4.0 DEMAND-CAPACITY ANALYSIS AND AIRPORT FACILITY REQUIREMENTS

4.1 Introduction

FAA notes that the primary method for determining airport facility requirements is by analyzing what additional facilities will be required to accommodate existing and forecasted aviation activity as well as improvements necessary to meet design standards. This task begins with an assessment of the ability of the existing facilities to meet current and future demand. If there is any shortfall in terms of airfield capacity, the additional facilities needed to accommodate demand will be identified. **Appendix 4-A** summarizes the demand-capacity analysis and facility recommendations, discussed in more detail in this chapter.

A number of other factors were also considered in relation to determining airport facility requirements:

Comparison of existing facilities with FAA design C-II standards. Kanab Municipal Airport (KNB or the Airport) currently meets FAA Airport Reference Code (ARC) B-II standards, and based on the forecast of activity and future critical design aircraft (i.e. Beech King Air 200, Cessna Mustang, Cessna Citation CJ-1/CJ-2, Embraer Phenom 100), KNB is recommended to remain B-II (**Table 4-1**) throughout the 20-year planning period.

The previous airport master plan and the Utah Continuous Airport System Plan both recommend upgrading KNB to FAA ARC C-II standards (**Figure 4-1**). However, there is insufficient existing or forecasted activity by C-II aircraft such as the Hawker 800/900, Gulfstream G-III/-IV, Challenger 300/350/604, Embraer Legacy 600/650, and other C-II aircraft to meet FAA's substantial use threshold.1 Data compiled from flight plans filed with the FAA2 indicate that there were less than 50 operations per year by C-II aircraft at KNB. While the data does not capture all corporate jet operations at KNB, the majority of corporate operators file flight plans with FAA. It is important to note that while KNB currently meets B-II design standards, KNB has, and will continue to accommodate mid- and large-size corporate jets on an as-needed basis.

As discussed in later chapters, significant financial investments would be required to bring KNB's facilities up to FAA's airport reference code (ARC) C-II design standards (**Table 4-1** and **Figure 4-1**). Cost estimates in the Airport's current Capital Improvement Plan (CIP) indicate that upgrading to C-II could cost as much as $18.78 million. In addition to that, the parallel taxiway to Runway 1-19 could cost another $4 million to $5 million, depending on the specific design standards used.

[1] FAA's substantial use threshold is a minimum of 500 itinerant operations per year by the critical design aircraft. That requires at least one takeoff and one landing by the critical aircraft 250 days per year. Sources: FAA Memorandum, Northwest Mountain Regional Policy and Guidance, Runway Extension Justification, April 3, 2009; and FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*.
[2] Source: GCR, Inc.

Given the level of forecasted activity within the planning period, but considering previous airport and state planning efforts, it is recommended that the ultimate plan for KNB be to aim for C-II ARC status beyond the 20-year planning period. By creating this ultimate plan, the airport preserves the ability to accommodate a greater level of service established in these other planning efforts while developing toward realistic goals within the planning period.

Improve or replace facilities that create operational conflicts, such as eliminate designated or potential hot spots where multiple taxiways intersect at a single point; taxiway/runway intersections that cause confusion; etc. One example is KNB's existing midfield taxiway that runs at a right angle between Runway 1-19 and the parking apron. That taxiway configuration does not meet current FAA design standards in that the direct taxiway connection between the runway and parking apron could potentially lead to a runway incursion.

Mitigation needed for existing or potential environmental impacts. Based on the current situation and future facilities recommended within the planning period at KNB, no environmental mitigation is required.

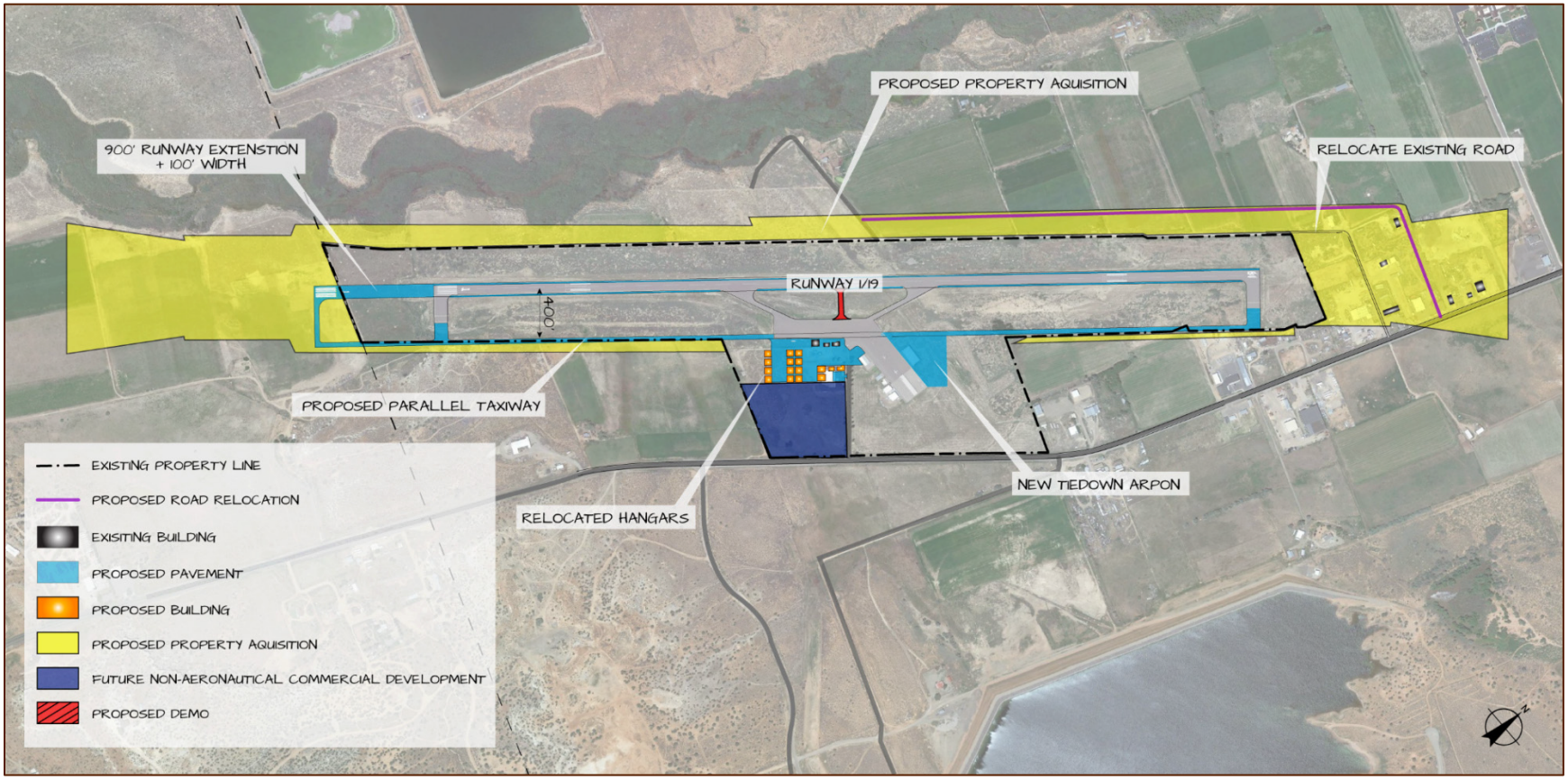
The need to bring airport facilities into compliance with local and state building and fire codes. The new terminal building at KNB meets all appropriate building and fire codes.

TABLE 4-1 – FAA AIRPORT DESIGN STANDARDS

Airport Facility	B-II	C-II
Runway 1-19	6,193' x 75'	7,100' x 100'
Existing Tie-down/Parking Apron	Meets B-II standards	Requires expansion and relocate tie-downs to meet C-II
Taxiway	Existing layout*	Full parallel, 25'W, Rwy CL–Twy CL = 300'
Runway Object Free Area (ROFA)	500'W x 300'L	800'W x 1,000'L
Runway Safety Area (RSA)	150'W x 300'L	500'W x 1,000'L
Runway Protection Zone (RPZ)	500'IWx700'OWx1,000'L	500'IWx1,010'OWx1,700'L

Sources: FAA AC 150/5300-13A, Airport Design; 2002 Kanab Municipal Airport Master Plan.
Notes: ROFA = Runway Object Free Area; RSA = Runway Safety Area; RPZ = Runway Protection Zone. L = length beyond runway end. IW = inner width. OW = outer width.
*A full length parallel taxiway may be justified within the planning period. If so, it should be constructed to C-II standards to meet potential ultimate design requirements.

FIGURE 4-1 – CAPITAL IMPROVEMENTS REQUIRED TO UPGRADE KNB TO FAA REFERENCE CODE C-II



Source: Creamer & Noble, 2004
Note: Presented in the 2002 Kanab Municipal Airport Master Plan

4.2 Airside Facility Requirements

Airside facilities deal with aircraft operational areas, including runways, taxiways, aircraft parking aprons, as well as navigation and communications aids. Each airside facility is discussed individually below.

4.2.1 Runways

The single runway at KNB, 1-19, meets FAA Runway Design Code (RDC) standards for B-II-5000. It is 6,193 feet long by 75 feet wide, with a 0.7% upslope from Runway 1 to 19. The wind data shows that Runway 1-19 provides better than 95% wind coverage for 10.5-knot, 13-knot, and 16-knot crosswinds. While there are periods when crosswinds exceed the limits of some aircraft operating at KNB, they are not of sufficient duration to justify constructing a new crosswind runway. A crosswind runway would require property acquisition, the preparation and approval of an environmental assessment (EA), and substantial cost to construct, as well as on-going maintenance costs.

In terms of runway length, Runway 1-19 is adequate for the type of aircraft that use the airport and the missions that they fly. **Table 4-2** shows that a number of corporate aircraft classified as B-II can take off from KNB on Runway 1-19 at maximum gross weight, i.e. with no weight penalty.

TABLE 4-2 – ACCELERATE/STOP TAKEOFF DISTANCE REQUIRED[1]

Aircraft	Distance (feet)
Beech King Air C90	4,779
Beech King Air 200GT	4,859
Embraer Phenom 300	5,114
Cessna CJ-2	5,180
Cessna CJ-3	4,750
Cessna CJ-4	5,021

Source: Business & Commercial Aviation, May 2014

It is likely that some corporate aircraft that operate at KNB reduce their takeoff weight to safely depart on Runway 1-19, particularly when temperatures are high in the summer, which increases the airport's density altitude and reduces performance. However, according to surveys undertaken by the National Business Aircraft Association (NBAA) and Business & Commercial Aviation (BCA)[2], the majority of all corporate aircraft takeoff at reduced weight, even on runways that impose no operational constraints. The majority of corporate aircraft fly missions shorter than their maximum range, and therefore they do not need to carry full fuel, and they typically carry less than full passenger loads.

In addition, aircraft reduce takeoff weight to improve climb performance after takeoff, particularly in the vicinity of high terrain. As a result, reducing weight to takeoff on Runway 1-19, particularly in

[1] Accelerate/stop distances are required by the FAA to be calculated by turbine aircraft prior to each takeoff to ensure that the runway being used is adequate. The accelerate/stop takeoff distances shown above are at maximum gross weight, 5,000' elev. above sea level, 25^0 C (77^0 F) outside temperature, zero wind. Source: Business & Commercial Aviation, May 2014.

[2] Sources: Harris Interactive for NBAA, *The Real World of Business Aviation: A Survey of Companies Using General Aviation Aircraft*, October, 2009; Business & Commercial Aviation, *Operations Planning Guide*, April, 2014

the summer, may limit the fuel carried and non-stop range an airplane could fly, but it is not unusual for corporate aircraft to takeoff at reduced weights.

FAA Advisory Circular (AC) 150/ 5325-4B, *Runway Length Requirements*, notes that 100% of "small airplanes" (those that weigh less than 12,500 pounds) can operate from an airport at an elevation of 5,000 feet with a 6,300-foot runway. The AC also notes that 75% of aircraft that weigh more than 12,500 pounds but less than 60,000 pounds (which encompasses a large share of the corporate jet fleet) can takeoff on a 6,200-foot runway at 60% useful load. In addition, based on flight plan data filed with FAA, some aircraft fly non-stop from KNB for 1,000 nautical miles (nm). Those missions fall within the range of the typical corporate flight, and indicate that turbine aircraft can depart KNB with adequate useful loads. Based on their average mission profile, turbine aircraft typically take off at less than maximum gross weight.

In general, corporate aircraft takeoff performance has been improving steadily for more than 20 years due to more efficient and powerful engines and to advanced aerodynamic design, thereby reducing the required runway length. One outcome has been to allow larger corporate aircraft to operate from airports with runways of 5,000 feet and shorter, particularly at reduced takeoff weights, as shown below. While some aircraft under certain conditions (for example, very high temperatures in the summer) may be required to takeoff from KNB at reduced weight, the existing runway length adequately serves the majority of existing and future aircraft at KNB. The airport is currently used occasionally by large corporate jets such as the Gulfstream G-IV, Canadair Challenger, etc. Those aircraft operate at reduced weights, particularly on takeoff during the summer months. A number of large corporate jets can takeoff from KNB's Runway 1-19 at reduced weight (**Table 4-3**). Therefore, maintaining the current Runway 1-19 length (6,193 feet) will not prevent large corporate jets from using KNB in the future, albeit at reduced take-off weight.

TABLE 4-3 – TAKEOFF DISTANCE AT REDUCED WEIGHT

Aircraft	Distance (feet)
Gulfstream G-550	5,274
Gulfstream G-450	4,838
Global Challenger 6000	3,446
Falcon 2000XLS	4,436
Falcon 7X	3,716
Challenger 350	5,244
Embraer Legacy 600	5,132

Source: Business & Commercial Aviation, May 2014
Note: Takeoff performance based on following mission profile:
- Balanced Field Length (BFL) shown
- Typical corporate passenger/ baggage payload
- Non-stop 1,000 nm mission
- Airport elev. 5,000' @ 25C / 77F temperature, 0 wind

Because the runway currently meets FAA B-II design standards and is long enough to accommodate B-II aircraft, as well as occasional operations by larger corporate jets, it is recommended that Runway 1-19 remain at its current size (6,193 feet by 75 feet) within the planning period. When additional, more demanding aircraft use the airport on a regular basis, the ultimate plan to meet C-II design

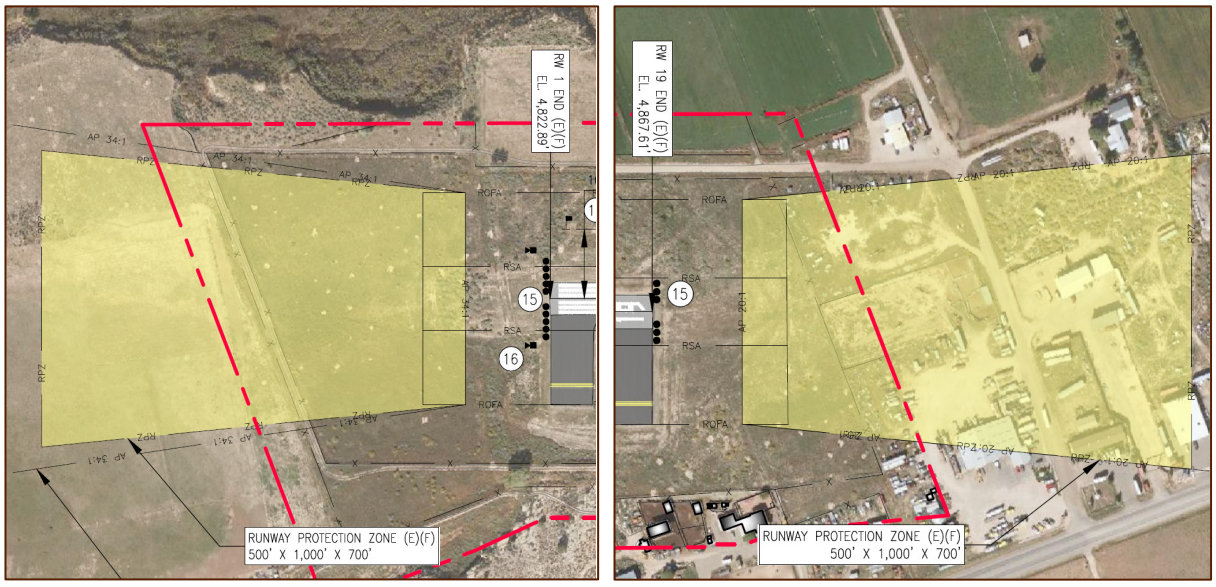
standards and increase the runway's length and width should be pursued. Based on the forecast of aviation activity this may likely take place beyond the 20-year planning period, but is included in the Airport Layout Plan set to preserve the ability to carry out this project.

4.2.2 Runway Protection Zones (RPZ)

Runway 1 and 19 each have a runway protection zone (RPZ). FAA defines RPZ as an "area at ground level prior to the threshold or beyond the runway end to enhance the safety and protection of people and property on the ground. This is best achieved through airport owner control over RPZs. Control is preferably exercised through the acquisition of sufficient property interest in the RPZ and includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities."

FAA issued a Memorandum dated September 27, 2012, *Interim Guidance on Land Uses Within a Runway Protection Zone*. The Memorandum states: "Although the FAA recognizes that in certain situations the airport sponsor may not fully control land within the RPZ, the FAA expects airport sponsors to take all possible measures to protect against and remove or mitigate incompatible land uses." FAA requires coordination with the airport sponsor concerning certain land uses if they are situated in RPZs, including non-aviation buildings (particularly residences, churches, hospitals, etc.), recreational facilities such as golf courses, amusement parks, sports fields, etc., rail facilities, public roads, vehicular parking facilities, fuel storage facilities, hazardous material storage, wastewater treatment plants, and above ground utilities. Both the Runway 1 and 19 RPZ extend off of airport property, as shown below in yellow.

FIGURE 4-2 – RUNWAY 1 AND RUNWAY 19 RPZ



Source: Jviation

A portion of the Runway 1 RPZ is situated in Arizona, and appears to be vacant. There are mixed land uses in the Runway 19 RPZ including a truck, trailer, and vehicle repair and sales business owned by Little's Diesel Service. When the runway is extended, it is recommended that the City attempt to acquire the property within the RPZs that are situated off-airport (approximately six acres

south of Runway 1, and approximately 10 acres north of Runway 19). Where property acquisition is not feasible FAA expects sponsors to "take all possible measures to protect against and remove or mitigate incompatible land uses."

4.2.3 Taxiways

There are three mid-field taxiways, two of which are high-speed exits off of Runway 1-19. Taxiway turnarounds located at both runway ends allow aircraft turnaround for departure or after landing. The distance from the south high-speed taxiway to the Runway 1 threshold is approximately 2,066 feet, and from the north high-speed taxiway to the Runway 19 threshold is approximately 2,320 feet. At typical taxi speeds[1] it takes approximately 2.5 minutes to taxi between the high-speed exit taxiway and the runway threshold.

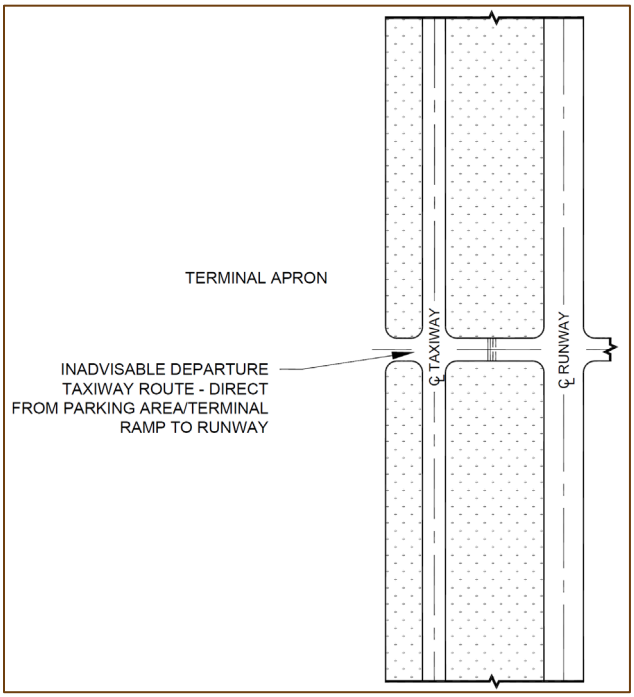
The existing mid-field taxiway at KNB is at a right angle between the runway and parking apron (**Figure 4-4**). FAA design standards require changing that configuration to prevent inadvertent runway incursions by aircraft taxiing directly from the parking apron onto the runway (**Figure 4-3**). It is recommended that an island be constructed on the apron adjacent to the taxiway intersection by removing existing pavement or painting of an artificial island on the pavement. The island would require aircraft to taxi around it, thereby reducing the chance of a runway incursion. Another option would be to close that taxiway, however, it is used by aircraft to exit the runway after landing, and it is recommended to remain open.

The 2002 KNB Master Plan and the 2007 Utah Continuous Airport System Plan recommended constructing a full parallel taxiway to FAA ARC C-II design standards. Both plans recommend a 400-foot separation between Runway 1-19 and parallel taxiway centerline. The current C-II design standard calls for a 300-foot separation from runway to taxiway and 400-foot separation from aircraft parking areas. A full parallel taxiway would minimize aircraft back-taxiing on the runway after landing or before takeoff, therefore enhancing safety and the level of service offered to airport users. Several aircraft tie-downs located in front of the terminal building would have to be relocated in order to meet the 400-foot runway to aircraft parking area separation requirement.

A full parallel taxiway would cost between $4 million and $5 million, depending on the specific design criteria used. A parallel taxiway would also require property acquisition as well as relocating existing paved tie-downs and some of the apron. The estimates do not include replacing the lost paved tie-downs, or environmental mitigation.

[1] FAA Safety Alert for Operators (SAFO 09004), 2/11/09, states: "Slow the aircraft to a fast walking speed on the centerline of the landing runway prior to attempting to exit the runway. Taxi at a fast walking speed until parked at the ramp or until aligned with the centerline of the runway for takeoff."

FIGURE 4-3 – FAA DIAGRAM OF INADVISABLE TAXIWAY CONFIGURATION



Sources: FAA Advisory Circular 150/5300-13A, *Airport Design*, Chp. 4

FIGURE 4-4 – EXISTING TAXIWAYS AT KNB

Source: Jviation

Consistent with previous plans and basic facilities offered at B-II airports in Utah, it is recommended that the existing taxiway system be improved to include the development of a full-length parallel taxiway, designed to C-II standards. The recommendation to develop a new parallel taxiway is based on the following reasons:

- Pilots operating B-II and larger aircraft, such as corporate and business users, have come to expect full-length parallel taxiways at the airports they operate from. Providing this airfield feature may attract some users that may otherwise be deterred.
- Many states and B-II airports throughout the country see full-length parallel taxiways as a basic necessity. Many states recommend this feature for B-II airports throughout their systems.
- Although the amount of time to taxi between the mid-field taxiways and the taxi turnarounds at each runway end is less than three minutes, less time spent taxiing on a runway reduces the risk of potential accidents or incidents.
- A full-length parallel allows taxiing aircraft to remain clear of the runway for landing and departing traffic.
- While separation standards for a B-II airport are slightly greater than C-II airports, the taxiway width of 25 feet, based on taxiway design group standards, is the same.
- The FAA recommends parallel taxiways for airports with instrument approach procedures. KNB has straight-in and circling procedures.

4.2.4 Navigation and Communication Aids

There are no ground-based radio navigation aids on KNB. The nearest ground-based navigation aids (NAVAIDs) are the Bryce Canyon VHF Omni-Range Transmitter (VOR), situated 42.1 nm to the north and the Colorado City Non-Directional Radio Beacon (NDB), situated 23.1 nm west of KNB. Communications are on Unicom radio (Common Traffic Advisory Frequency: CTAF), 122.8 MHz.

There is a published non-precision GPS approach to Runway 1 (lowest minimums = 569 feet and one mile). There are airport lights that serve as visual aids:

- Runway end identifier lights (REIL) – two flashing strobe lights – on Runway 1*
- Precision Approach Path Indicator Lights (PAPI), glide angle of 3^0 - Runway 1*
- Medium Intensity Runway Lights (MIRL)*
- Rotating Beacon

** According to the FAA Airport Facility Directory, lights are pilot controlled (PCL), activated by radio on CTAF freq. 122.8 MHz.*

Discussions with FAA Flight Procedures indicated that due to the high terrain north of KNB, FAA cannot publish an instrument approach procedure to Runway 19. Instrument approach procedures must comply with the provisions of FAA Order 8260.3B, *U.S. Standard for Terminal Instrument Procedures (TERPS)*. As a result, Runway 19 will remain a visual runway end. In addition, for the GPS instrument approach to Runway 1, the missed approach procedure requires a steep climb gradient because of the high terrain to the north. The climb gradient on the missed approach impacts the minimum descent altitude (MDA) that can be certified on an approach to Runway 1.

Recommendations:

- FAA publish a GPS lateral procedure with vertical guidance (LPV) approach to Runway 1 to provide vertical guidance to approaching aircraft and lower the MDA, if feasible. The mountains north of the airport impose steep climb requirements on the missed approach procedure, which limits the lowest minimum descent altitude that FAA can certify.
- An approach light system (ALS) would need to be installed to Runway 1 to lower the visibility minimums to less than one mile. However, it is **not** recommended that an ALS be installed due to the following considerations:
  - Cost (both installation and on-going maintenance costs);
  - ALS would require property acquisition—it would extend outside of airport property and across the state border into Arizona, which is approximately 745 feet south of the Runway 1 threshold;
  - With the steep climb requirements discussed above being a driving factor to the minimum descent altitude, approach lights would not likely lower minimums; and
  - There are relatively few periods of time when visibility is less than one mile.
- FAA, in concert with the National Weather Service (NWS), develop terminal aerodrome forecasts (TAF) for KNB. TAFs would benefit corporate aircraft operators, particularly those operating as air taxi/charter under 14 CFR Part 135.
- FAA install a remote communications outlet (RCO) on KNB to allow pilots on the ground and in the vicinity of KNB to talk directly with Los Angeles Center.
- FAA improve radar coverage by Los Angeles Center in the vicinity of KNB. The implementation of NextGen by the FAA, which will rely on satellite monitoring and communications, will improve ATC tracking where radar coverage is poor. FAA currently requires all aircraft owners that use ATC services to install equipment that meets some of the tracking requirements for NextGen[1] by 2020.
- No new instrument approach procedure to Runway 19 is proposed—it will remain visual. It is recommended that the airport study and engage the FAA in discussions regarding the potential installation of a PAPI to Runway 19 to aid visual approaches, particularly at night.

4.2.5 Airspace Obstruction Removal

The FAA has sole jurisdiction for the management and operation of the National Airspace System (NAS). The FAA has delegated some of that responsibility to airport sponsors. The FAA's Sponsor Grant Assurance Number 20, *Hazard Removal and Mitigation*, states: "It (i.e. 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

[1] The new equipment is Automatic Dependent Surveillance-Broadcast (ADS-B). ADS-B uses GPS technology to determine an aircraft's location, airspeed and other data, and broadcasts that information to a network of ground stations, which relays the data to air traffic control displays and to nearby aircraft equipped to receive the data via ADS-B. Operators of aircraft equipped with ADS-B can also receive weather and traffic position information delivered directly to the cockpit. Source: FAA https://www.faa.gov/nextgen/programs/adsb/faq/

future airport hazards." That policy is also stated in FAA advisory circulars and FAA's Airport Compliance Manual, Order 5190.6B. The FAA has defined the airspace to be protected by airport sponsors in several sources:

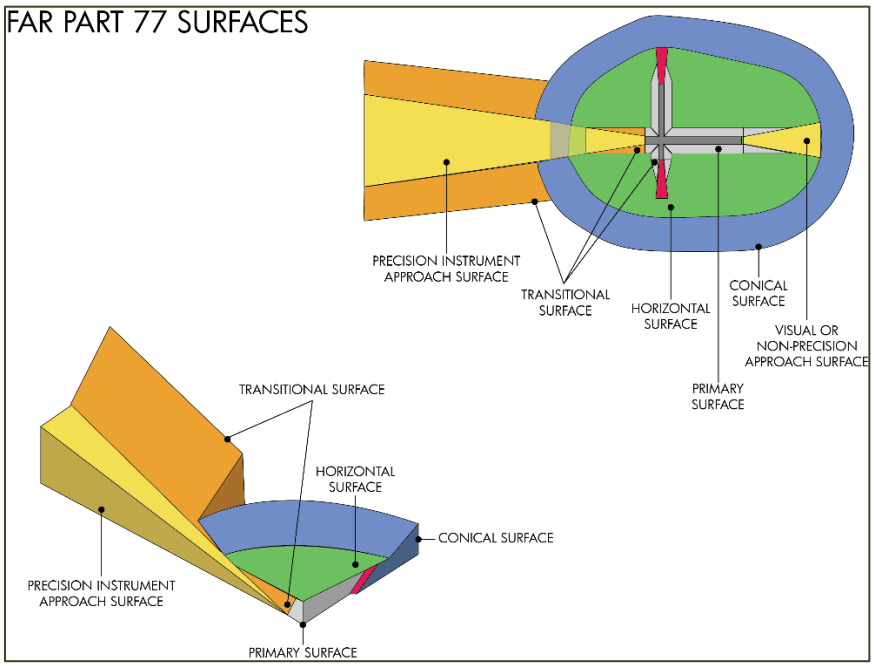
- 14 CFR Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace
- FAA Order 8260.3, U.S. Standard for Terminal Procedures (TERPS)
- FAA AC 150/5300-18B, *General Guidance and Specifications for Submission of Aeronautical Surveys to NGS: Field Data Collection and Geographic Information System (GIS) Standards*
- FAA Advisory Circular 150/5300-13A, *Airport Design*

Digital mapping of Kanab Municipal Airport and surrounding area was compiled by Woolpert, Inc. in the Fall of 2015. FAA requires that airport sponsors acquire digital mapping in compliance with Airports Geographic Information System (AGIS) standards. The area covered by AGIS mapping corresponds to the imaginary surfaces prescribed in 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 AGIS mapping has been uploaded to FAA's website (https://airports-gis.faa.gov/public/index.html), and has been reviewed and approved by FAA and the National Geodetic Survey (NGS). FAA will use that data to update their records regarding the airport and objects in the vicinity of the airport, particularly in relation to instrument approach procedures. Woolpert also compiled digital mapping for the 14 CFR Part 77 imaginary surfaces. There are five imaginary surfaces defined in Part 77 (**Figure 4-5**):

- Primary surface
- Approach surface
- Transitional surface
- Horizontal surface
- Conical surface

FIGURE 4-5 – AIRPORT IMAGINARY SURFACES



Source: Code of Federal Regulations 14 CFR Part 77

The protection of those imaginary surfaces is the responsibility of airport sponsors. The FAA notes in 14 CFR Part 77 that, "any object of natural growth, terrain, or permanent or temporary construction or alteration, including equipment or materials used and any permanent or temporary apparatus" that penetrates one or more of the imaginary surfaces is defined as an obstruction to air navigation.

FAA further notes that, "Objects that are considered obstructions under the standards described in this subpart are presumed hazards to air navigation unless further aeronautical study concludes that the object is not a hazard. Once further aeronautical study has been initiated, the FAA will use the standards in this subpart, along with FAA policy and guidance material, to determine if the object is a hazard to air navigation."

The FAA presumes that all penetrations are obstructions and hazards to air navigation unless it determines that specific penetrations are not hazards. FAA requires airport sponsors to protect the imaginary surfaces by "removing, lowering, relocating, marking, or lighting or otherwise mitigating existing airport hazards and by preventing the establishment or creation of future airport hazards."

A large portion of the imaginary surfaces extend beyond airport property, and even beyond the Kanab City limits and into Arizona to the south. In addition, to the north of the airport and the city there is high terrain (**Figure 4-9**). FAA recognizes that airport sponsors have limited jurisdiction over property situated off-airport, particularly outside of municipal boundaries. However, as noted in the grant assurances, FAA requires airport sponsors to make good faith efforts to remove, mark or light penetrations to the imaginary surfaces, wherever feasible. If penetrations to the imaginary surfaces cannot be removed, then sponsors use FAA Advisory Circular 70/7460-1L, *Obstruction Marking and Lighting*, to determine the appropriate methods.

There are a number of red obstruction lights that are situated on top of utility poles approximately two to three miles north of KNB, within the City limits (see **Figure 4-6** and **Figure 4-7)**. The obstruction lights are on top of utility poles, and the red obstruction lights were installed years ago in coordination with FAA (see photos on following page). The utility poles penetrate the Horizontal Surface, which is a flat surface situated 150 feet above airport elevation (horizontal surface = 5,018 feet above mean sea level). The obstruction lights create significant visual glare at night on the north side of the city. The utility poles and obstruction lights are approximately 900 feet lower than the mountain to the north.

FAA has examined the obstruction lights previously and determined that the lights are required. Based on extensive coordination with FAA as part of this Master Plan, FAA reiterated that determination. The options for removing the obstruction lights would require either burying the power lines and removing the poles, which is expensive, or re-routing the power lines and poles so that they do not penetrate the Horizontal Surface, which is also expensive.

Runway 19 is, and will continue to be, a visual approach with an approach surface slope of 20:1, and no utility poles penetrate the approach surface.

FIGURE 4-6 – UTILITY POLES AND OBSTRUCTION LIGHTS NORTH OF KNB

Source: Jviation

FIGURE 4-7 – UTILITY POLES AND OBSTRUCTION LIGHTS NORTH OF KNB

Source: Jviation

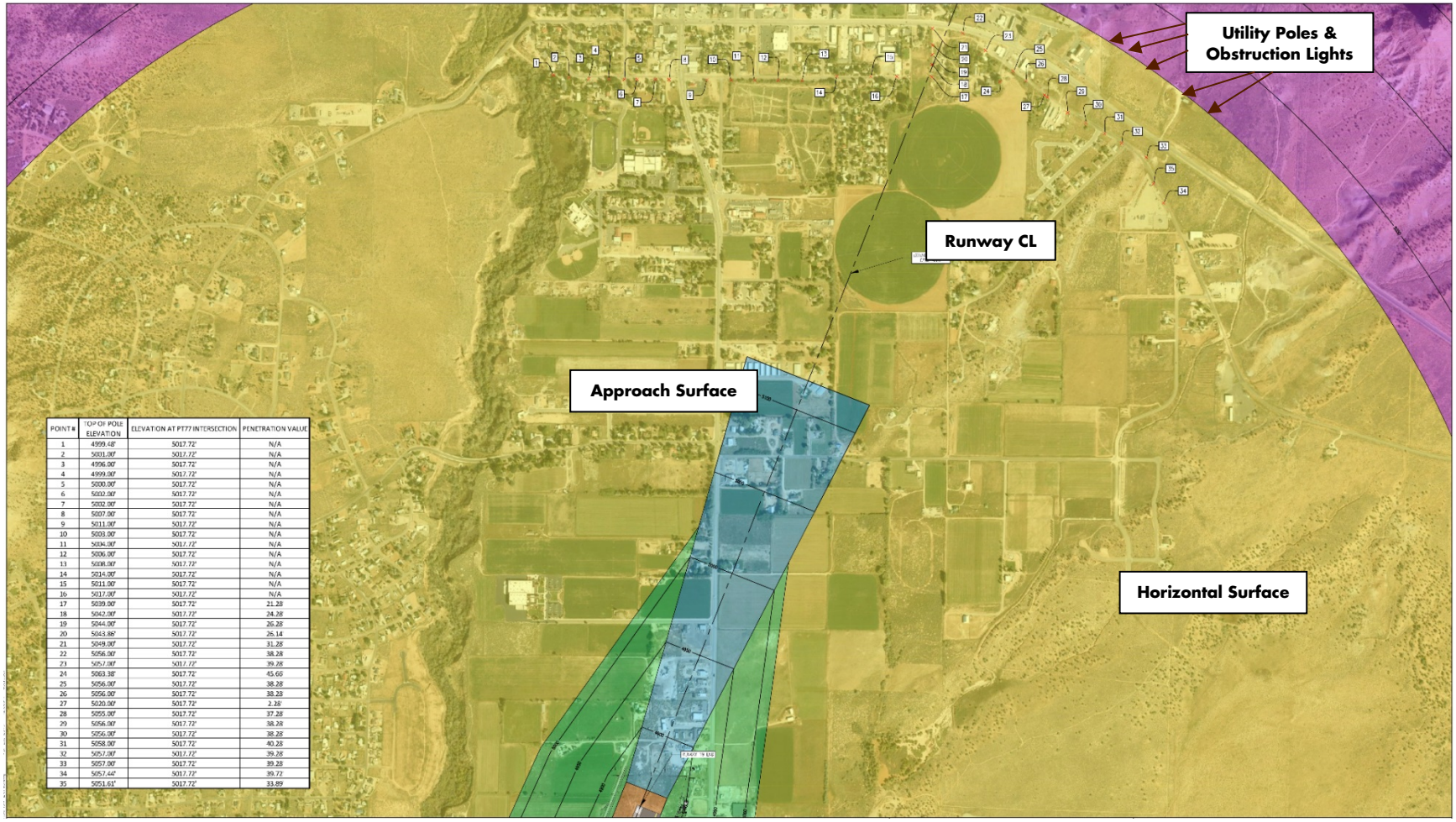
TABLE 4-4 – UTILITY POLES AND HILLS IN RELATION TO KNB

Feature	Distance from Airport	Elevation	Height Above Airport	Bearing off of RW1/19	Ownership
Airport	--	4,868'	--	--	Kanab
Utility Poles	2.3 nm	5,000'	130' – 190'	0 deg	Garkane Energy
Indian Dance Hall	2.8 nm	5,605'	740'	2 deg West	BLM
Savage Point	3.3 nm	5,805'	940'	4 deg East	BLM
TV Towers Ridge	3.5 nm	5,815'	950'	10 deg West	Verizon & AT&T

Source: Jviation

The top of the mountain is approximately 27 nm north of KNB, at an elevation of 9,440 feet, which is 4,572 feet above the Airport's elevation of 4,868 feet. There is another peak situated approximately 34 nm north of the Airport at 9,580 feet elevation, which is 4,712 feet above the Airport elevation.

FIGURE 4-8 – FAA IMAGINARY SURFACES – UTILITY POLES



POINT #	TOP OF POLE ELEVATION	ELEVATION AT PT77 INTERSECTION	PENETRATION VALUE
1	4999.48'	5017.72'	N/A
2	5001.00'	5017.72'	N/A
3	4996.00'	5017.72'	N/A
4	4999.00'	5017.72'	N/A
5	5000.00'	5017.72'	N/A
6	5002.00'	5017.72'	N/A
7	5002.00'	5017.72'	N/A
8	5007.00'	5017.72'	N/A
9	5011.00'	5017.72'	N/A
10	5003.00'	5017.72'	N/A
11	5004.00'	5017.72'	N/A
12	5006.00'	5017.72'	N/A
13	5008.00'	5017.72'	N/A
14	5014.00'	5017.72'	N/A
15	5011.00'	5017.72'	N/A
16	5017.00'	5017.72'	N/A
17	5039.00'	5017.72'	21.28
18	5042.00'	5017.72'	24.28
19	5044.00'	5017.72'	26.28
20	5043.88'	5017.72'	26.14
21	5049.00'	5017.72'	31.28
22	5056.00'	5017.72'	38.28
23	5057.00'	5017.72'	39.28
24	5063.38'	5017.72'	45.66
25	5056.00'	5017.72'	38.28
26	5056.00'	5017.72'	38.28
27	5020.00'	5017.72'	2.28'
28	5055.00'	5017.72'	37.28
29	5056.00'	5017.72'	38.28
30	5056.00'	5017.72'	38.28
31	5058.00'	5017.72'	40.28
32	5057.00'	5017.72'	39.28
33	5057.00'	5017.72'	39.28
34	5057.44'	5017.72'	39.72
35	5051.61'	5017.72'	33.89

Source: Jviation

FIGURE 4-9 – HIGH TERRAIN NORTH OF KNB

Source: Jviation
Note: Photo taken facing North from Runway 1 Threshold

Recommendations

Based on extensive coordination with FAA as part of this Master Plan, FAA has reiterated their previous determination that the obstruction lights must remain as long as the utility poles remain in their current locations and penetrate the Horizontal Surface. As a result, the only options currently available to remove the obstruction lights are to either bury the power lines and remove the poles, which is expensive, or re-route the utility poles and power lines so that the poles do not penetrate any FAR Part 77 imaginary surfaces, which is also expensive. Either option would require extensive involvement and cooperation by the utility company that owns the utility poles and power lines.

Based on the feedback from FAA and cost associated with relocating the utility poles or burying the powerlines, it is recommended that the City keep the utility poles and obstruction lights as they are. The FAA would not likely assist with the cost of addressing this issue since the obstruction lights currently in place meet FAA guidelines for obstruction awareness.

4.2.6 Aviation Fuel Storage & Dispensing

There is one 10,000-gallon, above-ground fuel storage tank at KNB for 100LL avgas (**Figure 4-10**). There is no permanent JetA fuel storage tank at the Airport, although there are two mobile fuelers for JetA. KNB owns and operates the fuel service. The storage capacity needed for each type of fuel is determined by demand and through-put capacity, measured by how frequently wholesale fuel deliveries are required to replenish the storage tank. For example, if sales were sufficiently strong to require wholesale fuel deliveries every day to replenish the storage tanks that would be a strong indicator that additional fuel storage is required. If the fuel storage capacity in relation to retail fuel sales requires wholesale deliveries once or twice a month that is considered adequate.

FIGURE 4-10 – 100LL AVGAS STORAGE TANK

Source: Jviation

The fuel storage capacity, in relation to the volume of fuel sold, should allow for regular use (rotation) of the fuel in the storage tanks. All fuel deteriorates over time the longer it sits in storage tanks, in part due to contamination from water, particulates, and bacteria. Quality control of the fuel is important, primarily to eliminate the possibility of an engine failure.

As noted by a large fuel wholesaler[1]:

> "Fuel quality degradation needs to be identified, characterized and addressed whenever aviation fuel is stored for a length of time. Jet fuel can form gum and must be regularly monitored in order to avoid problems in the future with aircraft fuel systems. Another danger to jet fuel quality is the growth of bacteria that develops within the product. Hydrocarbon utilizing micro-organisms can grow and develop in untreated Jet Fuel, causing fuel filter problems. If left untreated, bacteria growth can cause catastrophic problems in the future. Bacterial fuel contamination is usually overcome by treating the fuels with a biocide."

Another factor is that wholesale fuel distributors/wholesalers typically require airports (or FBOs) to buy a minimum amount of fuel on each delivery (approximately 8,000 gallons). Fuel wholesalers typically charge more per gallon if they deliver less than that.

The City of Kanab recently signed a contract with AVFUEL to serve as the wholesale supplier to the Airport. Airports typically order wholesale deliveries when there is sufficient available capacity in the storage tank to buy and store the minimum amount required. As a result, storage capacity needs to be sufficient to accept minimum deliveries from wholesalers, but not so great as to leave fuel in storage tanks for extended periods. The existing 100LL avgas storage tank is sufficient for the volume of fuel sold at KNB. In 2016 the city purchased a used Jet A fuel truck from the Moab Airport, which had been inspected and certified. It replaced an older fuel truck that required significant maintenance.

[1] Source: Intertek, *"Jet Fuel Degradation Storage Problems - Jet fuel quality and degradation testing for jet fuels stored for long periods of time"*, http://www.intertek.com/petroleum/testing/jet-fuel/storage-degradation/

The City plans to install a new 10,000-gallon above-ground JetA storage tank to replace the current 5,000-gallon mobile fuelers, which will allow the Airport to purchase more fuel at each delivery thereby further lowering the wholesale cost per gallon. Regarding Jet A fuel storage, there are two factors to consider:

- The need to sell a minimum volume of fuel per month to amortize the investment cost or operating and maintenance cost of a 10,000-gallon JetA storage tank. Margins on fuel sold are very small (i.e. profit after marked-up cost of goods). Corporate aircraft operators typically negotiate the price of fuel (i.e. do not pay listed retail price), and corporate aircraft have the capacity to tanker fuel so that operators can buy fuel at the airport that offers the lowest price.
- Maintaining the quality of JetA fuel that is stored for long periods of time (i.e. months or more) requires careful monitoring. Fuel handlers on airports are required to comply with National Fire Protection Association (NFPA) 407, *Aircraft Fuel Servicing*, as well as pertinent FAA advisory circulars such as AC 150/5230-4B, *Aircraft Fuel Storage, Handling, Training and Dispensing on Airports*, and AC 20-43C, *Aircraft Fuel Control*.

Recommendations

Install a Jet A storage tank with sufficient capacity to meet regular demand, but not so large that fuel will sit in the tank for long periods of time and suffer potential deterioration.

4.2.7 Aircraft Parking and Storage Requirements

As summarized in **Table 4-5**, the existing hangar storage and aircraft tie-down capacity exceeds existing and future demand. Some of the existing hangars will need to be replaced within the next 10 years due their current age and condition. There is room available for additional hangar development, shown in **Figure 4-11** (future hangars are shown in orange). The actual size of each hangar can vary depending on the specific needs of each operator. The existing row of T-hangars can be extended as well. It is anticipated that all future hangar development will be privately funded, including the site preparation and utility hook-ups. The future hangars will provide more than sufficient capacity to accommodate demand beyond the 20-year planning period (**Figure 4-11**).

TABLE 4-5 – AIRCRAFT STORAGE DEMAND – CAPACITY

Existing Storage Demand-Capacity	Future Storage Demand-Capacity
Current Based aircraft = 20	Future Based Aircraft = 29
Conventional Hangar storage capacity = 20 aircraft	Assume 20 stored in hangars, 9 on tie-downs
T-Hangar Capacity = 8 aircraft	Transient A/C Parking Peak Hour: 5 aircraft
Tie-down Apron (approximately 11,000 S.Y.) = 26 positions	
Total parking/storage capacity = 56 aircraft	
Transient parking positions = 8 (Beech King Air 200)	

Source: Jviation

The existing transient parking apron is large enough to meet projected demand. The transient parking apron can be expanded to the south if needed to accommodate additional transient parking.

FIGURE 4-11 – FUTURE HANGARS AND APRON EXPANSION

Source: Jviation

4.2.8 Airport Support Facilities

Airport support facilities include buildings for snow removal equipment (SRE) and airfield maintenance equipment, as well as the equipment itself. An SRE building should be constructed on the airport to protect the airport snow removal and maintenance equipment from the weather. The building can also include office/shop space. An example of a simple SRE storage building is shown in Figure 4-12.

The FAA has set limits on uses of the storage building that are eligible for FAA funding. As noted by the Airport Cooperative Research Program (ACRP): "Funding snow and ice control buildings is limited to space in the building necessary for eligible Snow Removal Equipment as well as storing abrasive or chemicals used in treatment of paved areas.

All other areas and equipment recommended in the current version of Advisory Circular 150/5220-18, *Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials*, must be paid for by the sponsor."

FIGURE 4-12 –EXAMPLE OF SNOW REMOVAL EQUIPMENT (SRE) STORAGE BUILDING

Source: ACEC Wisconsin, Becher Hoppe Associates, Inc.

4.3 Landside Facility Requirements

Landside facility requirements focus on the non-aircraft movement areas, including the terminal building, utilities, access road, and vehicle parking.

4.3.1 Transportation/Road Network

KNB is served by a public, paved, two-lane road, Route 89A. South of the Airport, Route 89A connects with Route 389 in Arizona and Route 59 in Utah to St. George and I-15. To the north, Route 89A connects with Route 89 that connects with I-70 north of Marysvale, and to Route 89 to the east which proceeds to Page, Arizona, and then south to Flagstaff, Arizona. There are signs to the Airport on Route 89A. There are no constraints in terms of vehicle access to KNB.

4.3.2 Airport Road Circulation & Vehicle Parking

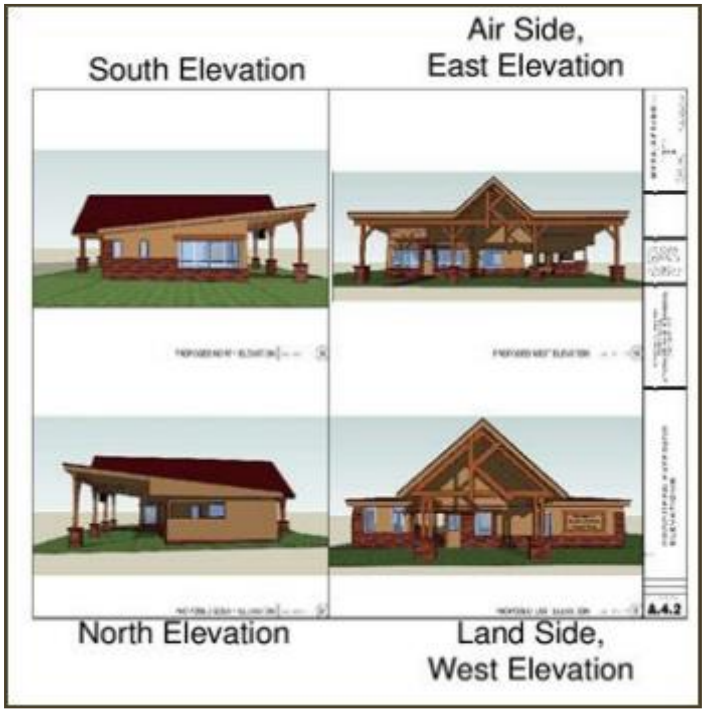
There is a two-lane paved road from Route 89A to the Airport terminal and parking lot. There is a prominent sign for the Airport at the intersection with Route 89A. There is paved and unpaved vehicle parking available and sufficient to meet demand. The existing access road and vehicle parking are adequate to meet existing and future demand. The vehicle parking lot will be upgraded and expanded as part of the new terminal building construction, and will provide more than adequate capacity for future demand.

4.3.3 Airport Terminal Building

The City of Kanab is in the process of constructing a new terminal building, directly behind the existing building, which will be removed. The new terminal project started before the current airport master plan, and is not FAA funded. The new building will be constructed in 2016 (**Figure 4-13** and **Figure 4-14**). The new terminal building was designed by Mesa Design, and the contract was awarded to the construction company, RBI Contracting (Ray Brothers) in March 2016; the City plans to have the building operational by October 2016.

The new terminal building will be one story, approximately 2,186 square feet in size, located east of the existing terminal building (i.e. further away from Runway 1-19). The paved parking lot will also be expanded. After the new building is constructed, the existing terminal building will be demolished and removed.

FIGURE 4-13 – FUTURE KNB TERMINAL BUILDING



Source: City of Kanab website

FIGURE 4-14 – FUTURE KNB TERMINAL BUILDING LOCATION

Source: Jviation

4.3.4 Utilities

The existing utilities—electricity, water, sewer, cable—meet existing and future demand. It is anticipated that the developers of future hangars at KNB will extend the utilities needed to their respective hangars.

4.3.5 Automated Weather Observation System (AWOS)

The AWOS-III is situated on the Airport, approximately 620 feet south of the Kane County Emergency Building. It is situated approximately 520 feet east of the runway centerline, and approximately 2,200 feet north of the Runway 1 threshold. The antennas are clear of the 14 CFR Part 77 imaginary surfaces, and it meets the current siting criteria specified for AWOS stations (Source: FAA Order 6560.20B). The AWOS was installed in 2003, and requires increasing maintenance. This Master Plan does not recommend moving the AWOS.

In general, any structure should be at least 500 feet from the AWOS sensors, and any new structures erected closer than 500 feet to the AWOS may interfere with the sensors. The height of the sensors relative to the top of the structure have a bearing on the extent of possible interference. The existing 100LL avgas storage tank is approximately 373 feet from the AWOS, but does not interfere with the sensors.

If new structures were constructed within 500 feet of the AWOS, and if it interfered with the sensors, the AWOS could be relocated. The previous Airport Master Plan had recommended it be relocated to the west of Runway 1-19. The AWOS could be relocated if it were replaced with an Airport Surface Observation System (ASOS). Installation of an ASOS could allow the FAA and National Weather Service (NWS) to develop terminal aerodrome forecasts (TAF) for KNB, which would provide operational benefits to pilots, particularly those operating under 14 CFR Part 135.

4.4 Non-Aeronautical Development

All non-aeronautical development on airports encumbered by FAA grant assurances, including KNB, must be approved by the FAA prior to the initiation of the non-aeronautical development. FAA approval to use land for non-aeronautical purposes is not included in an approval of an Airport Layout Plan (ALP). Approval for non-aeronautical uses "requires a separate approval from the FAA regional airports division."

All non-aeronautical activities such as restaurants and other terminal concessions, ground transportation, and car rentals, are excluded from the requirement for separate approval. FAA Order 5190.6B, *Airport Compliance Manual*, states that airport sponsors must "Use specific lands approved by the FAA for non-aeronautical use to generate revenue to support the airport's aviation needs."

The FAA Order also states: "In order for any surplus real or personal property to be transferred (for non-aeronautical use), the FAA must determine that it (i.e. the transfer to non-aeronautical use) is essential, suitable, or desirable for the development, improvement, operation, or maintenance of a public airport. This includes real property needed to develop sources of revenue from non-aeronautical commercial businesses at a public airport."

As a result, FAA must approve the designation of property on an airport as surplus for aeronautical purposes before the sponsor can allow non-aeronautical development. In addition, the sponsor must ensure that all non-aeronautical development will be fully compatible with airport operations and aircraft activity, and in compliance with appropriate FAA requirements.

4.4.1 Reasons for Non-Aeronautical Development

The primary reason for an airport sponsor to allow non-aeronautical development on an airport is to generate revenue. The revenue generated must be dedicated to the airport in terms of operations and maintenance (O&M) and/or capital investments in aeronautical facilities. Revenue generated on an airport by non-aeronautical tenants/uses cannot be used for items such as municipal police, fire, or public works. An airport may reimburse other departments and services only for the cost of the services provided directly to the airport. In addition, it is anticipated that all non-aeronautical development will be privately funded, although the city may participate in extending utility lines, if required.

In order to permit non-aeronautical development, property on the airport must be designated by the airport sponsor and the FAA as surplus for aeronautical purposes. In order to be designated as surplus it must be shown that the property will not be needed to accommodate any aeronautical uses beyond the end of the 20-year planning period. There are approximately 12.5 acres of property identified in the terminal area, adjacent to Route 89A, that could be reserved for non-aeronautical, commercial development. The remaining property is more than adequate to meet aviation demand beyond the 20-year planning period. Assuming a land lease rate of .20 cents per square foot per year, for example, 12.5 acres could generate approximately $108,000 annually. All non-aeronautical development must be fully compatible with airport operations and aircraft activity, and must be in full compliance with pertinent FAA standards and requirements.

4.4.2 FAA Policy Regarding Non-Aeronautical Development

FAA's grant assurances require airport sponsors to maintain their control and authority over the airport, including assuring that all development on an airport is fully compatible with airport and aircraft operations. **Appendix 4-B** provides draft provisions dealing with non-aeronautical tenants on an airport. Such provisions are not directly applicable to non-aeronautical activities such as a restaurant and/or rental car agencies situated in the terminal building, for example. They are applicable to commercial, light industrial, or other stand-alone non-aeronautical uses on and in the vicinity of an airport.

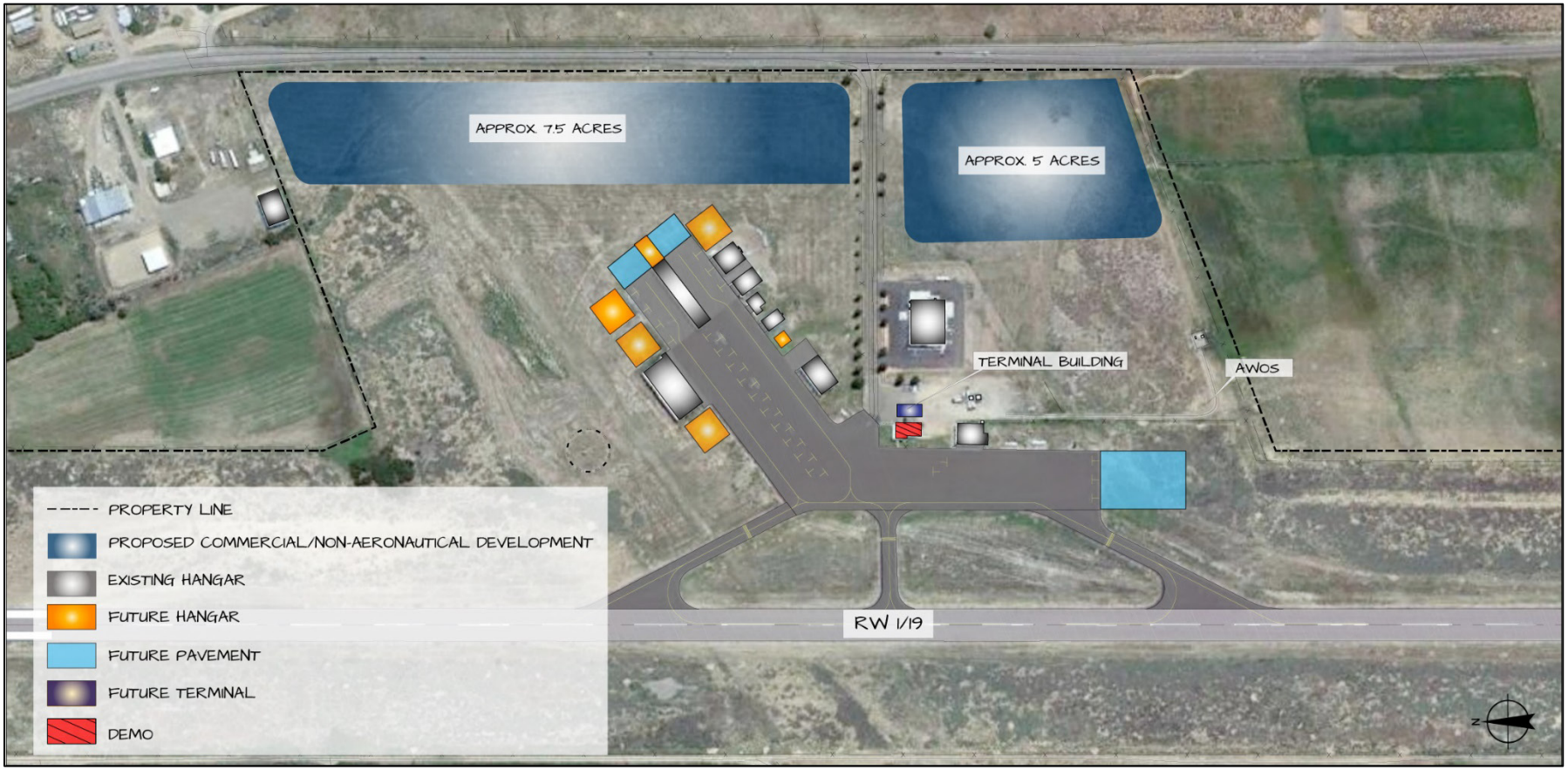
4.4.3 Recommendations for Kanab Municipal Airport

The City of Kanab and the FAA should designate approximately 12.5 acres of property in the terminal area (**Figure 4-15**) as surplus for aeronautical purposes (i.e. it can be used for non-aeronautical purposes).

The City should ensure that any non-aeronautical development be fully compatible with airport and aircraft operations, as well as the pertinent FAA grant assurances. **Appendix 4-B** presents sample lease provisions for non-aeronautical tenants describing compatibility with airport and aircraft operations.

In addition, no structures should be constructed within 500 feet of the AWOS unit. If it is relocated to the west of Runway 1-19, additional hangar and non-aeronautical development may occur south of the Kane County Emergency Building.

FIGURE 4-15 – AREAS RESERVED FOR NON-AERONAUTICAL DEVELOPMENT



Source: Jviation

4.5 Summary of Recommendations

- Maintain current Airport Reference Code (ARC) B-II within 20-year planning period, with ultimate goal of achieving C-II ARC.
- Maintain Runway 1-19 at 6,193 feet by 75 feet and runway design code (B-II-5000).
- Insufficient justification to install approach light system to Runway 1. GPS instrument approach visibility minimums (1 mile) adequate based on traffic levels and prevailing visual meteorological conditions. Pursue the development of a LPV approach on Runway 1 to provide vertical guidance.
- Construct full length parallel taxiway to C-II standards.
- Utilize space adjacent to existing hangars for future hangar development, as demand warrants. Future hangar development will be privately funded, on as-needed basis.
- Snow equipment removal building size based on eligible equipment.
- Study the feasibility of a PAPI on Runway 19 and coordinate with the FAA.
- Designate approximately 12.5 acres of the airport terminal area as surplus for aviation-related purposes, to be made available for future non-aeronautical development. All non-aeronautical development must be fully compatible with aircraft and airport operations.
- FAA install remote communications outlet (RCO) for pilots to talk with Los Angeles Center ATC; prepare terminal weather forecasts for KNB; and lower radar coverage by Los Angeles Center in the vicinity of KNB, if feasible.

Portions of the Runway 1 and 19 runway protection zones (RPZ) extend off of airport property. The City of Kanab should coordinate with FAA to determine the most appropriate measures to remove or mitigate incompatible land uses if/when the runway is extended and/or RPZ dimensions increase. The City should aim acquire the property of those portions of the RPZs situated off airport, or "take all possible measures to protect against and remove or mitigate incompatible land uses."

APPENDIX 4-A

Demand-Capacity Tables

TABLE 4-6 – DEMAND – CAPACITY ANALYSIS

Existing Operational Capacity	Existing & Future Demand (operations)
Annual service volume = 230,000 ops	3,200 ops / 4,500 ops
Peak hour visual (VFR) = 98 ops	4 ops
Peak hour instrument (IFR) = 59 ops	2 ops
Current Based aircraft = 20 Transient A/C Parking Peak Hour: 5 aircraft Conventional Hangar storage capacity = 20 aircraft T-Hangar Capacity = 10 aircraft Tie-down Apron (approximately 11,000 S.Y.) = 26 positions Transient parking positions = 8 (Beech King Air 200)	Future Based Aircraft = 29 Total parking/storage capacity = 56 aircraft

Miscellaneous	
Existing Facilities/Capacity	**Future Facilities**
Runway Wind Coverage	Exceeds 95% crosswind coverage – no new runway needed.
Utilities: Water, Sewer, Electricity, Phone, Cable	Yes - all connected to airport
Aviation Fuel: – 100LL Avgas - 10,000 gals. above ground storage w/ self-serve pump – JetA - mobile fuelers	Maintain 100LL avgas storage tank Install 10,000 gal. storage tank with self-serve pump
Pavement Condition: – Tie-down & Transient Apron – Runway 1-19	Pavement Condition: – Very good – Fair
Public Paved Road Access Vehicle Parking: – # Spaces paved 10 +/- – # Spaces unpaved 10 +/-	Yes (Route 89A & airport entrance road. Both are two-lane, paved, airport signs) – Peak hour 5 vehicles (paved) – Peak hour 2 vehicles (unpaved)
Instrument Approach Procedures: – Rwy 1 – Rwy 19	– GPS Non-Precision (LNAV) 569' & 1 mile. Recommend FAA publish LPV Rwy 1 approach w/lower MDA. if feasible. Approach slope=34:1 – Existing and Future Visual. Approach slope=20:1
Airfield Lighting: – Rwy 1-19 Medium Intensity Lights – Rwy 1 - REIL & PAPI – Rwy 19 – No REIL or PAPI – Rwy 1 Approach Light System (ALS)	 – Maintain MIRLs – Maintain REIL & PAPI – Install REIL & PAPI – Not required
Communications: – Unicom/CTAF – AWOS-III – Los Angeles Center	 – 122.8 – 133.175 (Ph: 435-644-2267) – 124.2

TABLE 4-7 – FAA DESIGN CRITERIA & EXISTING CONDITIONS

FAA Design Standards	Existing & Future Facilities
FAA Airport Reference Code (ARC) = B-II	FAA ARC = B-II
Critical Design Aircraft:	Beech King Air 200; Cessna Citation Mustang/CJ-1/CJ-2/CJ-3; Embraer Phenom 100/300
Runway 1-19 6,193' x 75' * Accelerate/stop distances shown at max. gross weight, 5,000' elev. @ 25^{0}C, zero wind. Source: Business & Commercial Aviation. Note: Runway 1-19 can accommodate mid & large corporate jets (Falcon 2000, Gulfstream G-450, Hawker 800, Canadair Challenger 300, Embraer Legacy 600) at reduced takeoff weights.	**Accelerate/Stop Takeoff Distance Required *** – Beech King AirC90 4,779' – Beech King Air 200GT 4,859' – Embraer Phenom 300 5,114' – Cessna CJ-2 5,180' – Cessna CJ-3 4,750' – Cessna CJ-4 5,021' **FAA Runway Length Requirements (AC 150/ 5325-4B)** – Airplanes <12,500 pounds 100% fleet = 6,300' – Aircraft >12,500 pounds <60,000 pounds (75% fleet @ 60% useful load) = 6,200'
– Runway 1-19 Design Code = B-II-5000 – Rwy Width = 75'	– Rwy 1-19 = B-II-5000 – Rwy Width = 75'
Runway weight bearing capacity	Single Wheel = 12,500 pounds
Runway lights & markings	– Medium Intensity runway lights (MIRLs) – Non-precision markings – Rwy 1 – REILs & PAPI
Taxiway – Runway Separation = NA	Taxiway – Runway Separation = NA
Runway 1-19 Object Free Area = 300'L x 500'W	Runway 1-19 Object Free Area = 300'L x 500'W
Runway 1-19 Safety Free Area = 300L' x 150'W	Runway 1-19 Safety Free Area = 300'L x 150'W

Sources:
FAA AC 150/5300-13A, Airport Design
FAA AC 150/5325-4B, Runway Length Requirements for Airport Design
FAA Airport/Facility Directory (AFD); Form 5010
Business & Commercial Aviation, Planning & Purchasing Handbook, May 2014