has the advantage of potentially being physically connected to the existing terminal area ramp. The west side currently supports two T-hangar structures. Since T-hangars are forecast to be in demand, future T-hangars should be co-located with these existing structures in order to create a complex of similar hangar types and similar activity levels.

The east side of Airport Road offers possibilities for the full range of aviation hangar types. Conceptually, when planning this area, high activity conventional hangars should be planned closest to the runway/taxiway system. Executive box and other medium and low activity hangars should be planned to be set back from these larger conventional hangars.

There are some constraints to planning for development of both of these areas. On the east side is an oxbow lake remnant that bisects the area. The oxbow has previously been identified as a wetland by the U.S. Army Corps of Engineers. The Environmental Assessment associated with the 2002 runway extension (400 feet to the south and 300 feet to the north) included this determination and the mitigation, which was a 1½ to 1 wetland replacement project. Any planning that would consider disturbing the wetland will likely require additional environmental documentation and mitigation.

LANDSIDE ALTERNATIVE I

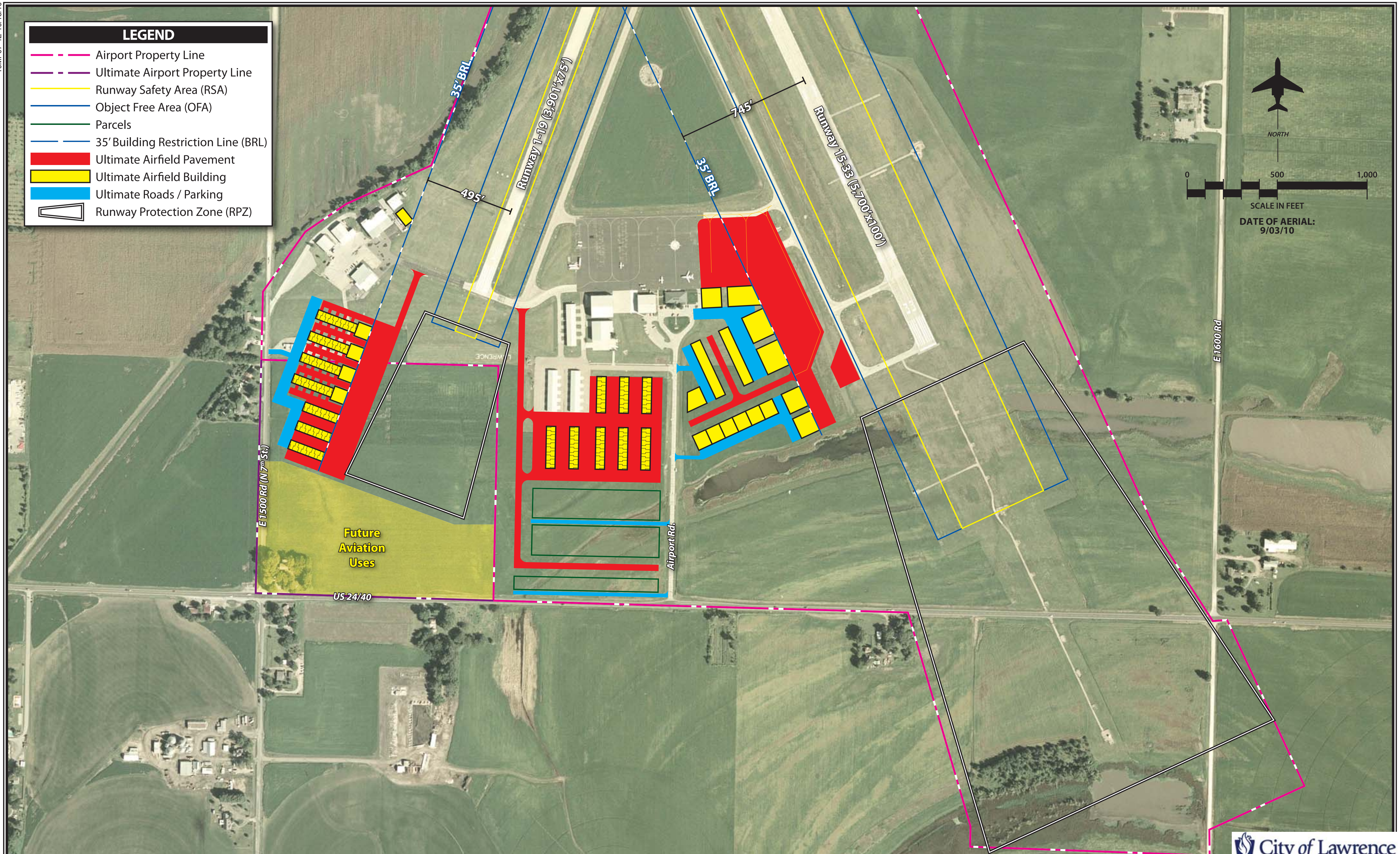
In this first alternative, shown on **Exhibit 4E**, the west side of Airport Road is planned for several additional nested T-hangar units. As shown, there are three 8-unit structures and five 10-unit structures for a total of 74 aircraft storage units. To the south of this planned T-hangar complex are three rows of development parcels. Development parcels have become increasingly popular with aircraft owners because they sign a long term land lease with the airport and then construct a custom hangar to meet their specific needs.

When planning hangar complexes, access to the airfield should be given priority consideration. Currently, taxilane access to the airfield from the two newest T-hangars is on either side of T-hangar Block A. These taxilane access points are separated by 130 feet, meaning they essentially serve the same functional purpose. While these taxilane access points may be adequate currently, when new T-hangars are constructed, efficiency of aircraft movements may be compromised. As a result, a new taxilane access point is considered in this alternative.

The planned new taxilane would extend from the intersection of Taxiway C and D and south into the development area west of Airport Road. This taxilane would provide a new primary access point to the development area. The taxilanes adjacent to T-hangar Block A should be maintained to provide some long term relief to the new access taxiway.

On the east side of Airport Road, or the east terminal area, a development concept is presented that provides for conventional and executive box hangars since the west side logically should support continued T-hangar development. The east side development area includes potential flight line property as well as area set back from the flight line.

In this alternative, a large conventional hangar is planned to the immediate east of the terminal building. For this to be possible, the airport beacon and an electrical vault would need to be relocated. Given the value of development space facing the terminal area apron, the cost of relocating the beacon and vault should be considered. A second conventional



City of Lawrence KANSAS

Exhibit 4E
LANDSIDE ALTERNATIVE I

hangar is then planned facing the main apron.

The main apron is planned to be expanded to the east and southeast, parallel to Runway 15-33. Four larger hangars are then planned to face the runway and the planned new apron. A taxilane is extended from the east side apron to allow for a variety of executive box hangars.

West Terminal Area

There may be some opportunities for development in the west terminal area. On Landside Alternative I, depicted on **Exhibit 4E**, a development layout is presented that considers airport acquisition of approximately 36 acres to the southwest of the airport. This property is then planned for multiple uses. First, the Runway 1 RPZ would be maintained undeveloped in order to meet RPZ design standards. The portion of this property adjacent to the west terminal area is then planned for aviation uses.

Low activity aviation uses are planned for the west terminal area. Access is planned from a new taxilane that would extend from Taxiway C. The first four rows of hangars are fronted by a single 80-foot by 80-foot executive box hangar. A 10-unit T-hangar facility then extends from the back of the executive box hangars. Three additional T-hangar structures, each with an 8-unit capacity, are then planned at the end of the access taxilane. This development concept provides 80,600 square feet of T-hangar space and 29,600 square feet of executive box hangar space.

The remaining portion of property, approximately 15 acres, is then planned for future aviation uses. Future aviation uses could include a potential extension to Runway 1-19 or additional hangars.

LANDSIDE ALTERNATIVE II

The development area to the west of Airport Road continues to be planned for lower activity facilities such as nested T-hangars and connected box hangars. To the immediate east of T-hangar Blocks B and C are three 10-unit T-hangar structures. The nested T-hangars planned would occupy an identical footprint to those of the existing T-hangars, placing them at the edge of Bryant Way. Therefore, to provide taxilane access, Bryant Way would be converted to a taxilane. The entrance to the T-hangar complex could then be secured with an access gate near the corner of Bryant Way and Airport Road.

Landside Alternative II, as shown on **Exhibit 4F**, also plans for a new primary access taxilane that extends from the intersection of Taxiway D and C. Set to the south of the planned T-hangar complex is a group of connected box hangars. As shown, there are 48 box hangars measuring 50 feet by 65 feet. This executive box hangar complex would have dedicated vehicle access and parking extending from Airport Road.

Planning for the east side of Airport Road maintains this area for larger conventional or corporate hangars to face the flight line, and stand alone executive box hangars set farther back. Two large conventional hangars would face Runway 15-33. As shown on the exhibit, these would not impact the existing airport beacon.

Aircraft access to the development area would be from a taxilane that would extend from the currently closed Taxiway B. A portion of taxiway B would need to be rehabilitated in order to provide access to Taxiway A. That portion of the closed taxiway extending to the main apron is planned to be removed. Adjacent to the two large conventional hangars is a taxilane extending to the west. This taxilane extension would open up additional area for three executive box hangars.

On the south side of the taxilane extending behind the two conventional hangars is an area proposed for development parcels. Development parcels have become increasingly popular for general aviation airports. Aircraft owners are provided an opportunity to sign a land lease with the airport and then proceed with the construction of a custom hangar that suits their specific needs. This public/private partnership benefits both parties in that the airport is able to save the expense of constructing hangars, while still promoting growth by allowing development.

Another feature to this alternative is the potential extension of the access taxilane over the oxbow wetland. Additional development parcels are then made available. Development parcels in this location, adjacent to U.S. Highway 24/40, may be especially desirable as aviation businesses would have airfield access and roadside visibility.

West Terminal Area

Development of the west terminal area in Landside Alternative II considers a layout that remains on existing airport property. As shown on **Exhibit 4F**, three rows of 10-unit nested T-hangars are planned for a total of 37,950 square feet of additional hangar space.

LANDSIDE ALTERNATIVE III

In Landside Alternative III on **Exhibit 4G**, the west side of Airport Road is planned for additional nested T-hangars. Three structures are shown, with each having 10 individual storage units. These T-hangars are identical to T-hangar Blocks B and C. The three hangar structures are situated to the south of the existing T-hangars and are spaced to allow aircraft movement between the existing and future buildings.

The primary drawback to this layout is the continued use of the taxilanes adjacent to T-hangar A. As discussed previously, the access point could lead to congestion as the airport adds more based aircraft. This T-hangar layout may prevent a logical secondary access point extending from Taxiway C. Constructing the westernmost of these three T-hangar buildings would pre-

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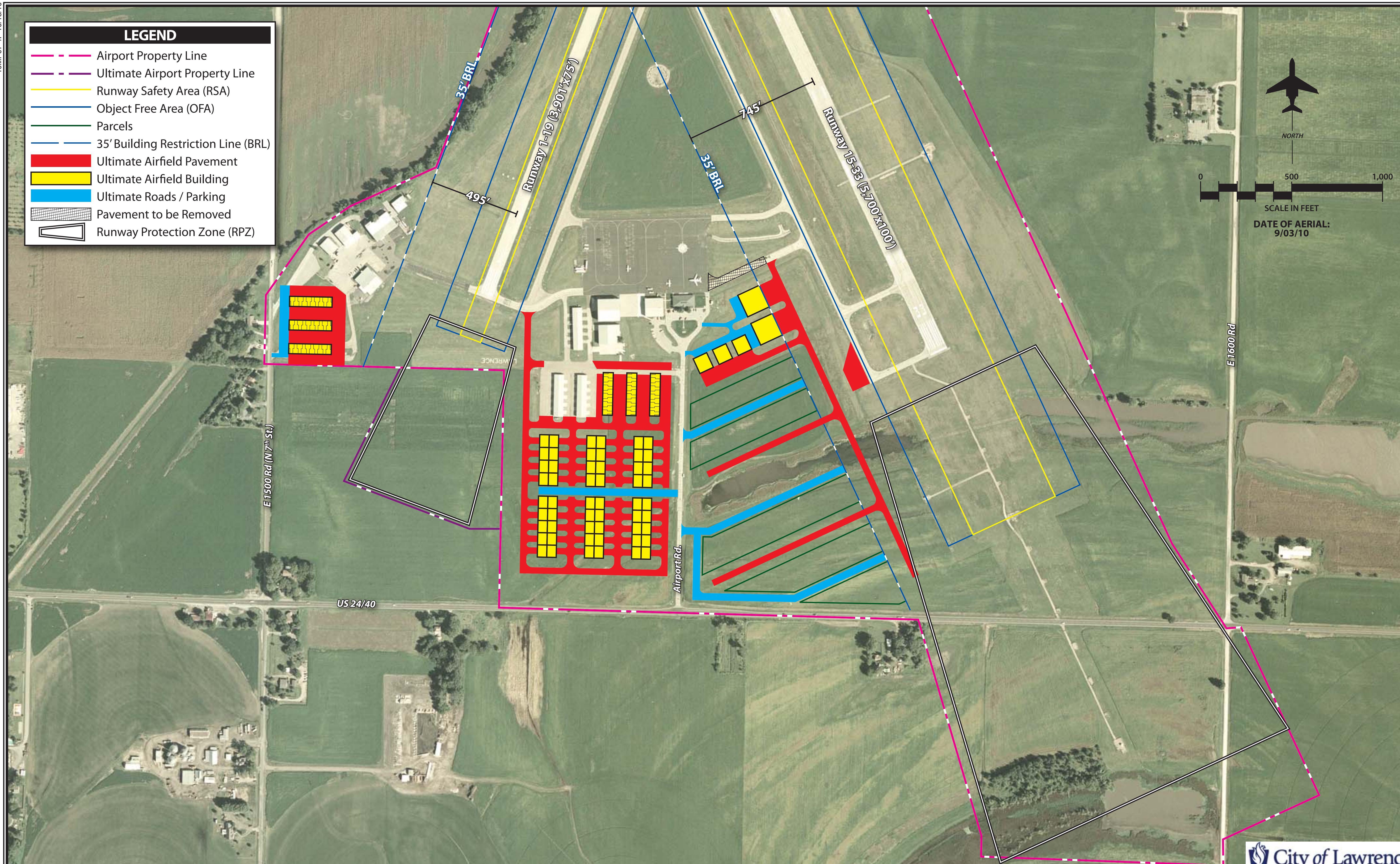

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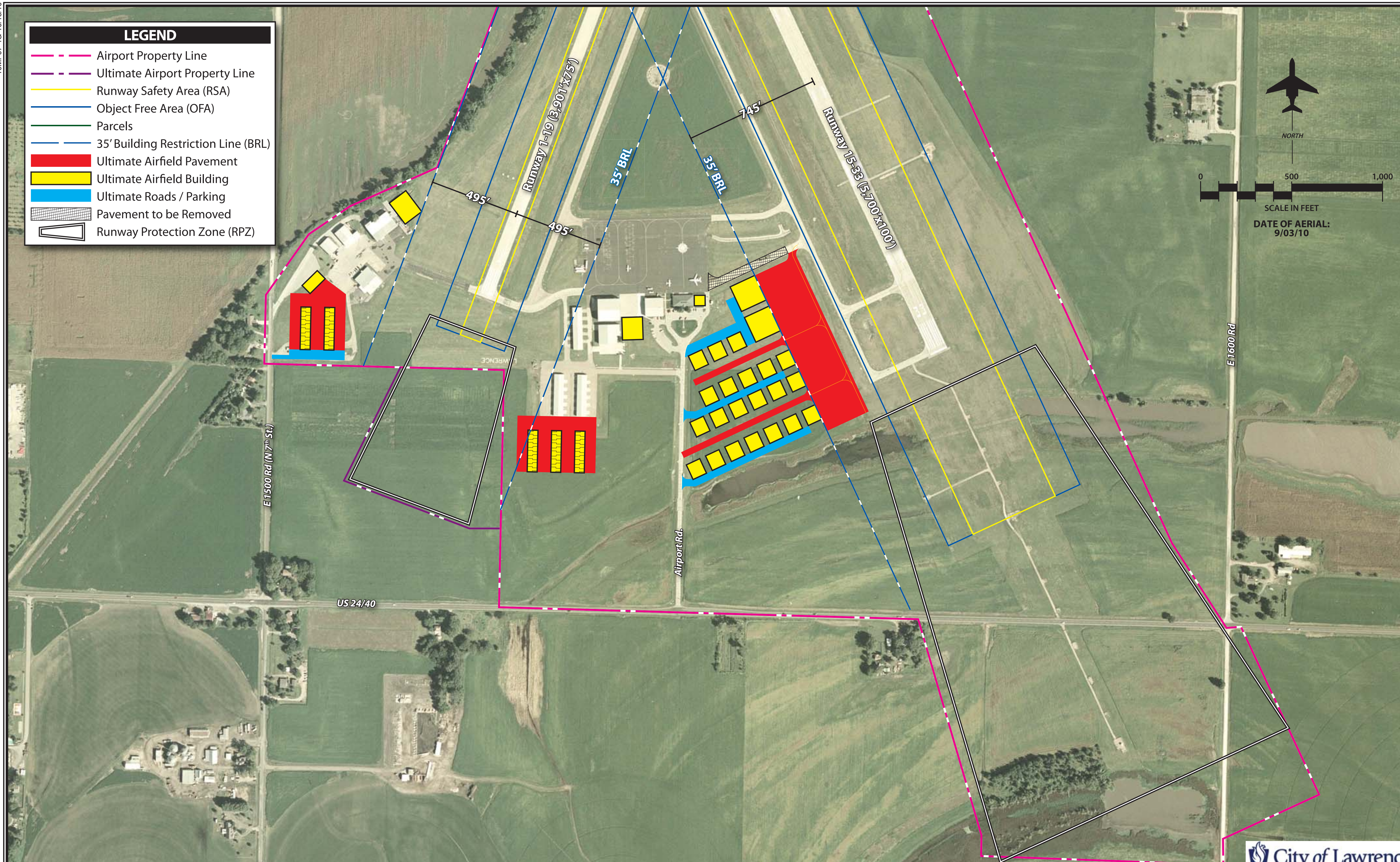
Exhibit 4F
LANDSIDE ALTERNATIVE II



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City of Lawrence KANSAS

Exhibit 4G
LANDSIDE ALTERNATIVE III

vent the future construction of another access taxilane.

This alternative considers the possibility of building a large hangar that would face the small apron located between the FBO hangars. This location could be an expansion opportunity for the FBO operator.

The east side layout presented generally follows the theme of reserving development for higher activity uses. Two conventional hangars are situated on an apron expansion which faces Runway 15-33. Extending from the planned apron are two taxilanes providing access to executive box hangar development areas.

The apron expansion shown in the exhibit provides for a taxliane to run along the apron edge. The apron edge taxilane precludes a hold apron at the end of Taxiway A. This alternative could be adjusted to make space for a hold apron at the end of Taxiway A, as was shown in Landside Alternative I.

West Terminal Area

West terminal area facility planning for Landside Alternative III considers infill opportunities for executive box hangars, as well as the addition of two 10-unit nested T-hangars. As depicted, the University of Kansas hangar currently housing the Mal Harned Propulsion Lab is planned to be replaced with a larger 16,500 square foot hangar. A second stand alone hangar is also planned adjacent to the Don's Diesel hangar, fronting an expansion of the apron.

LANDSIDE SUMMARY

The landside facility layout should follow basic industry standards, such as locating high activity hangars on or near the main terminal area apron. Medium activity executive box or connected box hangars should then be set back from the flight line, and low activity T-hangars should be the farthest from the flight line.

Each of the three landside alternatives follows these basic airport planning principles primarily by utilizing the potential development areas located to the east and west of Airport Road. These areas are large enough to easily accommodate forecast growth in based aircraft at the airport. In fact, each of the alternatives considers a long term vision that would extend beyond the 20-year scope of the master plan. Only under some unpredictable circumstances, such as the addition of hundreds of new aircraft to the airport, would this full build-out be necessary within 20 years. Nonetheless, it is beneficial to provide a long term vision for the airport for future generations.

As discussed in Chapter Three – Facility Requirements, the airport is forecast to need approximately 46,100 square feet of new hangar space over the next 20 years. **Table 4B** presents a summary of the total hangar area and parcel acreage proposed for each alternative.

While the long term vision far exceeds the forecast need, the potential layouts presented allow hangar development to follow a phased approach for each hangar type. For example, there are designated areas for each hangar type that are in close proximity to existing facilities. Therefore, if a T-hangar facility becomes the next priority, then it can be constructed immediately at the designated location with minimal extraneous costs.

TABLE 4B
Landside Summary
Lawrence Municipal Airport

	Alternative I		Alternative II		Alternative III	
Hangar Type	**Square Feet**	**Storage Units**	**Square Feet**	**Storage Units**	**Square Feet**	**Storage Units**
	MAIN TERMINAL AREA					
T-Hangar	93,250	74	37,950	30	37,950	30
Executive Box	9,000	4	19,200	8	134,400	54
Connected Box	58,600	12	190,900	54	0	0
Conventional	93,800	38	33,800	14	58,200	23
Subtotal	254,650	128	281,850	106	230,550	107
Parcel Acres	7.48	32	11.33	49	0	0
	WEST TERMINAL AREA					
T-Hangar	80,600	64	37,950	30	25,300	20
Executive Box Hangar	29,600	9	0	0	23,700	9
Subtotal	110,200	73	37,950	30	49,000	29
Total	364,850	233	319,800	185	279,550	136

Assumptions:
Executive Box and Conventional Hangars: Approximately 2,500 (sf^2) per aircraft
Parcels: Approximately one aircraft for every 10,000 (sf^2)
T-Hangars and Connected Box Hangars: One aircraft per unit

Source: Coffman Associates

ALTERNATIVES SUMMARY

Several development alternatives related to both the airside and the landside have been presented. On the airside, potential extensions of 100 feet, 400 feet, 600 feet, and 1,300 feet were considered for Runway 33. For the airport to move forward with plans for design and construction of any of these extension alternatives, further justification would be required. Specifically, 500 annual operations by the critical aircraft would need to be documented.

Runway 1-19 currently meets the design standards for a crosswind runway at Lawrence Municipal Airport. The potential to add 500 feet to the runway, thereby increasing its capability to serve as a backup runway for a larger percentage of operations, was examined. Either end of the runway could support such an extension or the extension could be split between the two ends. It should be noted that improving Runway 1-19 as considered would be a low priority for FAA participation.

Taxiway D is the partial parallel taxiway to Runway 1-19. This taxiway should be planned to connect to the Runway 19 threshold, thereby eliminating the need to back taxi on the runway.

After review by the Planning Advisory Committee (PAC) and interested local citizens, a recommended concept will be presented in the next chapter.

Chapter Five

Recommended Master Plan Concept

Chapter Five

Recommended Master Plan Concept

The airport master planning process for Lawrence Municipal Airport (LWC) has evolved through the development of forecasts of future demand, an assessment of future facility needs, and an evaluation of airport development alternatives to meet those future facility needs. The planning process has included the development of three sets of draft phase reports which were presented to the Planning Advisory Committee (PAC) and discussed at several coordination meetings.

The PAC is comprised of several constituencies with an investment or interest in Lawrence Municipal Airport. These groups included representatives from the Federal Aviation Administration (FAA), the City of Lawrence, Kansas Department of Transportation - Division of Aviation, airport businesses, and local and national aviation associations. This diverse group has provided extremely valuable input into the recommended plan.

In the previous chapter, several development alternatives were analyzed to explore options for the future growth and development of Lawrence Municipal Airport. The development alternatives have been refined into a single recommended concept for the master plan. This chapter describes, in narrative and graphic form, the recommended direction for the future use and development of Lawrence Municipal Airport.

The recommended concept provides the ability to meet the increasing demands on the airport by larger corporate aircraft operators while continuing to pro-

vide adequate space for smaller piston aircraft operators. The recommended master plan concept, as shown on **Exhibit 5A**, presents the ultimate configuration for the airport that preserves and enhances the role of the airport while meeting FAA design standards. A phased program to implement the recommended development concept will be presented in Chapter Six - Capital Improvement Program. The following subsections will describe the recommended master plan concept in detail.

The Lawrence Municipal Airport is classified by the FAA as a general aviation airport and it is included in the National Plan of Integrated Airport Systems (NPIAS). NPIAS airports are considered important to the national aviation infrastructure and, as such, are eligible for development grant funding from the FAA. The airport is considered a Regional Airport in the Kansas Airport System Plan. Regional airports accommodate regional economic activities, connecting to state and national economies, and serving all types of general aviation aircraft.

AIRSIDE CONCEPT

The airside plan generally considers those improvements related to the runway and taxiway system. Runway 15-33 is planned to be extended from 5,700 feet to 6,100 feet in the short term with a long term plan to extend the runway to 7,000 feet. Runway 1-19 is planned to be extended from 3,901 feet to 4,400 feet in length. Taxiway D is planned to be extended to the Runway 19 threshold. New access taxilanes are planned to the west, central, and east side development areas.

DESIGN STANDARDS

The FAA has established design criteria to define the physical dimensions of runways and taxiways, as well as the imaginary surfaces surrounding them which protect the safe operation of aircraft at the airport. These design standards also define the separation criteria for the placement of landside facilities.

As discussed previously, the design criteria primarily center on the airport's critical design aircraft. The critical aircraft is the most demanding aircraft or family of aircraft which currently, or are projected to, conduct 500 or more operations (take-offs and landings) per year at the 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 Airport Reference Code (ARC) to relate these critical aircraft factors to airfield design standards.

Analysis conducted in Chapter Three - Facility Requirements concluded that the current critical aircraft is represented by activity that falls in ARC C-II. The future critical aircraft is defined by those general aviation aircraft that fall within ARC D-II.

While airfield elements, such as runway length and safety areas, must meet design standards associated with ARC C/D-II, landside elements can be designed to accommodate specific categories of aircraft. For example, a taxilane into a T-hangar area only needs to meet the object free area (OFA) width standard for smaller single and multi-engine piston aircraft expected to utilize the taxilane, not those standards for the

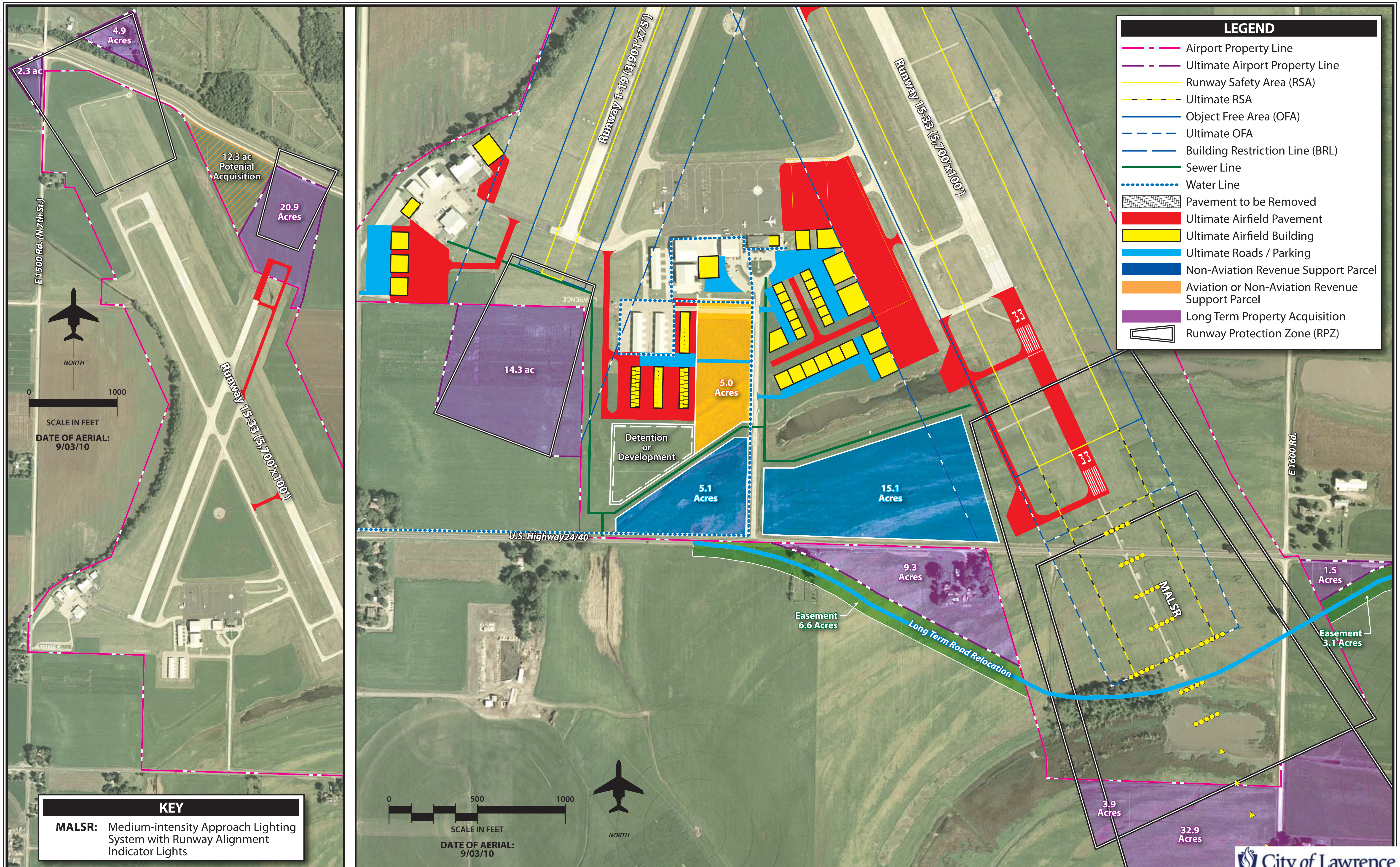


Exhibit 5A
MASTER PLAN CONCEPT

larger business jets representing the overall critical aircraft for the airport.

Crosswind Runway 1-19 currently meets design standards associated with ARC B-I, the minimum required as dictated by predominant wind conditions. The recommended concept considers improving this runway to meet ARC B-II design standards. Most of the associated safety design standards will need to be upgraded in order to meet the planned improvement. **Table 5A** presents the design standards to be applied at Lawrence Municipal Airport. Applicable changes to design standards based on the recommended concept are in bold print in the table.

TABLE 5A
FAA Design Standards
Lawrence Municipal Airport

Runway	**RUNWAY 1-19**		**RUNWAY 15-33**	
Current/Future Standard	Current	Ultimate	Current	Future
Design Standard	ARC B-I	**ARC B-II**	ARC C-II	**ARC D-II**
Aircraft Type	Cessna 425	**Beech King Air 350**	Citation 750 (X)	**Gulfstream II**
Applicable Approach	Visual	**1 mile**	½-mile (33) 1-mile (15)	½-mile (33) **¾-mile(15)**
RUNWAYS				
Ultimate Runway Length	3,901	**4,400**	5,700	**6,100 / 7,000***
Runway Width	60 (75 current)	75	100	100
Runway Shoulder Width	10	10	10	10
Runway Safety Area				
Width	120	**150**	500	500
Length Beyond End	240	**300**	1,000	1,000
Length Prior to Landing	240	**300**	600	600
Runway Object Free Area				
Width	400	**500**	800	800
Length Beyond End	240	**300**	1000	1,000
Runway Obstacle Free Zone				
Width	250	**400**	400	400
Length Beyond End	200	200	200	200
Runway Centerline to:				
Holding Position	200	200	250 (259 currently)	259
Parallel Taxiway	225	**240**	400	400
Aircraft Parking Area	200	**250**	500	500
TAXIWAYS				
Width	25	**35**	35	35
Shoulder Width	10	10	10	10
Safety Area Width	49	**79**	79	79
Object Free Area Width	89	**131**	131	131
Edge Safety Margin	5	**7.5**	7.5	7.5
Taxilane Object Free Area	79	**115**	115	115
Taxiway Centerline to:				
Fixed or Movable Object	44.5	**65.5**	65.5	65.5
Parallel Taxiway/Taxilane	69	**105**	105	105

RPZ	**Rwy 1-19**	**Rwy 1-19**	**Rwy 15**	**Rwy 33**	**Rwy 15**	**Rwy 33**
Inner Width	500	500	500	1,000	**1,000**	1,000
Outer Width	700	700	1,010	1,750	**1,510**	1,750
Length	1,000	1,000	1,700	2,500	**1,750**	2,500

All measurements in feet.
*Short and long term runway extensions planned.
BOLD indicates that the design standard changes based on the improvements planned.
Source: FAA AC 150/5300-13, Airport Design, Change 16

RUNWAY LENGTH

FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design* is utilized in Chapter Three – Facility Requirements to arrive at the minimum runway length necessary for Lawrence Municipal Airport. The FAA provides several categories of runway length calculations based primarily on documented activity by a group of similar aircraft. At Lawrence Municipal Airport, there is clear documentation that business jets exceed the threshold of 500 annual operations.

To accommodate 75 percent of business jets at 60 percent useful load, a runway length of 5,500 feet is necessary. To accommodate the remaining 25 percent of business jets at 60 percent useful load, a runway length of 5,800 feet is recommended. In addition to these calculations, the operating manuals of several business jets known to operate at the airport were consulted. Of particular note was the Cessna Citation X, model 750, which falls in the 75 to 100 percent category. The Citation X is known to operate at the airport but alone does not account for 500 annual operations. This aircraft would optimally need 6,200 feet of runway length to be fully capable at Lawrence Municipal Airport. The Challenger 600/604, another business jet operating at the airport, would optimally require up to 6,800 feet of runway.

Primary Runway 15-33 is planned for a 400-foot southerly runway extension in the short term planning period (next five years) bringing the total runway length to 6,100 feet. This is the maximum extension possible without impacting U.S. Highway 24/40 as both the RSA and OFA would be short of the highway. The short term extension is intended to better accommodate the needs of the current critical design aircraft. The long term plan includes an additional 900-foot southerly extension which would bring the total runway length to 7,000 feet. A runway of 7,000 feet would be intended to accommodate specific users who frequently (500 annual operations) utilize business jets with heavy loads.

Consideration was given to a possible northerly extension of Runway 15-33. Survey data gathered in association with this master plan has indicated that any northerly extension would be problematic. The primary concern is that the OFA would extend onto the Mud Creek levee, which would then become a penetration to the OFA. Experience has shown that relocating levees can be very costly and time-consuming process. Adequate runway length can be provided by the proposed southerly extension, thus, the more costly northerly extension option was considered unreasonable.

Implementation of these planned runway extensions would have to be fully justified by formal documentation of 500 annual operations by the critical design aircraft or aircraft group. Supporting documentation such as letters from operators stating runway length needs can help to justify a runway extension project. The 500 operations threshold would have to be exceeded by the combined activity of those business jets in the 75 to 100 percent of the national fleet category. Included in this group is the Lear 55 and 60, Hawker 800XP and 1000, Cessna Citation 650 and 750, Challenger 604, and IAI Astra, to name a few.

Wind coverage for the airport indicates that Runway 1-19 should be planned and designed, at a minimum, to satisfy the needs of aircraft in ARC B-I. The runway currently meets this standard. The recommended plan considers improving this runway to ARC B-II design standards. To this end, a 499-foot runway extension is planned to the north, bringing the total runway length to 4,400. At 4,400 feet in length, Runway 1-19 would meet the recommended length to accommodate all small aircraft including those with 10 or more passenger seats. More importantly, this length would provide an adequate backup capability for those times when the primary runway is closed, usually due to maintenance. A larger percentage of aircraft could continue to operate at the airport including many business jet models, such as some Lear and Cessna Citation models, under favorable operating conditions. Large business jets such as the Hawker 800, Challenger 604, and many Gulfstreams would not likely utilize this runway, even with the extension.

Both ends of Runway 1-19 were examined for potential obstructions when considering an extension of 499 feet. There are several imaginary obstruction surfaces serving runways, as defined by the FAA that must be considered. The first surface examined is the F.A.R. Part 77 approach surface. The planned approach surface would begin 200 feet from the runway end at a width of 500 feet. It would then extend outward and upward at a slope of 34 to 1 to a distance of 10,000 feet and a width of 3,500 feet. There would be numerous penetrations to the approach slope, primarily by trees and terrain. The FAA recommends that when considering a runway extension, the approach surface should be clear. If there are no other extension alternatives, then the threshold siting surface (TSS) becomes the primary obstruction surface considered.

The proposed future TSS for Runway 1-19 begins 200 feet from the runway end, has an inner width of 400 feet, and extends outward and upward at a 20 to 1 slope to a width of 3,800 feet at a length of 10,000 feet. There is one tree located just north of the levee that would penetrate the TSS by one foot. This tree would need to be topped or removed prior to extending the runway to the north.

Exhibit 5B presents the analysis of both the future approach surface and the threshold siting surface for a 499-foot extension on either end of Runway 1-19. A potential extension to the north presents numerous approach surface penetrations but only one threshold siting surface penetration, a tree that can be removed.

There are far fewer penetrations to the approach surface when considering a 499-foot extension to the south. Several trees and a pole adjacent to Interstate 70 penetrate the approach surface. There are two TSS penetrations, both of which are trees. One of these trees is an old growth tree located on a potentially historically significant property. The City would prefer to avoid impacting this property if possible.

Exhibit 5C presents an alternative which splits the planned 499-foot extension between the runway ends in an effort to minimize both approach surface and TSS penetrations. When adding 200 feet to the south end, the TSS is clear but several approach surface penetrations remain. The remaining 299 feet is then placed on the north end which results in no TSS penetrations.

The recommended master plan concept, as previously shown on **Exhibit 5A,** plans for a 499-foot extension of Runway 1-19 to the north. Extending the runway in this direction is preferable for several reasons. First, it is desirable to limit over-flights of the city and an extension to the north would accomplish this goal. Second, there would be no additional impact to the potentially historical property to the south of the runway end. Third, the single TSS penetration is a tree that can be removed. Finally, a single extension in one direction will be less costly than extensions to both runway ends.

RUNWAY STRENGTH

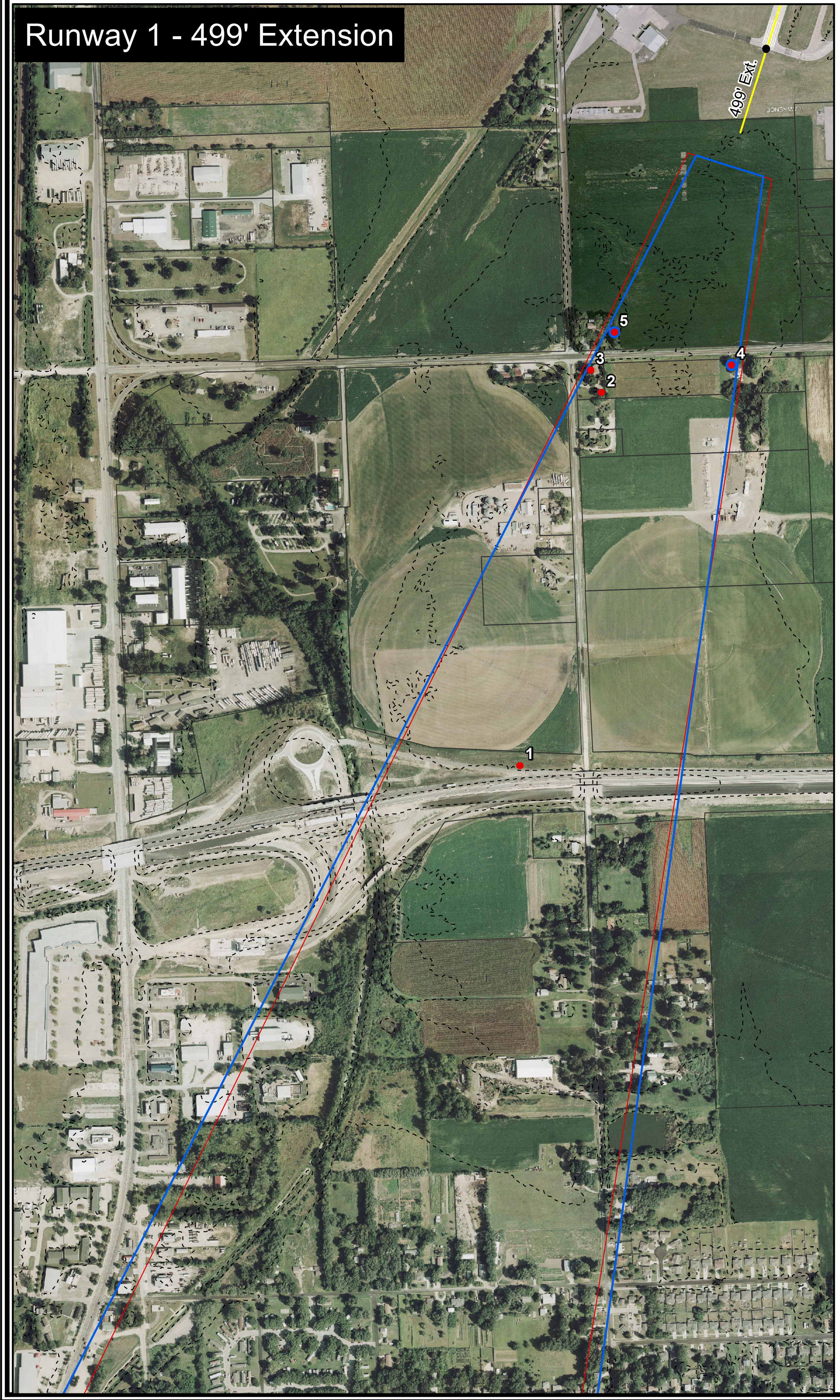
Runway 15-33 is strength rated at 40,000 pounds for single wheel loads (SWL) and 60,000 pounds for dual wheel loads (DWL). This strength fully meets the requirements of the critical aircraft family of business jets in ARC C-II. In the future, the airport is forecast to transition to ARC D-II. Aircraft in ARC D-II, such as the Gulfstream II, can weigh more than 60,000 pounds. Therefore, once justified by frequent activity (500 or more annual operations), the runway should be planned for an increase in its strength rating to 75,000 pounds SWL and 90,000 pounds DWL. This strength rating would more accommodate the full range of business jets under heavy operating conditions.

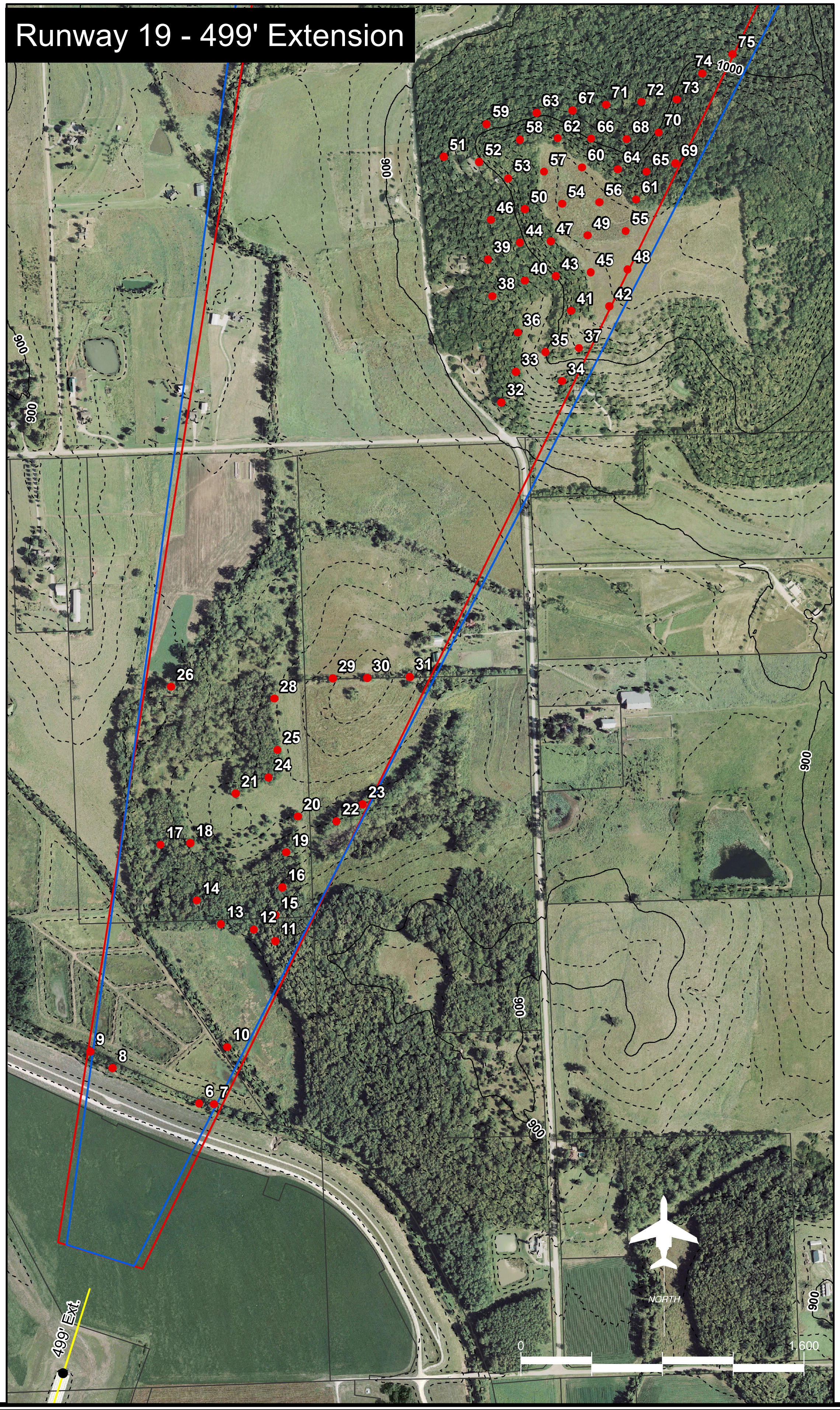
Since the forecasts indicate a transition to a heavier critical aircraft family in the long term planning, an increase in the strength of the runway is planned at this time. Increasing the strength of a runway is typically undertaken in conjunction with another major runway project, whether it is an extension or major rehabilitation. Therefore, the capital improvement program will include increasing the strength of the runway in the long term when justified.

RUNWAY SAFETY AREAS

The Facility Requirements chapter discussed the requirements for the runway safety area (RSA), object free area (OFA), obstacle free zone (OFZ), and the runway protection zones (RPZ). Of particular concern is the RSA, which must meet FAA design standard to the greatest extent possible. The RSA is an area surrounding the runway that must be cleared of all penetrating obstructions, graded, drained, and capable of supporting an aircraft veer-off or emergency vehicles.

The RSA for Runway 15-33 is 500 feet wide and extends 1,000 feet off each runway end. Only those navigational aids, with frangible bases, such as runway edge lights and approach lights, necessary for the safe operations of aircraft, are allowable within the RSA. The OFA must also be clear of penetrating obstructions but it does not have to be capable of supporting an aircraft or emergency vehicle. The OFA for Runway 15-33 is 800 feet wide and extends 1,000 feet beyond the runway end. The RSA and OFA are the controlling standards when considering an extension to Runway 33. The maximum extension feasible without impacting U.S. Highway 24/40 is approximately 400 feet.





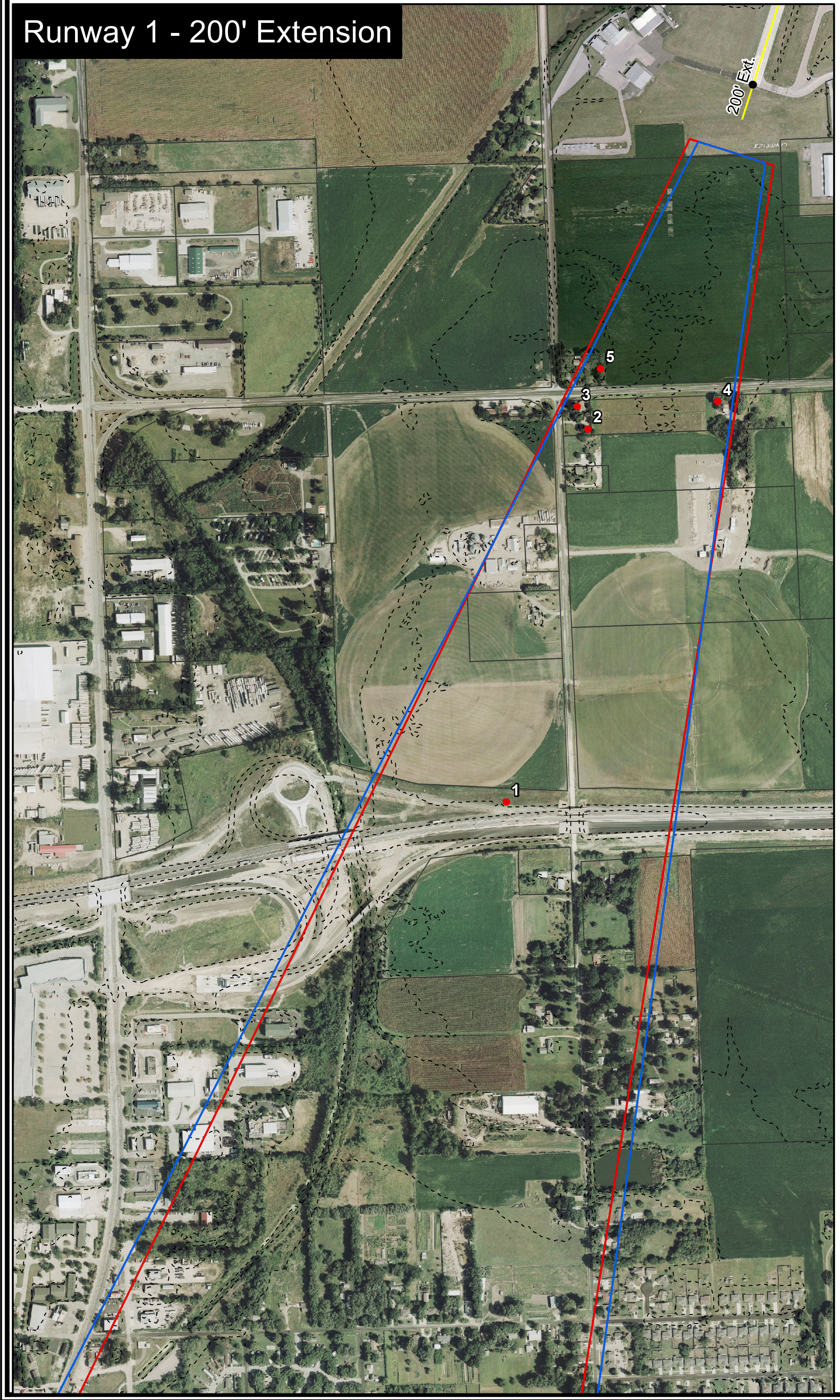
Legend

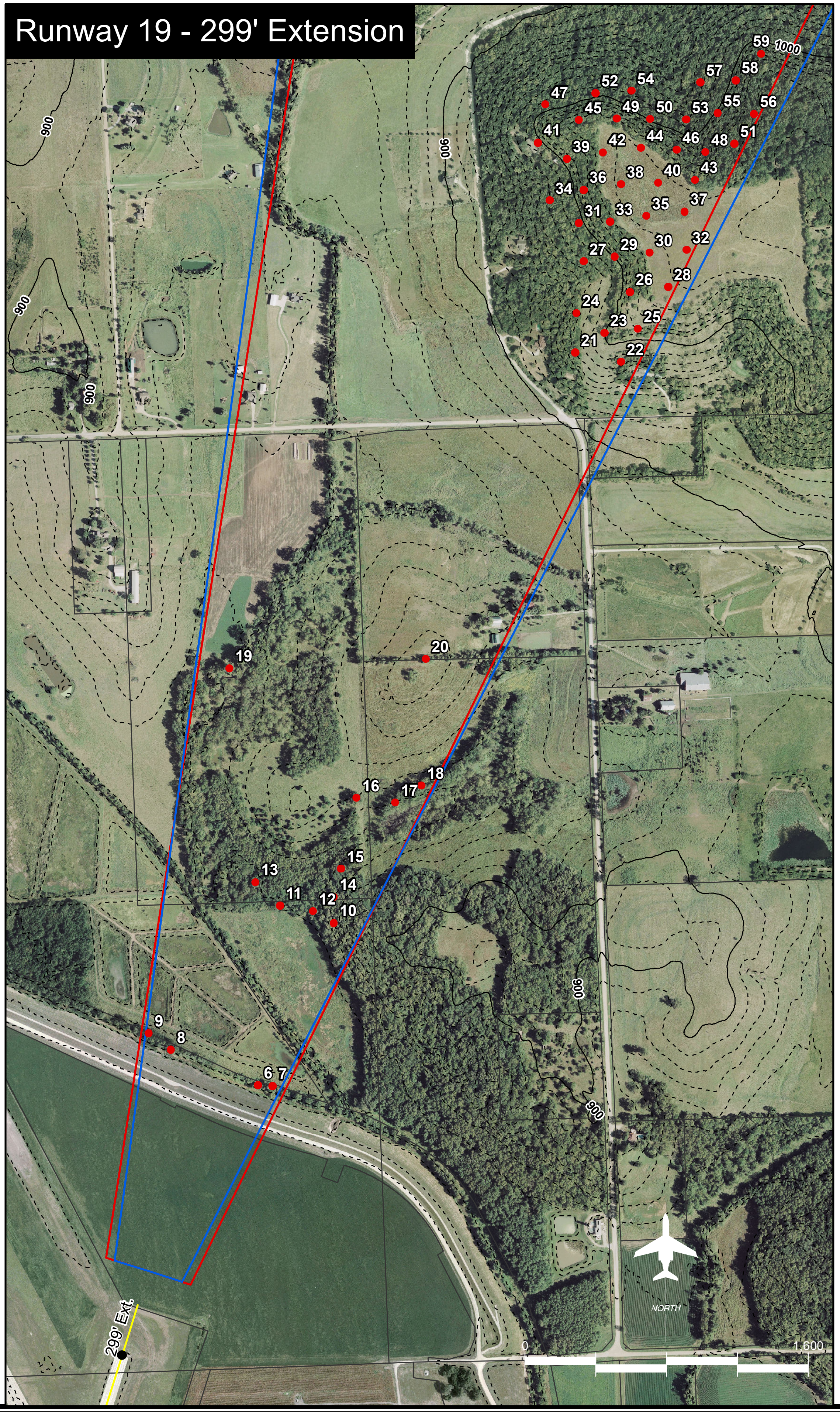
- Approach Surface Penetrations
- Threshold Siting Surface Penetrations
- Threshold Siting Surface 20:1
- Approach Surface 34:1
- Contours (Interval 10ft)
- Contours (Interval 100ft)

ID	OBJECT	TSS Clear or Penetration	Approach Clear or Penetration
1	POLE	60.73	13.76
2	TREE	15.24	14.63
3	TREE	2.60	25.13
4	TREE	3.17	25.41
5	TREE	8.80	31.47
6	TREE	14.39	5.92
7	TREE	1.03	21.75
8	TREE	9.12	12.10
9	TREE	x	12.70
10	TREE	27.36	0.16
11	TREE	5.94	35.02
12	TREE	18.76	22.76
13	TREE	16.87	24.10
14	TREE	23.98	18.77
15	TREE	1.35	42.50
16	TREE	29.77	17.43
17	TREE	43.44	4.24
18	TREE	46.13	2.77
19	TREE	48.40	2.80
20	TREE	46.12	9.49
21	TREE	52.48	3.53
22	TREE	48.43	7.99
23	TREE	50.09	9.13
24	TREE	53.27	5.69
25	TREE	56.73	5.57
26	TREE	59.49	6.07
27	TREE	64.04	3.32
28	TREE	64.71	3.16
29	TREE	67.85	4.31
30	TREE	60.45	12.97
31	TREE	71.86	3.16
32	TREE	108.52	0.19
33	TREE	87.51	25.10
34	TREE	87.04	26.13
35	TREE	65.42	50.40
36	TREE	96.02	21.03
37	TREE	84.00	33.42
38	TREE	117.33	2.85
39	TREE	121.66	2.46
40	TREE	108.96	14.06
41	TREE	63.19	58.08
42	NATURAL HIGH POINT	81.37	41.76
43	TREE	76.73	47.91
44	TREE	82.90	44.22
45	NATURAL HIGH POINT	91.37	34.91
46	TREE	111.26	17.35
47	TREE	62.95	65.41
48	NATURAL HIGH POINT	85.42	42.47
49	NATURAL HIGH POINT	93.84	36.41
50	TREE	72.73	58.25
51	TREE	132.30	1.67
52	TREE	111.78	22.84
53	TREE	94.27	39.58
54	NATURAL HIGH POINT	102.94	29.94
55	NATURAL HIGH POINT	97.42	34.66
56	NATURAL HIGH POINT	104.01	30.35
57	NATURAL HIGH POINT	114.28	21.50
58	TREE	78.11	60.45
59	TREE	109.87	29.25
60	NATURAL HIGH POINT	114.97	22.64
61	TREE	60.68	75.27
62	TREE	83.22	56.79
63	TREE	108.64	33.45
64	TREE	76.75	61.89
65	TREE	90.06	49.31
66	TREE	98.48	42.63
67	TREE	134.30	9.33
68	TREE	116.95	25.36
69	TREE	60.08	81.27
70	TREE	93.86	50.31
71	TREE	142.60	2.83
72	TREE	132.32	14.62
73	TREE	109.55	38.88
74	TREE	107.66	44.57
75	TREE	151.67	3.77

City of Lawrence KANSAS

Exhibit 5B
Runway 1-19 Extension Alternative 1





Legend

- ● Approach Surface Penetrations
- Threshold Siting Surface 20:1
- Approach Surface 34:1
- - - - - Contours (Interval 10ft)
- —— Contours (Interval 100ft)

ID	CLASSNAME	TSS Clear or Penetraton	Approach Clear or Penetraton
1	POLE	75.68	4.96
2	TREE	30.19	5.83
3	TREE	17.55	16.34
4	TREE	11.78	16.61
5	TREE	6.15	22.67
6	TREE	24.39	0.04
7	TREE	8.97	15.87
8	TREE	19.12	6.22
9	TREE	19.58	6.82
10	TREE	15.94	29.13
11	TREE	26.87	18.22
12	TREE	28.76	16.88
13	TREE	33.98	12.89
14	TREE	11.35	36.62
15	TREE	39.77	11.55
16	TREE	56.12	3.61
17	TREE	58.43	2.10
18	TREE	60.09	3.24
19	TREE	69.49	0.19
20	TREE	70.45	7.09
21	TREE	97.51	19.22
22	TREE	97.04	20.25
23	TREE	75.42	44.52
24	TREE	106.02	15.15
25	TREE	94.00	27.54
26	TREE	73.19	52.19
27	TREE	118.96	8.18
28	NATURAL HIGH POINT	91.37	35.88
29	TREE	86.73	42.03
30	NATURAL HIGH POINT	101.37	29.03
31	TREE	92.90	38.33
32	NATURAL HIGH POINT	95.42	36.59
33	TREE	72.95	59.53
34	TREE	121.26	11.47
35	NATURAL HIGH POINT	103.84	30.52
36	TREE	82.73	52.37
37	NATURAL HIGH POINT	107.42	28.78
38	NATURAL HIGH POINT	112.94	24.05
39	TREE	104.27	33.69
40	NATURAL HIGH POINT	114.01	24.47
41	TREE	121.78	16.96
42	NATURAL HIGH POINT	124.28	15.62
43	TREE	70.68	69.38
44	NATURAL HIGH POINT	124.97	16.76
45	TREE	88.11	54.57
46	TREE	86.75	56.01
47	TREE	119.87	23.37
48	TREE	100.06	43.43
49	TREE	93.22	50.90
50	TREE	108.48	36.75
51	TREE	70.08	75.38
52	TREE	118.64	27.57
53	TREE	126.95	19.48
54	TREE	144.30	3.45
55	TREE	103.86	44.43
56	TREE	77.39	72.04
57	TREE	142.32	8.74
58	TREE	119.55	33.00
59	TREE	117.66	38.69

City of Lawrence KANSAS

Exhibit 5C
Runway 1-19 Extension Alternative 2

The OFZ is 400 feet wide and extends 200 feet beyond the runway ends. Generally, the OFZ falls within the RSA. Like the RSA, the OFZ precludes penetrating obstructions except frangible navigational aids necessary for safe operation of aircraft at the airport. There are no OFZ concerns at the airport provided RSA standards are met.

The RPZ is a trapezoidal area beginning 200 feet beyond the runway end. The function of the RPZ is to protect people and property on the ground. Typically, this is achieved through airport ownership of the RPZs, although proper land use control measures, such as easements, are acceptable. The RPZs should be cleared of any incompatible objects or activities. Prohibited land uses include residences, and places of public assembly such as churches, schools, hospitals, office buildings, and shopping centers. The master plan concept includes acquisition of RPZ property, where considered feasible.

INSTRUMENT APPROACHES

The Lawrence Municipal Airport has excellent instrument approaches to the primary runway. A CAT-I instrument landing system (ILS) approach is available to Runway 33. This approach provides ½-mile visibility minimums and 200-foot cloud ceiling minimums. This type of approach is typically the most sophisticated available for general aviation airports. In addition, this runway provides a GPS-LPV (localizer performance with vertical guidance) approach with CAT-I minimums. The LPV approach does not require the localizer and glide slope antennas associated with the ILS. The approach lighting system is required to have visibility minimums down to ½-mile rather than only ¾-mile.

The planned 400-foot southerly extension to Runway 15-33 will require the relocation of the approach lighting system and the glide slope antenna. All ILS elements will need to be recalibrated and a new ILS approach will need to be developed. Planning for this eventuality should occur early in the runway extension design process as obtaining new procedures from the FAA can take up to 18 months. There is a possibility that the ILS could be removed and replaced by LPV approaches.

Runway 15 currently provides an RNAV GPS approach with visibility minimums of 1-mile and cloud ceilings of 509 feet. Initial analysis of the terrain north of this runway end indicates that an improved instrument approach with ¾-mile visibility minimums may be feasible. Therefore, planning will consider a ¾-mile LPV instrument approach to Runway 15. Lower visibility minimums are not likely due to the location of the Mud Creek levee.

The instrument approaches to Runway 15-33 are designated for aircraft in approach categories A, B, and C. Aircraft in approach category D, the future critical aircraft, are not currently available. The airport sponsor should initiate the process of obtaining instrument approach procedures that include approach category D aircraft since these planes currently operate at the airport.

Runway 1-19 is currently a visual runway only. Visual conditions are 3-mile visibility and 1,000-foot cloud ceilings, at a minimum. Both ends of this runway are planned for LPV instrument approaches with 1-mile visibility minimums.

RUNWAY/TAXIWAY SEPARATION

There are two factors that primarily influence the FAA standards for runway/taxiway separation. The first is the type and frequency of aircraft operations as described by the applicable ARC and the second is the capability of the instrument approaches available at the airport. The current ARC is C-II for Runway 15-33 and B-I for Runway 1-19. Runway 33 has a CAT-I ILS instrument approach with ½-mile visibility minimums. Runway 1-19 does not currently support a straight-in instrument approach procedure.

Taxiway A is 400 feet, centerline to centerline from Runway 15-33, which meets FAA design standards for ARC C and D-II. According to FAA AC 150/5300-13, *Airport Design*, the separation distance for aircraft hold lines must be increased by one foot for every 100 feet in airport elevation for ARC D-II airports. With an airport elevation of 833 feet above mean sea level, the hold lines should be at a distance of 259 feet from the runway centerline when the airport transitions to ARC D-II. The hold lines on the connecting taxiways to Runway 15-33 are currently 259 feet from the runway centerline.

The current separation standard for Runway 1-19 is 225 feet to Taxiway D, 200 feet for hold lines, and 200 feet for aircraft parking areas. Taxiway D is currently situated at 240 feet from Runway 1-19 which meets ARC B-II standards. This runway is planned to be improved to ARC B-II standards. The runway/taxiway separation standard, in this case, is 240 feet, which the airport currently meets. The hold lines remain at 200 feet, while the airport parking area is increased to 250 feet. The current layout for Runway 1-19 and Taxiway D meets design standard for both ARC B-I and B-II.

TAXIWAYS AND TAXILANES

Taxiways and taxilane design standards are a function of the airplane design group (ADG) for the airport. The ADG for Lawrence Municipal Airport is Group II, which dictates a taxiway width of 35 feet. Taxiways A and D meet this standard and should be maintained to this width. Taxiway C is 40 feet wide which provides an added margin of safety. Planning will consider maintaining Taxiway C at its current width. Taxilanes that extend into hangar areas, such as the planned T-hangar area, can be designed to lesser standards to accommodate smaller aircraft that would access those areas.

Several taxiway improvements are considered in the recommended concept. Taxiway D currently extends from the Runway 1 threshold to the intersection with Runway 15-33. This taxiway is planned to be extended to the Runway 19 threshold. This project should be a high priority as Runway 1-19 is frequently used and the lack of a threshold taxiway means that aircraft have to back-taxi on the runway. This maneuver reduces the capacity of the runway since the aircraft must remain on the runway for a longer period of time.

Taxiway A would need to be extended along with Runway 15-33 when that runway is extended. An additional connecting taxiway from Taxiway A to Runway 15-33 is planned. This taxiway would be located approximately 2,000 feet from the Runway 33 threshold. Currently, there is a gap of approximately 3,000 feet between the Runway 33 threshold and the first exit location, which is the intersection with Taxiway D.

A new taxilane is planned to provide an additional entrance to the central T-hangar development area. This taxilane would extend south from the intersection off Taxiways C and D. This taxilane will provide critical access and allow this area to expand to further hangar development in the future. Another taxilane is planned to the west development area in order to reduce future congestion to this area.

VISUAL NAVIGATION AIDS

The airport beacon is currently situated on a parcel immediately to the east of the terminal building. The beacon (and adjacent electrical vault) is planned to remain in place. Should a developer desire to place a larger hanger on this parcel than shown on **Exhibit 5A**, they could include relocation of the beacon and vault in their development plan.

All four runway ends currently provide a precision approach path indicator light system (PAPI). PAPIs provide pilots with visual confirmation of the appropriate glide path to the runway. Runway 15-33 provides a four-light PAPI configuration, while Runway 1-19 provides the two-light configuration. The PAPI serving Runway 33 will need to be relocated in conjunction with the runway extension project in order to maintain the preferred three-degree slide path. The two light PAPIs associated with Runway 1-19 are adequate for this runway but the PAPI serving Runway 19 would need to be shifted with the runway extension.

Runway end identification lights (REIL) are strobe lights set to the side of the runway which provide rapid identification of the landing threshold. REILs are normally provided for instrument capable runways when an approach lighting system is not available. Runway 1-19 currently has REILs on both ends. Runway 33 has an approach lighting system. REILs are planned for the Runway 15 end as an approach lighting system is not planned.

Business jet capable runways should provide distance-to-go markers. These lighted signs are set to the side of the runway every 1,000 feet. Each box shows a single number representing how many thousand feet of runway length remain until the end of the runway. Distance-to-go markers are planned for the airport.

Runway 33 has a medium intensity approach lighting system with runway alignment indicator lights (MALSR). This system provides pilots with alignment information during nighttime operations. The presence of the MALSR provides a ¼-mile credit for instrument approach visibility minimums to Runway 33. Without the MALSR, the visibility minimum could only be ¾-mile rather than the ½-mile currently available. The MALSR is planned to be shifted in conjunction with the planned runway extension.

PROPERTY ACQUISITION

Planning for growth of the airport includes the consideration of strategic property acquisition of adjacent lands in order to allow for facility expansion or for the protection of the function and role of the airport. The FAA supports and provides reimbursement for necessary property acquisition. The reimbursements are provided when the land is necessary for airport development or protection. Basically, the FAA supports and funds immediate land acquisition needs but does not support "land-banking" of property that may or may not be needed in the future.

There is no immediate need for the airport to acquire adjacent property. The runway safety areas (RSA), object free areas (OFA), and obstacle free zones (OFZ) are on airport property, which meets the design standard. The runway protection zones (RPZ) are controlled either through airport ownership or through easements, which also meets design standards.

The FAA recommends that the airport own the entirety of the RPZs where feasible. Therefore, those RPZs that extend beyond current airport property are recommended for fee simple acquisition, even where an airport-owned easement exists. The planned extensions to Runway 33 and Runway 19 also trigger additional land acquisition needs.

When the airport proceeds with the short term 400-foot extension of Runway 33, approximately 3.9 acres of RPZ land would fall outside of airport property. This agricultural land is thus recommended for acquisition. If Runway 33 is further extended to a total length of 7,000 feet in the long term, then an additional 32.9 acres, including one farmstead located in the RPZ, is recommended for acquisition. This long term project would also require the relocation of U.S. Highway 24/40 and require an additional acquisition of 20.5 acres and a home. This acquisition includes approximately 10 acres of property for the road easement.

The airport currently owns an avigation easement that encompasses the RPZ over private property beyond the south end of Runway 1-19. Following FAA recommendations, this easement, approximately 14.3 acres, should be purchased in fee-simple by the airport.

The planned northerly extension to Runway 1-19 will extend beyond the existing airport property line. At a minimum, the airport must purchase the RSA, OFA, and OFZ associated with the extended runway. It is further recommended that the airport purchase the RPZ up to the Mud Creek levee, an area of approximately 21.7 acres. An easement could be purchased for the very end of the RPZ that falls on the levee but the likelihood of incompatible development on the levee is remote.

Acquisition of the land associated with the extension of Runway 1-19 may potentially leave the property owner with an "uneconomic remnant" to the west. This area is approximately 12.3 acres and may also need to be acquired.

Land acquisition necessary for Airport Improvement Program (AIP)-assisted airport development must be accomplished in accordance with the *Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally Assisted Programs* (49 CFR Part 24), also referred to as the Uniform Act. The Uniform Act is the Federal law that provides property acquisition policies for the equitable treatment of persons displaced as the result of a federally assisted project. *Land Acquisition and Relocation Assistance for Airport Improvement Program Assisted Projects* (Advisory Circular 150/5100-17) provides guidance to assist airport sponsors in meeting the requirements.

ROAD RELOCATION

U.S. Highway 24/40 traverses to the south of the airport. The planned 400-foot short term extension of Runway 15-33 would not impact the highway as both the RSA and OFA remain clear of the road. However, in the long term, an additional 900-foot extension is planned, which would place both the RSA and OFA across the highway. The master plan includes shifting U.S. Highway 24/40 approximately 1,000 feet to the south in order for both the extended RSA and OFA to meet design standards. The total length of the road shift is approximately 4,800 feet. The only other option would be to tunnel U.S. Highway 24/40 under the extended RSA and OFA, which tends to be cost-prohibitive.

The initial rerouting design of U.S. Highway 24/40 was submitted to KDOT for review. KDOT's comments are presented in **Appendix F**. Based on KDOT's comments, the road section was redrawn to meet KDOT standards. The road segment shown on **Exhibit 5A** and subsequent exhibits reflect this update.

The depiction of the rerouted U.S. Highway 24/40 follows guidelines published in the *Kansas Department of Transportation – Design Manual* (11.2008 Edition). The obligation of the airport and the FAA when rerouting roads is to replace the road section to the existing standards. In this case, the rerouted road section must be designed to maintain the posted 65 mile-per-hour speed limit. To maintain this posted speed limit, the rerouted road must have a horizontal curve radius between 1,200 feet and 2,320 feet. As shown, the curve radius, including the departure/return control points, reflect a horizontal radius of 1,760 feet. A 140-foot wide easement is also planned.

KDOT has indicated a long term plan to upgrade U.S. 24/40 to a four-lane divided highway. If KDOT were to move forward with this plan, consideration should be given to all potential impacts to the airport and the approach surface airspace. For example, a clear 50:1 approach surface leading to Runway 33 should be maintained. It should be noted that the rerouted road segment depicted on the exhibit would not conform to freeway standards (only replacement standard is considered). Therefore; if the airport or KDOT moves forward with a project that impacts U.S. 24/40 near the airport, more detailed preliminary engineering should be undertaken that satisfies the needs of both the airport and KDOT.

LAND USE COMPATIBILITY

Land use compatibility is the responsibility of the airport sponsor and must be pursued in order to comply with FAA grant assurances. In effect since 1964, Grant Assurance 21, *Compatible Land Use*, implementing Title 49 United States Code (U.S.C.) § 47107 (a) (10), requires, in part, that the sponsor:

> *"…take appropriate action, to the extent reasonable, including the adoption of zoning laws, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft."*

In all cases, the FAA expects a sponsor to take appropriate actions to the extent reasonably possible to minimize incompatible land uses. FAA Order 5190.6B, *Airport Compliance Manual*, provides guidance on land use compatibility and other airport compliance issues.

Grant Assurance 20, *Hazard Removal and Mitigation*, states that the airport sponsor "will take appropriate action to assure that such terminal airspace as is required to protect instrument and visual operations to the airport (including established minimum flight altitudes) will be adequately cleared and protected by removing, lowering, relocating, marking, lighting, or otherwise mitigating existing airport hazards and by preventing the establishment or creation of future airport hazards."

The FAA provides further guidance in Advisory Circular (AC) 150/5200-33, *Hazardous Wildlife Attractants on or Near Airports*. The distance between the airport movement areas and wildlife attractants should be at least 10,000 feet for airports serving turbine-powered aircraft (such as Lawrence Municipal Airport) and should include approach and departure airspace to a distance of five miles. Examples of wildlife attractants (particularly for birds) include landfills, waste water treatment facilities, lakes, and wetlands.

The State of Kansas has a vested interest in the protection of airports within the state. *Kansas Statutes Annotated, Chapter 3, Article 3 – Zoning Regulations,* provides the legal framework for airport sponsors to develop plans and ordinances intended to protect airports from incompatible land uses.

AIRSIDE CONCLUSION

Design standards for Lawrence Municipal Airport are determined by the frequency of activity by the critical aircraft and the sophistication of the instrument approaches. The current critical aircraft falls in ARC C-II, while the future critical aircraft is forecast to transition to ARC D-II.

Runway 15-33 is planned to be extended 400 feet bringing the total length to 6,100 feet. A runway length of 6,100 feet is the maximum allowable without impacting U.S. Highway 24/40. Ultimately, the plan calls for a total runway length of 7,000 feet. The initial extension is necessary to accommodate the full range of aircraft that fall within ARC C-II. Several of these aircraft types that operate at the airport would benefit from the additional length.

Runway 1-19 is planned to be improved from ARC B-I to ARC B-II standards. This improvement will allow the crosswind runway to accommodate all small aircraft including those with 10 or more passenger seats. In addition, this upgrade will be able to serve as a more capable back-up for times when the primary runway is closed, typically due to maintenance. To this end, the runway is planned to be extended 499 feet to the north.

Several taxiway improvements are planned. Taxiway D is planned to be extended to the Runway 19 threshold, thus eliminating the need for aircraft to back-taxi on the runway. An additional connecting taxiway is planned between Taxiway A and Runway 15-33. Taxiway A is planned to be extended in conjunction with the extension of Runway 15-33.

A new taxilane is planned to extend from Taxiway C, south to the central T-hangar development area. Another taxilane is planned to provide access to the west development area. Both of these taxilanes are intended to reduce congestion and improve the efficiency of aircraft movements.

The presence of CAT-I and GPS LPV instrument approaches to Runway 33 is important to maintaining the airport as a 24-hour business jet capable airport. To enhance the capability of the airport, a ¾-mile GPS LPV approach is planned to Runway 15. Instrument approaches with 1-mile visibility minimums are also planned to both ends of Runway 1-19. All instrument procedures associated with Runway 15-33 should be updated to include aircraft in ARC D-II since they currently operate at the airport.

The recommended airside concept prepares the airport for a transition from ARC C-II to ARC D-II. This transition is significant as the safety area dimensions and runway length needs change. The concept presented allows the airport to meet the needs while meeting design standards.

LANDSIDE CONCEPT

The primary goal of landside facility planning is to provide adequate aircraft storage space to meet forecast needs, while also maximizing operational efficiencies and land uses. Achieving this goal yields a development scheme which segregates aircraft activity levels while maximizing the airport's revenue potential. **Exhibit 5D** presents a large scale view of the planned landside development for the airport.

There are an unlimited number of potential hangar layouts that could be considered. The layout presented here maximizes the limited development space while meeting airport design standards and philosophies.

There are three distinct hangar development areas that can be defined for the airport. The east development area would include all areas east of the terminal building and Airport Road. The central development area is the current location of the FBO facilities and the T-hangars. The west development area is to the west of the Runway 1 threshold accessible via Taxiway C.

HANGARS

The recommended concept shows the location for certain hangar types. Following the philosophy of separation of activity levels, larger high-activity conventional hangars are located facing the main apron. Lower activity T-hangars and box/executive hangars are farther from the main apron and grouped together. **Table 5B** presents the total hangar area provided in the master plan concept.

TABLE 5B
Planned Hangar Space
Lawrence Municipal Airport

Facility Type	Existing Hangar Space	Additional Hangar Space Needed	Total Airport Hangar Space Needed	New Hangar Space Provided in Master Plan
T-Hangar	41,600	31,400	73,000	49,000
Executive Hangar	18,300	14,700	33,000	82,500
Conventional Hangar	35,900	0	35,900	141,900
Total Hangar Space	**95,800**	**46,100**	**141,900**	**273,400**
Maintenance/Office	22,900	0	22,900	25,800

Measurements in square feet and encompass the building footprint.
Source: Coffman Associates analysis

As can be seen from the table, the master plan concept provides more than 273,400 square feet of new aircraft hangar space. The need over the course of the next 20 years is estimated at 46,100 square feet. Therefore, the hangar layout presented represents a vision for the airport that extends beyond the scope of this master plan. The reason for this is to provide airport decision-makers with dedicated areas on the airport that should be reserved for certain hangar types. For example, areas intended for T-hangars should remain reserved for T-hangars even beyond the scope of the master plan.

The hangar layout shown on the exhibit meets the separation of activity levels philosophy. In the east development area, conventional hangars exclusively occupy land that faces the main apron (as planned for expansion). According to the hangar type forecasts presented previously in Chapter Three – Facility Requirements, the airport currently provides adequate conventional hangar space. Nonetheless, private developers or aviation businesses may desire to construct a hangar on the main ramp. The airport should restrict these areas to larger, high activity conventional hangars because of the unique and limited nature of this space.

A taxilane is planned to extend from the main apron (as expanded) to provide access to an executive hangar development area. Approximately 82,000 square feet of executive hangar space is planned, which again, exceeds the 20-year forecast need of 14,700 square feet. In order to protect the continued viability of airport growth beyond the scope of this master plan, this area should be reserved for hangar development exclusively. In this case, executive hangars are recommended.

The central development area includes the FBO hangars that face the existing main apron as well as the T-hangars

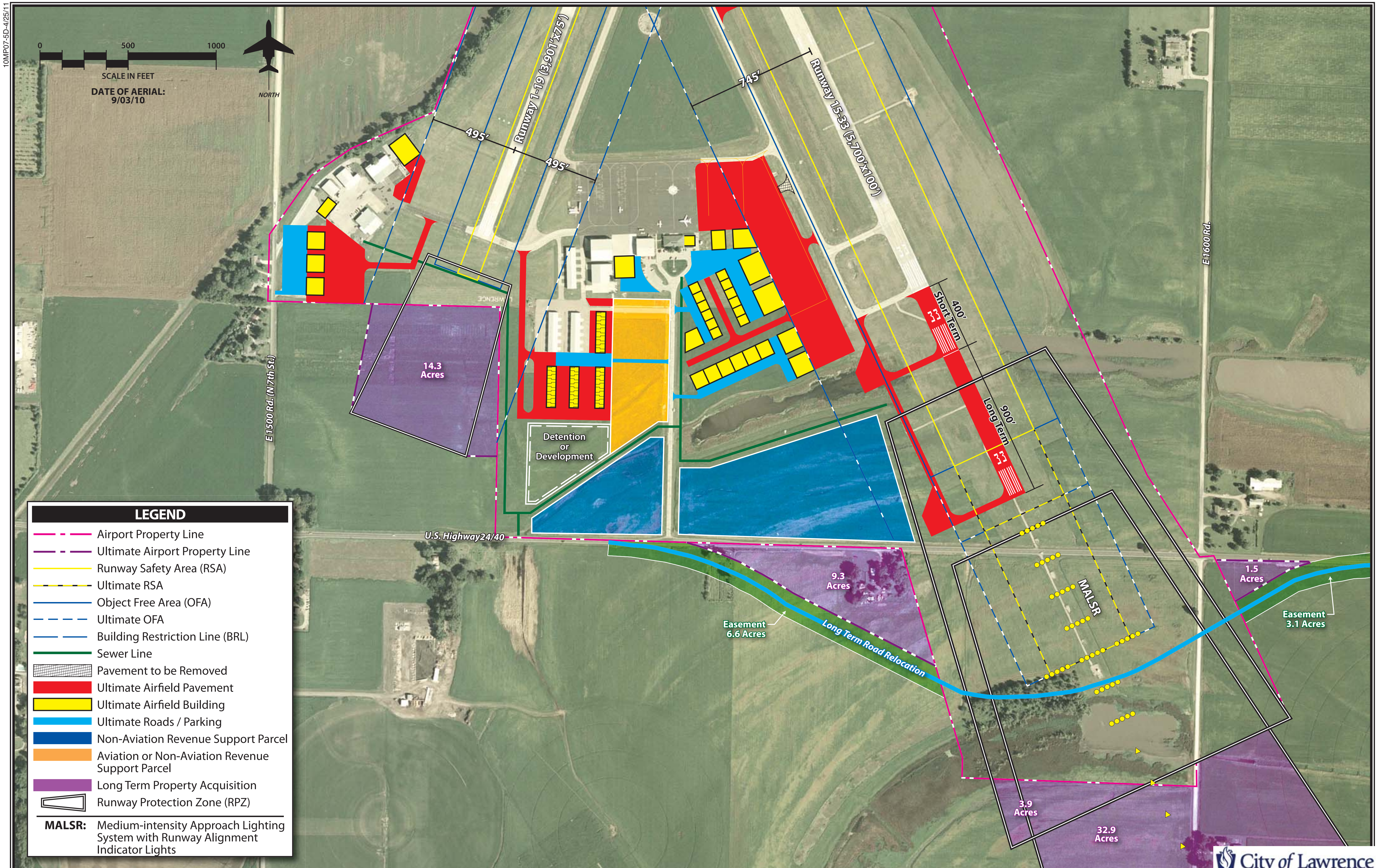


Exhibit 5D
TERMINAL AREA CONCEPT

that are set back from the apron. Once the sewer and water lines are in place on the airport (planned 2011 completion), a new parcel located between the two FBO hangars could be utilized for a new hangar. This location is currently a dispersion field that will no longer be needed once the utilities are in place. The hangar planned is a conventional hangar that would complement the existing FBO hangar complex.

Set back from the central FBO area is two existing T-hangar structures. The location of these T-hangars is appropriate, and future planning continues this development plan. Therefore, four additional T-hangar structures are planned. These T-hangars provide approximately 49,000 square feet of additional aircraft storage space. This, too, exceeds the forecast need of 31,400 square feet over the next 20 years. Nonetheless, this area, as outlined on **Exhibit 5B**, should be reserved for lower activity T-hangars or small connected box hangars.

The west side of the airport provides some limited in-fill opportunities. Long term plans by the University of Kansas show the potential to add an additional hangar to their complex. A single hangar is planned that would replace the aging small hangar immediately to the north of their main hangar. In addition to the hangar, an expansion of the ramp is planned to provide access to the planned hangar and to provide adequate circulation and ground movement capability.

The location of the Port-a-Port hangars is planned for redevelopment. As shown on **Exhibit 5B**, three medium sized conventional hangars are planned. This is just one potential option, as this area could also be developed for T-hangars or even as a single large hangar for a significant aviation business. Due to the number of airport businesses located in the west terminal area, a secondary access point is planned with a taxilane that extends from Taxiway C to an expanded west side apron.

Overall, Lawrence Municipal Airport has the land area available to accommodate forecast growth in aviation activity beyond the 20-year planning horizon. The areas identified for hangar development should be reserved for this purpose.

AIRCRAFT APRON AND TAXILANES

Lawrence Municipal Airport has limited aircraft apron space. At times throughout any given year, the aircraft ramp can be full of parked itinerant aircraft. These times are typically associated with university events such as football or basketball games or with auto races at the Kansas Speedway. As a result, the plan calls for expanding the apron to the east. The total additional apron planned is approximately 45,000 square yards. The apron expansion should be implemented with a phased approach as documented justification emerges. To this end, airport staff or the FBO operator should document, with pictures, those extremely busy times at the airport.

The expanded apron should support large conventional hangars exclusively. By locating these hangars efficiently, a total of six conventional hangars can be accommodated. Maximizing the ramp space for hangars will ultimately maximize airport revenues from these hangars.

A taxilane is planned to extend from the expanded apron to provide access for executive hangar development areas. While developer needs can, at times, differ from the preferred hangar layout, a future taxilane should be preserved.

A secondary taxilane is planned to extend from the intersection of Taxiway C and Taxiway D into the central T-hangar development area. This taxilane will become increasingly important as more T-hangar structures are built. The existing access points, adjacent T-hangar block A, will become congested as more aircraft are added to the central development area.

In the west development area, a large parcel is available for development. A new taxilane extending from Taxiway C is planned to access this area in order to prevent congestion that would result from the continued use of a single access point. This development area also supports a public apron fronted by three conventional hangars.

TERMINAL BUILDING

As discussed in the Facility Requirements chapter, the terminal building is a tremendous asset for the city. It is spacious and meets the needs of general aviation users. While expansion of the terminal building is not necessary to meet aviation demand, the master plan recommends two improvements. First, an enclosed walkway between the terminal building and the main FBO hangar would provide an additional level of comfort for airport users. Second, the existing break room and vending area is planned for an expansion that could accommodate a restaurant.

Restaurants on airports provide several community benefits. When successful, they attract people that might not otherwise have reason to visit the airport. Airport restaurants can also attract additional itinerant aviation activity leading to increased fuel sales and other revenues. It should be noted that all costs associated with expansion of the terminal building would be the responsibility of the airport sponsor.

ON-AIRPORT LAND USE

The Lawrence Municipal Airport currently encompasses approximately 445 acres. As the airport has accepted grants for capital improvements from the FAA, the 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 Airport Layout Plan and the Airport Property Map must then be updated to reflect the sale or land use change of the identified property.

Land Use Change

A land use change permits land to be leased for non-aeronautical purposes. A land-use change 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 that is 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 that 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 that is 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. If land is needed for aeronautical purposes, a land-use change is not justified. Ordinarily, land on or in proximity to the flight line and airport operations area is needed for aeronautical purposes and should not be used for non-aviation purposes.

The proceeds derived from the land-use change must be used exclusively for the benefit of the airport. The proceeds derived from the land-use change may not be used for a non-airport purpose. The proceeds cannot be diverted to the airport sponsor's general fund or for general economic development unrelated to the airport.

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 airport 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.

On-Airport Land Use Summary

Part of the master plan is to identify any property on the airport that could be released or have a land use change. The City does not intend to release any airport property for sale. The City does desire to market certain portions of property available to both aeronautical and non-aeronautical businesses. Aeronautical businesses are defined as those that require access to the runway/taxiway system, meaning they have at least one aircraft used for the business. Non-aeronautical businesses would include all other types of businesses.

The City of Lawrence has recently made a significant infrastructure investment that will directly benefit the airport. Water and sewer lines are currently being extended (estimated completion 2011) in order to serve areas adjacent the airport and facilities on the airport. The City intends to market the availability of these utilities in order to attract both aviation and non-aviation related businesses to the airport vicinity.

There are two distinct parcels of airport property that clearly will not ever serve aviation purposes and a third parcel that could serve either aeronautical or non-aeronautical purposes. The two parcels are located immediately south of the ox-bow remnant or slough that stretches under Airport Road. To the west of Airport Road is approximately 5.1 acres and to the east is approximately 15.1 acres. The slope from the terminal area to these parcels would make connection to the runway and taxiway system problematic. In addition, the oxbow has previously been identified as a wetland, which would require mitigation if it is disturbed. These parcels south of the ox-bow are, therefore, identified for non-aeronautical uses.

The third parcel designated for either aeronautical or non-aeronautical purposes is located north of the ox-bow and west of Airport Road encompassing approximately five acres. The City would like to preserve an option to lease this parcel for either aeronautical or non-aeronautical purposes should such an opportunity arise.

As discussed previously, the master plan concept presents approximately 273,400 square feet of additional hangar space and an aviation-related development parcel of approximately three acres. Over the next 20 years, there is a forecast need of 46,100 square feet of hangar space. Therefore, the master plan provides approximately six times the aeronautical development area needed for the airport over the next 20 years. The hangar space identified far exceeds the forecast need and provides an extended vision for the airport.

It appears reasonable for the third parcel to have a land use change in order to allow non-aeronautical development. This parcel could be attractive as it is close to the terminal building and it would have ready access to the new water and sewer lines. Of course, the benefit to the airport is land that is not expected to be developed for a very long time (50 to 100 years or more), may be marketed to a broader audience, thereby generating revenue for the airport.

VEHICULAR ACCESS AND PARKING

A planning consideration for any airport master plan is the segregation of vehicles and aircraft operational areas. This is both a safety and security consideration for the airport. Aircraft safety is reduced and accident potential increased when vehicles and aircraft share the same pavement surfaces. Vehicles contribute to the accumulation of debris on aircraft operational surfaces, which increases the potential for Foreign Object Damage (FOD), especially for turbine-powered aircraft. The potential for runway incursions is also increased, as vehicles may inadvertently access an active runway or taxiway area if they become disoriented once on the aircraft operational area (AOA). Airfield security may be compromised as there is loss of control over the vehicles as they enter the secure AOA. The greatest concern is for public vehicles, such as delivery vehicles and visitors, which may not fully understand the operational characteristics of aircraft and the markings in place to control vehicle access. The best solution is to provide dedicated vehicle access roads to each landside facility that is separated from the aircraft operational areas with security fencing.

The segregation of vehicle and aircraft operational areas is supported by FAA guidance established in June 2002. FAA AC 150/5210-20, *Ground Vehicle Operations on Airports*, states, "The control of vehicular activity on the airside of an airport is of the highest importance." The AC further states, "An airport operator should limit vehicle operations on the movement areas of the airport to only those vehicles necessary to support the operational activity of the airport."

The landside alternative for Lawrence Municipal Airport has been developed to reduce the need for vehicles to cross an apron or taxiway area. Dedicated vehicle parking areas, which would be outside the planned airport perimeter fence, are considered for all potential hangars.

STORM WATER CONSIDERATIONS

The Lawrence Municipal Airport is located on the floodplain for the Kansas River. The airport and North Lawrence is protected by a levee along the river to the south and west of the airport. The north side of the airport is protected by the Mud Creek levee. While locating airports on protected floodplains is common since the area is relatively flat, drainage can be an issue. Lawrence is no exception as airport property has several natural water collection points.

Immediately south of the primary runway is a slough that retains water most of the year. This slough has been considered a wetland previously. Numerous migratory birds and other wildlife have been identified in the area. Immediately to the west of the crosswind runway is a drainage channel that also retains water.

As the airport grows and more impervious surface (e.g., pavement) is constructed, these water collection points will likely become constrained. In fact, at times of heavy rainfall currently, the slough is known to fill and inundate neighboring properties. This problem will only become more of an issue over time.

The City is rightfully concerned that potential business development projects for the airport proper and the vicinity may be negatively impacted by the drainage issues. Therefore, the airport plans to begin the process of analyzing the drainage issues with an eye toward potential on-airport development outlined in this master plan. The capital improvement program will therefore include a project to study the drainage issues and develop a formal drainage plan. A second project will include the construction of appropriate drainage channels and culverts to facilitate the movement of runoff away from the airport.

SECURITY RECOMMENDATIONS

In cooperation with representatives of the general aviation community, the Transportation Security Administration (TSA) published security guidelines for general aviation airports. These guidelines are contained in the publication entitled, *Security Guidelines for General Aviation Airports*, published in May 2004. Within this publication, the TSA recognized that general aviation is not a specific threat to national security. However, the TSA does believe that general aviation may be vulnerable to misuse by terrorists as security is enhanced in the commercial portions of aviation and at other transportation links.

To assist in defining which security methods are most appropriate for a general aviation airport, the TSA defined a series of airport characteristics that potentially affect an airport's security posture. These include:

1. Airport Location – An airport's proximity to areas with over 100,000 residents or sensitive sites that can affect its security posture. Greater security emphasis should be given to airports within 30 miles of mass population centers (areas with over 100,000 residents) or sensitive areas such as military installations, nuclear and chemical plants, centers of government, national monuments, and/or international ports.

2. Based Aircraft – A smaller number of based aircraft increases the likelihood that illegal activities will be identified more quickly. Airports with based aircraft weighing more than 12,500 pounds warrant greater security measures.

3. Runways – Airports with longer paved runways are able to serve larger aircraft. Shorter runways are less attractive as they cannot ac-

commodate the larger aircraft which have more potential for damage.

4. Operations – The number and type of operations should be considered in the security assessment.

Table 5C summarizes the recommended airport characteristics and ranking criterion. The TSA suggests that an airport rank its security posture according to this scale to determine the types of security enhancements that may be appropriate. As shown in the table, the Lawrence Municipal Airport ranking on this scale is 36. Points are assessed for the airport having more than 101 based aircraft, having a runway greater than 5,001 feet in length, having a paved runway surface, having 14 CFR Part 135 charter operations, and for having flight training and rental aircraft activities at the airport. In addition, the airport's proximity to population centers, sensitive areas, Class B airspace and/or restricted airspace, enhance the need for adequate security.

As shown in **Table 5C**, a rating of 36 points places Lawrence Municipal Airport on the third tier ranking of security measures by the TSA. This rating clearly illustrates the importance of meeting security needs at Lawrence Municipal Airport as the activity at the airport grows. The airport is not projected to transition to the fourth tier during the planning period. Based upon the results of the security assessment, the TSA recommends 13 potential security enhancements for Lawrence Municipal Airport. These enhancements are outlined in **Table 5D** and are discussed in detail.

Access Controls: To delineate and adequately protect security areas from unauthorized access, it is important to consider boundary measures such as fencing, walls, or other physical barriers, electronic boundaries (e.g., sensor lines, alarms), and/or natural barriers. Physical barriers can be used to deter and delay the access of unauthorized persons onto sensitive areas of airports. Such structures are usually permanent and are designed to be a visual and psychological deterrent as well as a physical barrier. The airport provides perimeter fencing with access control gates for both vehicles and pedestrians.

Lighting System: Protective lighting provides a means of continuing a degree of protection from theft, vandalism, or other illegal activity at night. Security lighting systems should be connected to an emergency power source, if available.

Personal ID System: This refers to a method of identifying airport employees or authorized tenants and allowing access to various areas of the airport through badges or biometric controls.

Vehicle ID System: This refers to an identification system which can assist airport personnel and law enforcement in identifying authorized vehicles. Vehicles can be identified through the use of decals, stickers, or hang tags.

Challenge Procedures: This involves an airport watch program which is implemented in cooperation with airport users and tenants to be on guard for unauthorized and potentially illegal activities at the airport.

TABLE 5C
General Aviation Airport Security Measurement Tool
Transportation Security Administration

	Assessment Scale	
Security Characteristic	**Public Use Airport**	**Lawrence Municipal Airport**
Location		
Within 20nm of mass population areas[1]	5	5
Within 30nm of a sensitive site[2]	4	4
Falls within outer perimeter of Class B airspace	3	0
Falls within boundaries of restricted airspace	3	0
Based Aircraft		
Greater than 101 based aircraft	3	0
26-100 based aircraft	2	2
11-25 based aircraft	1	0
10 or fewer based aircraft	0	0
Based aircraft over 12,500 pounds	3	3
Runways		
Runway length greater than 5,001 feet	5	5
Runways less that 5,000 feet and greater than 2,001 feet	4	0
Runway length less than 2,000 feet	2	0
Asphalt or concrete runway	1	1
Operations		
Over 50,000 annual operations	4	0
Part 135 operations (Air taxi and fractionals)	3	3
Part 137 operations (Agricultural aircraft)	3	3
Part 125 operations (20 or more passenger seats)	3	3
Flight training	3	3
Flight training in aircraft over 12,500 pounds	4	0
Rental aircraft	4	4
Maintenance, repair, and overhaul facilities conducting long-term storage of aircraft over 12,500 pounds	4	0
Totals	**64**	**36**

[1] An area with a population over 100,000

[2] Sensitive sites include military installations, nuclear and chemical plants, centers of government, national monuments, and/or international ports

Source: Security Guidelines for General Aviation Airports (TSA 2004)

TABLE 5D
Recommended Security Enhancements
Lawrence Municipal Airport

	Points Determined Through Airport Security Characteristics Assessment			
Security Enhancements	**> 45**	**25-44**	**15-24**	**0-14**
Fencing	■			
Hangars	■			
Closed-Circuit Television (CCTV)	■			
Intrusion Detection System	■			
Access Controls	■	■		
Lighting System	■	■		
Personal ID System	■	■		
Challenge Procedures	■	■		
Law Enforcement Support	■	■	■	
Security Committee	■	■	■	
Transient Pilot Procedures	■	■	■	
Signs	■	■	■	
Documented Security Procedures	■	■	■	■
Positive/Passenger/Cargo/Baggage ID	■	■	■	■
Aircraft Security	■	■	■	■
Community Watch Program	■	■	■	■
Contact List	■	■	■	■

Law Enforcement Support: This involves establishing and maintaining a liaison with appropriate law enforcement including local, state, and federal agencies. These organizations can better serve the airport when they are familiar with airport operating procedures, facilities, and normal activities. Procedures may be developed to have local law enforcement personnel regularly or randomly patrol ramps and aircraft hangar areas, with increased patrols during periods of heightened security.

Security Committee: This committee should be composed of airport tenants and users drawn from all segments of the airport community. The main goal of this group is to involve airport stakeholders in developing effective and reasonable security measures and disseminating timely security information.

Transient Pilot Sign-in/Sign-Out Procedures: This involves establishing procedures to identify non-based pilots and aircraft using their facilities, and implementing sign-in/sign-out procedures for all transient operators and associating them with their parked aircraft. Having assigned spots for transient parking areas can help to easily identify transient aircraft on an apron.

Signs: The use of signs provides a deterrent by warning of facility boundaries as well as notifying of the consequences for violation.

Documented Security Procedures: This refers to having a written security plan. This plan would include documenting the security initiatives already in place at Lawrence Municipal Airport, as well as any new enhancements. This document should consist of airport and local law enforcement contact information, and include utilization of a program to increase airport user awareness of security precautions such as an airport watch program.

Positive/Passenger/Cargo/Baggage ID: A key point to remember regarding general aviation passengers is that the persons boarding these flights are generally better known to airport personnel and aircraft operators than the typical passenger on a commercial airliner. Recreational general aviation passengers are typically friends, family, or acquaintances of the pilot in command. Charter/sightseeing passengers typically will meet with the pilot or other flight department personnel well in advance of any flights. Suspicious activities such as use of cash for flights or probing or inappropriate questions are more likely to be quickly noted and authorities could be alerted. For corporate operations, typically all parties onboard the aircraft are known to the pilots. Airport operators should develop methods by which individuals visiting the airport can be escorted into and out of aircraft movement and parking areas.

Aircraft Security: The main goal of this security enhancement is to prevent the intentional misuse of general aviation aircraft for criminal purposes. Proper securing of aircraft is the most basic method of enhancing general aviation airport security. Pilots should employ multiple methods of securing their aircraft to make it as difficult as possible for an unauthorized person to gain access to it. Some basic methods of securing a general aviation aircraft include: ensuring that door locks are consistently used to prevent unauthorized access or tampering with the aircraft; using keyed ignitions where appropriate; storing the aircraft in a hangar, if available, and locking hangar doors, using an auxiliary lock to further protect aircraft from unauthorized use (i.e., propeller, throttle, and/or tie-down locks); and ensuring that aircraft ignition keys are not stored inside the aircraft.

Community Watch Program: The vigilance of airport users is one of the most prevalent methods of enhancing security at general aviation airports. Typically, the user population is familiar with those individuals who have a valid purpose for being on the airport property. Consequently, new faces are quickly noticed. A watch program should include elements similar to those listed below. These recommendations are not all-inclusive. Additional measures that are specific to each airport should be added as appropriate, including:

- Coordinate the program with all appropriate stakeholders, including airport officials, pilots, businesses and/or other airport users.
- Hold periodic meetings with the airport community.
- Develop and circulate reporting procedures to all who have a regular presence on the airport.
- Encourage proactive participation in aircraft and facility security and heightened awareness measures.

This should include encouraging airport and line staff to "query" unknowns on ramps, near aircraft, etc.

- Post signs promoting the program, warning that the airport is watched. Include appropriate emergency phone numbers on the sign.
- Install a bulletin board for posting security information and meeting notices.
- Provide training to all involved for recognizing suspicious activity and appropriate response tactics.

Contact List: This involves the development of a comprehensive list of responsible personnel/agencies to be contacted in the event of an emergency procedure. The list should be distributed to all appropriate individuals. Additionally, in the event of a security incident, it is essential that first responders and airport management have the capability to communicate. Where possible, coordinate radio communication and establish common frequencies and procedures to establish a radio communications network with local law enforcement.

FRACTIONAL JET OPERATOR SECURITY REQUIREMENTS

The major fractional jet operators have established minimum standards for airports serving their aircraft. These minimum standard documents specify the following general security requirements:

Identification: The airport should issue unique identification badges for employees who have access to the aircraft operations areas. Unescorted passenger access to the ramp is prohibited.

Employees: The airport must conduct FAA-compliant background checks on each employee. The airport must have pre-employment drug screening.

Aircraft Security: Aircraft cannot be left unattended when the ground power unit or auxiliary power unit is operating. Aircraft must be locked when unattended. Aircraft must be parked in well-lit, highly visible areas with a minimum of six-foot chain link fencing. Security cameras are preferred. Sightseers or visitors are not allowed access aboard or near aircraft.

Facility Security: Visual surveillance of all aircraft operational areas belonging to the airport is required. The airport shall establish controlled access to the aircraft operational areas. The airport should maintain at least six feet between safety fence and parked ground equipment. Bushes and shrubs must be less than four feet in height.

SUMMARY

The recommended master plan concept has been developed with significant input from the PAC. The PAC included representation from various City of Lawrence departments, including Engineering and Planning, the Chamber of Commerce, airport management, the airport advisory board, and airport businesses. This plan provides the necessary development to accommodate and satisfy the anticipated growth over the next 20 years and beyond.

The airport currently meets design standards for its critical aircraft (that grouping of general aviation aircraft that perform 500 or more annual operations) in ARC C-II. Representative aircraft include medium-sized business jets such as the Cessna Citation X (model 750). The future critical aircraft is forecast to fall in ARC D-II and is best represented by large business jets such as the Gulfstream II.

On the airside, primary Runway 15-33 is planned to be extended from its current length of 5,700 feet to 6,100 feet and again, in the long term, to a total length of 7,000 feet. The initial 400-foot extension is intended to accommodate those business jets within the critical aircraft category (ARC C-II) that may, at times, require the additional length. Of particular note were the runway length needs of the Cessna Citation X (model 750) and the Challenger 604, both of which may need more than the existing available length. The long term extension would only be justified by frequent operations by fully loaded aircraft travelling long distances.

Crosswind Runway 1-19 is planned for two primary improvements. First, parallel Taxiway D is planned to be extended approximately 1,000 feet to meet the Runway 19 threshold. This project will enhance safety by reducing runway occupancy times and eliminating the need for back-taxiing. Second, the runway is planned, ultimately, to be extended 499 feet, bringing the total length to 4,400 feet, in order to serve as a more adequate backup for those times when the primary runway is closed (usually due to maintenance). Runway 1-19 would be improved to meet ARC B-II standards and outfitted with instrument approaches.

On the landside, the main apron is planned to be expanded to the east. This expansion will position the airport to better accommodate the influx of transient aircraft that occurs periodically throughout the year. It will also open up additional apron frontage space for development.

Three distinct hangar development areas have been identified and recommendations for the appropriate type of development have been made. The east development area will front the planned apron expansion. The area is planned for conventional hangars and executive box hangars. The central development area is planned to continue the existing T-hangar layout. A secondary taxiway access point is also planned to reduce congestion. The west development area is currently shown with three large conventional hangars and a public apron.

Overall, the landside layout provides a vision for airport development that far exceeds the 20 year scope of the master plan. By implementing efficient facility locating strategies and maximizing the existing property, the airport is well positioned to accommodate growth well into the future.

Several adjacent properties are planned for acquisition. To accommodate the planned extension to Runway 15-33 in the short term, approximately 3.9 acres of property within the RPZ should be acquired. In the long term, an additional 32.9 acres would be recommended for acquisition. On the Runway 19 end, approximately 21.7 acres is planned for acquisition. A portion of this must be acquired to accommodate the planned runway extension and a portion is contained within the RPZ. On the Runway 1 end, the airport should ultimately purchase in-fee the 13.5 acres easement.

Overall, five specific development strategies have emerged from the master planning process:

1) Secondary access to the central T-hangar area.

2) Redesign of apron area to create a smoother transition from central ramp to new east ramp.

3) Identification of terminal area land that may be used for non-aviation revenue support.

4) Improvement of Runway 1-19 to ARC B-II standards.

5) A multi-phased approach to extending Runway15-33.

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 demand over the course of the next 20 years.

Chapter Six

Capital Improvement Program

LAWRENCE KS MUNICIPAL AIRPORT

CHAPTER SIX

CAPITAL IMPROVEMENT PROGRAM

The analyses completed in previous chapters evaluated development needs at the airport over the next 20 years and beyond, based on forecast activity and operational efficiency. Next, basic economic, financial, and management rationale is applied to each development item so that the feasibility of each item contained in the plan can be assessed.

The presentation of the capital improvement program (CIP) has been organized into two sections. First, the airport development schedule and CIP cost estimate is presented in narrative and graphic form. Second, capital improvement funding sources on the federal, state, and local levels are identified and discussed.

AIRPORT DEVELOPMENT SCHEDULES AND COST SUMMARIES

Now that the recommended concept has been developed and specific needs and improvements for the airport have been established, the next step is to determine a realistic schedule (implementation timeline) and the associated costs for the plan. This section will examine the overall cost of each project identified in the capital improvement program (CIP) and present a development schedule. The recommended improvements are grouped by planning horizon: short term, intermediate term, and long term. The short term planning horizon is further subdivided into yearly increments. Table 6A summarizes key activity

AIRPORT MASTER PLAN

milestones for the three planning horizons.

A key aspect of this master plan is the use of demand-based planning milestones. Many projects should be considered based on actual demand levels within the next five years. 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.

Table 6A
Planning Horizon Summary
Lawrence Municipal Airport

	Base Year 2010	Short Term	Intermediate Term	Long Term
Based Aircraft	60	65	75	90
ANNUAL OPERATIONS				
General Aviation				
Itinerant	16,800	18,251	19,858	23,487
Local	13,650	14,819	16,113	19,035
Subtotal	30,450	33,070	35,971	42,522
Air Taxi Activity				
Itinerant	2,100	2,280	2,479	2,928
Military Activity				
Itinerant	150	150	150	150
TOTAL OPERATIONS	**32,700**	**35,500**	**38,600**	**45,600**

Source: Coffman Associates analysis

Many development items included in the recommended concept will need to follow these demand indicators. For example, the plan includes construction of new aprons and taxilanes. Based aircraft will be the primary indicator for these projects. If based aircraft growth occurs as projected, additional hangars should be constructed to meet the demand. Often this potential growth is tracked with a hangar waiting list.

If growth slows or does not occur as forecast, some projects may be delayed. As a result, capital expenditures will be made on an as-needed basis, which leads to a more responsible use of capital assets.

Lawrence Municipal Airport has an immediate need for more hangar space as evidenced by a hangar waiting list of more than 30 aircraft owners. Construction of hangars is typically undertaken by the airport sponsor or by private developers. Since the return-on-investment for T-hangars has historically been limited or even subsidized, private developers are unlikely to invest in T-hangar facilities. Executive or conventional hangars have, historically, had a higher likelihood of breaking even or returning a profit. Therefore, for purposes of CIP, T-hangar construction will be assumed to be the responsibility of the airport sponsor, while executive and conventional hangar construction would be undertaken by private developers.

Some development items do not depend on demand, such as meeting design standards for runway safety area (RSA). Safety related projects should be programmed in a timely manner regardless of the forecast growth in activity. Other items, such as pavement maintenance, should be addressed in a scheduled manner and are not dependent on reaching aviation demand milestones. These types of projects typically are more associated with day-to-day operations.

As 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 and engineering analyses. Moreover, some projects may require additional infrastructure improvements (i.e., drainage improvements, extension of utilities, etc.) that may take more than one year to complete.

Once the list of necessary projects was identified and refined, project-specific cost estimates were developed. The cost estimates include design, engineering, construction administration, and contingencies that may arise on the project. Capital costs presented here should be viewed only as estimates subject to further refinement during design. Nevertheless, these estimates are considered sufficient for planning purposes. Cost estimates for the larger projects were provided by Olsson Associates, an engineering firm familiar with airport construction costs in the area. The detail on these estimates is provided in **Appendix C**. Cost estimates for each of the development projects in the CIP are in current (2011) dollars. **Exhibit 6A** presents the proposed CIP for Lawrence Municipal Airport. **Exhibit 6B** presents the CIP overlaid onto the airport aerial photograph and broken out into planning horizons.

The FAA utilizes a national priority ranking system to help objectively evaluate potential airport projects. Projects are weighted toward safety, infrastructure preservation, 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.

The following sections will describe in greater detail the projects identified for the airport over the next 20 years. The short term (0-5 years) projects are presented in yearly increments. The intermediate (years 6-10) and long term (years 10-20) are grouped by local priority.

SHORT TERM IMPROVEMENTS

The projects identified for the short term planning period have been prioritized based on airport need and potential to be funded. If any of these projects cannot be funded in the timeframe indicated, the airport sponsor should consider the project for the following year.

2013 Projects

The crosswind runway, Runway 1-19, is frequently used at the airport, up to 30 percent of the time by some estimates. The northernmost 1,000 feet of runway does not have access to a parallel taxiway. As a result, aircraft operators must back-taxi on the runway in order to proceed to the terminal area. To alleviate this situation, the first project considered is the extension of Taxiway D to the Runway 19 threshold.

As with all projects identified in the CIP, the FAA will input the project into the national priority ranking system and grade each project. Those projects receiving a higher ranking are more likely to be funded. Projects identified for Lawrence Municipal Airport that don't rank very high may not be funded in the specified timeframe. Nonetheless, the project should remain a priority for the airport and funding support should continue to be requested in subsequent years.

The next project considered for the 2013 timeframe is the development of an airport drainage plan and preliminary engineering of the plan. Drainage is currently an issue at the airport as several low areas retain standing water for much of the year. These areas have the potential to attract wildlife, which can present dangers for aircraft. As more development occurs at the airport and more storm water is introduced to the low areas, particularly on the airport sloughs, drainage can back up and impact not only the airport, but also neighboring properties.

The next project is the construction of a 10-unit T-hangar facility. As previously noted, there is a strong demand at the airport for more hangar space as there is a wait list of more than 30 aircraft owners. Normally, T-hangars are not eligible for FAA grant funding, unless all other priority projects have been completed. It is assumed in this master plan that T-hangar construction will be undertaken by the airport sponsor or private entity. The airport is free to pursue additional funding mechanisms such as state programs, economic development funds, and bonds to facilitate construction.

The last project in the first year of the CIP is the acquisition of approximately 14.3 acres of agricultural property adjacent to and immediately southwest of the airport. The airport currently owns an avigation easement, encompassing the Runway 1 runway protection zone (RPZ), over this property. Following FAA recommendations, the RPZ should be owned by the airport where possible.

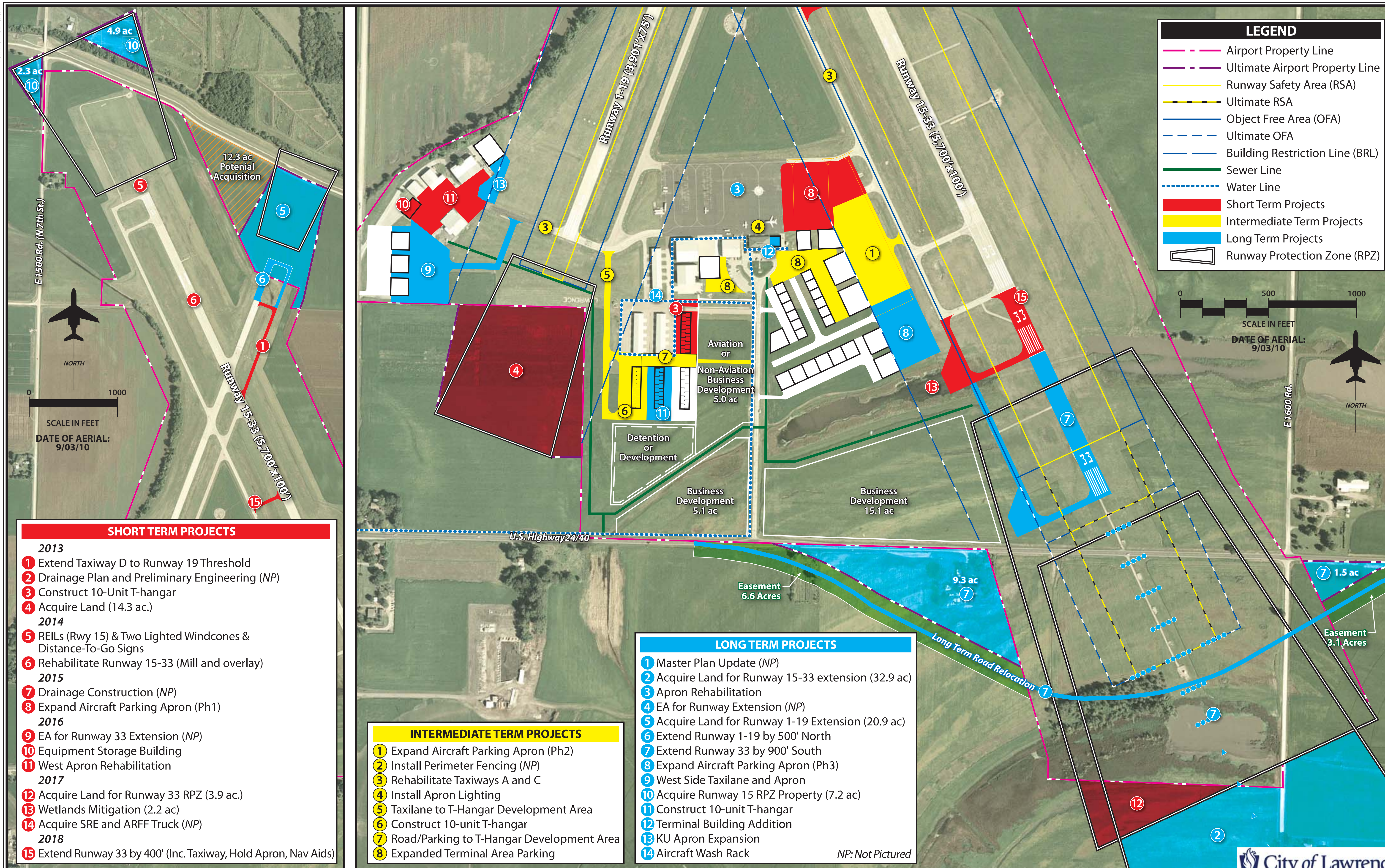
Ongoing maintenance of airport surfaces is considered throughout the plan. It is required by the FAA that airports that accept public funds, such as Lawrence Municipal Airport, maintain the useful life of their pavements. Because of the nature of pavement wear, some years may require a larger investment in rehabilitation. Pavement maintenance is an operating expense for the airport and not typically

10MP07-6A-6/07/11

	PROJECT DESCRIPTION	PROJECT COST	FAA ELIGIBLE	LOCAL SHARE
	SHORT TERM PROGRAM (0-5 YEARS)			
	2013			
1	Extend Taxiway D to Runway 19 Threshold	$780,000	$702,000	$78,000
2	Drainage Plan and Preliminary Engineering	$150,000	$135,000	$15,000
3	Construct 10-Unit T-hangar	$840,000	--	$840,000
4	Acquire Land (14.3 ac.)	$190,000	$171,000	$19,000
	2013 TOTAL	***$1,960,000***	***$1,008,000***	***$952,000***
	2014			
5	REILs (Rwy 15) & Two Lighted Windcones & Distance-To-Go Signs	$230,000	$207,000	$23,000
6	Rehabilitate Runway 15-33 (Mill and overlay)	$1,900,000	$1,710,000	$190,000
	2014 TOTAL	***$2,130,000***	***$1,917,000***	***$213,000***
	2015			
7	Drainage Construction	$1,500,000	$1,350,000	$150,000
8	Expand Aircraft Parking Apron (Ph1)	$2,100,000	$1,890,000	$210,000
	2015 TOTAL	***$3,600,000***	***$3,240,000***	***$360,000***
	2016			
9	EA for Runway 33 Extension	$200,000	$180,000	$20,000
10	Equipment Storage Building	$580,000	$522,000	$58,000
11	West Apron Rehabilitation	$270,000	--	$270,000
	2016 TOTAL	***$1,050,000***	***$702,000***	***$348,000***
	2017			
12	Acquire Land for Runway 33 RPZ (3.9 ac.)	$80,000	$72,000	$8,000
13	Wetlands Mitigation (2.2 ac)	$160,000	$144,000	$16,000
14	Acquire SRE and ARFF Truck	$600,000	--	$600,000
	2017 TOTAL	***$840,000***	***$216,000***	***$624,000***
	2018			
15	Extend Runway 33 by 400' (Inc. Taxiway, Hold Apron, Nav Aids)	$2,400,000	$2,160,000	$240,000
	2018 TOTAL	***$2,400,000***	***$2,160,000***	***$240,000***
	TOTAL SHORT TERM PROGRAM	***$11,980,000***	***$9,243,000***	***$2,737,000***
	INTERMEDIATE TERM PROGRAM (6-10 YEARS)			
1	Expand Aircraft Parking Apron (Ph2)	$2,100,000	$1,890,000	$210,000
2	Install Perimeter Fencing	$430,000	$387,000	$43,000
3	Rehabilitate Taxiways A and C	$850,000	$765,000	$85,000
4	Install Apron Lighting	$100,000	$90,000	$10,000
5	Taxilane to T-Hangar Development Area	$430,000	$387,000	$43,000
6	Construct 10-unit T-hangar	$1,200,000	--	$1,200,000
7	Road/Parking to T-Hangar Development Area	$530,000	$477,000	$53,000
8	Expanded Terminal Area Parking	$250,000	--	$250,000
	TOTAL INTERMEDIATE TERM PROGRAM	***$5,890,000***	***$3,996,000***	***$1,894,000***
	LONG TERM PROGRAM (11-20 YEARS)			
1	Master Plan Update	$250,000	$225,000	$25,000
2	Acquire Land for Runway 15-33 extension (32.9 ac)	$660,000	$594,000	$66,000
3	Apron Rehabilitation	$940,000	$846,000	$94,000
4	EA for Runway Extension	$150,000	$135,000	$15,000
5	Acquire Land for Runway 1-19 Extension (20.9 ac)	$210,000	$189,000	$21,000
6	Extend Runway 1-19 by 500' North	$880,000	$792,000	$88,000
7	Extend Runway 33 by 900' South	$9,100,000	$8,190,000	$910,000
8	Expand Aircraft Parking Apron (Ph3)	$1,530,000	$1,377,000	$153,000
9	West Side Taxilane and Apron	$1,410,000	$1,269,000	$141,000
10	Acquire Runway 15 RPZ Property (7.2 ac)	$50,000	$45,000	$5,000
11	Construct 10-unit T-hangar	$870,000	--	$870,000
12	Terminal Building Addition	$900,000	--	$900,000
13	KU Apron Expansion	$340,000	--	$340,000
14	Construct Aircraft Wash Rack & Oil Separator	$200,000	$180,000	$20,000
	TOTAL LONG TERM PROGRAM	***$17,490,000***	***$13,842,000***	***$3,648,000***
	TOTAL PROGRAM COSTS	***$35,360,000***	***$27,081,000***	***$8,279,000***

Note: Totals may not equal due to rounding
Source: Coffman Associates analysis; Olsson Associates estimates

Exhibit 6A
CAPITAL IMPROVEMENT PROGRAM



SHORT TERM PROJECTS

2013

1. Extend Taxiway D to Runway 19 Threshold
2. Drainage Plan and Preliminary Engineering (*NP*)
3. Construct 10-Unit T-hangar
4. Acquire Land (14.3 ac.)

2014

5. REILs (Rwy 15) & Two Lighted Windcones & Distance-To-Go Signs
6. Rehabilitate Runway 15-33 (Mill and overlay)

2015

7. Drainage Construction (*NP*)
8. Expand Aircraft Parking Apron (Ph1)

2016

9. EA for Runway 33 Extension (*NP*)
10. Equipment Storage Building
11. West Apron Rehabilitation

2017

12. Acquire Land for Runway 33 RPZ (3.9 ac.)
13. Wetlands Mitigation (2.2 ac)
14. Acquire SRE and ARFF Truck (*NP*)

2018

15. Extend Runway 33 by 400' (Inc. Taxiway, Hold Apron, Nav Aids)

INTERMEDIATE TERM PROJECTS

1. Expand Aircraft Parking Apron (Ph2)
2. Install Perimeter Fencing (*NP*)
3. Rehabilitate Taxiways A and C
4. Install Apron Lighting
5. Taxilane to T-Hangar Development Area
6. Construct 10-unit T-hangar
7. Road/Parking to T-Hangar Development Area
8. Expanded Terminal Area Parking

LONG TERM PROJECTS

1. Master Plan Update (*NP*)
2. Acquire Land for Runway 15-33 extension (32.9 ac)
3. Apron Rehabilitation
4. EA for Runway Extension (*NP*)
5. Acquire Land for Runway 1-19 Extension (20.9 ac)
6. Extend Runway 1-19 by 500' North
7. Extend Runway 33 by 900' South
8. Expand Aircraft Parking Apron (Ph3)
9. West Side Taxilane and Apron
10. Acquire Runway 15 RPZ Property (7.2 ac)
11. Construct 10-unit T-hangar
12. Terminal Building Addition
13. KU Apron Expansion
14. Aircraft Wash Rack

NP: Not Pictured

City of Lawrence KANSAS

Exhibit 6B
PROJECT STAGING

defined as a capital project. Nonetheless, the airport operators should be aware that continued maintenance is an important consideration.

2014 Projects

The first project considered for 2014 is the installation of Runway End Identification Lights (REILs) for the Runway 15 end. These strobe lighting systems, set to the sides of the runway threshold, provide pilots with rapid identification of the runway end. REILs should be installed on runway ends where night time operations are approved and where there may be difficulty discerning the runway end. As a business jet capable runway, with an approved instrument approach, the REILs would aid pilots and enhance safety. In addition, two lighted wind cones are planned to allow pilots to quickly determine the optimal runway end to which to land and depart. Also included in this project is the installation of distance-to-go signs. These lighted signs are placed every 1,000 feet to provide pilots an indication of how much runway length is available. Business jet capable runways, especially those with a precision approach, should have these signs.

The second project is a significant pavement preservation project for Runway 15-33. As presented, this project would involve milling and overlaying with asphalt the top two inches of the entire runway length. The runway would then be re-marked with precision markings on the Runway 33 end and non-precision markings on the Runway 15 end.

2015 Projects

In an effort to properly control storm water runoff at the airport, a significant drainage improvement project is planned. The planning and preliminary engineering for this project was previously identified in the CIP. The estimated cost of this project will change based on the results of the planning and preliminary engineering study. Conceptually, it is the goal of the city to route runoff to Mud Creek to the east.

The next project planned for the 2015 timeframe is the expansion of the main apron to the east. This apron is needed to alleviate apron congestion periodically experienced at the airport. The apron will also serve as an access point for a new conventional hangar at the airport. The new hangar is planned by a business that performs aerial inspections of utility lines.

Apron expansion typically does not rank very high on the FAA national priority ranking system. Therefore, the airport sponsor and existing airport businesses should document (pictures) those times when an expanded apron would be useful.

2016 Projects

As with all capital projects funded in whole or in part by federal funds, environmental considerations must be undertaken. The level of documentation necessary for each project must be determined in consultation with the Federal Aviation Administration (FAA). There are three major levels of environmental review to be considered under the *National Environmental Policy Act* (NEPA): categorical exclusion (CATEX), environmental assessment (EA), or environmental impact statement (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 1050.1E, *Environmental Impacts: Policies and Procedures*.

It is anticipated that several short term projects will need to be addressed in an EA. Property acquisition of more than three acres requires an EA.

Snow events are common in the Midwest and it is important for airports to be able to rapidly clear the primary aircraft movement surfaces. The airport does not currently have a dedicated snow removal equipment (SRE) facility. Some existing equipment is stored in an un-leased T-hangar unit, while other public works resources are brought in as needed for snow removal. Dedicated SRE buildings are eligible for grant funding provided the equipment stored is dedicated for airport use.

The west apron is rapidly deteriorating, creating foreign object debris (FOD) that can be unsafe for aircraft. The entirety of the west apron is planned for a two-inch mill and overlay project. This area is approximately 9,600 square yards of pavement. The FAA currently considers the west apron to be private use pavement and, therefore, not eligible for grant funding. Therefore, this project is assumed to be undertaken by the airport.

2017 Projects

Three projects are considered in 2017. The first is the acquisition of approximately 3.9 acres of property that would fall under the Runway 33 RPZ once that runway is extended to 6,100 feet. This project should be included within the EA conducted in 2015.

The next project is also associated with the extension of Runway 33. It is anticipated that the extension will impact a designated wetland. In the past, the on-airport slough has been identified as a wetland that required mitigation. An Individual Section 404 permit would be required and a cost for wetlands preservation programs is estimated.

The last project for 2017 is the acquisition, by the airport, of SRE equipment and an airport rescue and fire fighting truck (outfitted pickup truck). The ARFF truck would be maintained to Index A standards. While the SRE may be eligible for FAA funding, the ARFF truck is not, as only certified commercial service airports (Part 139 certificated) are required to maintain an ARFF vehicle. The airport has indicated that they plan to fund acquisition of equipment and reserve FAA grants for more extensive capital projects.

2018 Projects

The last project in the short term planning period is the southerly extension of Runway 18-33 by 400 feet increasing the runway length to 6,100 feet. This project is necessary to provide adequate runway length for the full range of business jets currently operating at the airport. Several business jets are currently weight-restricted under certain conditions, primarily hot summer days.

As part of the runway extension project, Taxiway A would be extended, and an aircraft hold apron at the threshold is planned. The approach lighting system would have to be relocated as would the precision approach path indicator (PAPI) visual approach aid and glide slope antenna instrument landing system (ILS) antenna. An additional connecting taxiway between Taxiway A and the runway is also planned with the runway extension.

Short Term Summary

The group of short term projects addresses several outstanding needs of the airport. A drainage study and construction projects are planned to address airport water runoff issues. Taxiway D should be completed by extending it to the Runway 19 threshold. Additional hangar space is needed today, thus a T-hangar facility is proposed. Airport ownership of the RPZ lands is also recommended in the short term. Finally, Runway 15-33 is planned for a 400-foot southerly extension, bringing the total runway length to 6,100 feet.

The short term projects total approximately $11.98 million. Approximately $9.24 million is eligible for FAA grant funding. The remaining $2.74 million would be the responsibility of the local airport sponsor.

INTERMEDIATE TERM IMPROVEMENTS

Planning new projects beyond a five-year timeframe can be challenging. Project need is heavily dependent on local demand and the economic outlook of the aviation industry. Therefore, intermediate term projects are grouped together to represent years 6-10. The use of planning horizons to group potential airport projects provides the airport flexibility to accelerate those projects that are needed immediately and delay those projects that no longer have a high priority. The projects are prioritized based on the aviation forecasts, but these priorities may change.

The first project in the intermediate planning horizon is phase two of the terminal area aircraft apron expansion to the east. This project encompasses approximately 17,000 square yards of new apron pavement. The apron would potentially front two large conventional hangars. As noted previously, apron expansion is typically a lower priority for the FAA; therefore, to receive FAA participation, the need will have to be documented.

As urbanized growth continues to approach the airport, it will become more important to provide adequate security fencing. Approximately 30,000 linear feet of perimeter fencing is considered in this project. Approximately 25,000 linear feet is planned as six-foot high chain link with three strand barbed wire and the remaining is three-foot high chain link in the terminal areas. It is not unusual for the airport to prioritize traditional access points such as the terminal area apron and install additional fencing as budgets allow. Three electronically controlled access gates are planned.

Ongoing maintenance is critical to preserving the useful life of airport pavements. Even with regular maintenance, surfaces will still deteriorate over time necessitating major rehabilitation. Taxiways A and C are planned for major rehabilitation in the intermediate time frame. For Taxiway A, there may be a need to shift the taxiway to a separation distance from the runway of 409 feet. Further consultation with the FAA should be undertaken at the appropriate time to confirm shifting the taxiway.

As the airport grows and experiences more nighttime operations, safety of ground movements can be improved with lighting of the main apron. This project considers four light stands with adequate lighting to illuminate the apron.

As discussed previously, a secondary access taxilane is planned to the central T-hangar development area. The taxilane is planned at a width of 35 feet and a length of 950 feet.

The next project in the intermediate term is the construction of a 10-unit T-hangar facility. This project includes the surrounding access pavement. In addition, a dedicated T-hangar parking lot is planned. The parking lot project is an effort to limit vehicular access to the aircraft movement areas. It also meets recommendations from the Transportation Security Administration regarding security at general aviation airports. Additional parking lots for the terminal area are also considered in this timeframe.

The intermediate term projects total approximately $5.89 million. Approximately $4.00 million is eligible for FAA grant funding with approximately $1.89 million being the responsibility of the airport sponsor.

LONG TERM IMPROVEMENTS

The aviation industry is subject to rapid changes. Therefore, the FAA recommends that airports update their master plans every five to seven years. An update to this master plan is considered at the beginning of the long term planning horizon.

Several projects are presented that are associated with the second southerly extension of Runway 15-33 by 900 feet for a total runway length of 7,000 feet. An EA will be needed prior to acquisition of approximately 33 acres that would be encompassed by the future RPZ. This property includes one home. An additional 17 acres and another home would need to be acquired to accommodate the relocation of U.S. Highway 24/40.

Justification for extending Runway 15-33 an additional 900 feet for a total length of 7,000 feet will be needed at the time this project is undertaken. As discussed, justification would likely arise from frequent activity by an aircraft operator needing the additional runway length. Several sources could potentially generate this need at Lawrence Municipal Airport including large charter aircraft (team flights) or a cargo operator.

Runway 1-19 is also planned for extension and upgrade to ARC B-II standards in the long term planning horizon. This project includes acquisition of 20.9 acres to accommodate the extension and RPZ. An additional 12.3 acres may also need to be acquired so that the property owner is not left with an uneconomic remnant.

The west terminal area provides an undeveloped five-acre parcel. A long term project includes development of a public apron and access taxilane. This area would be ideally suited for airport businesses or corporate hangars. An expansion of the apron fronting the KU hangar is also planned. This project is considered private in nature and would only be undertaken should the lease holder desire to expand the apron.

The airport owns an avigation easement to the north of Runway 15. Approximately 7.2 acres of the easement is planned to be acquired. The portion to be acquired represents the extent to which an RPZ associated with a ¾-mile instrument approach would extend.

The main apron is planned for major rehabilitation and expansion in the long term. The phasing of these projects will be dependent upon the needs of the airport at the time.

As the airport grows in terms of based aircraft, it will be important to provide a central location for owners to wash and perform routine maintenance, such as changing the oil. Therefore, a wash rack and oil separator is planned in the long term planning period.

A line item has been reserved for an additional 10-unit T-hangar. A terminal building expansion project that includes a restaurant and a covered walkway to the FBO hangar is included. Both of these projects would be self-funded as the FAA does not prioritize these projects.

The long term projects total approximately \$17.49 million, of which approximately \$13.84 million is eligible for FAA funding. Approximately \$3.65 million would be the responsibility of the airport sponsor

CAPITAL IMPROVEMENT SUMMARY

The CIP is intended as a road map of airport improvements to help guide the airport sponsor, the FAA, and the state aviation division on needed projects. The plan as presented will meet the forecast demand over the next 20 years and, in many respects, beyond. The first five years of the CIP are separated into yearly installments, and the intermediate and long term projects are grouped together. It should be noted that the sequence of projects will likely change due to availability of funds or changing priorities. Nonetheless, this is a comprehensive list of capital projects the airport should consider in the next 20 years.

The total 20-year CIP proposes approximately $35.36 million in airport development. Of this total, approximately $27.08 would be eligible for FAA grant funding. The local funding requirement for the proposed 20-year CIP is $8.28 million.

CAPITAL IMPROVEMENT FUNDING SOURCES

Financing capital improvements at the airport will not rely solely on the financial resources of the airport or the city. Capital improvement funding is available through various grant-in-aid programs on both the state and federal levels. Historically, Lawrence Municipal Airport has received federal and state grants. While some years more funds could be available, the CIP was developed with project phasing in order to remain realistic and within the range of anticipated grant assistance. The following discussion outlines key sources of funding potentially available for capital improvements at Lawrence Municipal 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. The most recent legislation affecting federal funding was enacted in late 2003 and is titled, *Century of Flight Authorization Act of 2003,* or Vision 100.

The four-year bill covered FAA fiscal years 2004, 2005, 2006, and 2007. AIP funding was authorized at $3.4 billion in 2004, $3.5 billion in 2005, $3.6 billion in 2006, and $3.7 billion in 2007. This bill provided the FAA the opportunity to plan for longer term projects versus one-year reauthorizations. As of summer 2011, a new multi-year bill has not been passed by Congress, but several (17) continuing resolutions have maintained funding for priority airport projects.

The source for AIP funds is the Aviation Trust Fund. The Aviation Trust Fund 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. It is funded by user fees, including taxes on airline tickets, aviation fuel, and various aircraft parts. The Aviation Trust Fund is also up for reauthorization.

Funding for AIP-eligible projects is undertaken through a cost sharing arrangement in which FAA provides up to 95 percent of the cost and the airport sponsor invests the remaining five 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.

On February 17, 2012, the President signed the *FAA Modernization and Reform Act of 2012*. The law authorizes the FAA's AIP Program at $3.35 billion for fiscal years 2012 through 2015. The most significant change in the new law is that FAA grants provide for up to 90 percent funding with a required local match of 10 percent. The estimated project cost sharing totals in the Capital Improvement Program for the airport have been updated to reflect this change.

Entitlement Funds

Federal funds are distributed each year by the FAA from appropriations by Congress. A portion of the annual distribution is to commercial service airports based upon minimum enplanement levels of at least 10,000 passengers annually.

General aviation airports can receive up to $150,000 each year in Non-Primary Entitlement (NPE) funds (*National Plan of Integrated Airport Systems* [NPIAS] inclusion is required for general aviation entitlement funding). These funds can be carried over and combined for up to four years, thereby allowing for completion of a more expensive project. It should be noted that some versions of the current bills moving through Congress do not include future NPE funds. In the past, Lawrence Municipal Airport has received NPE funding.

Discretionary Funds

The remaining AIP funds are distributed by the FAA based on the priority of the project for which they have requested federal assistance through discretionary apportionments. A national priority ranking system is used to evaluate and rank each airport project. Those projects with the highest priority from airports across the country are given preference in funding. High priority projects include those related to meeting design standards, capacity improvements, and other safety enhancements.

Under the AIP program, examples of eligible development projects include the airfield, public aprons, and access roads. Additional buildings and structures may be eligible if the function of the structure is to serve airport operations in a non-revenue generating capacity, such as maintenance facilities. Some revenue-enhancing structures, such as T-hangars, may be eligible if all airfield improvements have been made but the priority ranking of these facilities is very low.

Whereas entitlement monies are guaranteed on an annual basis, discretionary funds are not assured. If the combination of entitlement, discretionary, and airport sponsor match does not provide enough capital for planned development, projects may be delayed. Other supplemental funding sources are described in the following subsections.

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 ATCTs, enroute 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.

KANSAS AIRPORT IMPROVEMENT PROGRAM

The State of Kansas recognizes the valuable contribution to the state's transportation economy that airports make. Therefore, the Kansas Department of Transportation – Aviation Division administers the Kansas Airport Improvement Program. The program provides approximately $3 million annually through fiscal year 2013, which will increase to $5 million annually beginning in fiscal 2014.

All public-use airports are eligible to apply for KAIP funding. There are several criteria for project consideration:

1. Scope of eligible project:
   a) Projects addressing safety and preservation concerns
   b) Projects focused on development needs identified in the Kansas Airport System Plan (KASP)
   c) All projects deemed by the sponsor to be critical to the airport's ability to support the community

2. Projects should be capable of completion in one year
3. State funding cannot be used to leverage federal assistance projects

All KAIP funding requests are reviewed by the Project Evaluation Team whose members are designated by the Secretary of Transportation and consist of members with aviation, construction, and maintenance knowledge. All grant requests are evaluated objectively through a priority rating system. The factors used in evaluating projects are:

a. Safety
b. System Preservation
c. KASP Recommendation
d. Geographic remoteness
e. Discretionary
   i) willingness of sponsor to exceed minimum match requirements
   ii) previous project experience
   iii) other considerations

A financial match is required of the airport sponsors. The sponsor participation levels are as follows:

1. Design and Planning projects are funded 95 percent state and 5 percent sponsor match.

2. Privately owned, public-use airport projects will be funded 90 percent state and 10 percent sponsor match.

3. For publicly owned airports, the state/sponsor match is determined by the population of the associated city. Cities with less than 3,000 people will participate at 90 percent state and 10 percent sponsor match. Cities with between 3,000 and 10,000 people will participate at 75 percent state and 25 percent sponsor match. Cities larger than 10,000 people will participate at a 50 percent state and 50 percent sponsor match.

In addition, the airport sponsor must agree to keep the airport open to the public for a minimum of ten years. The maximum level of state participation is $800,000, unless the project is a new runway which is eligible for up to $1.6 million or a full-depth replacement runway which is eligible for up to $1.2 million.

LOCAL FUNDING

The balance of project costs, after consideration has been given to grants, must be funded through local resources. The goal of the airport is to generate enough revenue to cover all operating and capital expenditures. As with many general aviation airports, this is not always possible and other financing methods will be needed.

There are several alternatives for local financing options for future development at the airport, including airport revenues, direct funding from the airport sponsors, bonds, and leasehold financing. These strategies could be used to fund the local matching share, or complete a project if grant funding cannot be arranged.

There are several municipal bonding options available, including general obligation bonds, limited obligation bonds, and revenue bonds. General obligation bonds are a common form of municipal bond which is issued by voter approval, is secured by the full faith and credit of the community, and future tax revenues are pledged to retire the debt. As instruments of credit and because the community secures the bonds, general obligation bonds reduce the available debt level of the community. Due to the community pledge to secure and pay general obligation bonds, they are the most secure type of municipal bond and are generally issued at lower interest rates and carry lower costs of issuance. The primary disadvantage of general obligation bonds is that they require voter approval and are subject to statutory debt limits. This requires that they be used for projects that have broad support among the voters, and that they are reserved for projects that have the highest public priorities.

In contrast to general obligation bonds, limited obligation bonds (sometimes referred to as self-liquidating bonds) are secured by revenues from a local source. While neither general fund revenues nor the taxing power of the local community is pledged to pay the debt service, these sources may be required to retire the debt if pledged revenues are insufficient to make interest and principal payments on the bonds. These bonds still carry the full faith and credit pledge of the local community and are considered, for the purpose of financial analysis, as part of the debt burden of the local community. The overall debt burden of the local community is a factor in establishing interest rates on municipal bonds.

There are several types of revenue bonds, but in general, they are a form of municipal bond which is payable solely from the revenue derived from the operation of a facility that was constructed or acquired with the proceeds of the bonds. For example, a lease revenue bond is secured with the income from a lease assigned to the repayment of the bonds. Revenue bonds have become a common form of financing airport improvements. Revenue bonds present the opportunity to provide those improvements without direct burden to the taxpayer. Revenue bonds normally carry a higher interest rate because they lack the guarantees of general and limited obligation bonds.

Leasehold 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 community of all responsibility for raising the capital funds for improvements. However, the private development of facilities on a ground lease, particularly on property owned by a government agency, produces a unique set of concerns.

In particular, it may be more difficult to obtain private financing as only the improvements and the right to continue the lease can be claimed in the event of a default. Ground leases normally provide for the reversion of improvements to the airport at the end of the lease term, which reduces their potential value to a lender taking possession. Also, companies that want to own their property as a matter of financial policy may not locate where land is only available for lease. Hangar development, other than T-hangars, is assumed to be undertaken by private developers.

Local Airport Revenue

The balance of project costs, after consideration has been given to grants, must be funded through local resources. According to **Exhibit 6A**, local funding will be needed in each planning horizon. This includes approximately $2.62 million in the short term, $1.89 million in the intermediate term, and $3.65 million in the long term.

The operation of the airport generates revenues, which are secured by federal grant assurances to be utilized at the airport. While the revenues generated are significant, they are often times not enough to fund both airport operating expenditures and capital improvement requirements. Most general aviation airports in this country do not generate enough revenues to cover operating expenses. Nearly all need some level of community tax or bonding support to fund operations and capital expenditures.

There are several alternatives for local finance options for future development at the airport, including airport revenues, direct funding from the city, issuing bonds, and leasehold financing. These strategies could be used to fund the local matching share or complete the project if grant funding cannot be arranged.

The airport is owned by the City of Lawrence and conducts its daily operations 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 for additions or improvements to airport facilities.

All general aviation 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 city-owned hangars, terminal building office space, and ground leases. Fuel flowage fees and aircraft tie-down fees should also be uniform.

SUMMARY

The best means to begin implementation of the recommendations in this master plan is to first recognize that planning is a continuous process that does not end with completion and approval of this document. Rather, the airport should implement measures that allow them to track various demand indicators such as based aircraft and operations as well as those times when the main apron is full. Operations, particularly by business jets, will be important when providing justification for several projects in the future. The issues upon which this master plan is based will remain valid for a number of years. The primary goal is for the airport to best serve the air transportation needs of the region, while continuing to be economically self-sufficient.

The actual need for facilities is most appropriately established by airport activity levels rather than a specified date. For example, projections have been made as to when additional hangars may be needed at the airport. In reality, however, 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 when facility improvements need to be delayed or accelerated.

The real value of a usable master plan is in keeping the issues and objectives in the minds of the managers and decision-makers so that they are better able to recognize change and its effect. In addition to adjustments in aviation demand, decisions made as to when to undertake the improvements recommended in this master plan will impact the period that the plan remains valid. The format used in this plan is intended to reduce the need for formal and costly updates by simply adjusting the timing. Updating can be done by the manager, thereby improving the plan's effectiveness.

In summary, the planning process requires the airport management to consistently monitor the progress of the airport in terms of aircraft operations and based aircraft. 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.

Appendix A

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 specific aviation subject.

AIR CARRIER: An operator which: (1) performs at least five round trips per week between two or more points and publishes flight schedules which specify the times, days of the week, and places between which such flights are performed; or (2) transports mail by air pursuant to a current contract with the U.S. Postal Service. Certified in accordance with Federal Aviation Regulation (FAR) Parts 121 and 127.

AIRCRAFT: A transportation vehicle that is used or intended for use for flight.

AIRCRAFT APPROACH CATEGORY: A grouping of aircraft based on 1.3 times the stall speed in their landing configuration at their maximum certificated 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 specified 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 existing 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 fulfillment 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 airfield 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 defining 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 flight 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 flight 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 certificated 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 specific trips.

AIR TRAFFIC CONTROL: A service operated by an appropriate organization for the purpose of providing for the safe, orderly, and expeditious flow of air traffic.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC): A facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled airspace and principally during the en route phase of flight.

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER: A facility operated by the FAA which is responsible for the central flow 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 categorization 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 flight 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 final 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 defined 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 specified portion of the airfield 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 flight 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.

AUTOMATED 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 flight in the airspace is established.

AZIMUTH: Horizontal direction expressed as the angular distance between true north and the direction of a fixed point (as the observer's heading).

B

BASE LEG: A flight 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 specific 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 eliminating 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 identifies 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 specified 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.

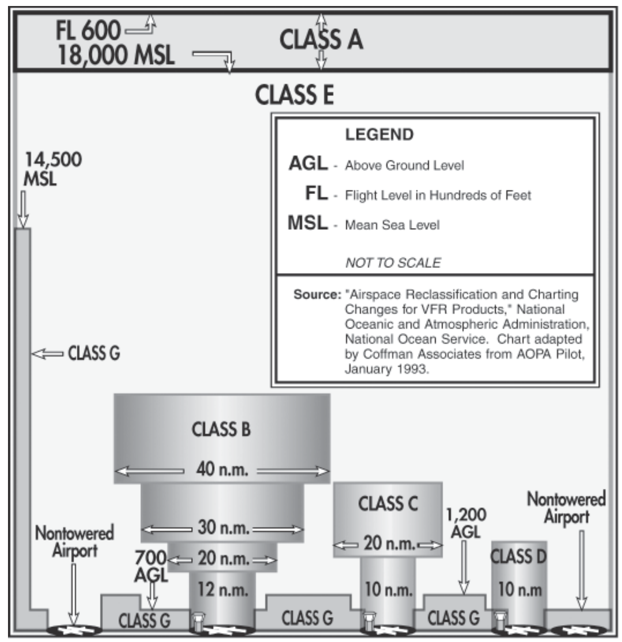
CATEGORY I: An Instrument Landing System (ILS) that provides acceptable guidance information to an aircraft from the coverage limits of the ILS to the point at which the localizer course line intersects the glide path at a decision height of 100 feet above the horizontal plane containing the runway threshold.

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 50 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 specified 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 flying 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 identified 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.

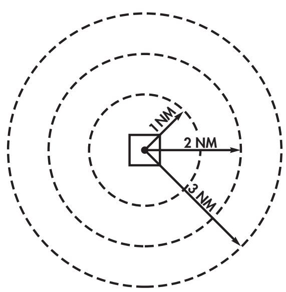
CONICAL SURFACE: An imaginary obstruction-limiting surface defined in FAR Part 77 that extends from the edge of the horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

CONTROLLED AIRPORT: An airport that has an operating airport traffic control tower.

CONTROLLED AIRSPACE: Airspace of defined dimensions within which air traffic control services are provided to instrument flight rules (IFR) and visual flight rules (VFR) flights in accordance with the airspace classification. 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 flight 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 configuration 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 traffic 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 five 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 configured 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 classified 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 configured to contain all instrument procedures. Class E airspace encompasses all Victor Airways. Only aircraft following instrument flight rules are required to establish two-way radio communication with air traffic control.

- **CLASS G**: Generally, that airspace not classified 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 flight path of an aircraft.

CROSSWIND COMPONENT: The component of wind that is at a right angle to the runway centerline or the intended flight path of an aircraft.

CROSSWIND LEG: A flight 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: 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 acceleration 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 specified 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 flight 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 specified form of development or activity, as well as any other legal rights in the property that may be specified 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 significantly 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 executive 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 flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. See "traffic pattern."

FINAL APPROACH AND TAKEOFF AREA (FATO). A defined area over which the final 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 final 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 significant 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, flight training, repair, and maintenance.

FLIGHT LEVEL: A designation for altitude within controlled airspace.

FLIGHT SERVICE STATION: An operations facility in the national flight advisory system which utilizes data interchange facilities for the collection and dissemination of Notices to Airmen, weather, and administrative data and which provides pre-flight and in-flight 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 certificate 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 24 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 classification 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 aircraft turning off the runway after landing (at speeds to 60 knots), thus reducing runway occupancy time.

HORIZONTAL SURFACE: An imaginary obstruction- limiting surface defined in FAR Part 77 that is specified as a portion of a horizontal plane surrounding a runway located 150 feet above the established airport elevation. The specific 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 flight 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 flight in weather conditions below Visual Flight Rules weather minimums. The term IFR is often also used to define weather conditions and the type of flight 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 specific visibility and ceiling conditions that are less than the minimums specified for visual meteorological conditions.

ITINERANT OPERATIONS: Operations by aircraft that are not based at a specified 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 certified 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 flights 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 fixed transmitters. Loran is used for en route navigation.

LOW INTENSITY RUNWAY LIGHTS: The lowest clas- sification 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 classification 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 flight training at speeds above 250 knots.

MISSED APPROACH COURSE (MAC): The flight 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 certificates 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 finding 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 flight 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 aircraft 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 final approach.

P

PILOT CONTROLLED LIGHTING: Runway lighting systems at an airport that are controlled by activating the microphone of a pilot on a specified 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 final 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 defined in FAR Part 77 that is specified as a rectangular surface longitudinally centered about a runway. The specific 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 flight 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 flight 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 flights over determined tracks within prescribed accuracy tolerances without the need to overfly ground-based navigation facilities. Used en route and for approaches to an airport.

RUNWAY: A defined 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 flashing lights installed on the extended centerline of the runway usually in conjunction with an approach lighting system.

RUNWAY END IDENTIFIER LIGHTS (REIL): Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification 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 SAFETY AREA (RSA): A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway.

RUNWAY 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 five feet above the runway centerline to any point five 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 identifies and defines 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 transition 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 AIRPLANE: An airplane that has a maximum certified takeoff weight of up to 12,500 pounds.

SPECIAL-USE AIRSPACE: Airspace of defined dimensions identified by a surface area wherein activities must be confined 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 classifications 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 defined vertical and lateral dimensions established outside Class A airspace to separate/segregate certain military activities from instrument flight rule (IFR) traffic and to identify for visual flight rule (VFR) traffic where these activities are conducted.

- **PROHIBITED AREA**: Designated airspace within which the flight of aircraft is prohibited.

- **RESTRICTED AREA**: Airspace designated under Federal Aviation Regulation (FAR) 73, within which the flight 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 flight 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 final 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 defined path established for the taxiing of aircraft from one part of an airport to another.

TAXIWAY SAFETY AREA (TSA): A defined surface alongside the taxiway prepared or suitable for reducing the risk of damage to an airplane unintentionally departing the taxiway.

TERMINAL INSTRUMENT PROCEDURES: Published flight 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.

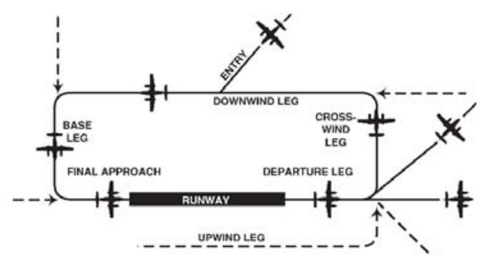
TOUCHDOWN AND LIFT-OFF AREA (TLOF): A load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off.

TOUCHDOWN ZONE (TDZ): The first 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 flow that is prescribed for aircraft 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 final approach.



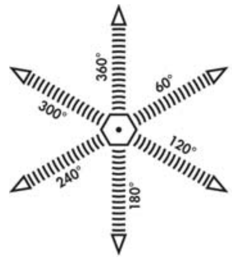
U

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 flight 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 identifies itself by Morse Code and may have an additional voice identification feature.

VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE/ TACTICAL AIR NAVIGATION (VORTAC): A navigation 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 defined by radio navigational aids.

VISUAL APPROACH: An approach wherein an aircraft on an IFR flight 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 flight 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 flight plan.

VISUAL METEOROLOGICAL CONDITIONS: Meteorological conditions expressed in terms of specific 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 flight.

AC: advisory circular

ADF: automatic direction finder

ADG: airplane design group

AFSS: automated flight 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 flashers (CAT I configuration)

ALSF-2: standard 2,400-foot high intensity approach lighting system with sequenced flashers (CAT II configuration)

AOA: Aircraft Operation Area

APV: instrument approach procedure with vertical guidance

ARC: airport reference code

ARFF: aircraft rescue and fire fighting

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 (100L)

AWOS: automated 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: fixed base operator

FY: fiscal year

GPS: global positioning system

GS: glide slope

HIRL: high intensity runway edge lighting

IFR: instrument flight 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 ILS outer marker

LORAN: long range navigation

MALS: midium 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 committee

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

REIL: runway end identifier 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: simplified 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

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 flight rules (FAR Part 91)

VHF: very high frequency

VOR: very high frequency omni-directional range

VORTAC: VOR and TACAN collocated

Appendix B

Forecast Approval Letter

U.S. Department
of Transportation
Federal Aviation Administration

Central Region
Iowa, Kansas,
Missouri, Nebraska

901 Locust
Kansas City, Missouri 64106
(816) 329-2600

November 10, 2010

Charles Soules, P.E.
Public Works Director
6 East 6th Street
Lawrence, KS 66044

Dear Mr. Soules:

Lawrence Municipal Airport
Lawrence, Kansas
AIP No. 3-20-0047-15
Forecast/Critical Design Aircraft Approval

The submitted Aviation Demand Forecast and proposed existing and ultimate Critical Design Aircraft, C-II, is **APPROVED**. I also have the following comments on the draft Master Plan chapters:

1. Page 2-8: Please add "annually" after "216 new VLJs" in the last sentence of **Very Light Jets**.
2. Page 2-16: Per discussion at the November 4, 2010 PAC meeting, update the "Number Based at LWC" column in Table 2F if any verifiable local data is available.
3. Page 3-4: Please add "annual" after "...has averaged 893" in the last paragraph on the page.
4. Page 3-5: Please add any evidence from the FBO records that supports the suspected significant biz jet activity during VFR conditions.
5. Page 3-21: Please add ownership information in the Instrument Navigational Aids and Visual Navigational Aids sections.
6. Page 3-25: Per an April 30, 2010 press release on the Kansas Speedway website, a Hollywood Casino is being built at Kansas Speedway.

Our review should not be construed as relieving you, the sponsor, or the engineer of the responsibility for the accuracy, completeness, and technical content of the project documents.

Please 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 email me at jeff.deitering@faa.gov.

Sincerely,

Original Signed By
Jeffrey D. Deitering

Jeffrey D. Deitering, P.E.
Airport Planning Engineer – Kansas

cc: C.Edward Young, KDOT
Patrick Taylor, Coffman Associates

Appendix C

CIP Cost Estimates

Short Term (0-5 years)

1. Extend Taxiway D to Runway 19 Threshold	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$50,000.00	50,000	
Culvert	150	LF	$100.00	15,000	
Relocate Wind Cone	1	LS	$5,000.00	5,000	
Gas Line Encasement	100	LF	$500.00	50,000	
Relocate Ground Water Testing	1	LS	$10,000.00	10,000	
Unclassified Excavation	10,000	CY	$8.00	80,000	
Subgrade (9" Treated)	5,599	SY	$5.00	27,995	
Aggregate Base (4")	5,332	SY	$10.00	53,320	
Concrete (6")	5,078	SY	$50.00	253,900	
Lights (MITL)	35	EA	$800.00	28,000	
Cable, Conduit, and Counterpoise	2,800	LF	$7.50	21,000	
Regulator and Vault Work	1	LS	$10,000.00	10,000	
Seeding/Mulching	3	AC	$2,500.00	7,500	
Drainage/Erosion Control	1	LS	$10,000.00	10,000	
Engineering and Admin.	1	LS	$158,285.00	158,285	
Total					780,000

2. Construct 10-Unit T-Hangar	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$50,000.00	50,000	
T-hangar	10	Stall	$50,000.00	500,000	
Unclassified Excavation	3,000	CY	$10.00	30,000	
Subgrade (9" Treated)	3,480	SY	$5.00	17,400	
Aggregate Base (8")	3,314	SY	$16.00	53,024	
Asphalt (4")	700	TN	$100.00	70,000	
Seeding/Mulching	1	AC	$2,500.00	2,500	
Drainage/Erosion Control	1	LS	$5,000.00	5,000	
Engineering and Admin.	1	LS	$112,076.00	112,076	
Total					840,000

3. Acquire Land (14.3 acres)	Quantity	Unit	Unit Cost	Total	
Land in Fee	14.3	AC	$10,000.00	$143,000.00	
Survey	1	LS	$5,000.00	$5,000.00	
Environmental Site Assessment	1	EA	$5,000.00	$5,000.00	
Appraisal & Review	1	EA	$4,000.00	$4,000.00	
Legal	1	LS	$15,000.00	$15,000.00	
Administration	1	LS	$18,000.00	$18,000.00	
Total					190,000

4. REILS (Runway 15) & 2 Lighted Windcones & Distance-To-Go-Markers	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$20,000.00	$20,000.00	
Cable, Conduit, and Counterpoise	12,000	LF	$7.50	$90,000.00	
REILS	2	EA	$10,000.00	$20,000.00	
Wind Cone	2	EA	$10,000.00	$20,000.00	
Distance-to-Go Signs	14	EA	$2,000.00	$28,000.00	
Seeding and Mulching	1	LS	$5,000.00	$5,000.00	
Engineering and Admin.	1	LS	$35,000.00	$47,000.00	
Total					230,000

5. Rehabilitate Runway 15-33 Including center section of RW 1/19 (Mill and Overlay)	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$150,000.00	$150,000.00	
Milling	71,666	SY	$5.00	$358,330.00	
Crack Filling	30,000	LF	$2.00	$60,000.00	
Patching	2,000	SY	$80.00	$160,000.00	
Asphalt (2") (71,666 SY)	8,000	TN	$80.00	$640,000.00	
Pavement Marking (Temp & Perm)	70,000	SF	$2.00	$140,000.00	
Seeding/Mulching	4	AC	$2,500.00	$10,000.00	
Engineering and Admin.	1	LS	$381,670.00	$381,670.00	
Total					1,900,000

6. Drainage Plan & Prelimnary Engineering	Quantity	Unit	Unit Cost	Total	
Engineering	1	LS	$150,000.00	150,000	150,000

7. Expand Aircraft Parking Apron (Ph1)	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$150,000.00	150,000	
Unclassified Excavation	20,000	CY	$6.00	120,000	
Area Inlet	3	EA	$2,000.00	6,000	
Storm Sewer (24")	1,000	LF	$50.00	50,000	
Subgrade (9" Treated)	18,005	SY	$5.00	90,025	
Aggregate Base (6")	17,148	SY	$15.00	257,220	
Concrete (8")	16,331	SY	$60.00	979,860	
Pavement Marking	4,000	SF	$2.00	8,000	
Seeding/Mulching/Erosion Control	1	LS	$20,000.00	20,000	
Engineering & Admin.	1	LS	$418,895.00	418,895	
Total					2,100,000

8. Environmental Assessment For Runway 33 Extension	Quantity	Unit	Unit Cost	Total	
Environmental Assessment	1	LS	$200,000.00	200,000	200,000

9. Equipment Storage Building	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$40,000.00	40,000	
Removal old elec building	1	LS	$10,000.00	10,000	
Grading	1,200	CY	$10.00	12,000	
PCC Apron	400	SY	$75.00	30,000	
Building	6,600	SF	$50.00	330,000	
Floor Drains & Plumbing	1	LS	$20,000.00	20,000	
Heating	1	LS	$20,000.00	20,000	
Seeding	1	LS	$5,000.00	5,000	
Engineering & Admin.	1	LS	$113,000.00	113,000	
Total					580,000

10. Acquire land for Runway 33 RPZ (3.9 acres)	Quantity	Unit	Unit Cost	Total	
Land in Fee	3.9	AC	$10,000.00	$39,000.00	
Survey	1	LS	$5,000.00	$5,000.00	
Environmental Site Assessment	1	EA	$5,000.00	$5,000.00	
Appraisal & Review	1	EA	$4,000.00	$4,000.00	
Legal	1	LS	$15,000.00	$15,000.00	
Administration	1	LS	$12,000.00	$12,000.00	
Total					80,000

11. Wetlands Mitigation	Quantity	Unit	Unit Cost	Total	
Wetlands Mitigation	2.2	AC	$60,000.00	132,000	
Engineering & Admin.	1	LS	$28,000.00	28,000	
Total					160,000

12. Acquire SRE and ARFF Truck	Quantity	Unit	Unit Cost	Total	
Snow Removal Equipment	1	EA	$200,000.00	200,000	
ARFF Truck	1	EA	$400,000.00	400,000	
					600,000

13. Extend Runway 33 South 400' (Including Taxiway, Hold Apron, Nav Aids)	Quantity	Unit	Unit Cost	Total	
Mobilization	1.0	LS	$150,000.00	150,000	
Extend Box Culvert	400	LF	$800.00	320,000	
Unclassified Excavation	40,000	CY	$5.00	200,000	
Subgrade (9" Treated)	11,480	SY	$5.00	57,400	
Aggregate Base (10")	10,933	SY	$20.00	218,660	
Asphalt (6") (10,412 SY)	3,500	TN	$100.00	350,000	
Lights (MIRL & MITL)	40	EA	$800.00	32,000	
Cable, Conduit, and Counterpoise	2,000	LF	$7.50	15,000	
Relocate PAPI	1	LS	$20,000.00	20,000	
Relocate MALSR	1	LS	$250,000.00	250,000	
Relocate Glideslope Antenna	1	LS	$200,000.00	200,000	
Pavement Marking	35,000	SF	$2.00	70,000	
Seeding/Mulching	6	AC	$2,500.00	15,000	
Drainage/Erosion Control	1	LS	$10,000.00	10,000	
Engineering and Admin.	1	LS	$491,940.00	491,940	
Total					2,400,000

TOTAL - SHORT TERM PROGRAM 10,210,000

Intermediate Term (6-10 years)

1. Expand Aircraft Parking Apron (Ph2)	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$150,000.00	150,000	
Unclassified Excavation	20,000	CY	$6.00	120,000	
Area Inlet	3	EA	$2,000.00	6,000	
Storm Sewer (24")	550	LF	$50.00	27,500	
Subgrade (9" Treated)	18,005	SY	$5.00	90,025	
Aggregate Base (6")	17,148	SY	$15.00	257,220	
Concrete (8")	16,855	SY	$60.00	1,011,300	
Pavement Marking	5,000	SF	$2.00	10,000	
Seeding/Mulching	1	LS	$10,000.00	10,000	
Engineering & Admin.	1	LS	$417,955.00	417,955	
Total					2,100,000

2. Install Perimeter Fencing	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$30,000.00	30,000	
6' Chain Link	25,500	LF	$10.00	255,000	
4' Chain Link	4,000	LF	$8.00	32,000	
Seeding	12	AC	$2,500.00	30,000	
Engineering & Admin.	1	LS	$83,000.00	83,000	
Total					430,000

3. Rehabilitate Taxiways A & C	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$50,000.00	$50,000.00	
Milling	29,167	SY	$5.00	$145,835.00	
Crack Filling	20,000	LF	$2.00	$40,000.00	
Patching	1,000	SY	$80.00	$80,000.00	
Asphalt (2") (29,167 SY)	3,300	TN	$100.00	$330,000.00	
Pavement Marking (Temp & Perm)	15,000	SF	$2.00	$30,000.00	
Seeding/Mulching	2	AC	$2,500.00	$5,000.00	
Engineering and Admin.	1	LS	$169,165.00	$169,165.00	
Total					850,000

4. Drainage Cosntruction	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$100,000.00	100,000	
Grading	100,000	CY	$10.00	1,000,000	
Seeding/Erosion Control	1	LS	$100,000.00	100,000	
Engineering & Admin.	1	LS	$300,000.00	300,000	
Total					1,500,000

5. Install Apron Lighting	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$10,000.00	10,000	
Area Lights	4	EA	$12,000.00	48,000	
Cable, counterpoise, duct	1,800	LF	$7.50	13,500	
Engineering & Admin.	1	LS	$28,500.00	28,500	
Total					100,000

6. Taxilane to T-Hangar Development Area	Quantity	Unit	Unit Cost	Total	
Mobilization	1.0	LS	$30,000.00	30,000	
Culvert	80	LF	$100.00	8,000	
Unclassified Excavation	5,000	CY	$10.00	50,000	
Subgrade (9" Treated)	4,909	SY	$5.00	24,545	
Aggregate Base (8")	4,675	SY	$16.00	74,800	
Asphalt (4") (4,452 SY)	990	TN	$100.00	99,000	
Lights	35	EA	$800.00	28,000	
Cable, Conduit, and Counterpoise	2,100	LF	$7.50	15,750	
Seeding/Mulching	2	AC	$2,500.00	5,000	
Drainage/Erosion Control	1	LS	$5,000.00	5,000	
Engineering and Admin.	1	LS	$89,905.00	89,905	
Total					430,000

7. Construct 10-unit T-Hangar	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$50,000.00	50,000	
T-hangar	10	Stall	$50,000.00	500,000	
Unclassified Excavation	6,000	CY	$10.00	60,000	
Subgrade (9" Treated)	6,141	SY	$5.00	30,705	
Aggregate Base (4")	5,848	SY	$16.00	93,568	
Concrete (8")	5,569	SY	$60.00	334,140	
Seeding/Mulching	1	AC	$2,500.00	2,500	
Drainage/Erosion Control	1	LS	$5,000.00	5,000	
Engineering and Admin.	1	LS	$124,087.00	124,087	
Total					1,200,000

8. Road/Parking Lot to T-Hangar Development Area	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$40,000.00	40,000	
Relocate / Encase Water Line	1	LS	$50,000.00	50,000	
Area Inlet	3	EA	$2,000.00	6,000	
Storm Sewer (24")	500	LF	$50.00	25,000	
Unclassified Excavation	1,200	CY	$10.00	12,000	
Subgrade (9" Treated)	3,935	SY	$5.00	19,675	
Aggregate Base (4")	3,748	SY	$10.00	37,480	
Concrete (8")	3,569	SY	$60.00	214,140	
Pavement Marking	1,000	SF	$2.00	2,000	
Seeding/Mulching	1	LS	$5,000.00	5,000	
Drainage/Erosion Control	1	LS	$10,000.00	10,000	
Engineering & Admin.	1	LS	$108,705.00	108,705	
Total					530,000

9. Expanded Terminal

Parking Area	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$20,000.00	20,000	
Unclassified Excavation	700	CY	$10.00	7,000	
Subgrade (9" Treated)	2,357	SY	$5.00	11,785	
Aggregate Base (4")	2,245	SY	$10.00	22,450	
Concrete (8")	2,138	SY	$60.00	128,280	
Pavement Marking	1,000	SF	$2.00	2,000	
Seeding/Mulching	1	LS	$5,000.00	5,000	
Drainage/Erosion Control	1	LS	$5,000.00	5,000	
Engineering & Admin.	1	LS	$48,485.00	48,485	
Total					250,000

TOTAL - INTERMEDIATE TERM PROGRAM 7,390,000

Lawrence Municipal Airport
Lawrence, KS
Development Program

Olsson Associates
Lincoln, Nebraska
July, 2011

Long Term (11-20 years)

1. Master Plan Update	Quantity	Unit	Unit Cost	Total	
Master Plan Update	1	LS	$250,000.00	250,000	250,000

2. Acquire Land for Runway 15-33 Extension (32.9 acres)	Quantity	Unit	Unit Cost	Total	
Land in Fee	32.9	AC	$10,000.00	$329,000.00	
Acquire Residence	1	LS	$200,000.00	$200,000.00	
Environmental Site Assessment	3	EA	$4,000.00	$12,000.00	
Survey	1	LS	$15,000.00	$15,000.00	
Appraisals (2) & Review	1	EA	$6,000.00	$6,000.00	
Negotiator	1	LS	$10,000.00	$10,000.00	
Relocation Assistance	1	EA	$50,000.00	$50,000.00	
Legal	1	LS	$25,000.00	$25,000.00	
Administration	1	LS	$13,000.00	$13,000.00	
Total					660,000

3. Apron Rehabilitation	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$50,000.00	50,000	
Milling	32,700	SY	$5.00	163,500	
Crack Filling	20,000	LF	$2.00	40,000	
Patching	1,000	SY	$80.00	80,000	
Asphalt (2") (32,700 SY)	4,000	TN	$100.00	400,000	
Marking	10,000	SF	$2.00	20,000	
Engineering & Admin.	1	LS	$186,500.00	186,500	
Total					940,000

4. Environmental Assessment For Runway 15-33 Extension	Quantity	Unit	Unit Cost	Total	
Environmental Assessment	1	LS	$150,000.00	150,000	150,000

5. Acquire Land for Runway 1-19 Extension (20.9 acres)	Quantity	Unit	Unit Cost	Total	
Land in Fee	20.9	AC	$8,000.00	$167,200.00	
Environmental Site Assessment	1	EA	$4,000.00	$4,000.00	
Survey	1	LS	$5,000.00	$5,000.00	
Appraisal & Review	1	EA	$4,000.00	$4,000.00	
Legal	1	LS	$17,000.00	$17,000.00	
Administration	1	LS	$12,800.00	$12,800.00	
Total					210,000

6. Extend Runway 1-19

North 500'	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$50,000.00	50,000	
Culvert	150	LF	$100.00	15,000	
Unclassified Excavation	10,000	CY	$5.00	50,000	
Subgrade (9" Treated)	7,653	SY	$5.00	38,265	
Aggregate Base (4")	7,288	SY	$10.00	72,880	
Concrete (6")	6,941	SY	$40.00	277,640	
Lights (MIRL & MITL)	80	EA	$800.00	64,000	
Cable, Conduit, and Counterpoise	12,000	LF	$7.50	90,000	
Regulator and Vault Work	1	LS	$20,000.00	20,000	
Seeding/Mulching	6	AC	$2,500.00	15,000	
Drainage/Erosion Control	1	LS	$10,000.00	10,000	
Engineering and Admin.	1	LS	$177,215.00	177,215	
Total					880,000

7. Extend Runway 33 South 900'
& Increase Pavement Strength (RW & TW "A")

including taxiway & hold apron	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$500,000.00	500,000	
Box Culvert	500	LF	$800.00	400,000	
Wetlands Mitigation	7	AC	$60,000.00	420,000	
Unclassified Excavation	40,000	CY	$5.00	200,000	
Subgrade (9" Treated)	19,585	SY	$5.00	97,925	
Aggregate Base (10")	18,652	SY	$20.00	373,040	
Asphalt (8") (17,764 SY)	8,000	TN	$80.00	640,000	
Asphalt (4") (100,000 SY)	22,000	TN	$80.00	1,760,000	
Relocate U.S. Highway 24/40	14,560	SY	$100.00	1,456,000	
Land for Highway	17	AC	$12,500.00	212,500	
Residential Acquisition for Highway	1	LS	$250,000.00	250,000	
Utility relocation for Highway	1	LS	$100,000.00	100,000	
Lights (MIRL & MITL)	90	EA	$800.00	72,000	
Cable, Conduit, and Counterpoise	16,000	LF	$7.50	120,000	
Relocate PAPI	1	LS	$20,000.00	20,000	
Relocate MALSR	1	LS	$400,000.00	400,000	
Relocate Glideslope Antenna	1	LS	$200,000.00	200,000	
Seeding/Mulching	10	AC	$2,500.00	25,000	
Drainage/Erosion Control	1	LS	$50,000.00	50,000	
Engineering and Admin.	1	LS	$1,323,535.00	1,803,535	
Total					9,100,000

8. Expand Aircraft Parking

Apron (Ph3)	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$100,000.00	100,000	
Unclassified Excavation	25,000	CY	$5.00	125,000	
Area Inlet	2	EA	$2,000.00	4,000	
Storm Sewer (24")	500	LF	$50.00	25,000	
Subgrade (9" Treated)	12,700	SY	$5.00	63,500	
Aggregate Base (6")	12,096	SY	$15.00	181,440	
Concrete (8")	11,520	SY	$60.00	691,200	
Pavement Marking	3,500	SF	$2.00	7,000	
Seeding/Mulching	1	LS	$5,000.00	5,000	
Drainage/Erosion Control	1	LS	$20,000.00	20,000	
Engineering & Admin.	1	LS	$307,860.00	307,860	
Total					1,530,000

9. Acquire Runway 15 RPZ

Property (7.2 AC)	Quantity	Unit	Unit Cost	Total	
Easement	7.2	AC	$2,000.00	$14,400.00	
Survey	1	LS	$5,000.00	$5,000.00	
Appraisal & Review	2	EA	$4,000.00	$8,000.00	
Legal	1	LS	$15,000.00	$15,000.00	
Administration	1	LS	$7,600.00	$7,600.00	
Total					50,000

10. West Side Taxilane And Apron	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$80,000.00	80,000	
Relocate Water Line	1	LS	$50,000.00	50,000	
Unclassified Excavation	20,000	CY	$5.00	100,000	
Subgrade (9" Treated)	13,640	SY	$5.00	68,200	
Aggregate Base (4")	12,991	SY	$10.00	129,910	
Concrete (6")	12,372	SY	$50.00	618,600	
Pavement Marking	5,000	SF	$2.00	10,000	
Lights (MITL)	32	EA	$800.00	25,600	
Cable, Conduit, and Counterpoise	3,000	LF	$7.50	22,500	
Regulator and Vault Work	1	LS	$10,000.00	10,000	
Seeding/Mulching	1	LS	$10,000.00	10,000	
Drainage/Erosion Control	1	LS	$5,000.00	5,000	
Engineering & Admin.	1	LS	$280,190.00	280,190	
Total					1,410,000

11. Construct 10-unit T-Hangar	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$50,000.00	50,000	
T-hangar	10	Stall	$50,000.00	500,000	
Unclassified Excavation	2,640	CY	$10.00	26,400	
Subgrade (9" Treated)	3,635	SY	$5.00	18,175	
Aggregate Base (8")	3,462	SY	$16.00	55,392	
Asphalt (4")	733	TN	$100.00	73,300	
Seeding/Mulching	1	AC	$2,500.00	2,500	
Drainage/Erosion Control	1	LS	$5,000.00	5,000	
Engineering and Admin.	1	LS	$139,233.00	139,233	
Total					870,000

12. Terminal Building Addition	Quantity	Unit	Unit Cost	Total	
Terminal Building Expansion	3,500	SF	$200.00	700,000	
Engineering and Admin.	1	LS	$200,000.00	200,000	
					900,000

13. KU Apron Expansion	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$20,000.00	20,000	
Unclassified Excavation	5,000	CY	$10.00	50,000	
Subgrade (9" Treated)	2,965	SY	$5.00	14,825	
Aggregate Base (4")	2,824	SY	$10.00	28,240	
Concrete (6")	2,689	SY	$50.00	134,450	
Pavement Marking	3,500	SF	$2.00	7,000	
Seeding/Mulching	1	LS	$5,000.00	5,000	
Drainage/Erosion Control	1	LS	$10,000.00	10,000	
Engineering & Admin.	1	LS	$70,485.00	70,485	
Total					340,000

14. Construct Aircraft Wash Rack & Oil Separator

Rack & Oil Separator	Quantity	Unit	Unit Cost	Total	
Mobilization	1	LS	$20,000.00	20,000	
Concrete (6") with base	1,200	SY	$80.00	$96,000.00	
Plumbing / Hold tank	1	LS	$40,000.00	$40,000.00	
Engineering and Admin.	1	LS		44,000	
					200,000

TOTAL - LONG TERM PROGRAM 17,490,000

GRAND TOTAL - 20-YEAR PROGRAM 35,090,000

Appendix D

Environmental Overview

Appendix D
ENVIRONMENTAL OVERVIEW

A review of the potential environmental impacts associated with proposed airport projects is an essential consideration in the Airport Master Plan process. The primary purpose of this appendix is to review the proposed improvement program at Lawrence Municipal Airport to determine whether the proposed developments identified in the Master Plan could, individually or collectively, significantly affect existing environmental resources. The information contained in this section was obtained from previous studies, internet websites, and analysis by the consultant.

Construction of any and all improvements depicted on the Airport Layout Plan (ALP) 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 Federal Aviation Administration (FAA) Order 1050.1E, *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, an Environmental Impact Statement (EIS) may be required.

While this portion of the master plan is not designed to satisfy the NEPA requirements, it will provide a preliminary review of environmental issues that may need to be considered in more detail within the environmental review processes. This evaluation considers all environmental categories required as outlined within FAA Order 1050.1E and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementation Instructions for Airport Actions*.

The following sections describe environmental resources which could be impacted by the proposed ultimate airport development depicted on **Exhibit D1**. As discussed in Chapter One, it was determined that the following resources are not present within the airport environs:

- Coastal Barriers
- Coastal Zone Management Areas
- Wild and Scenic Rivers

AIR QUALITY

Air quality in a given location is described by the concentrations of various pollutants in the atmosphere. 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 oxides (NO_x), particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb).

Based on both federal and state 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. Lawrence Municipal Airport is located in Douglas County, which is an attainment area for all criteria pollutants.

Planned projects at the airport could result in impacts to air quality. Temporary impacts would result during the construction of improvements such as the Runway 15-33 extension to the south, apron and taxiway construction, T-hangar construction, and road relocation. Exhaust emissions from the operation of construction vehicles and fugitive dust from pavement removal are common air pollutants during construction. During evaluation of these specific projects, an emissions inventory using on-road and off-road construction emissions models may be required.

More permanent air quality impacts may result from the forecast increase in aircraft operations at the airport. As the number of operations increase, these potential impacts may need to be evaluated as part of any required environmental documentation for planned projects. This may include operational emissions modeling using FAA's Emission and Dispersion Modeling System (EDMS).

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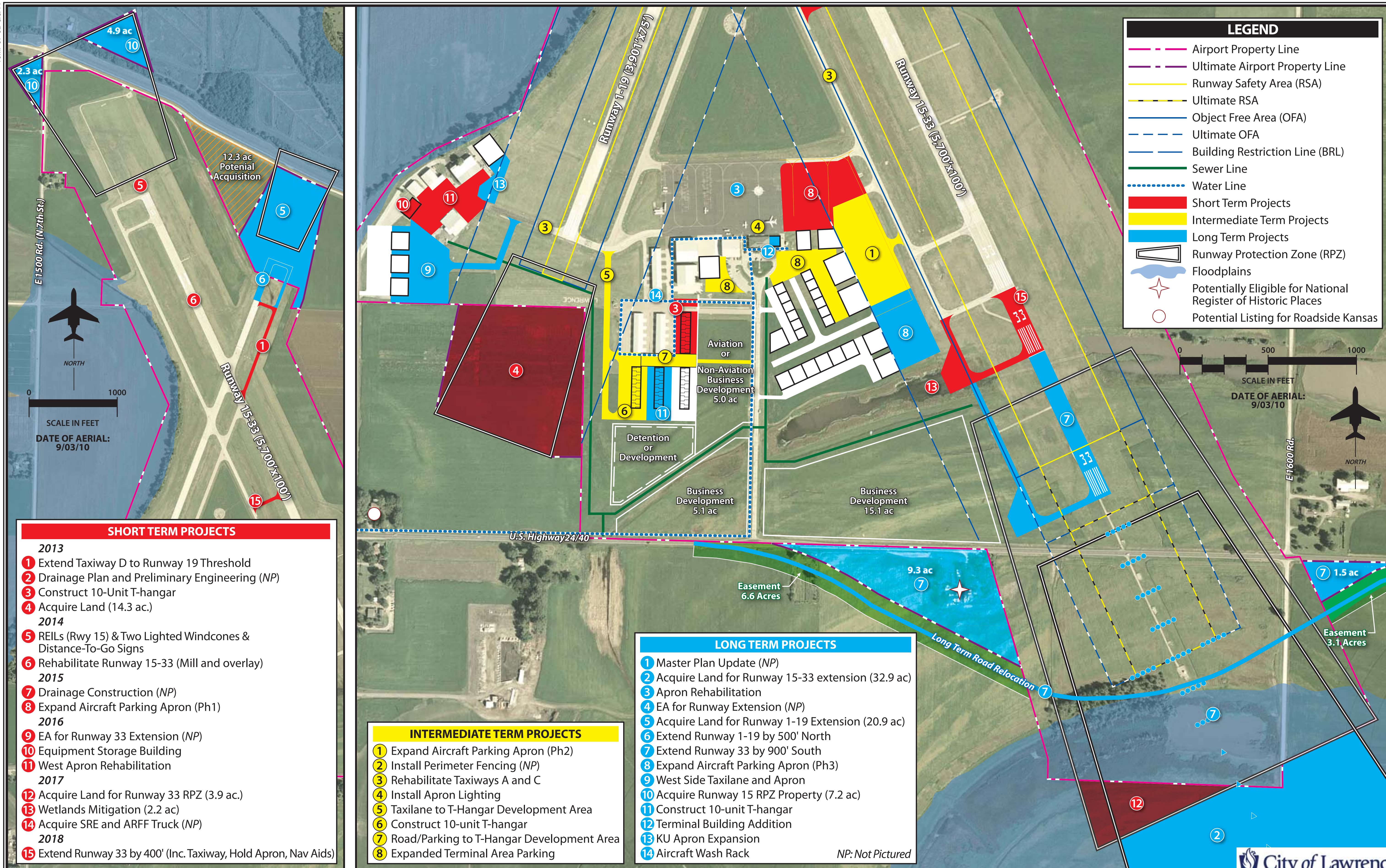

Exhibit D1
ENVIRONMENTAL CONSIDERATIONS

SECTION 4(f) RESOURCES

Section 4(f) properties include publicly owned land from a public park, recreational area, or wildlife and waterfowl refuge of national, state, or local significance; or any land from a historic site of national, state, or local significance.

Riverfront Park, located less than one mile west of the airport along the Kansas River, is a potential Section 4(f) property. None of the proposed airport improvements will result in direct or indirect impacts to the park.

FISH, WILDLIFE, AND PLANTS

Biotic resources include the various types of plants and animals that are present in a particular area. The term also applies to rivers, lakes, wetlands, forests, and other habitat types that support plants, birds, and/or fish. Typically, development in areas such as previously disturbed airport property, populated places, or farmland would result in minimal impacts to biotic resources.

The Fish and Wildlife Service (FWS) is charged with overseeing compliance with Section 7 of the *Endangered Species Act*. This Act was put into place to protect animal or plant species whose populations are threatened by human activities. The FAA and FWS review 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

Table D1 depicts federally and state listed threatened and endangered species for Douglas County. Aquatic species including the flathead chub, hornyhead chub, pallid sturgeon, sicklefin chub, sturgeon chub, and western silvery minnow are unlikely to be present within the proposed development areas as the habitat to support these species is not present.

Several of the planned projects at the airport, including the apron expansion and hangar projects, will be undertaken in areas that are regularly maintained for airport uses and would not likely require field investigation.

Other projects, such as property acquisition, runway extensions, and roadway relocation, due to the relatively undisturbed nature of the sites and presence of potential wetland areas, may require field surveys to determine the potential occurrence of protected species. Coordination with the FWS and/or the Kansas Department of Wildlife and Parks may be necessary to determine the extent, if any, of field investigations prior to undertaking these planned improvements.

TABLE D1
Threatened or Endangered Species - Douglas County, Kansas

Common Name	Species	State Status	Federal Status
American Burying Beetle	*Nicrophorus americanus*	Endangered	-
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	-
Chestnut Lamprey	*Ichthyomyzon castaneus*	Threatened	-
Eastern Spotted Skunk	*Spilogale putorius*	Threatened	-
Eskimo Curlew	Numenius borealis	Endangered	-
Flathead Chub	*Platygobio gracilis*	Threatened	-
Hornyhead Chub	*Nocomis biguttatus*	Threatened	-
Least Tern	*Sterna antillarum*	Endangered	-
Mead's Milkweed	Asclepias meadii	-	Threatened
Pallid Sturgeon	Scaphirhynchus albus	Endangered	Endangered
Peregrine Falcon	*Falco peregrinus*	Endangered	-
Piping Plover	*Charadrius melodus*	Threatened	-
Redbelly Snake	*Storeria occipitomaculata*	Threatened	-
Sicklefin Chub	*Macrhybopsis meeki*	Endangered	-
Silver Chub	*Macrhybopsis storeriana*	Endangered	-
Smooth Earth Snake	*Virginia valeriae*	Threatened	-
Snowy Plover	*Charadrius alexandrinus*	Threatened	-
Sturgeon Chub	*Macrhybopsis gelida*	Threatened	-
Topeka Shiner	*Notropis topeka*	Threatened	-
Western Prairie Fringed Orchid	Platanthera praeclara	-	Threatened
Western Silvery Minnow	*Hybognathus argyritis*	Threatened	-
Whooping Crane	*Grus americana*	Endangered	-

Source: USFWS, http://www.fws.gov/mountain-prairie/endspp/CountyLists/Kansas.pdf accessed June 2011.
Kansas Department of Wildlife and Parks, County Lists, Threatened and Endangered Species, http://www.kdwp.state.ks.us/news/content/download/6530/31373/file/Douglas%20County.pdf, accessed June 2011,

FLOODPLAINS

As defined in FAA Order 1050.1E, floodplains consist of "lowland and relatively flat areas adjoining inland and coastal water including flood prone areas of offshore islands, including at a minimum, that area subject to one percent or greater chance of flooding in any given year." Federal agencies are directed 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 floodplains. Floodplains have natural and beneficial values, such as providing ground water recharge, water quality maintenance, fish, wildlife, plants, open space, natural beauty, outdoor recreation, agriculture, and forestry. FAA Order 1050.1E (12) (c) indicates that "if the proposed action and reasonable alternatives are not within the limits of a base floodplain (100-year flood area)," that it may be assumed that there are no floodplain impacts. The limits of base floodplains are determined by Flood Insurance Rate Maps (FIRM) prepared by the Federal Emergency Management Agency (FEMA).

A review of FEMA FIRMs for Douglas County indicates several areas designated as 100-year floodplains are located within the vicinity of the airport. The location of the floodplains, associated with tributaries to the Kansas River, is depicted on **Exhibit D1**. As indicated on the exhibit, two acquisition areas are proposed within the 100-year floodplain. The area located west of the runway intersection is located within the building restriction line. As noted on the exhibit, no development is planned within this area. Additionally, the acquisition area south of the Runway 33 end is located within the ultimate RPZ. By FAA airport design guidelines, this area should be kept clear of any non-compatible development. Accordingly, the airport will not allow development in this area following acquisition. Therefore, no airport development will occur within the 100-year floodplain.

FARMLAND

The *Farmland Protection Policy Act* (FPPA) was enacted to preserve farmland. FPPA guidelines 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 indicates that the airport property includes six soil types, all of which are classified as prime farmland[1]. Development of projects proposed on existing airport property will likely be exempt from the requirements of FPPA as NRCS may consider them committed to urban use. Further coordination with the NRCS may be required prior to undertaking the planned projects.

Additionally, *Horizon 2020, The Comprehensive Plan for Lawrence and Unincorporated Douglas County*, February 2011, states that preservation of high-quality agricultural land is of important value to the community. The plan identifies high-quality agricultural land as land that has good soil quality and produces high yields of crops. Within Douglas County, these are capability class (non-irrigated) I and II, as identified by NRCS. The area surrounding the airport includes capability class I and class II soils. These soil classifications are not protected under the FPPA; however, coordination with Lawrence/Douglas County Metropolitan Planning Office may be necessary prior to implementing the recommended development plan for the airport.

HAZARDOUS MATERIALS, POLLUTION PREVENTION, AND SOLID WASTE

Federal, state, and local laws regulate hazardous materials use, storage, transport, and disposal. These laws may extend to past and future landowners of properties

[1] http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx, accessed June 2011

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.

Based on a review of EPA's *Enviromapper for Envirofacts*, no Superfund hazardous waste sites located within the vicinity of the airport[2]. Regarding *Clean Water Act* Section 303(d) impaired waters, the site indicates the Kansas River, located approximately one mile southwest of the airport, and Mud Creek, located immediately north of the airport, are listed. The proposed improvements included in the master plan will not directly impact either of these water bodies.

The proposed property acquisition for a portion of the parcel north of the airport may require the preparation of a Phase I environmental site assessment to determine the presence of any recognized environmental conditions (RECs). An REC is defined by the American Society for Testing and Materials as the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances, or petroleum products into the ground, groundwater, or surface water of a property.

A construction-related National Pollutant Discharge Elimination System (NPDES) permit may be required prior for on-airport construction projects. The permit requires a Notice of Intent for all construction activities disturbing one or more acre of land. In conjunction with the NPDES, a Storm Water Pollution Prevention Plan (SWPPP) may be required to outline the Best Management Practices to be used to minimize impacts to storm water conveyance systems.

HISTORICAL AND CULTURAL RESOURCES

Determination of a project's impact to historical and cultural resources is made in compliance with the *National Historic Preservation Act* (NHPA) *of 1966*, as amended for federal undertakings. A historic property is defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). Properties or sites having traditional religious or cultural importance to Native American Tribes may also qualify. To satisfy the requirements of NHPA, further coordination with the Kansas State Historic Preservation Office (SHPO) may be necessary to determine the extent, if any, of field investigations prior to undertaking any of the planned improvements.

A review of the NRHP indicates that no listed sites are located on or adjacent to airport property.

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[2] http://www.epa.gov/emefdata/em4ef.home, accessed June 2011

One property to the south of US Highway 24/40 falls in property planned for acquisition to accommodate the long term extension of Runway 15-33 to the south. This property has been noted by the Historic Resource Administrator for the City of Lawrence as being potentially historic in nature. The FAA may require additional field survey of this property during an Environmental Assessment associated with the property acquisition.

Several of the planned projects at the airport, including the apron expansion and hangar projects, will be undertaken in areas that are regularly maintained for airport uses and would not likely require field investigation for cultural resources prior to implementation. Other projects, such as the property acquisition, runway extensions, and roadway relocation, due to their relatively undisturbed nature, may require cultural resource field surveys, records research, and coordination with SHPO prior to implementation.

NOISE

Per federal regulation, the Yearly Day-Night Average Sound Level (DNL) is used in this study to assess aircraft noise. DNL is the metric currently accepted by the FAA, 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. Noise exposure contours are overlaid on maps of existing and planned land uses to determine areas that may be affected by aircraft noise at or above 65 DNL. The noise exposure contours are developed using the FAA-approved Integrated Noise Model (INM) which accepts inputs for several airport characteristics including: aircraft type, operations, flight tracks, time of day, and topography.

The standard methodology for analyzing noise conditions at airports involves the use of a computer simulation model. The FAA has approved the INM for use in Environmental Assessments.

A variety of user-supplied input data is required to use the INM. This includes the airport elevation, average annual temperature, airport area terrain, a mathematical definition of the airport runways, the mathematical description of ground tracks above which aircraft fly, and the assignment of specific take-off weights to individual flight tracks.

Airport activity is defined as the take-offs and landings by aircraft operating at the facility; this is also referred to as aircraft operations. Activity is further described as either *local*, indicating aircraft practicing take-offs and landings (i.e., performing touch-and-go's), or *itinerant*, referring to the initial departure from or final arrival at the airport.

Table D2 provides a summary of operations for the existing condition (2010) and two forecast years (2015 and 2030).

TABLE D2
Operations Summary and Fleet Mix Data
Lawrence Municipal Airport

Aircraft Type	INM Description	2010 Operations	2015 Operations	2030 Operations
ITINERANT OPERATIONS				
Turbojet				
Business Jet	LEAR35	50	250	400
Business Jet	CNA500	330	340	880
Business Jet	MU3001	0	0	0
Business Jet	CNA55B	0	0	0
Business Jet	CL600	250	400	584
Business Jet	GIV	20	250	600
Business Jet	LEAR25	0	0	0
Subtotal		650	1,240	2,464
Piston/Turboprop/Helicopter				
Single Engine Variable	GASEPF	7,633	7,864	9,421
Single Engine Fixed	GASEPV	7,633	7,864	9,421
Multi-engine	BEC58P	1,250	1,250	1,500
Turboprop	DHC6	415	726	1,406
Helicopter (P)	B206	100	150	200
Helicopter (T)	H500D	1,370	1,588	2,153
Subtotal		18,400	19,441	24,101
Military				
Helicopter	Blackhawk (UH60)	0	0	0
King Air 100	CNA441	0	0	0
Subtotal		0	0	0
TOTAL ITINERANT		**19,050**	**20,681**	**26,565**
LOCAL OPERATIONS				
Piston/Turboprop/Helicopter				
Single Engine Fixed	GASEPF	6,775	7,335	9,318
Single Engine Variable	GASEPV	6,775	7,335	9,318
Multi-Engine Fixed	BEC58P	0	0	0
Helicopter (P)	B206	50	75	200
Helicopter (T)	H500D	50	75	200
Subtotal		13,650	14,819	19,035
Military				
Helicopter	Blackhawk (UH60)	0	0	0
King Air 100	CNA441	0	0	0
Subtotal		0	0	0
TOTAL LOCAL		**13,650**	**14,819**	**19,035**
TOTAL ACTIVITY		**32,700**	**35,500**	**45,600**

Source: Coffman Associates analysis utilizing Integrated Noise Model (INM) v7.0

The time of day during which operations occur is important as input to the INM due to the 10 decibel nighttime (10:00 p.m. to 7:00 a.m.) weighting of flights. In calculating airport noise exposure, one operation at night has the same noise emission value as 10 operations during the day by the same aircraft. **Table D3** summarizes the operational percentages for the airport.

TABLE D3
Day/Night Operational Percentages
Lawrence Municipal Airport

Aircraft Type	Day	Night
Single-Engine Piston	95%	5%
Twin Engine Piston	95%	5%
Turboprop	95%	5%
Business Jet	95%	5%
Helicopter	95%	5%

Source: Interviews with FBO and airport staff and analysis of 10 years of wind data.

Runway usage data is another essential input to the INM. For modeling purposes, wind data analysis usually determines runway use percentages. **Table D4** summarizes the runway use assumptions used to prepare the noise exposure contours.

TABLE D4
Existing and Future Runway Use
Lawrence Municipal Airport

Runway	Business Jet	Turboprop	Piston	Local	Military
Existing Runway Use					
15	70%	50%	35%	25%	50%
33	30%	50%	35%	25%	50%
1	0%	0%	15%	25%	0%
19	0%	0%	15%	25%	0%
2015 Forecast Runway Use					
15	70%	50%	25%	25%	50%
33	30%	50%	25%	25%	50%
1	0%	0%	25%	25%	0%
19	0%	0%	25%	25%	0%
2030 Forecast Runway Use					
15	65%	65%	25%	25%	50%
33	31%	31%	25%	25%	50%
1	2%	2%	25%	25%	0%
19	2%	2%	25%	25%	0%

Source: Interviews with airport board and analysis of 10 years of wind data.

Using the previously discussed assumptions, noise exposure contours, depicted on **Exhibit D2**, were for 2010, 2015 and 2030. As shown on the left side of the exhibit, the 65 DNL noise contour does not extend off airport property and does not affect any noise-sensitive land uses. The center portion of the exhibit depicts the 2015 noise exposure contours with the proposed southerly runway extension. In this scenario, the 65 DNL noise contour approaches the airport boundary in the areas northeast and southwest of the runway intersection. There are no noise-sensitive land uses within the 65 DNL noise contour. For the 2030 condition, the 65 DNL noise contour extends beyond the existing airport property line northeast and southwest of the runway intersection. As noted on the exhibit, these areas are proposed for acquisition. The 2010, 2015, and 2030 noise exposure contours do not affect any existing noise-sensitive land uses.

COMPATIBLE LAND USE

The compatibility of existing and planned land uses in the vicinity of an airport is typically associated with the extent of the airport's noise impacts. Noise impacts are generally evaluated by comparing the extent of the airport's noise exposure contours to the land uses within the immediate vicinity of the airport. As previously discussed, the existing and future noise contours for Lawrence Municipal Airport do not affect any noise-sensitive land uses.

Land use compatibility also includes a consideration of wildlife attractants. Wildlife attractants include those land uses that bring wildlife into areas that can prove hazardous to aircraft operations. Wildlife attractants include landfills, wastewater treatment facilities, wetlands, agricultural crops, wildlife refuges, or any other land use that attracts wildlife. FAA AC 150/5200-33B states that the aforementioned land uses prove hazardous if they are located within:

- 5,000 feet of an airport serving piston-powered aircraft;
- 10,000 feet of an airport serving turbine-powered aircraft; and/or
- For all airports, the FAA recommends a distance of five miles between the farthest end of the airport operating area and the hazardous wildlife attractant if the attractant can cause hazardous wildlife movement into or across the airport approach or departure airspace.

With regard to FAA AC 150/5200-33B, there are no solid waste landfills, existing or proposed dredge spoil containment areas, or wastewater treatment facilities within the immediate vicinity of the proposed airport site that would be considered wildlife attractants. However, numerous water features, including intermittent drainages and ponds, are located on the proposed development parcels.

LIGHT EMISSIONS AND VISUAL IMPACTS

Airport lighting is characterized as either airfield lighting (i.e., runway, taxiway, approach and landing lights) or landside lighting (i.e., security lights, building interior lighting, parking lights, and signage). Generally, airport lighting does not re-

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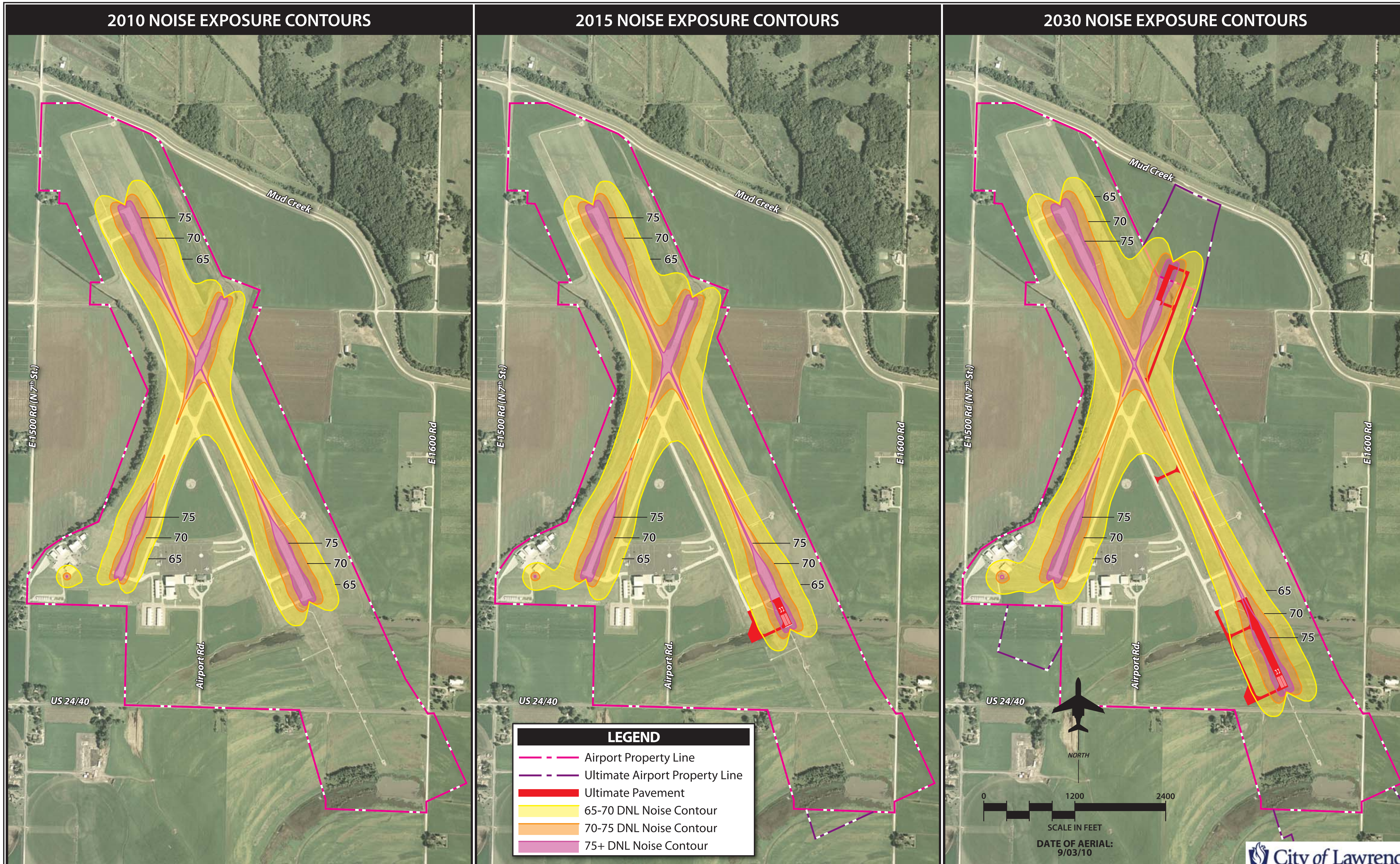

City of Lawrence
KANSAS

Exhibit D2
NOISE EXPOSURE CONTOURS

sult in significant impacts unless a high intensity strobe light, such as a REIL, would produce glare on any adjoining site, particularly residential uses.

Visual impacts relate to the extent that the proposed development contrasts with the existing environment and whether a jurisdictional agency considers this contrast objectionable. The visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not be assumed to constitute an adverse impact.

Additional security lighting may be constructed as part of planned hangar development. These lights would be shielded and focused on the taxilanes and hangars to minimize increases in off-airport illumination.

In the short term, the planned MALSR relocation associated with the Runway 15-33 extension will shift the existing lights 400 feet closer to two existing residences south of the airport. The long term Runway 15-33 extension will also require MALSR relocation to the south to areas immediately adjacent to existing residences. Under this scenario, the existing residences would be acquired to accommodate the road relocation phase of the project; therefore, light impacts would not impact these land uses. If the potential for lighting or visual impacts is determined to be associated with the planned development, consultation with local residents and the owners of light-sensitive sites may be needed to determine possible alternatives to minimize these effects without risking aviation safety or efficiency. Additional coordination with State, regional, or local art or architecture councils, tribes, or other organizations having an interest in airport-associated visual effects may be necessary.

SOCIOECONOMIC IMPACTS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

Socioeconomic impacts known to result from airport improvements are often associated with relocation activities or other community disruptions, including alterations to surface transportation patterns, division or disruption of existing communities, interferences with orderly planned development, or an appreciable change in employment related to the project.

The acquisition of real property or displacing people or businesses is required to conform to the *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970* (URARPAPA). These regulations mandate that certain relocation assistance services be made available to owners/tenants of the properties. As indicated on **Exhibit D1**, three tracts of land are proposed for acquisition near the airport to accommodate areas within the building restriction line and within the runway protection zone (RPZ). Additionally, in the long term, areas south of the airport are proposed for acquisition to complete the extension of Runway 15-33, associated RPZ, and road relocation. Fee simple acquisition of these properties will require compliance with URARPAPA and coordination with the FAA and the property owners.

Executive Order 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 FAA to provide for meaningful public involvement by 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.

According to the U.S. Census Bureau, the block group[3] that includes the airport, the airport environs do not contain high percentages (above 50 percent) of minority populations or high percentages of residents below the poverty level.

Pursuant to Executive Order 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.

During construction of the projects outlined within the Master Plan, appropriate measures should be taken to prevent access by unauthorized persons to construction project areas. Additionally, best management practices should be implemented to decrease environmental health risks to children.

WATER QUALITY

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.

As previously discussed, the Kansas River and Mud Creek are listed as *Clean Water Act* Section 303(d) impaired waters as they violate established water quality standards. If the proposed drainage improvement project for the airport includes introducing a new discharge point into Mud Creek, then additional permitting may need to be coordinated with the Kansas Department of Health and Environment – Bureau of Water and the U.S. Army Corps of Engineers.

[3] U.S. Census Bureau, http://www.census.gov/, accessed June 2011

During construction of any of the planned improvements at the airport, it is suggested that mitigation measures from FAA AC 150/5370-10A, *Standards for Specifying Construction of Airports, Item P-156, Temporary Air and Water Pollution, Soil Erosion and Siltation Control*, be incorporated into project design specifications to further mitigate potential water quality impacts. These standards include temporary measures to control water pollution, soil erosion, and siltation through the use of berms, fiber mats, gravels, mulches, slope drains, and other erosion control methods.

Additionally, as development occurs at the airport, the SWPPP will need to be modified to reflect the additional impervious surfaces and any stormwater retention facilities. The addition and removal of impervious surfaces may require modifications to this plan should drainage patterns be modified.

WETLANDS

Through the *Clean Water Act*, the U.S. Army Corps of Engineers (USACE) regulates the discharge of dredged or fill material into "Waters of the U.S.," including wetlands. Waters of the U.S., defined in 33 CFR Part 328 of the *Clean Water Act*, include "intrastate lakes, rivers, streams, mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds." USACE jurisdiction is limited to those waters or wetlands that have a connection to a traditional navigable water. Wetlands or ponds that do not have such a connection are considered "non-jurisdictional."

Wetlands are defined by Executive Order 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 seasonally saturated soil conditions for growth and reproduction." Categories of wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mud flats, natural ponds, estuarine area, tidal overflows, and shallow lakes and ponds with emergent vegetation. Wetlands exhibit three characteristics: hydrology, hydrophytes (plants able to tolerate various degrees of flooding or frequent saturation), and poorly drained soils.

A review of the National Wetland Inventory maps indicates the presence of potential wetlands on airport property. The potential wetlands are located within the area south of Runway 15-33 and north of US-40.

Prior to the construction of the short term Runway 15-33 extension, a wetlands delineation will likely be required to identify any potentially jurisdictional wetlands within the project area. This information will be used to coordinate with the USACE to determine the level of permitting and mitigation necessary to comply with the Section 404 of the *Clean Water Act*.

Additional field investigation and USACE coordination will likely be necessary prior to acquisition of the parcel parallel to Runway 1-19 and implementation of the long term Runway 15-33 extension project.

Appendix E

Wildlife Boundary

Appendix E
WILDLIFE PERIMETER

Airport Master Plan
Lawrence Municipal Airport

The Federal Aviation Administration (FAA) Central Region requests that airport master plans include an exhibit and a discussion of potential wildlife attractants in relation to safe airport operations. Advisory Circular (AC) 150/5200-33B, *Hazardous Wildlife Attractants on or Near Airports*, is the primary reference source. The AC provides guidance on certain land uses that have the potential to attract hazardous wildlife on or near public-use airports. It also discusses airport development projects (including airport construction, expansion, and renovation) affecting aircraft movement near hazardous wildlife attractants.

The wildlife species and the size of the populations attracted to the airport environment vary considerably depending on several factors, including land-use practices on or near the airport. The following is a list of land uses that are specifically identified as being of concern in the airport environment:

- Waste Disposal Operations
- Water Management Facilities
- Wetlands
- Dredge Spoil Containment Areas
- Agricultural Activities
- Golf Courses, Landscaping, and other Land-Use Considerations

Airport Operators should reference both AC 150/5200-33B and *Wildlife Hazard Management at Airports,* prepared by the FAA and U.S. Department of Agriculture

(USDA) staff which can be downloaded from the FAA's wildlife hazard mitigation web site: http://wildlife-mitigation.tc.FAA.gov. Another resource is *Prevention and Control of Wildlife Damage,* compiled by the University of Nebraska Cooperative Extension Division.

For airports serving turbine-powered aircraft, such as Lawrence Municipal Airport, the FAA recommends a separation distance of 10,000 feet for any of the wildlife attractants. In addition, the FAA recommends a distance of five statute miles between the farthest edge of the airport's operations area and the hazardous wildlife attractant if the attractant could cause hazardous wildlife movement into or across the approach or departure airspace. **Exhibit E1** presents the separation distances for Lawrence Municipal Airport within which hazardous wildlife attractants should be avoided, eliminated, or mitigated.

10MP07-E1-7/21/11

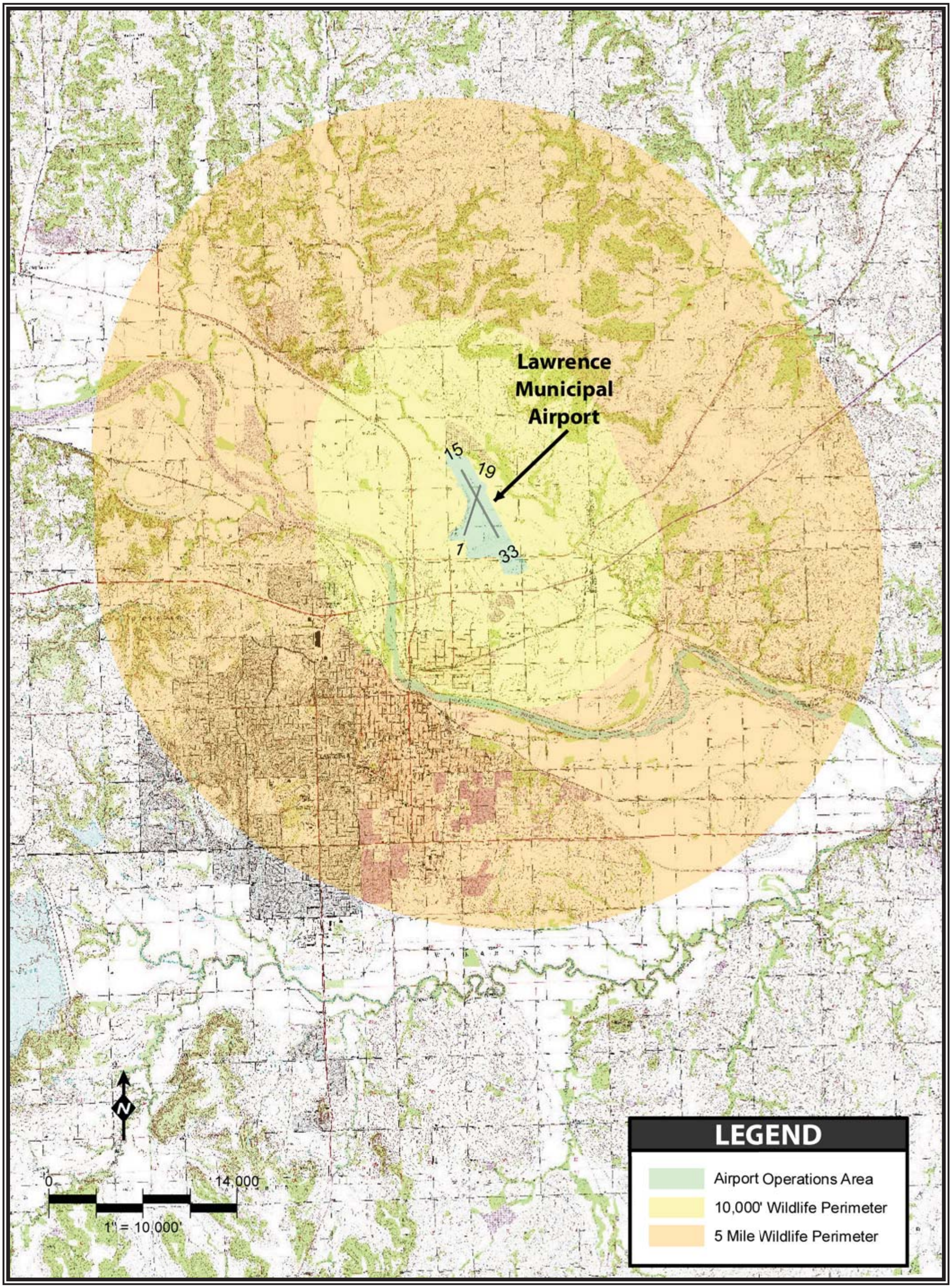

Exhibit E1
WILDLIFE LIMITATION BOUNDARIES

Appendix F

KDOT Communications

Appendix F
KDOT COMMUNICATIONS

The recommended master plan concept for the airport includes a long term extension of Runway 15-33 to the southeast which would bring the total runway length to 7,000 feet. In order to accomplish the long term extension, U.S. Highway 24/40 would need to be rerouted in order to accommodate the extension and the associated safety areas, as previously shown on Exhibit 5A.

In order to determine the feasibility of such a runway extension, a scoping letter was sent to the Kansas Department of Transportation (KDOT). In the letter, a request was made for comment regarding the proposed shifting of U.S. 24/40 immediately south of the airport. Included in this appendix is the original scoping letter sent to KDOT as well as their response.

While KDOT is unable to approve such a plan at this early stage, they were able to indicate that long term planning for rerouting U.S. Highway 24/40 in order to accommodate a potential runway extension is acceptable. At a minimum, FAA would be obligated to reroute the roadway to maintain the speed limit and the design standards at that time. KDOT indicated they have long term plans to improve U.S. Highway 24/40 to a four-lane divided freeway in the area. Close coordination should be undertaken between FAA and KDOT if either party plans to move forward with a project that would impact U.S. Highway 24/40 immediately south of the airport. At that time, preliminary engineering could impact the road alignment depicted in the airport master plan.

July 5, 2011

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Bureau of Transportation Planning
700 SW Harrison, Second Floor
Topeka, KS 66603

Re:* *Proposed Runway Improvements at Lawrence Municipal Airport, Lawrence, Kansas

Dear Mr. Moriarty:

The City of Lawrence is in the process of preparing an update the Lawrence Municipal Airport Master Plan. The City (Charles Soules – Public Works Director) and the FAA representative (Mr. Jeff Deitering) have indicated they would like to provide the Kansas Department of Transportation with an opportunity to comment on the long term plan. The long term plan would necessitate the shifting U.S. Highway 24/40, as shown on **Exhibit 5A**. The shift of the highway would be required in order to meet the various clearance and safety design standards if the runway were extended to an ultimate length of 7,000 feet.

The purpose of this letter is to solicit your comments regarding the proposed shifting of U.S. Highway 24/40. This is a long term project (10-20 years) and would only be justified by frequent activity (500 or more annual operations) by aircraft requiring the additional runway length. The forecasting element of the Master Plan does not indicate that that such activity levels will be reached within the next 20 years.

Please send any written comments to the Master Plan consultants, Coffman Associates:

Coffman Associates
Attn: Patrick Taylor
237 NW Blue Parkway
Lee's Summit, MO 64063

As another option, you may fax or e-mail your comments to:

FAX: (816) 524-2575
E-mail: ptaylor@coffmanassociates.com

If you have any questions or need additional information, please feel free to contact me at (816) 524-3500. Thank you for your consideration and timely response.

Sincerely,

Patrick Taylor
Airport Planner

Enclosures

Cc: Charles Soules – Public Works Director
Jeff Deitering – FAA
Mike Dmyterko – Principal – Coffman Associates

Bureau of Transportation Planning
Dwight D. Eisenhower State Office Building
700 S.W. Harrison Street
Topeka, KS 66603-3745

Kansas

Phone: 785-296-3841
Fax: 785-296-8168
Hearing Impaired - 711
publicinfo@ksdot.org
http://www.ksdot.org

Deb Miller, Secretary
Dennis R Slimmer, P.E., Chief

Kansas Department of Transportation

Sam Brownback, Governor

August 19, 2011

Chuck Soules, P.E.
Public Works Director
Lawrence City Hall
6 East 6th Street
Lawrence, KS 66044

Mr. Soules,

This letter regards the Lawrence Municipal Airport Master Plan update. The Kansas Department of Transportation (KDOT) has reviewed the materials sent over by Coffman Associates and we kindly offer the following comments:

1. A US-24 Reconstruction Discovery Phase report was completed by KDOT in May of 2001. The report recommended US-24 be reconstructed to freeway standards, from near Perry to K-32, with interchanges at various locations. This reconstruction would take place on a new alignment that generally parallels existing US-24. Per the report, the new alignment **would be located north of existing US-24/40** through the subject area and encroach upon airport property (see attached drawing).

2. The Federal Aviation Administration (FAA) reviewed the Discovery Phase report prior to being finalized. At that time, FAA officials were not concerned with the proposed northern shift of the highway. However, it is our understanding that opinions have changed and FAA no longer supports a northern shift of US-24/40 as depicted in the report.

3. KDOT could support the conceptual relocation of US-24/40, depicted in Exhibit 5A, under the following conditions:

   a) The proposed realignment of US-24/40 should be illustrated as being consistent with KDOT's ultimate vision of a freeway section through the subject area.

      i. Note: While the Discovery Phase report illustrates a northern shift of US-24/40, KDOT concedes this is no longer a feasible alignment because of changed opinions at FAA and could therefore support a conceptual southern shift of US-24/40 in the Airport Plan.

      ii. Note: As currently shown, the horizontal curvatures for the proposed realignment would suggest a design speed between 35-40 mph and that is not acceptable. KDOT requests a more appropriate "conceptual blue line" (i.e. a multilane roadway with appropriate access features for adjoining properties) be drawn with horizontal curvatures that support a higher design speed (e.g.70+ mph for a freeway) and realistic departure/return control points. In short, we are asking for a "southern mirror image" of what has been illustrated in the Discovery Phase report.

   b) The Plan should clearly state KDOT would not be financially responsible for realigning US-24/40. This effort would be financed by FAA and/or through local funding sources.

   c) The realigned US-24/40 would be designed to prevailing engineering standards of the day; subject to KDOT review and approval.

d) Design plans must be developed by the FAA/Local Units of Government in compliance with the National Environmental Policy Act (NEPA) and all other requirements at the time of project development.

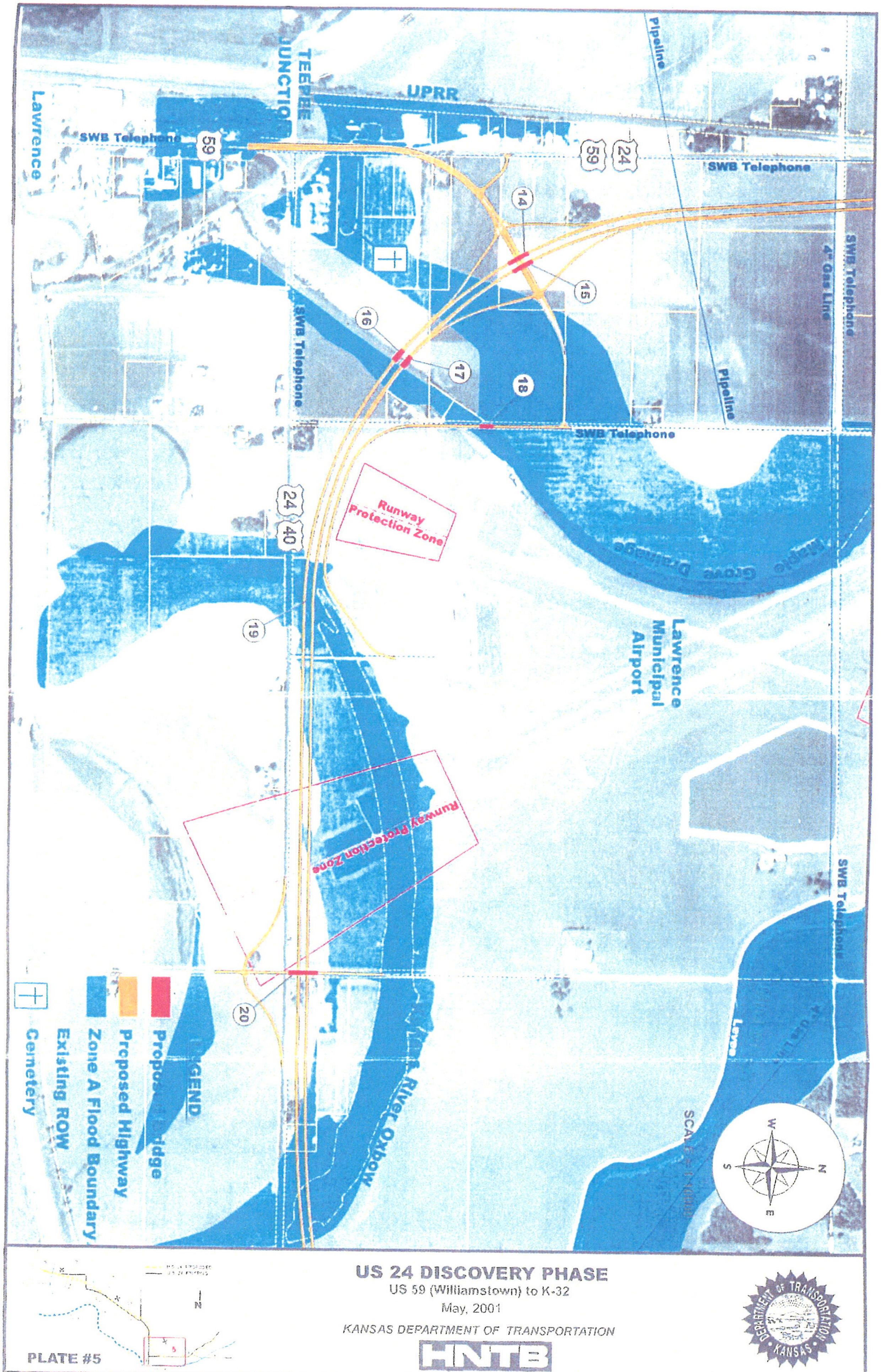
e) KDOT will not be responsible for preservation of the necessary right-of-way corridor for the US-24/40 relocation. Acquisition of right-of-way necessary for the US-24/40 relocation would be the responsibility of the FAA/Local Units of Government through either purchase, easement or by an approved platting process.

Thank you for providing an opportunity for KDOT to comment on the Lawrence Municipal Airport Master Plan.

Sincerely,

Mike Moriarty
Corridor Management Administrator

c:
Jerry Younger, P.E., Deputy Secretary and State Transportation Engineer
W. Clay Adams, P.E., District 1 Engineer
Earl Bosak, P.E., Area 2 Engineer
Chris Herrick, P.E., Director of Planning and Development
Dan Scherschligt, P.E., Director of Engineering and Design
Ed Young, Director of Aviation
Dennis R. Slimmer, P.E., Chief of Transportation Planning
Jim L. Kowach, P.E., Chief of Design
Thomas Dow, AICP, State Transportation Planner
James O. Brewer, P.E., Engineering Manager, State Road Office
Jesse Romo, Aviation Coordinator
George Laliberte, Aviation Program Consultant
Jessica Upchurch, P.E., Corridor Management Engineer


Lawrence
SWB Telephone
59
UPRR
24
59
Pipeline
SWB Telephone
14
15
16
17
18
SWB Telephone
4" Gas Line
Pipeline
SWB Telephone
Runway Protection Zone
24
40
Maple Grove Drainage
Lawrence Municipal Airport
19
Runway Protection Zone
SWB Telephone
20
River Oxbow
Levee
Proposed Highway
Zone A Flood Boundary
Existing ROW
Cemetery
W
N
S
E
US 24 DISCOVERY PHASE
US 59 (Williamstown) to K-32
May, 2001
KANSAS DEPARTMENT OF TRANSPORTATION
HNTB
PLATE #5
DEPARTMENT OF TRANSPORTATION
KANSAS

Appendix G

Airport Plans

Appendix G
AIRPORT PLANS

As part of this master plan, the Federal Aviation Administration (FAA) requires the development of several computer drawings detailing specific parts of the airport and its environs. These drawings were created on a computer-aided drafting system (CAD) and serve as the official depiction of the current and planned condition of the airport. These drawings will be delivered to the FAA for their review and inspection. The FAA will critique the drawings from a technical perspective to be sure all applicable federal regulations are met. The FAA will use the CAD drawings as the basis and justification for funding decisions.

It should be noted that the FAA requires that any changes to the airfield (i.e., runway and taxiway system, etc.) be represented on the drawings. The landside configuration developed during this master planning process is also depicted on the drawings, but the FAA recognizes that landside development is much more fluid and dependent upon developer needs. Thus, an updated drawing set is not typically necessary for future landside alterations unless the land use category changes (e.g., aviation related to non-aviation).

The following is a description of the CAD drawings included with this master plan.

AIRPORT LAYOUT PLAN

An official Airport Layout Plan (ALP) drawing has been developed for Lawrence Municipal Airport, a draft of which is included in this appendix. The ALP drawing graphically presents the existing and ultimate airport layout plan. The ALP drawing will include such elements as the physical airport features, wind data tabulation, location of airfield facilities (i.e., runways, taxiways, navigational aids), and existing general aviation development (and commercial development for air carrier airports). Also presented on the ALP are the runway safety areas, airport property boundary, and revenue support areas. The ALP is used by FAA to determine funding eligibility for future capital projects.

The computerized plan provides detailed information on existing and future facility layouts on multiple layers that permit the user to focus on any section of the airport at a desired scale. The plan can be used as base information for design and can be easily updated in the future to reflect new development and more detail concerning existing conditions as made available through design surveys.

Airport Layout Plan Data Features

The FAA is making an effort to transition from primarily a paper-based ALP system to a digital or electronic ALP. As part of the ALP development process, survey information about the airport was collected and compiled in a digital format acceptable to the FAA Airport Surveying GIS Program. Feature data and attributes of the ALP were collected in compliance with FAA AC 150/5300-18B, *General Guidance And Specifications For Submission Of Aeronautical Surveys To NGS: Field Data Collection And Geographic Information System (GIS) Standards*. The ultimate product is an FAA-compliant GIS detailing feature groups and classes required to be provided to the FAA. The data groups rendered into attributes include data easily viewable via aerial photography and/or via site visit. The attributes included in the GIS product are outlined in the work plan developed by the sub-consultant (Woolpert) and agreed upon with the FAA. The GIS has been submitted to the FAA Airport Surveying GIS website and confirmation of successful migration was received.

FAR PART 77 AIRSPACE DRAWING

Federal Aviation Regulation (F.A.R.) Part 77, *Objects Affecting Navigable Airspace*, was established for use by local authorities to control the height of objects near airports. The FAR Part 77 Airspace Drawing included in this master plan is a graphic depiction of this regulatory criterion. The FAR Part 77 Airspace Drawing is a tool to aid local authorities in determining if proposed development could present a hazard to aircraft using the airport. The FAR Part 77 Airspace Drawing can be a critical tool for the airport sponsor's use in reviewing proposed development in the vicinity of the airport.

The airport sponsors should do all in their power to ensure development stays below the FAR Part 77 surfaces to protect the role of the airport. The following discussion will describe those surfaces that make up the recommended FAR Part 77 surfaces at Lawrence Municipal Airport.

The FAR Part 77 Airspace Drawing assigns three-dimensional imaginary surfaces associated with the airport. These imaginary surfaces emanate from the runway centerline(s) and are dimensioned according to the visibility minimums associated with the approach to the runway end and size of aircraft to operate on the runway. The FAR Part 77 imaginary surfaces include the primary surface, approach surface, transitional surface, horizontal surface, and conical surface. Each surface is described as follows.

Primary Surface

The primary surface is an imaginary surface longitudinally centered on the runway. The primary surface extends 200 feet beyond each runway end. The elevation of any point on the primary surface is the same as the elevation along the nearest associated point on the runway centerline. Under FAR Part 77 regulations, the primary surface for Runway 15-33 is 1,000 feet wide as the runway supports a precision approach. The primary surface for the improved Runway 1-19 is 500 feet wide meeting the specifications for a utility runway with visual approaches.

Approach Surface

An approach surface is also established for each runway end. The approach surface begins at the same width as the primary surface, extends upward and outward from the primary surface end, and is centered along an extended runway centerline. The approach surface leading to each runway is based upon the type of approach available (instrument or visual) or planned.

In an effort to protect the airport from future adjacent incompatible land uses, approach surfaces with instrument approach procedures are planned to each runway end. The approach surface dimensions for Runway 33 are based on a precision approach. The approach surface expands uniformly to an outer width of 16,000 feet. The approach surface extends for a horizontal distance of 10,000 feet at a slope of 50 to 1 with an additional 40,000 feet at a slope of 40 to 1.

The dimensions of the approach surface to Runway 15 are a function of the existing GPS non-precision instrument approach (1-mile visibility minimums). The approach surface extends from the primary surface at a slope of 34 to 1 at a horizontal distance of 10,000 feet and an outer width of 3,500 feet.

Non-precision instrument approaches are planned to an improved Runway 1-19. The approach surface begins at the end of the primary surface and extends uniformly to a distance of 10,000 feet at a slope of 20 to 1 and a width of 3,500 feet.

Transitional Surface

Each runway has a transitional surface that begins at the outside edge of the primary surface at the same elevation as the runway. The transitional surface also connects with the approach surfaces of each runway. The surface rises at a slope of 7 to 1, up to a height 150 feet above the highest runway elevation. At that point, the transitional surface is replaced by the horizontal surface.

Horizontal Surface

The horizontal surface is established at 150 feet above the highest elevation of the runway surface. Having no slope, the horizontal surface connects the transitional and approach surfaces to the conical surface at a distance of 10,000 feet from the end of the primary surfaces of each runway.

Conical Surface

The conical surface begins at the outer edge of the horizontal surface. The conical surface then continues for an additional 4,000 feet horizontally at a slope of 20 to 1. Therefore, at 4,000 feet from the horizontal surface, the elevation of the conical surface is 350 feet above the highest airport elevation.

APPROACH SURFACE PROFILE DRAWINGS

The runway profile drawing presents the entirety of the FAR Part 77 approach surface to the runway ends. It also depicts the runway centerline profile with elevations. This drawing provides profile detail that the Airspace Drawing does not. The profile drawings also depict the existing and future Threshold Siting Surface.

INNER APPROACH SURFACE DRAWINGS

The Inner Portion of the Approach Surface Drawing contains the plan and profile view of the inner portion of the approach surface to the runway and a tabular listing of all surface violations. The drawing also contains other approach surfaces, such as the threshold siting surface. Detailed obstruction and facility data is provided to identify planned improvements and the disposition of obstructions. A drawing of each runway end is provided.

DEPARTURE SURFACE DRAWING

For runways supporting instrument operations, such as Runway 14-32, a separate drawing depicting the departure surface is required. The departure service, also called the one engine inoperable (OEI) obstacle identification surface (OIS), is a surface emanating from the departure end of the runway to a distance of 10,200 feet. The inner width is 1,000 feet and the outer width is 6,466 feet. The departure surface emanates at a slope of 40 to 1. The departure surface information should be made available to any commercial operator at the airport.

There are three recommended methods to mitigate penetrations to this surface:

1. The object is removed or lowered.
2. The Takeoff Distance Available (TODA) is decreased (i.e., pilots are instructed to lift off prior to the runway end in order to avoid the obstruction.
3. Instrument departure minimums are raised.

Existing obstacles of 35 feet or less would not require mitigation; instead, new departure procedures may be introduced or existing departure procedures may be altered or no action may be taken.

LANDSIDE FACILITY DRAWING

The landside facility drawing is a larger scale plan view drawing of existing and planned aprons, buildings, hangars, parking lots, and other landside facilities. The focus of the drawing is the airport terminal area development. It is prepared in accordance with FAA AC 150/5300-13, *Airport Design*.

AIRPORT LAND USE DRAWING

The objective of the Airport Land Use Drawing is to coordinate uses of the airport property in a manner compatible with the functional design of the airport facility. Airport land use planning is important for orderly development and efficient use of available space. There are two primary considerations for airport land use planning. These are to secure those areas essential to the safe and efficient operation of the airport and to determine compatible land uses for the balance of the property which would be most advantageous to the airport and community.

In the development of an airport land use plan for Lawrence Municipal Airport, the airport property was broken into several large general tracts. Each tract was analyzed for specific site characteristics, such as tract size and shape, land characteristics, and existing land uses. The availability of utilities and the accessibility to various transportation modes were also considered. Limitations and constraints to development such as height and noise restrictions, runway visibility zones, and contiguous land uses were analyzed next. Finally, the compatibility of various land uses in each tract was analyzed.

The depiction of on-airport land uses on this drawing becomes the official FAA acceptance of current and future land uses. For Lawrence Municipal Airport, all airport property adjacent to the taxiways and runways is planned for aviation purposes.

AIRPORT PROPERTY MAP

The Airport Property Map provides information on property under airport control and is, therefore, subject to FAA grant assurances. The various recorded deeds that make up the airport property are listed in tabular format. The primary purpose of the drawing is to provide information for analyzing the current and future aeronautical use of land acquired with federal funds.

ALP APPROVAL

The ALP set has been developed in accordance with accepted FAA standards. The ALP set has been conditionally approved by the FAA.

U.S. Department
of Transportation

Federal Aviation Administration

Central Region
Iowa, Kansas,
Missouri, Nebraska

901 Locust
Kansas City, Missouri 64106
(816) 329-2600

June 18, 2012

Charles Soules, P.E.
Public Works Director
6 East 6th Street
Lawrence, KS 66044

Dear Mr. Soules:

Lawrence Municipal Airport
Lawrence, Kansas
AIP No. 3-20-0047-15
ALP Conditional Approval/Master Plan Acceptance

We have completed our review of the final submission of the Master Plan and Airport Layout Plan (ALP) drawing set. The documents are acceptable from the standpoint of safety, efficiency, and utility. This does not necessarily mean that we agree with each and every specific statement, nor does it imply a commitment of Federal funds to participate in any of the development recommended depicted on the Airport Layout Plan. Determinations regarding funding of improvements are made only after a specific request for federal funds is submitted.

The Airport Layout Plan is being studied under Airspace Study No. 2011-ACE-1804-NRA. The determination will be sent in a separate airspace determination letter. Although future structures on or near the airport may be in conformance with the ALP, all future structures will be subject to the notice provisions of Federal Aviation Regulations (FAR) Part 77.

This ALP approval does not constitute a commitment of Federal funds, does not authorize construction or development, nor constitute FAA's commitment to take part in the recommended development.

The actions listed below are subject to Federal environmental laws, statutes, and regulations. FAA must first make an environmental finding on these actions before the airport sponsor may begin them. To satisfy these responsibilities, FAA must complete the environmental process described in the most current version of FAA Order 5050.4. This conditional approval of the ALP does not indicate that the proposed development is environmentally approved. The proposed airport development identified below shall not

be undertaken without prior written environmental approval by the FAA. These items include:

- Extend Runway 15-33
- Extend Runway 01-19
- Apron construction
- Taxiway construction
- Road relocation
- Terminal Area development
- Miscellaneous land acquisition

Our review and approval should not be construed as relieving the sponsor or the engineer of the responsibility for the accuracy, completeness, and technical content of the Airport Layout Plan drawings. The ALP is an important document and should be kept up-to-date at all times with respect to future planned development and existing features.

One set of the of conditionally approved ALP drawings is enclosed. We are keeping one set of the conditionally approved ALP drawing sets for the official FAA files. Copies of this letter with sets of conditionally approved ALP drawings are being furnished to: C. Edward Young, KDOT, and your consultant.

If you have any questions, please contact me by telephone at (816) 329-2637 or by email at jeff.deitering@faa.gov.

Sincerely,

Original Signed By
Jeffrey D. Deitering

Jeffrey D. Deitering, P.E.
Airport Planning Engineer - Kansas

Enclosure [1 set drawings]

cc: C. Edward Young, KDOT (w/ encl [1 set drawings])
Patrick Taylor, Coffman Associates (w/ encl [1 set drawings])

AIRPORT LAYOUT PLANS

PREPARED FOR

City of Lawrence
KANSAS

DRAWING INDEX

1. AIRPORT LAYOUT DRAWING
2. AIRPORT DATA SHEET
3. AIRPORT AIRSPACE DRAWING
4. AIRPORT AIRSPACE APPROACH PROFILE, RUNWAY 1-19
5. AIRPORT AIRSPACE APPROACH PROFILE, RUNWAY 15-33
6. INNER PORTION OF THE APPROACH SURFACE, RUNWAY 1
7. INNER PORTION OF THE APPROACH SURFACE, RUNWAY 19
8. INNER PORTION OF THE APPROACH SURFACE , RUNWAY 15
9. INNER PORTION OF THE APPROACH SURFACE , RUNWAY 33
10. TERMINAL AREA DRAWING
11. LAND USE DRAWING
12. RUNWAY 15-33, DEPARTURE SURFACE DRAWING
13. AIRPORT PROPERTY MAP

Coffman Associates
Airport Consultants

June 4, 2012

LEGEND

EXISTING	SHORT TERM	ULTIMATE	DESCRIPTION
	N/A	N/A	AVIGATION EASEMENT
XPL	N/A		AIRPORT PROPERTY LINE
			AIRPORT REFERENCE POINT (ARP)
			BUILDING
BRL-35	SAME	SAME	BUILDING RESTRICTION LINE (BRL)
			CRITICAL AREA
	SAME	SAME	HOLDING POSITION MARKING
PAPI	PAPI	PAPI	NAVIGATION AID
OFA (E)	OFA (ST)	OFA (U)	OBJECT FREE AREA (OFA)
OFZ (E)	OFZ (ST)	OFZ (U)	OBSTACLE FREE ZONE (OFZ)
RSA (E)	RSA (U)	RSA (U)	RUNWAY SAFETY AREA (RSA)
			RUNWAY END IDENTIFIER LIGHTS (REILS)
			THRESHOLD LIGHTS
	N/A	N/A	SURVEY MONUMENT
	N/A	N/A	SEGMENTED CIRCLE/WIND INDICATOR
	SAME	SAME	WIND INDICATOR (Lighted)
1070	N/A	N/A	CONTOURS

SURVEY MONUMENTS IDENTIFIER			
PERMANENT IDENTIFIER	LATITUDE (N)	LONGITUDE (w)	ELEV (FT)
AJ8082	39 00 31.77	95 13 00.38	830.2
KE1085	39 00 21.91	95 12 49.73	828.75
KE1086	39 00 49.73	95 12 59.04	829.61

*From http://www.ngs.noaa.gov/cgi-bin/ds_radius.prl

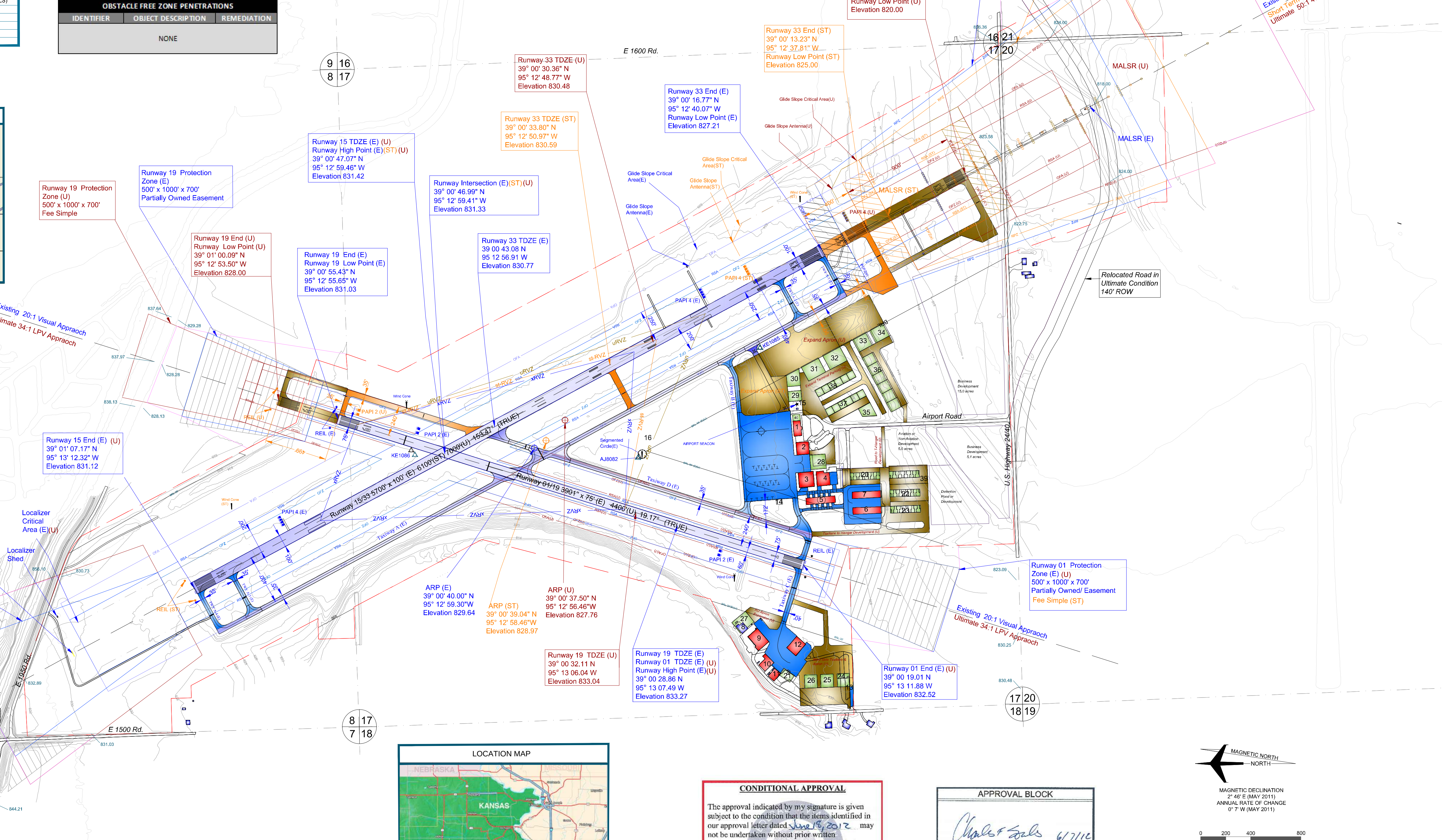
The Primary Airport Control monument AJ8082 is part of the Federal Base Network (FBN) of permanently monumented stations.

OBSTACLE FREE ZONE PENETRATIONS		
IDENTIFIER	OBJECT DESCRIPTION	REMEDIATION
NONE		

THRESHOLD SITING SURFACE PENETRATIONS						
No.	Description	Existing Penetration	Short Term Penetration	Ultimate Penetration	Runway	Remediation
1	TREE	4.87	NA	NA	15	Remove or Trim
2	TREE	26.32	NA	1.96	19	Remove or Trim
3	TREE	23.94	NA	4.33	19	Remove or Trim
4	TREE	16.56	2.58	28.88	33	Remove or Trim
5	TREE	20.5	6.52	24.94	33	Remove or Trim
6	TREE	11.4	2.57	34.04	33	Remove or Trim
7	TREE	13.23	0.74	x	33	Remove or Trim
8	TREE	16.56	2.58	28.8	33	Remove or Trim
9	TREE	5.7	8.19	x	33	Remove or Trim
10	TREE	5.32	8.64	x	33	Remove or Trim

TSS Obstructions Shown on Inner Portion of Approach Surface Drawings

VICINITY MAP



MAGNETIC DECLINATION
2° 46' E (MAY 2011)
ANNUAL RATE OF CHANGE
0° 7' W (MAY 2011)

0 200 400 800
GRAPHIC SCALE

LOCATION MAP

GENERAL NOTES:

SURVEY MONUMENT LOCATIONS PER NATIONAL GEODETIC SURVEY DATA SHEET,
HTTP:WWW.NGS.NOAA.GOV/CGI-BIN/DS_RADIUS.PRL

EXISTING RUNWAY END COORDINATES AND ELEVATIONS FROM SURVEY PERFORMED BY WOOLPERT, ENGLEWOOD, CO

ALL REFERENCE DATUM NAD 83 HORIZONTAL, NAVD 88 VERTICAL. ALL VERTICAL ELEVATIONS PROVIDED AS MSL.

EXISTING AND ULTIMATE THRESHOLD SITING SURFACE PENETRATIONS SHOWN ON INNER PORTION OF APPROACH SURFACE DRAWINGS

THREE CONDITIONS ARE DEPICTED IN THE DRAWING SET; (E) FOR EXISTING (ST) FOR SHORT-TERM AND (U) FOR ULTIMATE

CONDITIONAL APPROVAL

The approval indicated by my signature is given subject to the condition that the items identified in our approval letter dated June 18, 2012 may not be undertaken without prior written environmental approval by the Federal Aviation Administration. This approval action does not imply any commitment for Federal funding, or approval of future structures requiring notice under FAR Part 77.

[signature] 6-18-2012
Airport Planning Engineer — Date
FAA Central Region

APPROVAL BLOCK

[signature] 6/7/12
Director of Public Works — Date

No.	REVISIONS	DATE	BY	APP'D.

"The preparation of this document may have been supported, in part, through the Airport Improvement Program financial assistance from the Federal Aviation Administration (Project Number 3-20-0047-15) as provided under Title 49 U.S.C., Section 47104. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable or would have justification in accordance with appropriate public laws."

LAWRENCE MUNICIPAL AIRPORT

AIRPORT LAYOUT DRAWING

Lawrence, Kansas

PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011 — SHEET 1 OF 13

Coffman Associates Airport Consultants
www.coffmanassociates.com

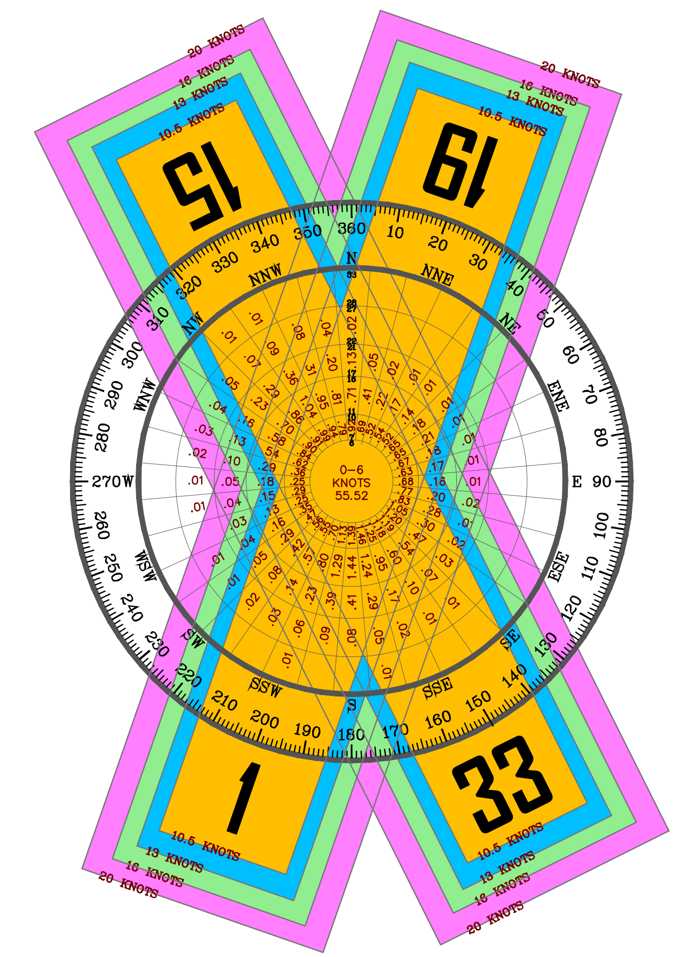
RUNWAY END COORDINATES (NAD 83)			
RUNWAY	END EL	LATITUDE	LONGITUDE
EXISTING RUNWAY 01	832.52	39 00' 19.01"N	95 13' 11.88"W
EXISTING RUNWAY 19	831.03	39 00' 55.43"N	95 12' 55.65"W
EXISTING RUNWAY 15	831.12	39 01' 07.17"N	95 13' 12.32"W
EXISTING RUNWAY 33	827.21	39 00' 16.77"N	95 12' 40.07"W
SHORT TERM RUNWAY 15	831.12	39 01' 07.17"N	95 13' 12.32"W
SHORT TERM RUNWAY 33	825.00	39 00' 13.23"N	95 12' 37.81"W
ULTIMATE RUNWAY 1	831.03	39 00' 19.01"N	95 13' 11.88"W
ULTIMATE RUNWAY 19	827.79	39 01' 00.09"N	95 12' 53.50"W
ULTIMATE RUNWAY 15	831.12	39 01' 07.17"N	95 13' 12.32"W
ULTIMATE RUNWAY 33	820.00	39 00' 5.27"N	95 12' 32.72"W

ALL WEATHER WIND COVERAGE				
Runways	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 1-19	89.81%	94.40%	98.11%	99.50%
Runway 15-33	93.58%	96.87%	98.13%	99.80%
Combined	97.69%	99.10%	99.74%	99.95%

BUILDING/FACILITES			
EXIST	ULT	DESCRIPTION	MSL ELEV
1		TERMINAL	849.54
2		CONVENTIONAL HANGAR	857.31
3		CONVENTIONAL HANGAR	874.51
4		CONVENTIONAL HANGAR	858.78
5		T-HANGARS (A)	850.76
6		T-HANGARS (B)	851.98
7		T-HANGARS (C)	851.69
8		BOX HANGAR	856.75
9		CONVENTIONAL HANGAR	862.78
10		BOX HANGAR	854.73
11		BOX HANGAR	850.74
12		BOX HANGAR	852.18
13		PORTABLE T-HANGARS	844.55
14		FUEL FARM	841.8
15		AIRPORT BEACON	830.97
16		SEGMENTED CIRCLE	844.55
	20	T-HANGARS	852.0 (est)
	21	EQUIPMENT STORAGE	845.0 (est)
	22	T-HANGARS	848.0 (est)
	23	T-HANGARS	848.0 (est)
	24	CONVENTIONAL HANGAR	853.0 (est)
	25	CONVENTIONAL HANGAR	852.0 (est)
	26	CONVENTIONAL HANGAR	851.0 (est)
	27	CONVENTIONAL HANGAR	853.0 (est)
	28	CONVENTIONAL HANGAR	851.0 (est)
	29	CONVENTIONAL HANGAR	851.0 (est)
	30	CONVENTIONAL HANGAR	850.0 (est)
	31	CONVENTIONAL HANGAR	849.0 (est)
	32	CONVENTIONAL HANGAR	847.0 (est)
	33	CONVENTIONAL HANGAR	843.0 (est)
	34	CONVENTIONAL HANGAR	835.0 (est)
	35	EXECUTIVE HANGAR	848.0 (est)
	36	EXECUTIVE HANGAR	840.0 (est)
	37	EXECUTIVE HANGAR	849.0 (est)
	38	EXECUTIVE HANGAR	848.0 (est)
	39	T-HANGARS	848.0 (est)
	40	TERMINAL EXPANSION	851.0 (est)

ACTUAL ULTIMATE BUILDING ELEVATIONS MAY VARY DUE TO FINAL GRADING AND DRAINAGE PLAN

RUNWAY DATA TABLE										
	EXISTING		ULTIMATE		EXISTING		SHORT TERM		ULTIMATE	
	1	19	1	19	15	33	15	33	15	33
AIRCRAFT APPROACH CATEGORY-DESIGN GROUP	B-I		B-II		C-II		C-II		D-II	
RUNWAY LENGTH/WIDTH	3901 x 75		4400 x 75		5700 x 100		6100 x 100		7000 x 100	
PART 77 APPROACH USE TYPE	B(V)	B(V)	C	C	C	PIR	D	PIR	D	PIR
RUNWAY APPROACH SURFACE SLOPE	20 : 1	20 : 1	34 : 1	34 : 1	34 : 1	50:1 / 40:1	34 : 1	50:1 / 40:1	34 : 1	50:1 / 40:1
APPROACH VISIBILITY MINIMA	Visual	Visual	1 Mile	1 Mile	1 Mile	1/2 Mile	3/4 Mile	1/2 Mile	3/4 Mile	1/2 Mile
AERONATUICAL SURVEY TYPE REQUIRED FOR APPROACH	NVGS	NVGS	VGS	VGS	VGS	VGS	VGS	VGS	VGS	VGS
TOUCHDOWN ZONE ELEVATION (TDZE)	833.27	833.27			831.42	830.77				
THRESHOLD SITING SURFACE LINE NUMBER	4	4	4	4	5	9,7	5	9,7	6	9,7
RUNWAY BEARING (TRUE)	19.17	199.17	19.17	199.17	153.47	333.47	153.47	333.47	153.47	333.47
RUNWAY SAFETY AREA (RSA) LENGTH/WIDTH	4381 x 120		5000 x 150		7700 x 500		8100 x 500		9000 x 500	
RUNWAY OBJECT FREE AREA (OFA) LENGTH/WIDTH	4381 x 400		5000 x 500		7700 x 800		8100 x 800		9000 x 800	
RUNWAY OBJECT FREE ZONE (OFZ) LENGTH/WIDTH	4301 x 400		4800 x 400		6100 x 400		6500 x 400		7400 x 400	
RUNWAY PAVEMENT MATERIAL	Concrete		Concrete		Asphalt		Asphalt		Asphalt	
RUNWAY PAVEMENT DESIGN STRUCTURE (thousands of lbs.)	12.5 (S) 15.6 (D)		30.0 (S) 48.0 (D)		40.0 (S) 60.0 (D)		40.0 (S) 60.0 (D)		40.0 (S) 60.0 (D)	
RUNWAY MAXIMUM LONGITUDINAL GRADE	0.05%		0.05%		0.07%		0.07%		0.07%	
RUNWYAY TO TAXIWAY HOLDING POSITION MARKING	200'		200'		250'		250'		251'	
RUNWAY MARKING	NPI-G	NPI-G	NPI-G	NPI-G	NPI	PIR	NPI	PIR	NPI	PIR
RUNWAY LIGHTING	MIRL		MIRL		MIRL		MIRL		MIRL	
TAXIWAY WIDTH	25'		35'		35'		35'		35'	
TAXIWAY LIGHTING	MITL / reflectors		MITL / reflectors		MITL / reflectors		MITL / reflectors		MITL / reflectors	
TAXIWAY MARKING	Centerline		Centerline		Centerline		Centerline		Centerline	
TAXIWAY SAFETY AREA WIDTH	49'		79'		79'		79'		79'	
TAXIWAY OBJECT FREE AREA WIDTH	89'		131'		131'		131'		131'	
RUNWAY ELECTRONIC AIDS	VOR/DME-A Circling		GPS Straight In		CAT I ILS (R33)		CAT I ILS (R33)		CAT I ILS (R33)	
					LPV GPS (R33)		LPV GPS (R33)		LPV GPS (R33)	
					LNAV GPS (R15)		LNAV GPS (R15)		LNAV GPS (R15)	
							LPV GPS (R15)			
RUNWAY VISUAL AIDS	Airport Beacon, ASOS		Airport Beacon, ASOS		Airport Beacon, ASOS		Airport Beacon, ASOS		Airport Beacon, ASOS	
	PAPI-2L		PAPI-2L		PAPI-4L (R15)		PAPI-4L (R15)		PAPI-4L (R15)	
	REIL		REIL		PAPI-4R (R33)		PAPI-4R (R33)		PAPI-4R (R33)	
	Segmented Circle		Segemented Circle		MALSR (R33)		MALSR (R33)		MALSR (R33)	
	Lighted Wind Cone		Lighted Wind Cone				REIL (R15)			
	Supplemental Wind Cone (3)		Supplemental Wind Cone(3)		Segmented Circle		Segmented Circle		Segmented Circle	
					Lighted Wind Cone		Lighted Wind Cone		Lighted Wind Cone	
					Supplemental Wind Cone(3)		Supplemental Wind Cone (3)		Supplemental Wind Cone(3)	
TAKE-OFF RUN AVAILABLE	3901	3901	4400	4400	5700	5700	6100	6100	7000	7000
TAKE-OFF DISTANCE AVAILABLE	3901	3901	4400	4400	5700	5700	6100	6100	7000	7000
LANDING DISTANCE AVAILABLE	3901	3901	4400	4400	5700	5700	6100	6100	7000	7000
ACCELERATE STOP DISTANCE AVAILABLE	3901	3901	4400	4400	5700	5700	6100	6100	7000	7000

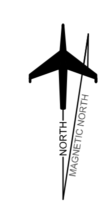


SOURCE:
NOAA National Climatic Center
Asheville, North Carolina
Lawrence Municipal Airport
Lawrence, Kansas

OBSERVATIONS:
83,822 All Weather Observations
2000–2010

APPROVED MODIFICATIONS TO DESIGN STANDARDS	
DESCRIPTION	APPROVAL DATE
NONE	

AIRPORT DATA				
		Existing	Short Term	Ultimate
AIRPORT REFERENCE CODE		C-II	C-II	D-II
AIRPORT ELEVATION (MSL)		833.27	833.27	833.27
AIRPORT REFERENCE POINT (ARP)	Latitude	39° 00' 40.00" N	39° 00' 39.04" N	39° 00' 37.50" N
COORDINATES (NAD 83)	Longitude	95° 12' 59.30" W	95° 12' 58.46" W	95° 12'56.46" W
MEAN MAXIMUM TEMPERATURE OF HOTTEST MONTH		91.0°	91.0°	91.0°
CRITICAL DESIGN AIRCRAFT		Citation X	Citation X	Gulfstream IV
AIRPORT ELECTRONIC AIDS		GPS, ILS, VOR/DME	GPS, ILS, VOR/DME, LPV 1, 19 & 15	GPS, ILS, VOR/DME, LPV 1, 19 & 15
OWNER: City of Lawrence			AIRPORT NPIAS CODE: General Aviation	
CITY: Lawrence, Kansas			COUNTY: Douglas	



MAGNETIC DECLINATION
2° 46' E (MAY 2011)
ANNUAL RATE OF CHANGE
0° 7' W (MAY 2011)

No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

AIRPORT DATA SHEET

Lawrence, Kansas

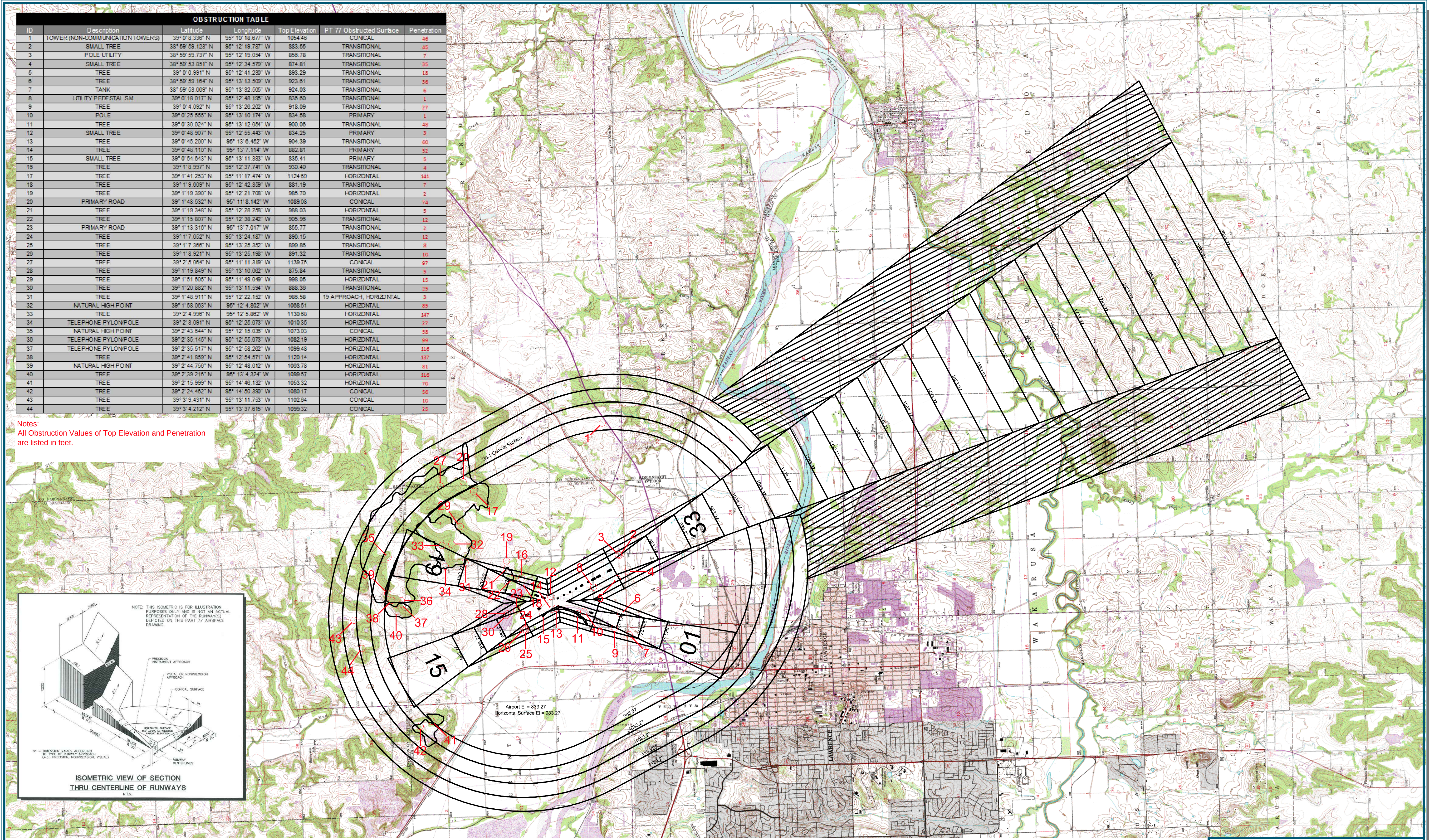
PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011 | SHEET 2 OF 13

OBSTRUCTION TABLE

ID	Description	Latitude	Longitude	Top Elevation	PT 77 Obstructed Surface	Penetration
1	TOWER (NON-COMMUNICATION TOWERS)	39° 0' 8.336" N	95° 10' 18.677" W	1054.46	CONICAL	46
2	SMALL TREE	38° 59' 59.123" N	95° 12' 19.787" W	883.55	TRANSITIONAL	45
3	POLE UTILITY	38° 59' 59.737" N	95° 12' 19.054" W	856.78	TRANSITIONAL	7
4	SMALL TREE	38° 59' 53.851" N	95° 12' 34.579" W	874.81	TRANSITIONAL	35
5	TREE	39° 0' 0.991" N	95° 12' 41.230" W	893.29	TRANSITIONAL	18
6	TREE	38° 59' 59.164" N	95° 13' 13.509" W	923.61	TRANSITIONAL	36
7	TANK	38° 59' 53.669" N	95° 13' 32.505" W	924.03	TRANSITIONAL	6
8	UTILITY PEDESTAL SM	39° 0' 18.017" N	95° 12' 48.196" W	836.60	TRANSITIONAL	1
9	TREE	39° 0' 4.092" N	95° 13' 26.202" W	918.09	TRANSITIONAL	27
10	POLE	39° 0' 25.555" N	95° 13' 10.174" W	834.58	PRIMARY	1
11	TREE	39° 0' 30.024" N	95° 13' 12.054" W	900.06	TRANSITIONAL	48
12	SMALL TREE	39° 0' 48.907" N	95° 12' 55.443" W	834.25	PRIMARY	3
13	TREE	39° 0' 45.200" N	95° 13' 6.452" W	904.39	TRANSITIONAL	60
14	TREE	39° 0' 48.110" N	95° 13' 7.114" W	882.81	PRIMARY	52
15	SMALL TREE	39° 0' 54.643" N	95° 13' 11.383" W	835.41	PRIMARY	5
16	TREE	39° 1' 8.997" N	95° 12' 37.741" W	930.40	TRANSITIONAL	4
17	TREE	39° 1' 41.253" N	95° 11' 17.474" W	1124.69	HORIZONTAL	141
18	TREE	39° 1' 9.609" N	95° 12' 42.359" W	881.19	TRANSITIONAL	7
19	TREE	39° 1' 19.390" N	95° 12' 21.708" W	985.70	HORIZONTAL	2
20	PRIMARY ROAD	39° 1' 48.532" N	95° 11' 8.142" W	1089.08	CONICAL	74
21	TREE	39° 1' 19.348" N	95° 12' 28.258" W	988.03	HORIZONTAL	5
22	TREE	39° 1' 15.807" N	95° 12' 38.242" W	905.96	TRANSITIONAL	12
23	PRIMARY ROAD	39° 1' 13.316" N	95° 13' 7.017" W	855.77	TRANSITIONAL	2
24	TREE	39° 1' 7.652" N	95° 13' 24.187" W	890.15	TRANSITIONAL	12
25	TREE	39° 1' 7.366" N	95° 13' 25.352" W	899.86	TRANSITIONAL	8
26	TREE	39° 1' 8.921" N	95° 13' 25.198" W	891.32	TRANSITIONAL	10
27	TREE	39° 2' 5.064" N	95° 11' 11.319" W	1139.76	CONICAL	97
28	TREE	39° 1' 19.849" N	95° 13' 10.062" W	875.84	TRANSITIONAL	5
29	TREE	39° 1' 51.605" N	95° 11' 49.049" W	998.05	HORIZONTAL	15
30	TREE	39° 1' 20.882" N	95° 13' 11.594" W	888.36	TRANSITIONAL	25
31	TREE	39° 1' 48.911" N	95° 12' 22.152" W	986.58	19 APPROACH, HORIZONTAL	3
32	NATURAL HIGH POINT	39° 1' 58.063" N	95° 12' 4.802" W	1068.51	HORIZONTAL	85
33	TREE	39° 2' 4.996" N	95° 12' 5.862" W	1130.68	HORIZONTAL	147
34	TELEPHONE PYLON/POLE	39° 2' 3.091" N	95° 12' 25.073" W	1010.35	HORIZONTAL	27
35	NATURAL HIGH POINT	39° 2' 43.644" N	95° 12' 15.036" W	1073.03	CONICAL	58
36	TELEPHONE PYLON/POLE	39° 2' 35.145" N	95° 12' 55.073" W	1082.19	HORIZONTAL	99
37	TELEPHONE PYLON/POLE	39° 2' 35.517" N	95° 12' 58.262" W	1099.48	HORIZONTAL	116
38	TREE	39° 2' 41.859" N	95° 12' 54.571" W	1120.14	HORIZONTAL	137
39	NATURAL HIGH POINT	39° 2' 44.756" N	95° 12' 48.012" W	1063.78	HORIZONTAL	81
40	TREE	39° 2' 39.216" N	95° 13' 4.324" W	1099.57	HORIZONTAL	116
41	TREE	39° 2' 15.999" N	95° 14' 46.132" W	1053.32	HORIZONTAL	70
42	TREE	39° 2' 24.462" N	95° 14' 50.390" W	1080.17	CONICAL	56
43	TREE	39° 3' 9.431" N	95° 13' 11.753" W	1102.64	CONICAL	10
44	TREE	39° 3' 4.212" N	95° 13' 37.615" W	1099.32	CONICAL	25

Notes:
All Obstruction Values of Top Elevation and Penetration are listed in feet.



ISOMETRIC VIEW OF SECTION THRU CENTERLINE OF RUNWAYS
N.T.S.

GENERAL NOTES:

SURVEY MONUMENT LOCATIONS PER NATIONAL GEODETIC SURVEY DATA SHEET,
HTTP:WWW.NGS.NOAA.GOV/CGI-BIN/DS_RADIUS.PRL

EXISTING RUNWAY END COORDINATES AND ELEVATIONS FROM SURVEY PERFORMED BY WOOLPERT, ENGLEWOOD, CO

ALL REFERENCE DATUM NAD 83 HORIZONTAL, NAVD 88 VERTICAL. ALL VERTICAL ELEVATIONS PROVIDED AS MSL.

EXISTING AND ULTIMATE THRESHOLD SITING SURFACE PENETRATIONS SHOWN ON INNER PORTION OF APPROACH SURFACE DRAWINGS

MAGNETIC NORTH
NORTH

MAGNETIC DECLINATION
2° 46' E (MAY 2011)
ANNUAL RATE OF CHANGE
0° 7' W (MAY 2011)

0 1500 3000 6000
GRAPHIC SCALE

No.	REVISIONS	DATE	BY	APP'D.

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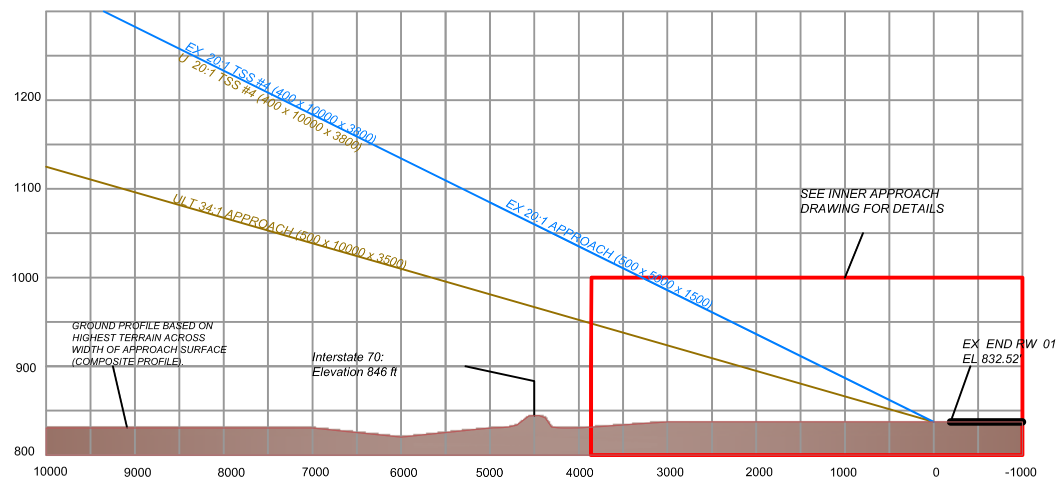
LAWRENCE MUNICIPAL AIRPORT

AIRPORT AIRSPACE DRAWING

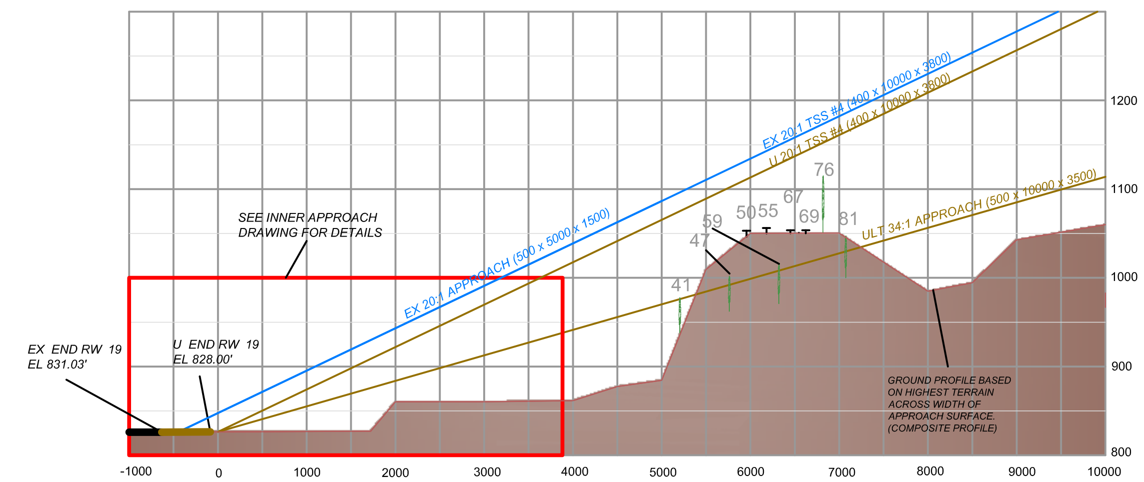
Lawrence, Kansas

PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011



RUNWAY 1 APPROACH PROFILE

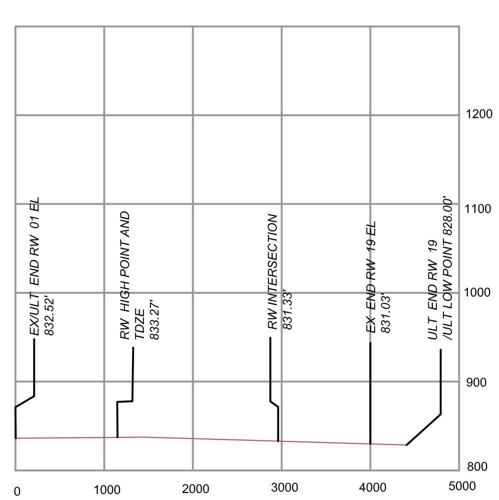


RUNWAY 19 APPROACH PROFILE

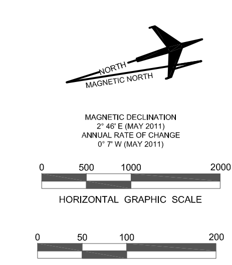
RUNWAY 01 OBSTRUCTION TABLE							
No.	Description	Latitude	Longitude	Top Elevation	Ultimate Penetration	TSS Penetration	Remediation
SEE INNER PORTION OF THE APPROACH SURFACE DRAWING FOR CLOSE-IN OBSTRUCTIONS							

RUNWAY 19 OBSTRUCTION TABLE							
No.	Description	Latitude	Longitude	Top Elevation	Ultimate Penetration	TSS Penetration	Remediation
31	TREE	39° 1' 26.685" N	95° 12' 32.952" W	924.82	12.44	0	Clears TSS, Remove or Trim
34	TREE	39° 1' 34.223" N	95° 12' 45.473" W	930.66	6.63	0	Clears TSS, Remove or Trim
35	TREE	39° 1' 32.737" N	95° 12' 39.042" W	931.22	6.47	0	Clears TSS, Remove or Trim
37	TREE	39° 1' 33.741" N	95° 12' 32.345" W	948.96	16.28	0	Clears TSS, Remove or Trim
41	TREE	39° 1' 48.911" N	95° 12' 22.152" W	986.58	3.50	0	Clears TSS, Remove or Trim
47	TREE	39° 1' 54.851" N	95° 12' 22.554" W	1005.63	6.16	0	Clears TSS, Remove or Trim
50	NATURAL HIGH POINT	39° 1' 54.085" N	95° 12' 14.197" W	1048.77	45.07	0	Clears TSS, RAS
55	NATURAL HIGH POINT	39° 1' 56.121" N	95° 12' 12.779" W	1056.28	45.78	0	Clears TSS, RAS
59	TREE	39° 2' 0.546" N	95° 12' 24.483" W	1015.76	1.76	0	Clears TSS, Remove or Trim
67	NATURAL HIGH POINT	39° 2' 1.702" N	95° 12' 18.567" W	1046.58	24.81	0	Clears TSS, RAS
69	NATURAL HIGH POINT	39° 2' 1.891" N	95° 12' 15.831" W	1050.34	25.95	0	Clears TSS, RAS
76	TREE	39° 2' 1.970" N	95° 12' 9.136" W	1114.29	84.58	0	Clears TSS, Remove or Trim
81	TREE	39° 2' 5.360" N	95° 12' 13.973" W	1041.69	6.14	0	Clears TSS, Remove or Trim

RAS: Request Aeronautical Study



RUNWAY 1-19 PROFILE



No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

Airport Airspace Approach Profile

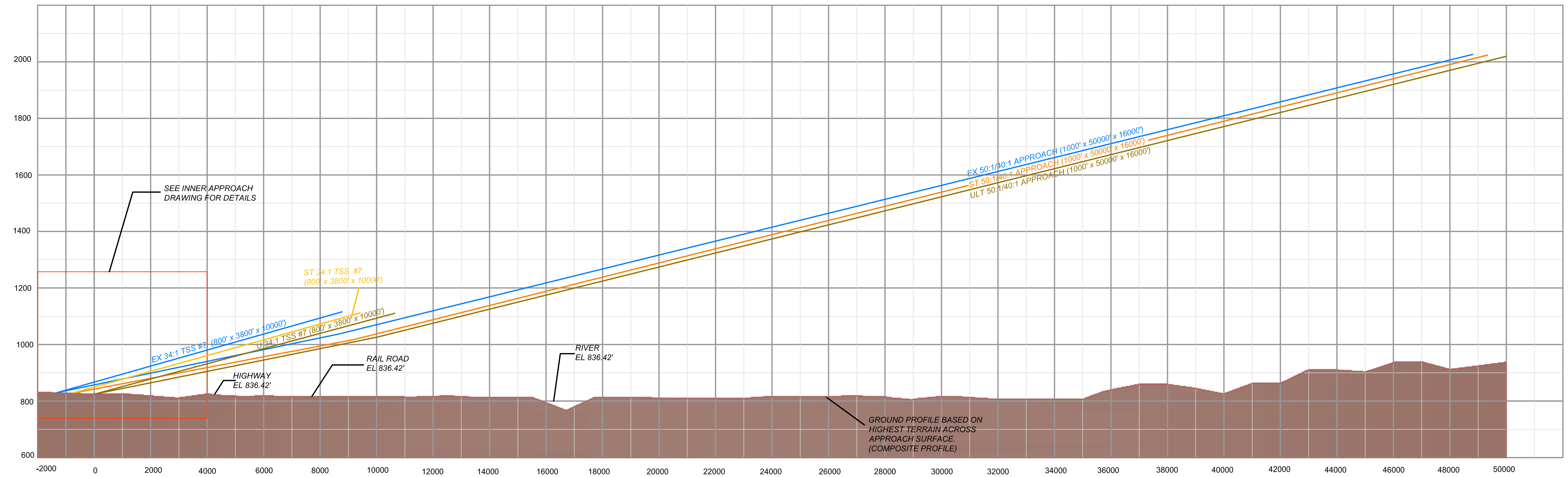
Runway 1-19

Lawrence, Kansas

PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011 SHEET 4 OF 13

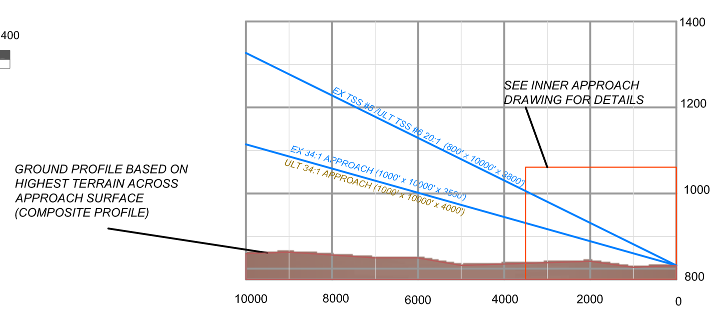
Coffman Associates Airport Consultants www.coffmanassociates.com



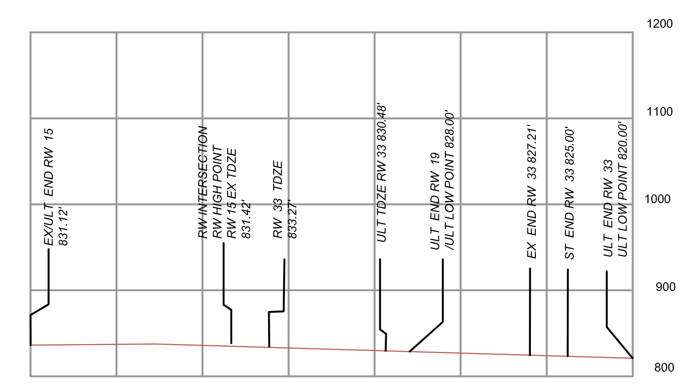
RUNWAY 33 APPROACH PROFILE

HORIZONTAL GRAPHIC SCALE APPROACH PROFILES

VERTICAL GRAPHIC SCALE APPROACH PROFILES



RUNWAY 15 APPROACH PROFILE



RUNWAY 15-33 PROFILE

HORIZONTAL GRAPHIC SCALE RUNWAY PROFILE

VERTICAL GRAPHIC SCALE RUNWAY PROFILE

MAGNETIC DECLINATION
2° 46' E (MAY 2011)
ANNUAL RATE OF CHANGE
0° 7' W (MAY 2011)

RUNWAY 15 OBSTRUCTION TABLE

No.	Description	Latitude	Longitude	Top Elevation	Ultimate Penetration	TSS Penetration	Remediation
SEE INNER PORTION OF THE APPROACH SURFACE DRAWING FOR CLOSE-IN OBSTRUCTIONS							

RUNWAY 33 OBSTRUCTION TABLE

No.	Description	Latitude	Longitude	Top Elevation	Ultimate Penetration	TSS Penetration	Remediation
SEE INNER PORTION OF THE APPROACH SURFACE DRAWING FOR CLOSE-IN OBSTRUCTIONS							

No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

Airport Airspace Approach Profile Runway 15-33

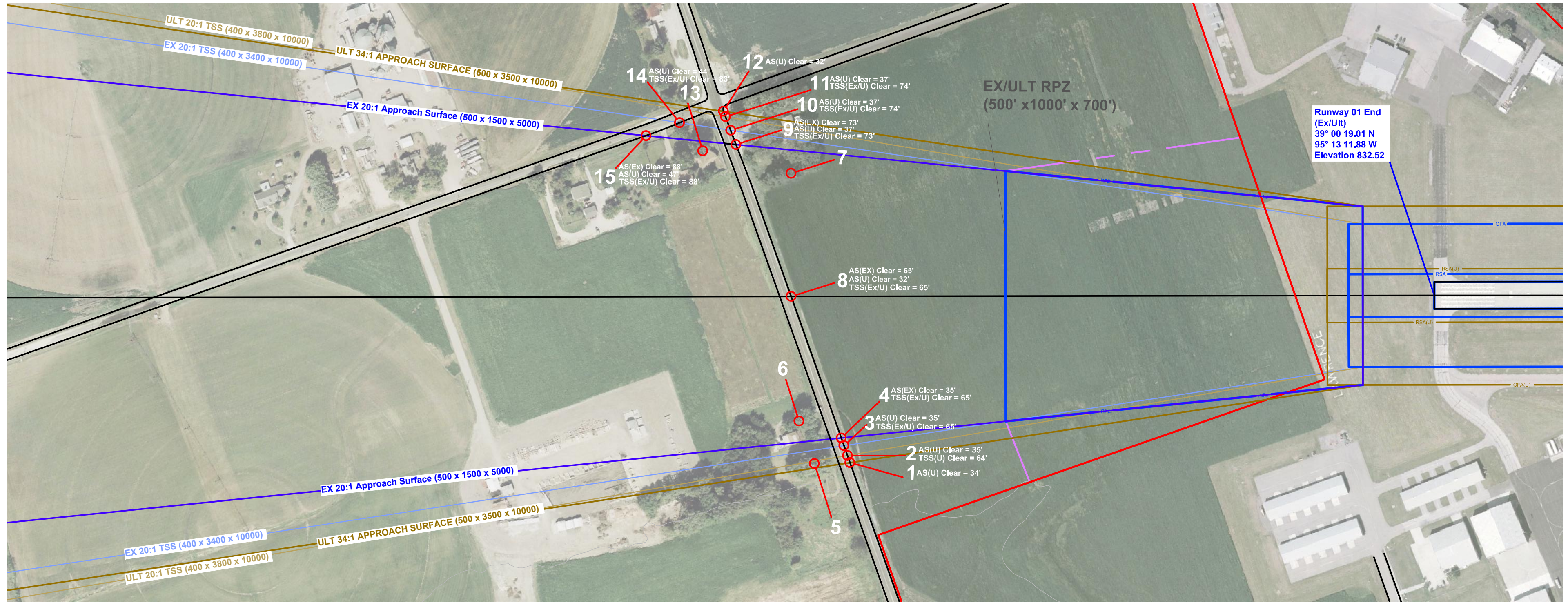
Lawrence, Kansas

PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011 — SHEET 5 OF 13

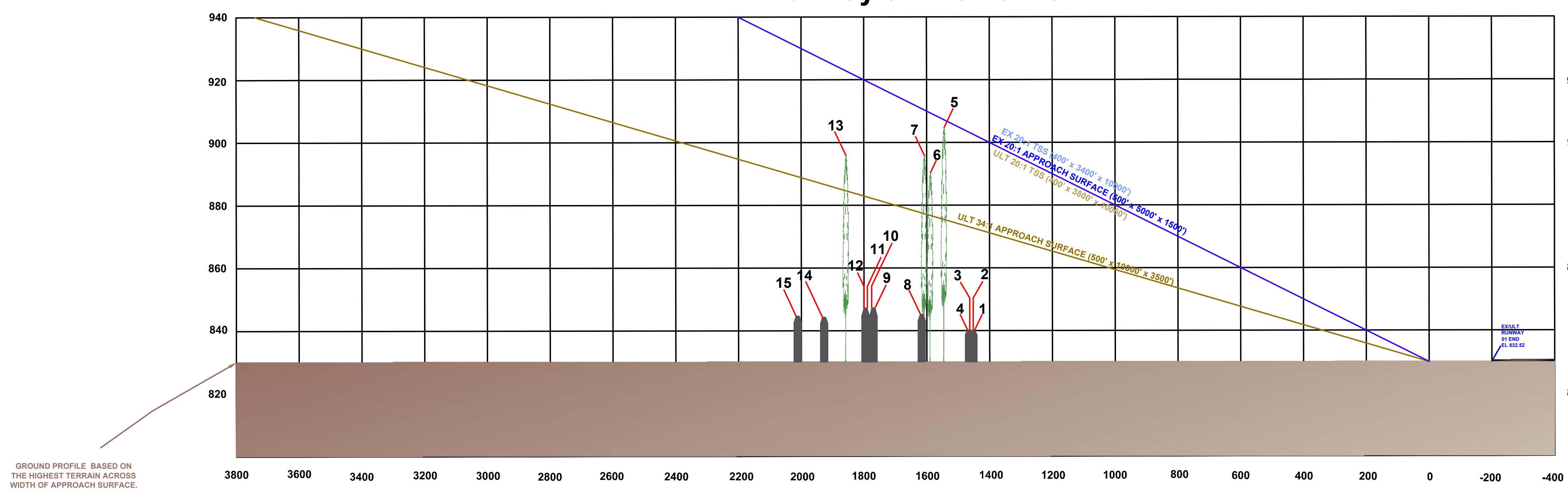
Coffman Associates Airport Consultants www.coffmanassociates.com

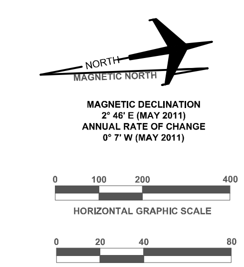
Runway 01 Plan View



DATE OF AERIAL PHOTO: 9/03/2010

Runway 01 Profile View





EXISTING RUNWAY 1 OBSTRUCTION TABLE							
No.	Description	Latitude	Longitude	Elevation	AS Penetration	TSS Penetration	Remediation
NONE							

ULTIMATE RUNWAY 1 OBSTRUCTION TABLE							
No.	Description	Latitude	Longitude	Elevation	AS Penetration	TSS Penetration	Remediation
5	TREE	39° 0' 1.280" N	95° 13' 13.492" W	904.13	-26	N/A	CLEARS TSS; NAR
6	TREE	39° 0' 1.269" N	95° 13' 15.105" W	889.67	-11	22	CLEARS TSS; NAR
7	TREE	39° 0' 3.318" N	95° 13' 23.472" W	896.35	-17	16	CLEARS TSS; NAR
13	TREE	39° 0' 1.230" N	95° 13' 25.262" W	897.25	-10	28	CLEARS TSS; NAR

No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

INNER PORTION OF APPROACH SURFACE, RUNWAY 01

Lawrence, Kansas

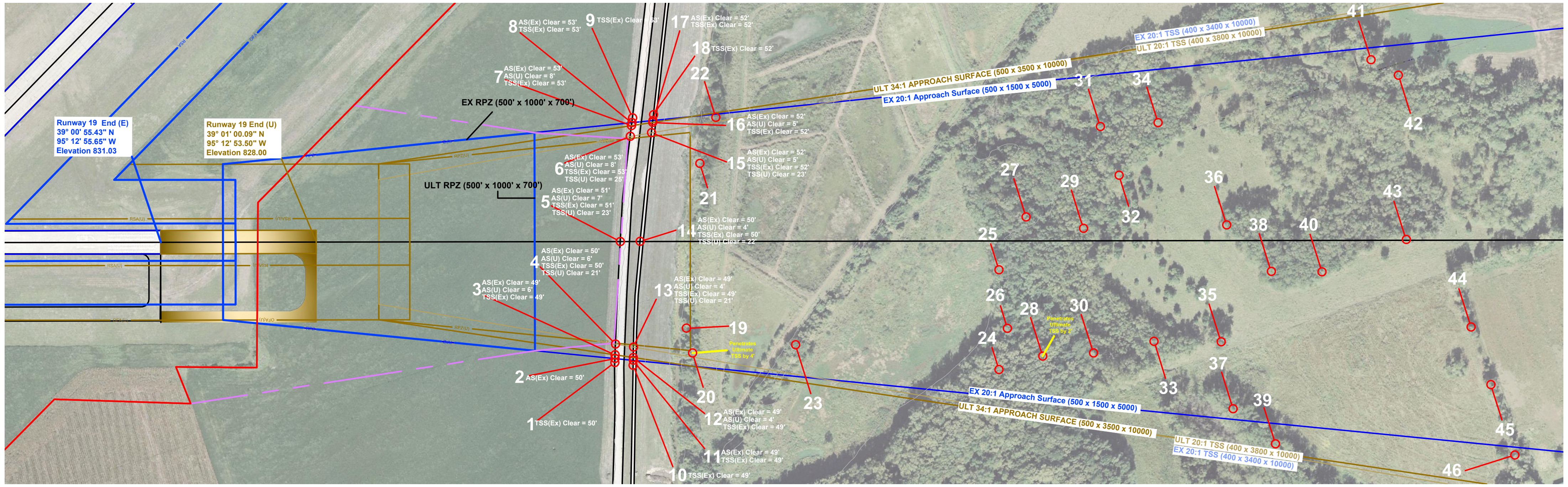
PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011

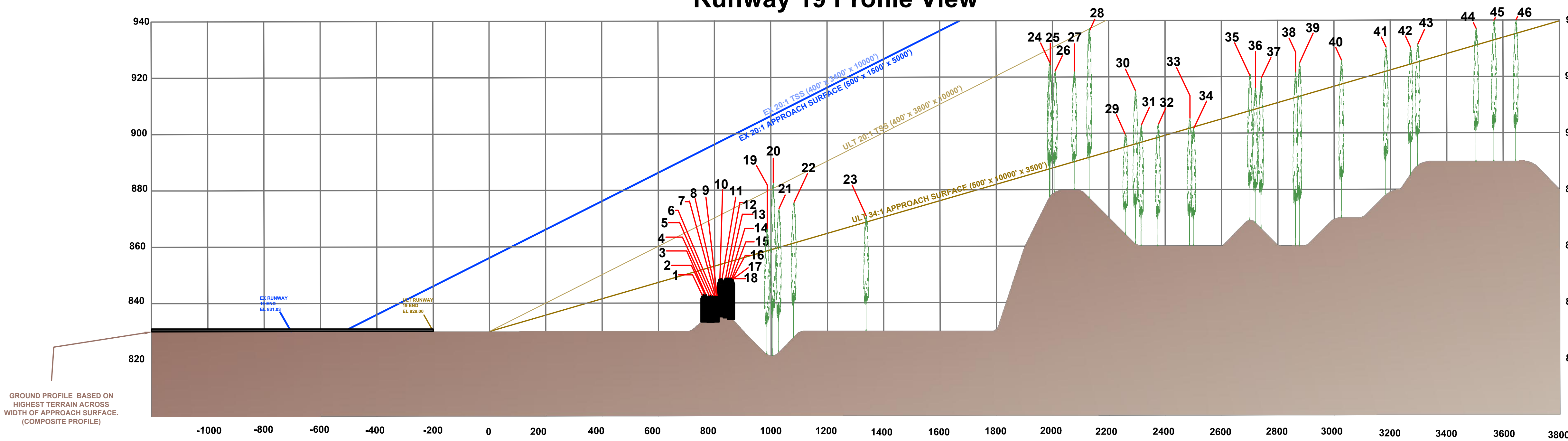
SHEET 6 OF 13

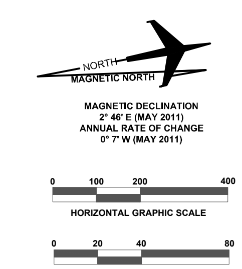
Coffman Associates
Airport Consultants
www.coffmanassociates.com

Runway 19 Plan View



Runway 19 Profile View





EXISTING RUNWAY 19 OBSTRUCTION TABLE

No.	Description	Latitude	Longitude	Elevation	AS Penetration	TSS Penetration	Remediation
NONE							

ULTIMATE RUNWAY 19 OBSTRUCTION TABLE

No.	Description	Latitude	Longitude	Elevation	AS Penetration	TSS Penetration	Remediation
19	TREE	39° 1' 10.259" N	95° 12' 45.294" W	866.04	-9	11	CLEARS TSS; NAR
20	TREE	39° 1' 10.187" N	95° 12' 44.264" W	882.452	-25	-4	REMOVE OR TRIM
21	TREE	39° 1' 12.391" N	95° 12' 51.445" W	873.523	-15	6	CLEARS TSS; NAR
22	TREE	39° 1' 13.350" N	95° 12' 52.986" W	875.634	-16	N/A	CLEARS TSS; NAR
23	TREE	39° 1' 13.355" N	95° 12' 43.192" W	870.587	-3	24	CLEARS TSS; NAR
24	TREE	39° 1' 19.187" N	95° 12' 39.517" W	924.631	-38	3	CLEARS TSS; NAR
25	TREE	39° 1' 20.231" N	95° 12' 43.345" W	913.734	-27	14	CLEARS TSS; NAR
26	TREE	39° 1' 19.872" N	95° 12' 40.989" W	913.178	-26	15	CLEARS TSS; NAR
27	TREE	39° 1' 21.588" N	95° 12' 45.016" W	910.942	-22	21	CLEARS TSS; NAR
28	TREE	39° 1' 20.638" N	95° 12' 39.448" W	936.248	-46	-2	REMOVE OR TRIM
29	TREE	39° 1' 23.194" N	95° 12' 43.807" W	897.148	-3	44	CLEARS TSS; NAR
30	TREE	39° 1' 22.189" N	95° 12' 38.884" W	915.97	-21	26	CLEARS TSS; NAR
31	TREE	39° 1' 24.765" N	95° 12' 47.490" W	903.452	-8	40	CLEARS TSS; NAR
32	TREE	39° 1' 24.812" N	95° 12' 45.382" W	903.722	-6	43	CLEARS TSS; NAR
33	TREE	39° 1' 24.124" N	95° 12' 38.523" W	907.054	-6	45	CLEARS TSS; NAR
34	TREE	39° 1' 26.534" N	95° 12' 46.865" W	901.631	0	51	CLEARS TSS; NAR
35	TREE	39° 1' 26.115" N	95° 12' 37.618" W	920.022	-13	43	CLEARS TSS; NAR
36	TREE	39° 1' 27.516" N	95° 12' 42.025" W	914.645	-7	48	CLEARS TSS; NAR
37	TREE	39° 1' 25.784" N	95° 12' 34.870" W	919.687	-11	45	CLEARS TSS; NAR
38	TREE	39° 1' 28.363" N	95° 12' 39.630" W	921.006	-9	50	CLEARS TSS; NAR
39	TREE	39° 1' 26.685" N	95° 12' 32.952" W	924.82	-12	47	CLEARS TSS; NAR
40	TREE	39° 1' 29.875" N	95° 12' 38.934" W	925.666	-9	53	CLEARS TSS; NAR
41	TREE	39° 1' 33.569" N	95° 12' 46.432" W	930.837	-9	56	CLEARS TSS; NAR
42	TREE	39° 1' 34.223" N	95° 12' 45.473" W	930.657	-7	61	CLEARS TSS; NAR
43	TREE	39° 1' 32.737" N	95° 12' 39.042" W	931.221	-6	61	CLEARS TSS; NAR
44	TREE	39° 1' 33.766" N	95° 12' 34.815" W	938.479	-8	65	CLEARS TSS; NAR
45	TREE	39° 1' 33.741" N	95° 12' 32.345" W	948.962	-16	57	CLEARS TSS; NAR
46	TREE	39° 1' 33.731" N	95° 12' 29.308" W	941.439	-6	69	CLEARS TSS; NAR

NAR: No Action Required

No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

INNER PORTION OF APPROACH SURFACE, RUNWAY19

Lawrence, Kansas

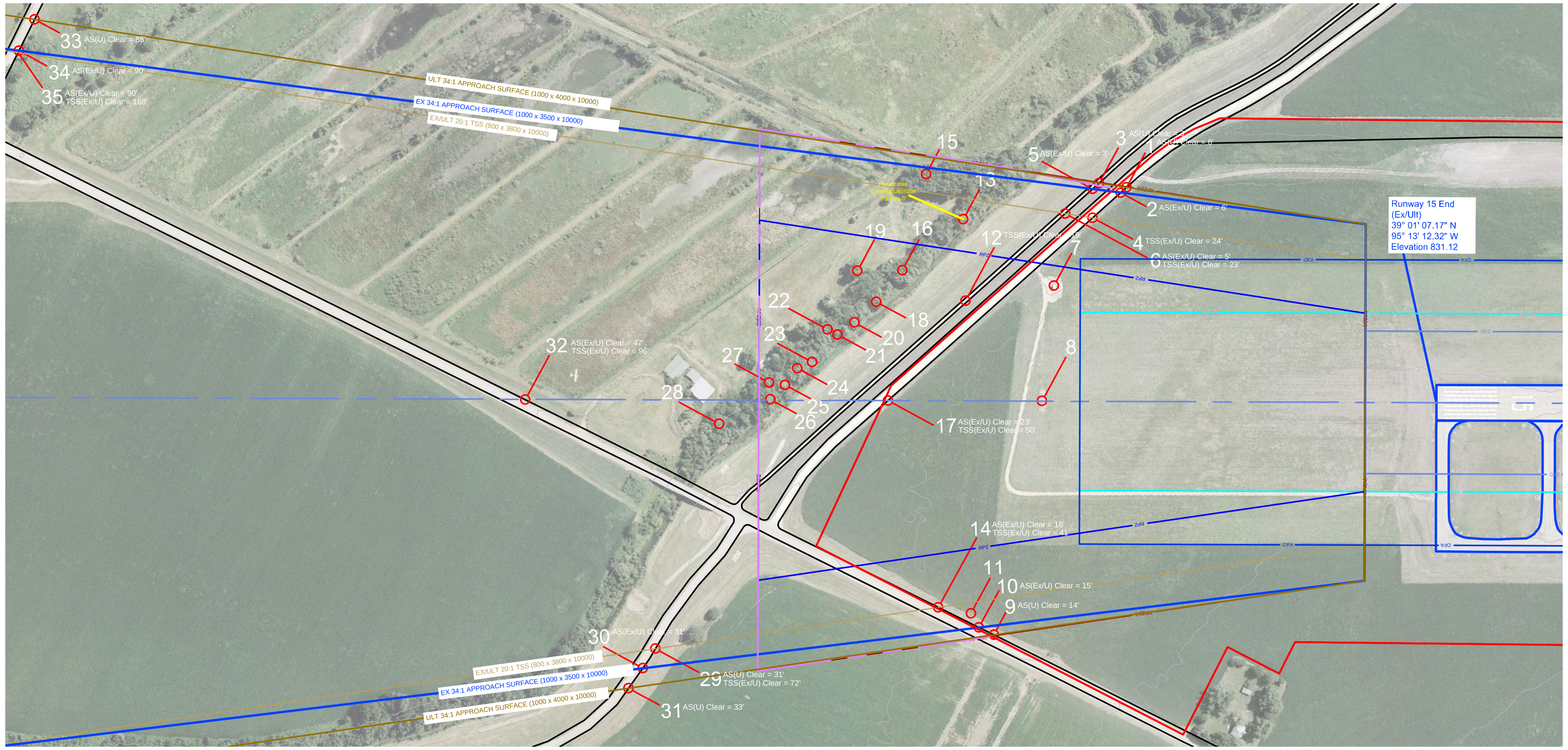
PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011

SHEET 7 OF 13

Coffman Associates
Airport Consultants
www.coffmanassociates.com

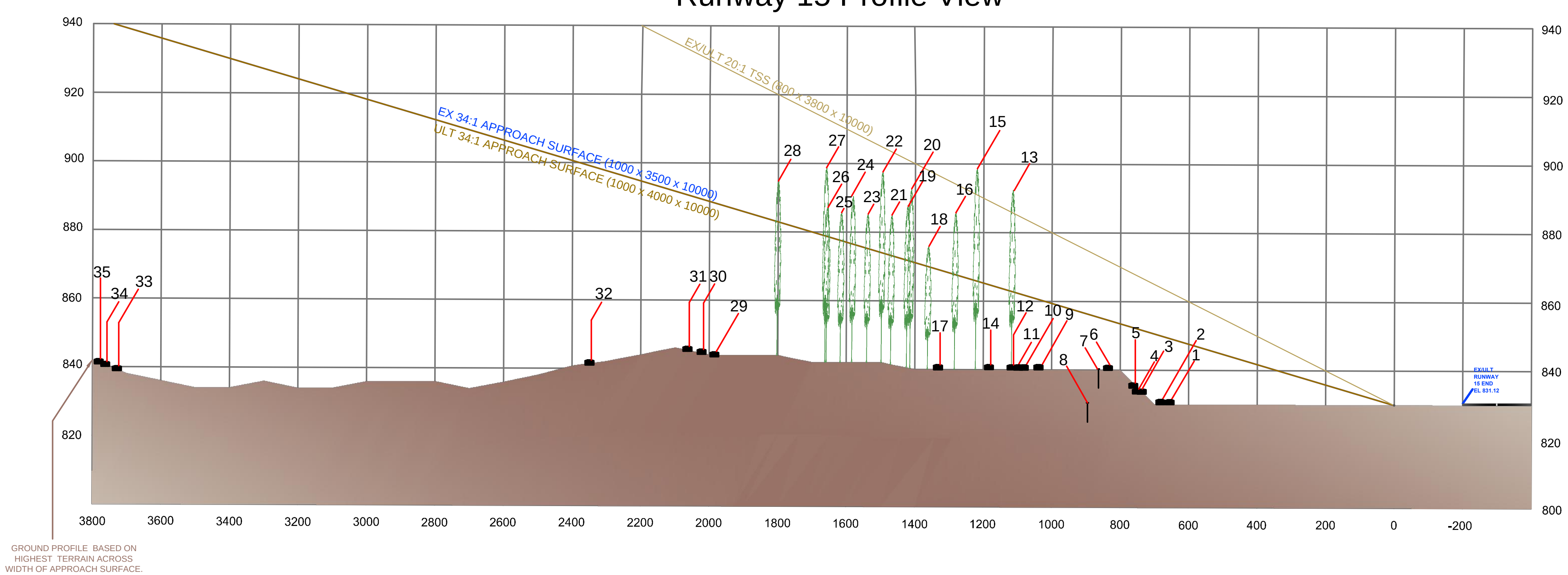
Runway 15 Plan View

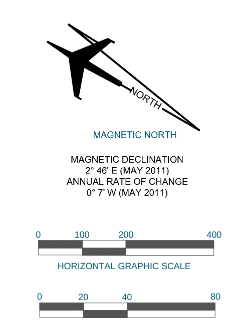


EXISTING/ULTIMATE RUNWAY 15 OBSTRUCTION TABLE							
No.	Description	Latitude	Longitude	Elevation	AS Penetration	TSS Penetration	Remediation
11	POLE UTILITY	39° 1' 16.070" N	95° 13' 26.448" W	864.10	-1	N/A	CLEARS TSS; NAR
12	ACCESS ROAD	39° 1' 20.096" N	95° 13' 16.592" W	867.63	-4	20	CLEARS TSS; NAR
13	TREE	39° 1' 21.172" N	95° 13' 14.054" W	892.41	-28	-5	TRIM OR REMOVE
15	TREE	39° 1' 22.655" N	95° 13' 13.217" W	898.26	-31	N/A	CLEARS TSS; NAR
16	TREE	39° 1' 22.039" N	95° 13' 16.650" W	887.10	-18	9	CLEARS TSS; NAR
18	TREE	39° 1' 22.294" N	95° 13' 18.077" W	877.60	-6	22	CLEARS TSS; NAR
19	TREE	39° 1' 23.147" N	95° 13' 17.395" W	891.78	-19	11	CLEARS TSS; NAR
20	TREE	39° 1' 22.586" N	95° 13' 19.085" W	886.17	-13	17	CLEARS TSS; NAR
21	TREE	39° 1' 22.844" N	95° 13' 19.744" W	883.01	-8	22	CLEARS TSS; NAR
22	TREE	39° 1' 23.151" N	95° 13' 19.733" W	896.64	-21	10	CLEARS TSS; NAR
23	TREE	39° 1' 23.128" N	95° 13' 21.012" W	883.19	-6	25	CLEARS TSS; NAR
24	TREE	39° 1' 23.425" N	95° 13' 21.447" W	890.61	-13	20	CLEARS TSS; NAR
25	TREE	39° 1' 23.511" N	95° 13' 22.173" W	884.26	-5	28	CLEARS TSS; NAR
26	TREE	39° 1' 23.692" N	95° 13' 22.862" W	887.75	-8	27	CLEARS TSS; NAR
27	TREE	39° 1' 23.933" N	95° 13' 22.356" W	898.88	-19	16	CLEARS TSS; NAR
28	TREE	39° 1' 24.658" N	95° 13' 24.462" W	893.86	-9	28	CLEARS TSS; NAR

NAR: No Action Required

Runway 15 Profile View





No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

INNER PORTION OF APPROACH SURFACE, RUNWAY 15

Lawrence, Kansas

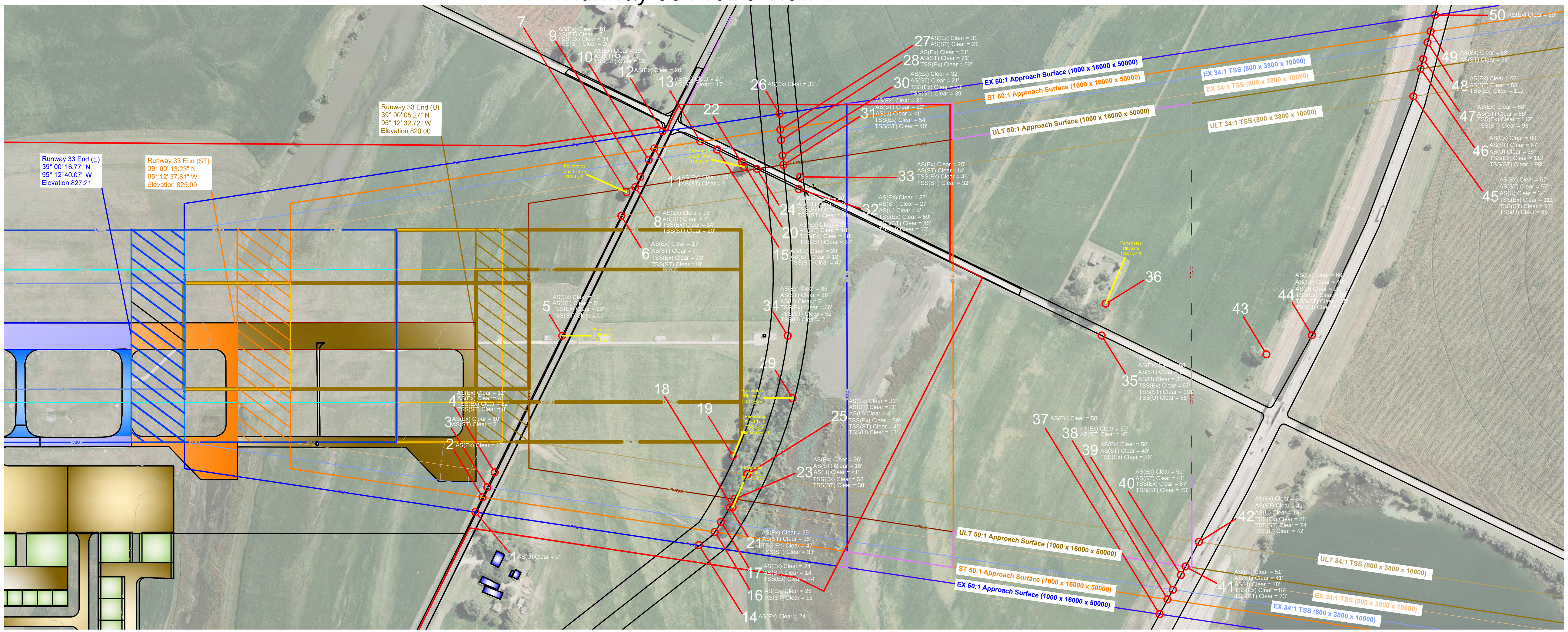
PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011

SHEET 8 OF 13

Coffman Associates Airport Consultants www.coffmanassociates.com

Runway 33 Profile View



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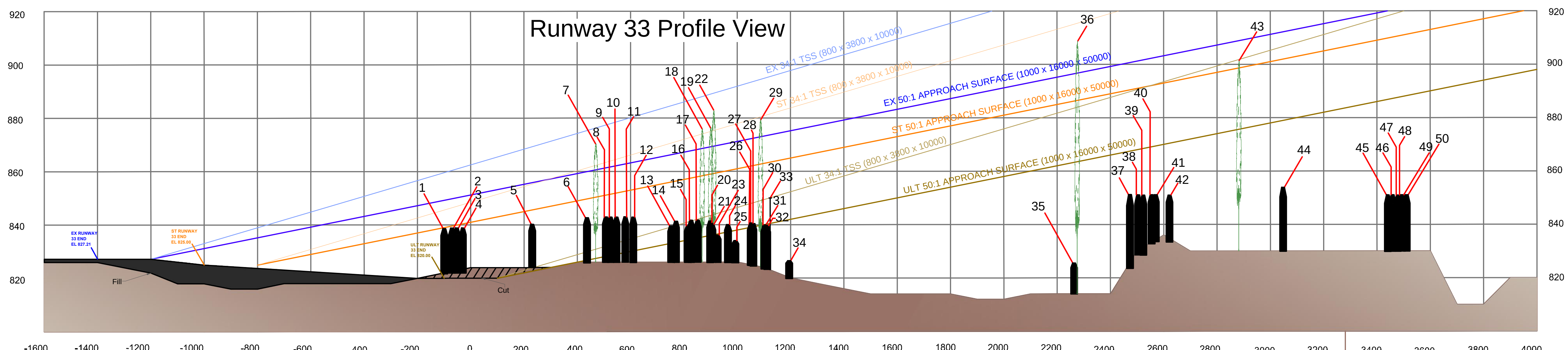

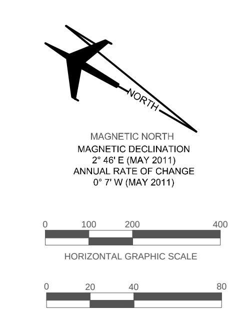

GROUND PROFILE BASED ON HIGHEST TERRAIN ACROSS WIDTH OF APPROACH SURFACE. (COMPOSITE PROFILE)

EXISTING RUNWAY 33 OBSTRUCTION TABLE

No.	Description	Latitude	Longitude	Elevation	AS Penetration	TSS Penetration	Remediation
7	SMALL TREE	39° 0' 2.626" N	95° 12' 23.353" W	870.980343	-10	5	CLEARS TSS; NAR
18	SMALL TREE	38° 59' 53.851" N	95° 12' 34.579" W	874.806021	-6	13	CLEARS TSS; NAR
19	SMALL TREE	38° 59' 54.684" N	95° 12' 32.383" W	876.693293	-8	11	CLEARS TSS; NAR
22	SMALL TREE	38° 59' 59.123" N	95° 12' 19.787" W	883.554675	-14	6	CLEARS TSS; NAR
29	TREE	38° 59' 53.679" N	95° 12' 28.634" W	878.0978	-5	17	CLEARS TSS; NAR
36	TREE	38° 59' 44.780" N	95° 12' 17.920" W	908.957	-12	21	CLEARS TSS; NAR

NAR: No Action Required

SHORT TERM RUNWAY 33 OBSTRUCTION TABLE

No.	Description	Latitude	Longitude	Elevation	AS Penetrations	TSS Penetrations	Remediation
2	HIGHWAY	39° 0' 2.360" N	95° 12' 39.475" W	839.79585	<1	N/A	CLEARS TSS; NAR
7	SMALL TREE	39° 0' 2.626" N	95° 12' 23.353" W	870.980343	-21	-9	REMOVE OR TRIM
18	SMALL TREE	38° 59' 53.851" N	95° 12' 34.579" W	874.806021	-16	-1	REMOVE OR TRIM
19	SMALL TREE	38° 59' 54.684" N	95° 12' 32.383" W	876.693293	-18	-3	REMOVE OR TRIM
22	SMALL TREE	38° 59' 59.123" N	95° 12' 19.787" W	883.554675	-24	-8	REMOVE OR TRIM
29	TREE	38° 59' 53.679" N	95° 12' 28.634" W	878.0978	-15	3	CLEARS TSS; NAR
36	TREE	38° 59' 44.780" N	95° 12' 17.920" W	908.957	-22	7	CLEARS TSS; NAR
43	TREE	38° 59' 38.582" N	95° 12' 16.656" W	901.464	-3	32	CLEARS TSS; NAR

ULTIMATE RUNWAY 33 OBSTRUCTION TABLE

No.	Description	Latitude	Longitude	Elevation	AS Penetration	TSS Penetration	Remediation
5	HIGHWAY	39° 0' 2.387" N	95° 12' 30.874" W	840.589925	-18	-17	ROAD TO BE RELOCATED
6	HIGHWAY	39° 0' 2.411" N	95° 12' 24.490" W	842.765347	-16	-13	ROAD TO BE RELOCATED
7	SMALL TREE	39° 0' 2.626" N	95° 12' 23.353" W	870.980343	-44	N/A	CLEARS TSS; NAR
8	HIGHWAY	39° 0' 2.417" N	95° 12' 22.960" W	843.597221	-16	N/A	CLEARS TSS; NAR
19	SMALL TREE	38° 59' 54.684" N	95° 12' 32.383" W	876.693293	-41	-34	REMOVE OR TRIM
24	PUBLIC ROAD	38° 59' 58.666" N	95° 12' 19.588" W	840.090127	-3	N/A	CLEARS TSS; NAR
29	TREE	38° 59' 53.679" N	95° 12' 28.634" W	878.0978	-38	-29	REMOVE OR TRIM
33	POLE UTILITY	38° 59' 57.096" N	95° 12' 19.001" W	849.149281	-9	N/A	CLEARS TSS; NAR
36	TREE	38° 59' 44.780" N	95° 12' 17.920" W	908.957	-45	-25	REMOVE OR TRIM
43	TREE	38° 59' 38.582" N	95° 12' 16.656" W	901.464	-26	0	CLEARS TSS; NAR

No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

INNER PORTION OF APPROACH SURFACE, RUNWAY 33

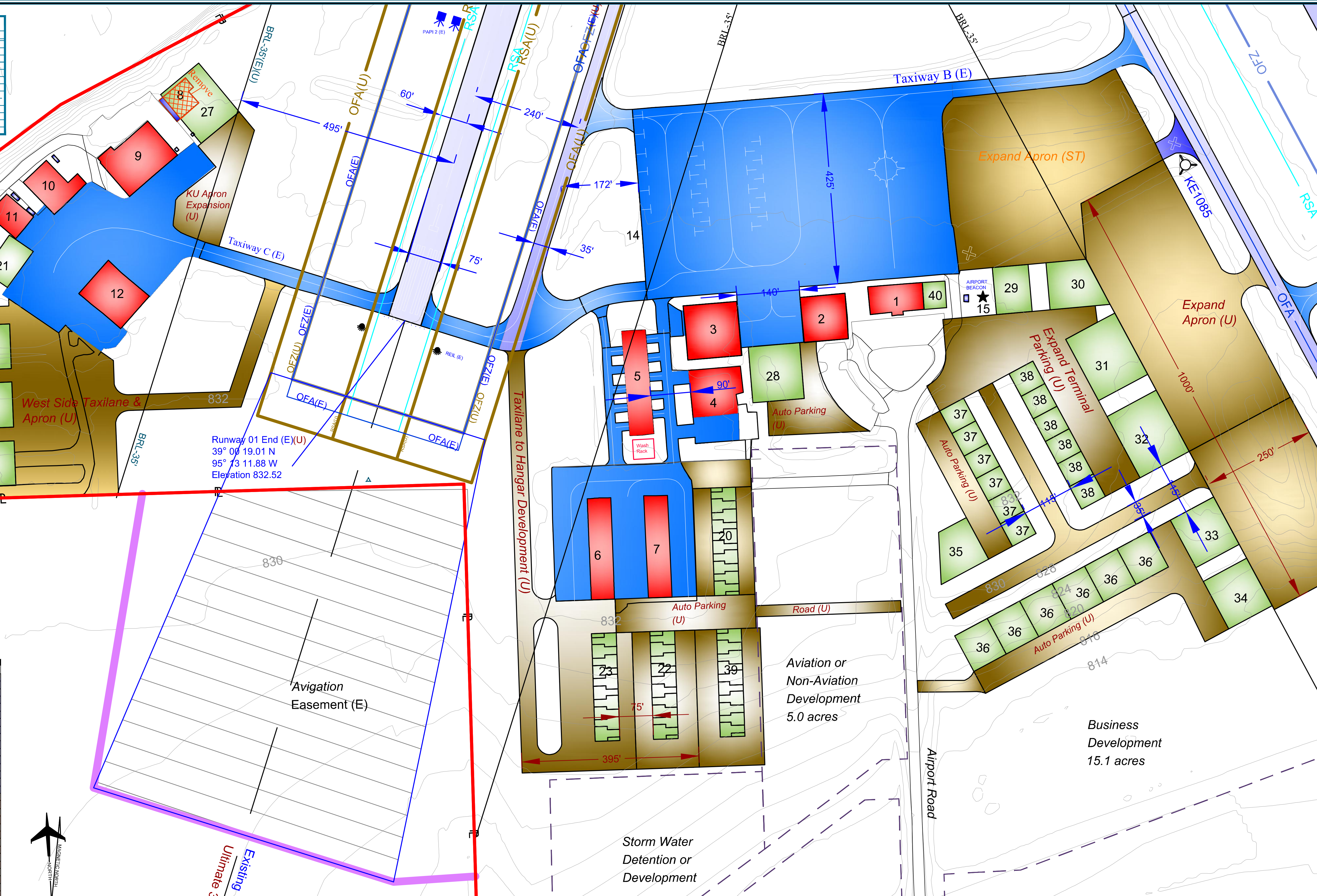
Lawrence, Kansas

PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011

SHEET 9 OF 13

Coffman Associates
Airport Consultants
www.coffmanassociates.com



LEGEND

EXISTING	ULTIMATE	DESCRIPTION
	N/A	AVIGATION EASEMENT
— PL(U) —	— PL(U) —	AIRPORT PROPERTY LINE
		BUILDING
— BRL-35	— BRL-35	BUILDING RESTRICTION LINE (BRL)
— PAPI-2 —	— PAPI-4	NAVIGATION AID
— OFA (E) —	— OFA (U) —	OBJECT FREE AREA (OFA)
— OFZ (E) —	— OFZ (U) —	OBSTACLE FREE ZONE (OFZ)
— RSA (ST) —	— RSA (U) —	RUNWAY SAFETY AREA (RSA)
		RUNWAY END IDENTIFIER LIGHTS (REILS)
	Same	THRESHOLD LIGHTS
	N/A	SURVEY MONUMENT
— 1070 —	N/A	CONTOURS

BUILDING/FACILITIES

EXIST	ULT	DESCRIPTION	MSL ELEV
1		TERMINAL	849.54
2		CONVENTIONAL HANGAR	857.31
3		CONVENTIONAL HANGAR	874.51
4		CONVENTIONAL HANGAR	858.78
5		T-HANGARS (A)	850.76
6		T-HANGARS (B)	851.98
7		T-HANGARS (C)	851.69
8		BOX HANGAR	856.75
9		CONVENTIONAL HANGAR	862.78
10		BOX HANGAR	854.73
11		BOX HANGAR	850.74
12		BOX HANGAR	852.18
13		PORTABLE T-HANGARS	844.55
14		FUEL FARM	841.8
15		AIRPORT BEACON	830.97
16		SEGMENTED CIRCLE	844.55
	20	T-HANGARS	852.0 (est)
	21	EQUIPMENT STORAGE	845.0 (est)
	22	T-HANGARS	848.0 (est)
	23	T-HANGARS	848.0 (est)
	24	CONVENTIONAL HANGAR	853.0 (est)
	25	CONVENTIONAL HANGAR	852.0 (est)
	26	CONVENTIONAL HANGAR	851.0 (est)
	27	CONVENTIONAL HANGAR	853.0 (est)
	28	CONVENTIONAL HANGAR	851.0 (est)
	29	CONVENTIONAL HANGAR	851.0 (est)
	30	CONVENTIONAL HANGAR	850.0 (est)
	31	CONVENTIONAL HANGAR	849.0 (est)
	32	CONVENTIONAL HANGAR	847.0 (est)
	33	CONVENTIONAL HANGAR	843.0 (est)
	34	CONVENTIONAL HANGAR	835.0 (est)
	35	EXECUTIVE HANGAR	848.0 (est)
	36	EXECUTIVE HANGAR	840.0 (est)
	37	EXECUTIVE HANGAR	849.0 (est)
	38	EXECUTIVE HANGAR	848.0 (est)
	39	T-HANGARS	848.0 (est)
	40	TERMINAL EXPANSION	851.0 (est)

ACTUAL ULTIMATE BUILDING ELEVATIONS MAY VARY DUE TO FINAL GRADING AND DRAINAGE PLAN

GENERAL NOTES:

SURVEY MONUMENT LOCATIONS PER NATIONAL GEODETIC SURVEY DATA SHEET,
HTTP:WWW.NGS.NOAA.GOV/CGI-BIN/DS_RADIUS.PRL

EXISTING RUNWAY END COORDINATES AND ELEVATIONS FROM SURVEY PERFORMED BY WOOLPERT, ENGLEWOOD, CO

ALL REFERENCE DATUM NAD 83 HORIZONTAL, NAVD 88 VERTICAL. ALL VERTICAL ELEVATIONS PROVIDED AS MSL.

KE1085 IS A SECONDARY AIRPORT CONTROL POINT

No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

TERMINAL AREA DRAWING

Lawrence, Kansas

PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011

Coffman Associates
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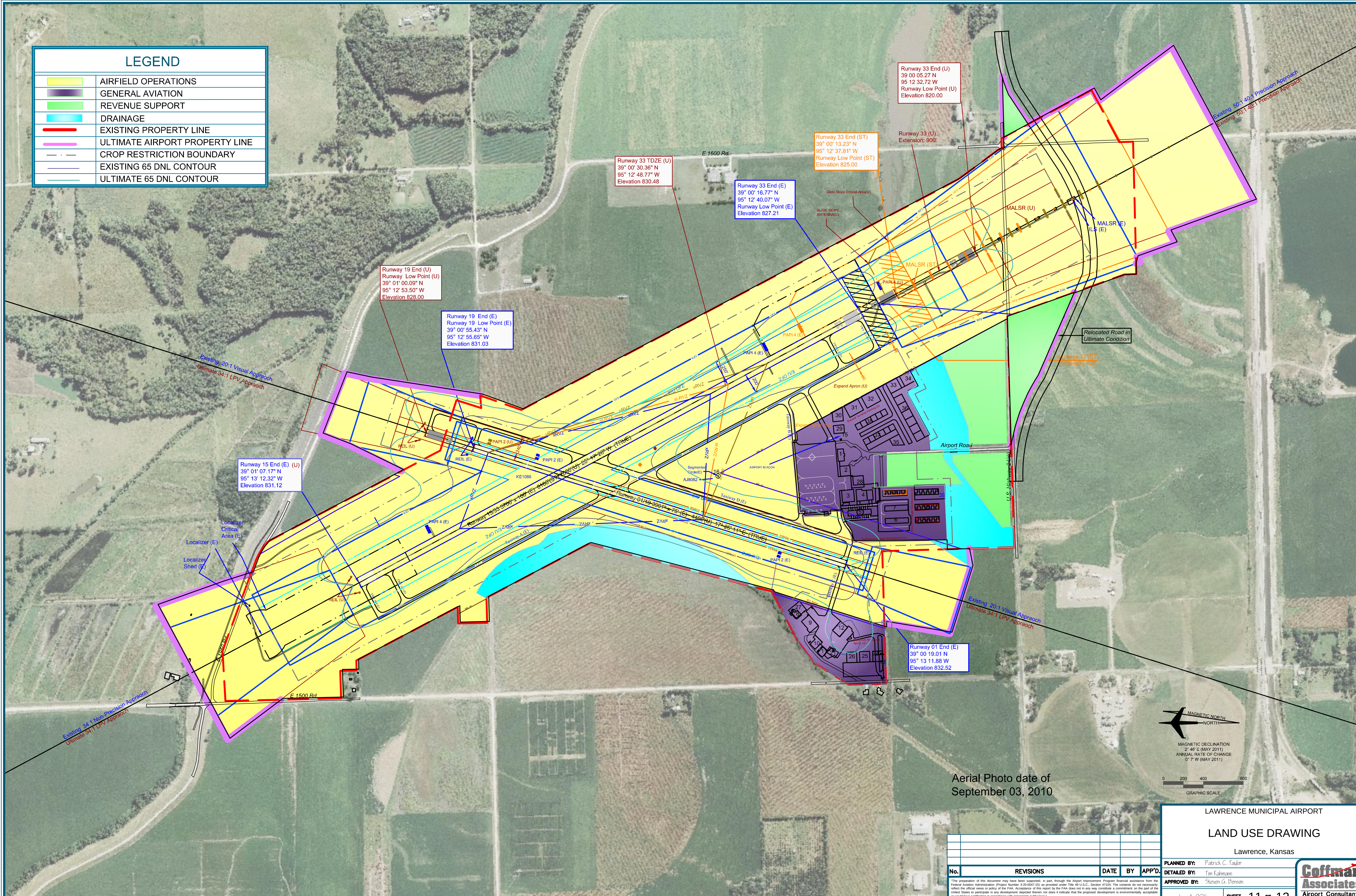
www.coffmanassociates.com



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LAWRENCE MUNICIPAL AIRPORT

LAND USE DRAWING

Lawrence, Kansas

PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011

SHEET 11 OF 13

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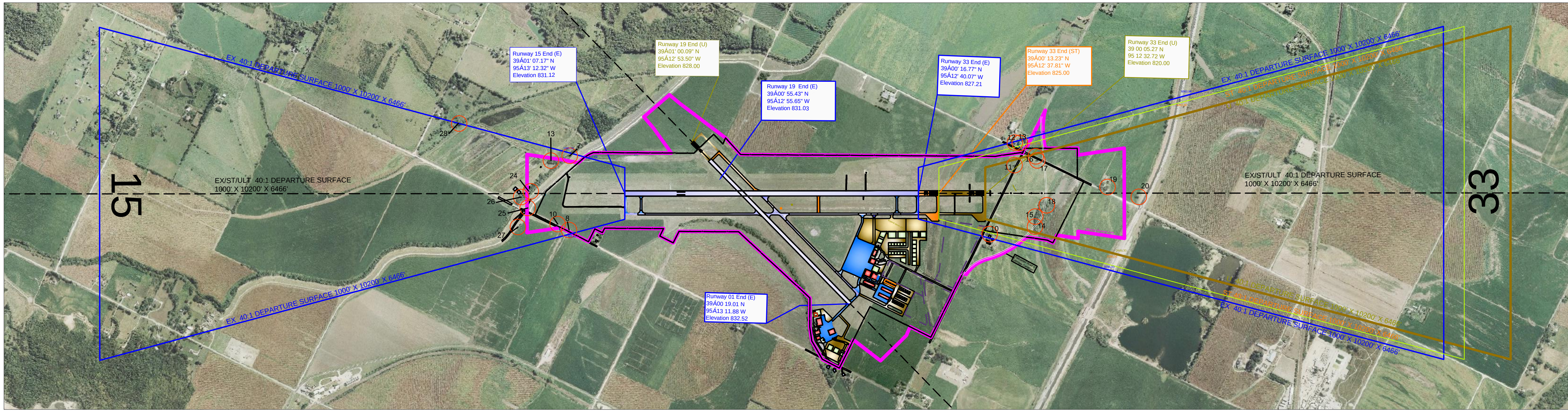
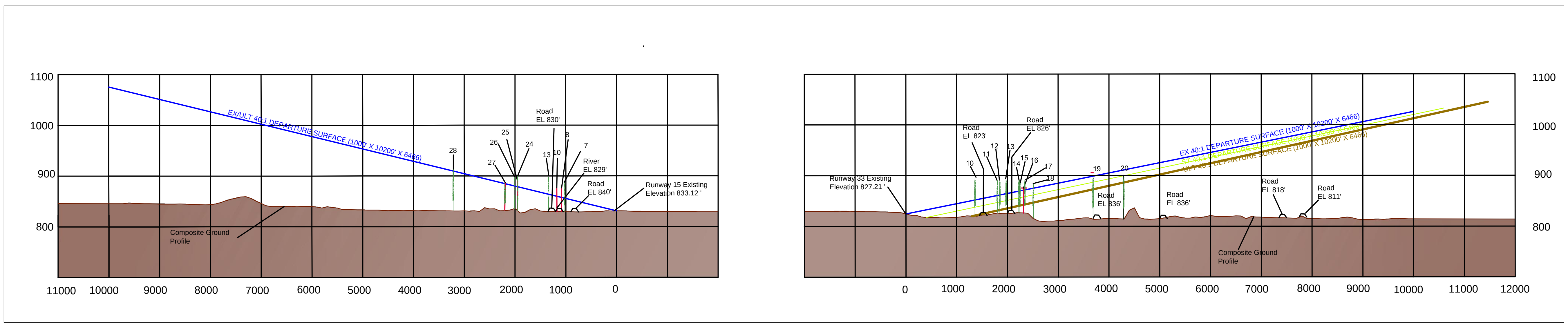


RUNWAY 15-33 PLAN



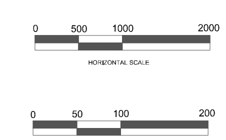
RUNWAY 15-33 PROFILE

Runway 15 Departure Obstructions

No.	Description	Latitude	Longitude	Top Elevation	EX/ULT Pentration	Remediation
7	TREE	39° 1' 19.849" N	95° 13' 10.062" W	875.84	18.02	Remove or Trim
8	POLE UTILITY	39° 1' 13.619" N	95° 13' 26.468" W	865.53	7.35	Bury Line/Remove Pole
10	POLE UTILITY	39° 1' 16.070" N	95° 13' 26.448" W	864.10	0.39	Bury Line/Remove Pole
13	TREE	39° 1' 22.655" N	95° 13' 13.217" W	898.26	31.31	Remove or Trim
24	TREE	39° 1' 23.933" N	95° 13' 22.356" W	898.88	20.99	Remove or Trim
25	POLE UTILITY	39° 1' 22.594" N	95° 13' 26.144" W	878.36	0.16	Bury Line/Remove Pole
26	TREE	39° 1' 24.658" N	95° 13' 24.462" W	893.86	12.47	Remove or Trim
27	TREE	39° 1' 22.659" N	95° 13' 31.413" W	883.60	0.60	Remove or Trim
28	TREE	39° 1' 41.605" N	95° 13' 15.124" W	913.85	2.33	Remove or Trim

Runway 33 Departure Obstructions

No.	Description	Latitude	Longitude	Top Elevation	Existing Penetration	Short Term Penetration	Ultimate Penetration	Remediation
10	TREE	39° 0' 0.991" N	95° 12' 41.230" W	893.29	32	x	x	Remove or Trim
11	TREE	39 ° 0' 2.626" N	95° 12' 23.353" W	870.98	x	10	37	Remove or Trim
12	TREE	39 ° 0' 4.499" N	95° 12' 18.321" W	874.21	1	x	x	Remove or Trim
13	TREE	39° 0' 3.648" N	95° 12' 17.859" W	879.06	3	x	x	Remove or Trim
14	TREE	38° 59' 53.851" N	95° 12' 34.579" W	874.81	x	4	31	Remove or Trim
15	TREE	38° 59' 54.684" N	95° 12' 32.383" W	876.69	x	5	33	Remove or Trim
16	POLE UTILITY	38° 59' 59.737" N	95° 12' 19.054" W	856.78	x	x	13	Bury Line/Remove Pole
17	TREE	38° 59' 59.123" N	95° 12' 19.787" W	883.55	x	11	39	Remove or Trim
18	TREE	38° 59' 53.679" N	95° 12' 28.634" W	878.10	x	1	29	Remove or Trim
19	TREE	38° 59' 44.780" N	95° 12' 17.920" W	908.96	x	3	30	Remove or Trim
20	TREE	38° 59' 38.582" N	95° 12' 16.656" W	901.46	x	x	7	Remove or Trim



MAGNETIC DECLINATION
2° 46' E (MAY 2011)
ANNUAL RATE OF CHANGE
0° 7' W (MAY 2011)

No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

Runway 15-33 DEPARTURE SURFACE DRAWING

Lawrence, Kansas

PLANNED BY: Patrick C. Taylor
DETAILED BY: Tim Kahmann
APPROVED BY: Steven G. Benson

June 4, 2011

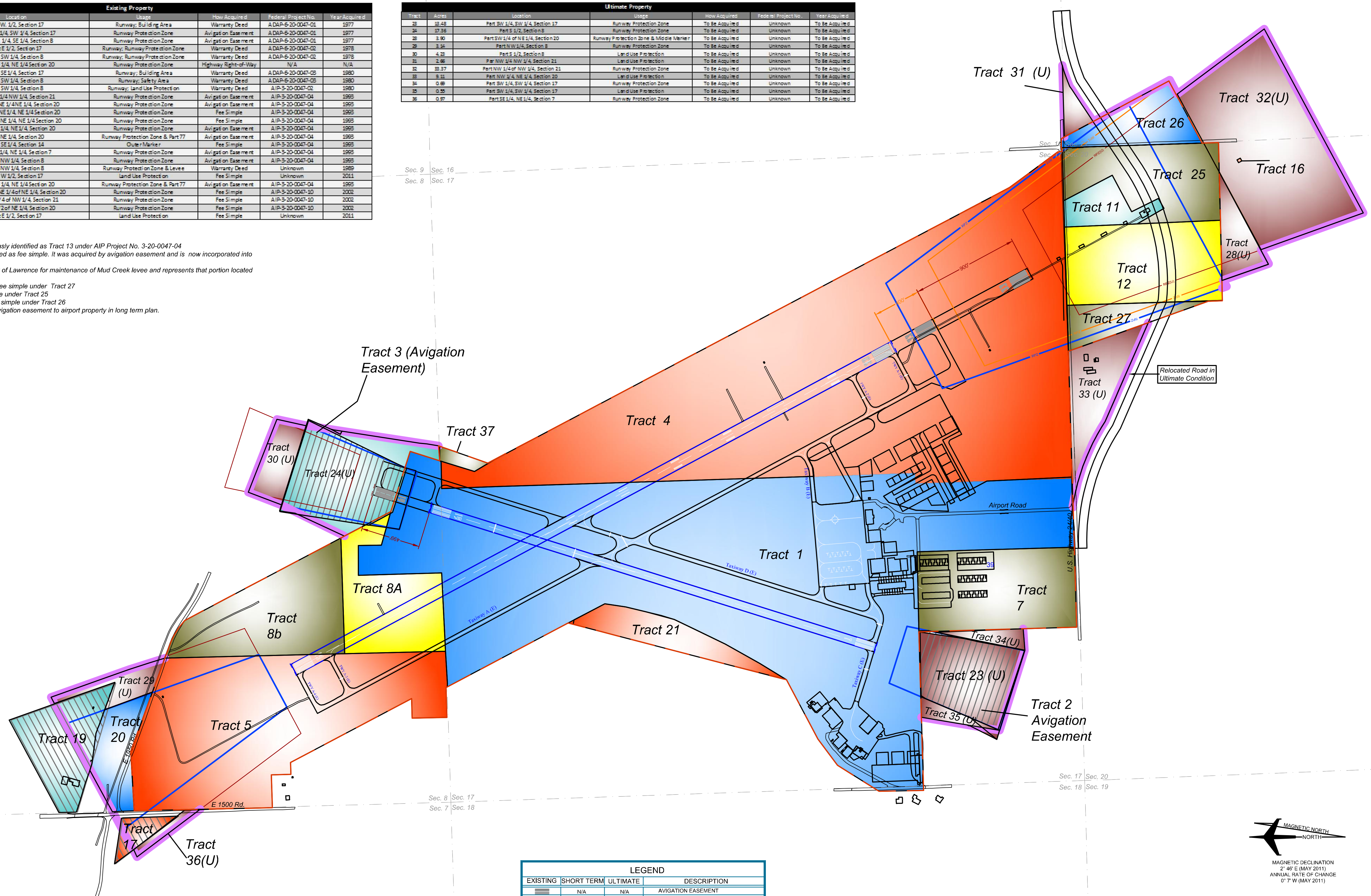
Coffman Associates Airport Consultants www.coffmanassociates.com

Existing Property						
Tract	Acres	Location	Usage	How Acquired	Federal Project No.	Year Acquired
1	174.08	Part W. 1/2, Section 17	Runway; Building Area	Warranty Deed	ADAP-6-20-0047-01	1977
2	12.30	Part SW. 1/4, SW 1/4, Section 17	Runway Protection Zone	Avigation Easement	ADAP-6-20-0047-01	1977
3	13.74	Part SW. 1/4, SE 1/4, Section 8	Runway Protection Zone	Avigation Easement	ADAP-6-20-0047-01	1977
4	158.97	Part E 1/2, Section 17	Runway; Runway Protection Zone	Warranty Deed	ADAP-6-20-0047-02	1978
5	55.64	Part SW 1/4, Section 8	Runway; Runway Protection Zone	Warranty Deed	ADAP-6-20-0047-02	1978
6	0.03	Part NW 1/4, NE 1/4 Section 20	Runway Protection Zone	Highway Right-of-Way	N/A	N/A
7	20.16	Part SE 1/4, Section 17	Runway; Building Area	Warranty Deed	ADAP-6-20-0047-03	1980
8a	14.67	Part SW 1/4, Section 8	Runway; Safety Area	Warranty Deed	ADAP-6-20-0047-03	1980
8b	20.00	Part SW 1/4, Section 8	Runway; Land Use Protection	Warranty Deed	AIP-3-20-0047-02	1980
9	0.71	Part NW 1/4 NW 1/4, Section 21	Runway Protection Zone	Avigation Easement	AIP-3-20-0047-04	1993
10	2.93	Part E 1/2 NE 1/4NE 1/4, Section 20	Runway Protection Zone	Avigation Easement	AIP-3-20-0047-04	1993
11	4.56	Part E 1/2, NE 1/4, NE 1/4 Section 20	Runway Protection Zone	Fee Simple	AIP-3-20-0047-04	1993
12	8.07	Part W 1/2, NE 1/4, NE 1/4 Section 20	Runway Protection Zone	Fee Simple	AIP-3-20-0047-04	1993
14	4.84	Part NW 1/4, NE 1/4, Section 20	Runway Protection Zone	Avigation Easement	AIP-3-20-0047-04	1993
15	0.05	Part NE 1/4, Section 20	Runway Protection Zone & Part 77	Avigation Easement	AIP-3-20-0047-04	1993
16	0.58	Part SE 1/4, Section 14	Outer Marker	Fee Simple	AIP-3-20-0047-04	1993
17	1.09	Part SE 1/4, NE 1/4, Section 7	Runway Protection Zone	Avigation Easement	AIP-3-20-0047-04	1993
19	10.23	Part NW 1/4, Section 8	Runway Protection Zone	Avigation Easement	AIP-3-20-0047-04	1993
20	16.04	Part NW 1/4, Section 8	Runway Protection Zone & Levee	Warranty Deed	Unknown	1989
21	6.42	Part W 1/2, Section 17	Land Use Protection	Fee Simple	Unknown	2011
22	0.01	Part NW 1/4, NE 1/4 Section 20	Runway Protection Zone & Part 77	Avigation Easement	AIP-3-20-0047-04	1993
25	15.50	Part E 1/2 of NE 1/4 of NE 1/4, Section 20	Runway Protection Zone	Fee Simple	AIP-3-20-0047-10	2002
26	8.00	Part NW 1/4 of NW 1/4, Section 21	Runway Protection Zone	Fee Simple	AIP-3-20-0047-10	2002
27	5.10	Part W 1/2 of NE 1/4, Section 20	Runway Protection Zone	Fee Simple	AIP-3-20-0047-10	2002
37	0.92	Part E 1/2, Section 17	Land Use Protection	Fee Simple	Unknown	2011

Ultimate Property						
Tract	Acres	Location	Usage	How Acquired	Federal Project No.	Year Acquired
23	13.48	Part SW 1/4, SW 1/4, Section 17	Runway Protection Zone	To Be Acquired	Unknown	To Be Acquired
24	17.36	Part S 1/2, Section 8	Runway Protection Zone	To Be Acquired	Unknown	To Be Acquired
28	3.90	Part SW 1/4 of NE 1/4, Section 20	Runway Protection Zone & Middle Marker	To Be Acquired	Unknown	To Be Acquired
29	3.14	Part NW 1/4, Section 8	Runway Protection Zone	To Be Acquired	Unknown	To Be Acquired
30	4.23	Part S 1/2, Section 8	Land Use Protection	To Be Acquired	Unknown	To Be Acquired
31	2.66	Par NW 1/4 NW 1/4, Section 21	Land Use Protection	To Be Acquired	Unknown	To Be Acquired
32	33.37	Part NW 1/4 of NW 1/4, Section 21	Runway Protection Zone	To Be Acquired	Unknown	To Be Acquired
33	9.11	Part NW 1/4, NE 1/4, Section 20	Land Use Protection	To Be Acquired	Unknown	To Be Acquired
34	0.69	Part SW 1/4, SW 1/4, Section 17	Runway Protection Zone	To Be Acquired	Unknown	To Be Acquired
35	0.55	Part SW 1/4, SW 1/4, Section 17	Land Use Protection	To Be Acquired	Unknown	To Be Acquired
36	0.97	Part SE 1/4, NE 1/4, Section 7	Runway Protection Zone	To Be Acquired	Unknown	To Be Acquired

Notes:

1. *Tract 12 includes the parcel previously identified as Tract 13 under AIP Project No. 3-20-0047-04*
2. *Tract 22 was originally to be acquired as fee simple. It was acquired by avigation easement and is now incorporated into Tract 14*
3. *Tract 20 is property held by the city of Lawrence for maintenance of Mud Creek levee and represents that portion located within Runway 15 RPZ.*
4. *Tract 14 and 15 were acquired as fee simple under Tract 27*
5. *Tract 10 was acquired as fee simple under Tract 25*
6. *Tract 6 and 9 were acquired as fee simple under Tract 26*
7. *Tracts 23 and 24 converted from avigation easement to airport property in long term plan.*



LEGEND			
EXISTING	SHORT TERM	ULTIMATE	DESCRIPTION
	N/A	N/A	AVIGATION EASEMENT
	N/A		AIRPORT PROPERTY LINE

MAGNETIC NORTH
NORTH
MAGNETIC DECLINATION
2° 46' E (MAY 2011)
ANNUAL RATE OF CHANGE
0° 7' W (MAY 2011)

0 200 400 800
GRAPHIC SCALE

No.	REVISIONS	DATE	BY	APP'D.

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LAWRENCE MUNICIPAL AIRPORT

'EXHIBIT A' AIRPORT PROPERTY MAP

Lawrence, Kansas

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SHEET 13 OF 13

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