C. Capacity Analysis and Facility Requirements

Master Plan

Nephi

Municipal Airport

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INTRODUCTION. The capacity of an airfield is primarily a function of the major aircraft operating surfaces that compose the facility and the configuration of those surfaces (runways and taxiways). However, it is also related to, and considered in conjunction with, wind coverage, airspace utilization, and the availability and type of navigational aids. Capacity refers to the number of aircraft operations that a facility can accommodate on either an hourly or yearly basis. Based upon the existing and projected operations levels at Nephi Municipal Airport, the operational capacity of the facility will not be a factor in this Master Plan. Facility requirements are analyzed to determine those facilities needed to meet the forecast demand and aircraft fleet, provided they are consistent with the established role and goals of the Airport. Evaluation procedures will focus on the Airport's appropriate Airport Reference Code (ARC), dimensional criteria, runway length, pavement strength, instrument approach capability, and layout of aircraft storage facilities.

Airport Role

The current role of Nephi Municipal Airport is to serve the general aviation needs of the community by providing many aviation-related services, including: business-related flying, recreational flying, flight training, air charters, air ambulance, hangar leasing and sales, and aerial surveillance, along with other aviation–related activities. Additionally, the Bureau of Land Management (BLM) operates a temporary Single-Engine Air Tanker (SEAT) firefighting base at the Airport. The management of Nephi Municipal Airport correlates directly with its designated role, which influences both Capital Improvements Programming and revenue generation opportunities. Therefore, all facility requirement and planning recommendations should reflect these general guiding principles explained in this chapter.

Knowledge of the types of aircraft currently using, and those aircraft expected to use, Nephi Municipal Airport provides information concerning the Airport Reference Code (ARC). FAA Advisory Circular 150/5300-13, *Airport Design*, provides guidelines for this determination. The ARC designation is based on the "Design Aircraft" that is judged the most critical aircraft using, or projected to use, the Airport. The ARC relates aircraft operational and physical characteristics to design criteria that are applied to various airport components. Under this methodology, safety margins are provided in the physical design of airport facilities.

There are two components in determining the ARC for an airport. The first component, depicted by a capital letter, is the Aircraft Approach Category and relates to aircraft approach speed. The second component, depicted by a Roman numeral, is the Airplane Design Group and relates to airplane wingspan.

Currently, a large number of multi-engine turboprop aircraft utilize the Airport on a regular basis; however, this traffic is supplemented by fair amounts of single-engine piston and turboprop aircraft, multi-engine piston, and jet aircraft that are operated primarily for business purposes. In addition, the Airport accommodates a significant number of military helicopter operations, due to training activity associated with the Utah Army National Guard facilities based at South Valley Regional Airport, located approximately 80 miles to the north.

Airfield Layout

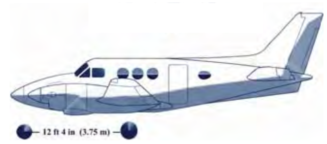
The layout or "design" of the airfield refers to the arrangement and interaction of the airfield components, which include the runway system, taxiways, and ramp entrances. As previously described, Nephi Municipal Airport operates around a single runway (i.e., Runway 17/35[1]). This runway is served by a full-length east side parallel taxiway system (i.e., Taxiway "A") and three connector taxiways.

All of the Airport's existing landside facilities are located on the east side of the runway, approximately midfield. These include FBO facilities and individual executive/corporate hangars. Each of these facilities is located to make efficient use of the existing apron/taxiway system. As mentioned previously, the BLM operates a temporary SEAT firefighting base at the Airport and utilizes the FBO facilities on an as-needed basis during the summer fire season (i.e., June – September).

[1] The runway was previously oriented at 16/34, and updated to 17/35 in 2010.

Runway 17/35. All of the general aviation fixed-wing aircraft, including single-engine and multi-engine piston aircraft, turboprop aircraft, and jets utilize this runway. Past planning documents identified that the future "Design Aircraft" for this runway would be represented by an ARC C-II business jet (i.e., the Cessna Citation X), and these are the design standards that were utilized in the recent reconstruction of the Airport. The Cessna Citation X is a business jet aircraft that has an approach speed of 129 knots and a wingspan of 63.9 feet. The following illustration, entitled *REPRESENTATIVE AIRCRAFT BY AIRPORT REFERENCE CODE (ARC) DESIGNATION*, has been included for reference and comparison.

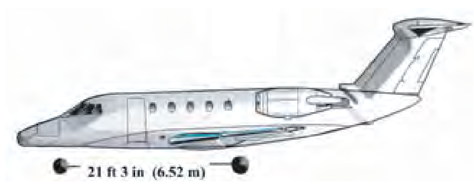
ARC A-I
Single-Engine Aircraft - 2 to 6 Seats
Beech Bonanza
deHaviland DHC-2 Beaver
Cessna-150



ARC B-I
Twin-Piston Aircraft - 4 to 10 Seats
Beech King Air B100
Piper 31-310 Navajo
Beech Baron 58

ARC B-I
Very Light Jet/Small Cabin 4-6 Seats
Citation Mustang

ARC B-II
Twin-Turboprop Aircraft - 6 to 10 seats
Includes most commercial turboprop aircraft.
Beech Super King Air B200
Cessna 441 Conquest
Grumman Gulfstream I



ARC B-II
Twin-Turboprop/Business Jet/Small Cabin Aircraft
6 to 12 Seats
Cessna Citation II/III/VII
Dassault Falcon 50
Dassault Falcon 900

ARC C-II
Business Jet/Medium Cabin - 8 to 19 Seats
Cessna Citation X
Gulfstream III
Bombardier CL-604 Challenger

Note: Representative Aircraft proportional, but not to scale.

Figure C1 Representative Aircraft by Airport Reference Code (ARC) Designation

Source: Aircraft Ground Service Guide, 2002 and Aircraft Manufacturer.

According to current operational estimates, approximately 2,537 turboprop operations were conducted at the Airport in 2008, including approximately 151 ARC B-II and C-II business jets. FAA guidance defines a "substantial use threshold" on federally funded projects for critical design airplanes (i.e., the design aircraft) to have at least 500 or more annual itinerant operations at the Airport. For Nephi Municipal Airport, it is estimated that this operational activity could increase to approximately 5,632 and 727 operations, respectively, by the end of the planning period, which would support the specified ARC C-II design criteria. For future planning purposes, the ARC C-II runway and taxiway dimensional design criteria will be maintained and protected to accommodate future operational increases by these higher performance aircraft.

Environmental Conditions

Climatological conditions specific to the location of an airport not only influence the layout of the airfield but also affect the utilization of the runway system. Variations in the weather, resulting in limited cloud ceilings and reduced visibility, typically lower airfield capacity, while changes in wind direction and velocity typically dictate runway usage and influence runway capacity.

Wind Coverage. Surface wind conditions (i.e., direction and speed) generally determine the desired alignment and configuration of the runway system. Runways that are not oriented to take advantage of prevailing winds will restrict the capacity of the Airport. Wind conditions affect all airplanes in varying degrees; however, the ability to land and takeoff in crosswind conditions varies according to pilot proficiency and aircraft type. Generally, the smaller the aircraft, the more it is affected by the crosswind component.

According to FAA AC 150/5300-13, *Airport Design*, for ARC-A-I and B-I airports, a crosswind component of 10.5-knots is considered maximum. For ARC A-II and B-II airports, a crosswind component of 13-knots is considered maximum. For ARC A-III, B-III, and C-I through D-III airports, a crosswind component of 16-knots is considered maximum. Finally, for ARC A-IV through D-VI airports, a crosswind component of 20-knots is considered maximum. In consideration of the Airport's ARC C-II classification, these standards specify that a maximum crosswind of 16-knots be considered in the analysis. For informational purposes, the 20-knot crosswind component is also included. In addition, it is known that the Airport will also continue to serve small single and twin-engine aircraft for which the 10.5-knot and 13-knot crosswind component is considered maximum; therefore, four crosswind components are important to be analyzed for this airport (the 10.5-knot, the 13-knot, the 16-knot, and the 20-knot).
Wind data to construct the all weather wind rose is typically obtained from a local weather reporting station, often located on the airport site, and is collected and maintained by the National Climatic Data Center (NCDC). As identified in the *Inventory of Existing Conditions* chapter, the existing

Automated Weather Observing System (AWOS) at the Airport was only recently installed (late 2008), and, therefore, insufficient wind and weather data is available for analysis[2] from this source. Wind data, both velocity and direction, to construct the all weather wind rose for Nephi Municipal Airport were obtained for the period October 1995-May 2000 from observations taken at Nephi Municipal Airport using portable wind instruments installed and monitored by the UDOT Division of Aeronautics. There were approximately 37,398 observations available for analysis during this five-year period. The allowable crosswind component is dependent upon the ARC for the type of aircraft that utilize the Airport on a regular basis. Accurate wind velocity and direction at Nephi Municipal Airport were obtained, and an all weather wind rose was constructed using the 10.5, 13, 16, and 20-knot crosswind components, and is presented in the following illustration entitled *ALL WEATHER WIND ROSE*.

The desirable wind coverage for an airport is 95%. This means that the runway should be oriented so that the maximum crosswind component is not exceeded more than 5% of the time. The following table, entitled *ALL WEATHER WIND COVERAGE SUMMARY*, quantifies the wind coverage offered by the Airport's existing runway system, including the coverage for each runway end.

Table C1
ALL WEATHER WIND COVERAGE SUMMARY

	Wind Coverage Provided Under All Weather Conditions			
	10.5-Knot	**13-Knot**	**16-Knot**	**20-Knot**
Runway 17/35	98.13%	99.03%	99.75%	99.96%
Runway 17	83.27%	84.07%	84.70%	84.89%
Runway 35	71.15%	71.54%	71.94%	72.03%

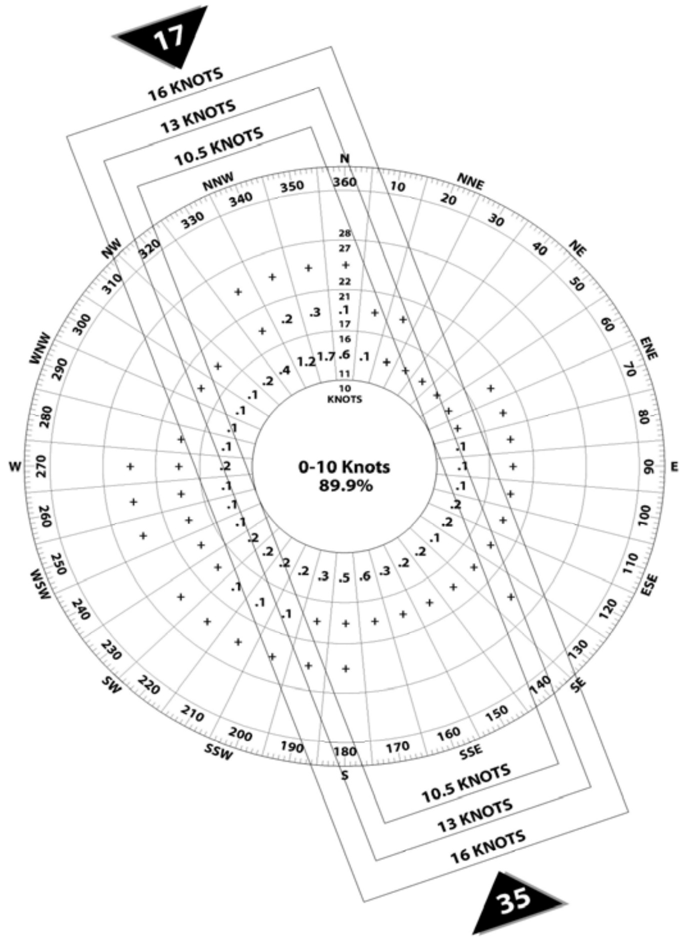
Source: Wind analysis tabulation provided by Barnard Dunkelberg & Company utilizing the FAA Airport Design Software supplied with AC 150/5300-13.

Note: Wind data obtained by the Utah Department of Transportation, Division of Aeronautics, from Nephi Municipal Airport, Nephi, Utah. Period of Record – October 1995-May 2000. Total Observations: 37,398.

[2] The FAA prefers to have a period of record of 10 years of hourly data from which to conduct the wind analysis. However, in extreme conditions a minimum of 1-year of on-site wind observations can be augmented with personal observations and interviews.

Figure C2
ALL WEATHER WIND ROSE: 16-, 13-, & 10.5-KNOT CROSSWIND COMPONENTS

Source: Utah Department of Transportation, Division of Aeronautics. Data obtained from Nephi Municipal Airport, Nephi, Utah. Period of Record – October 1995-May 2000. Total Observations: 37,398.



Based on this all weather wind analysis for Nephi Municipal Airport, utilizing the FAA Airport Design Software supplied with AC 150/5300-13, the existing single runway configuration provides excellent wind coverage (i.e., in excess of 98%) for each of the crosswind components. Therefore, no additional runways are required from a *wind coverage* standpoint.

At present, the Airport does not offer an instrument approach procedure; however, the Utah Department of Transportation (UDOT), Division of Aeronautics, is undertaking a study to determine the feasibility of establishing a GPS-based instrument approach procedure at the facility. With the absence of site-specific Instrument Flight Rules (IFR) wind and weather data for Nephi to evaluate the effectiveness of this future approach, the IFR wind data for a neighboring airport to the north (i.e., South Valley Regional Airport) was analyzed for comparison. It was concluded that, due to similarities in the all weather wind coverage of the two airports, which is dictated by the valley locations and surrounding mountainous terrain, similar wind patterns would also be present during IFR weather conditions. This would result in Runway 35 offering the better wind coverage during IFR weather conditions for each crosswind component, and this information has been incorporated into the formulation of various future, airside development alternatives and the ultimate development recommendations for the Airport. In addition, there is considerable anecdotal evidence that the percentage of VFR flying weather is greater in the Nephi area as compared to Provo, located to the north, due the localized effects of fog that can be attributed to the proximity of Utah Lake.

Facility Requirements

In efforts to identify future demand at the Airport for those facilities required to adequately serve future needs, it is necessary to translate the forecast aviation activity into specific types and quantities. This section addresses the actual physical facilities and/or improvements to existing facilities needed to safely and efficiently accommodate the projected demand placed on the Airport. This section consists of two separate analyses: those requirements dealing with *airside* facilities and those dealing with *landside* facilities.

Airside Facilities

The analysis of airfield requirements focuses on the determination of needed facilities and spatial considerations related to the actual operation of aircraft on the Airport. This evaluation includes the delineation of airfield dimensional criteria, the establishment of design parameters for the runway and taxiway system, and an identification of airfield instrumentation and lighting needs.

Airfield Dimensional Criteria

The types of aircraft that currently operate at Nephi Municipal Airport, and those that are projected to utilize the facility in the future, have an impact on the planning and design of airport facilities. This knowledge assists in the selection of FAA specified design standards for the Airport, which includes runway/taxiway dimensional requirements and runway length; and, runway, taxiway, and apron strength. These standards apply to the "Design Aircraft", which either currently utilize the Airport or which are projected to utilize the Airport in the future. As previously mentioned, the Cessna Citation X is currently identified as the Airport's future "Design Aircraft" for Runway 17/35 with regard to physical dimensions (i.e., 63.9-foot wingspan) and an approach speed of 129 knots. Therefore, based upon the Airport's forecast operational activity, as presented in the *Aviation Activity Demand Forecast* chapter of this document, it is recommended that the ARC C-II dimensional requirements be maintained to accommodate future increases by these higher performance aircraft.

According to FAA Advisory Circular 150/5300-13, *Airport Design*, the first step in defining an airport's design geometry is to determine its Airport Reference Code (ARC). A runway/airport that accommodates aircraft with an approach speed as great as 121 knots, but less than 141 knots, and with wingspans as great as 49 feet, but less than 79 feet, should be designed utilizing ARC C-II dimensional criteria. In addition, the Airport's existing design standards have been reviewed to ensure FAA compliance.

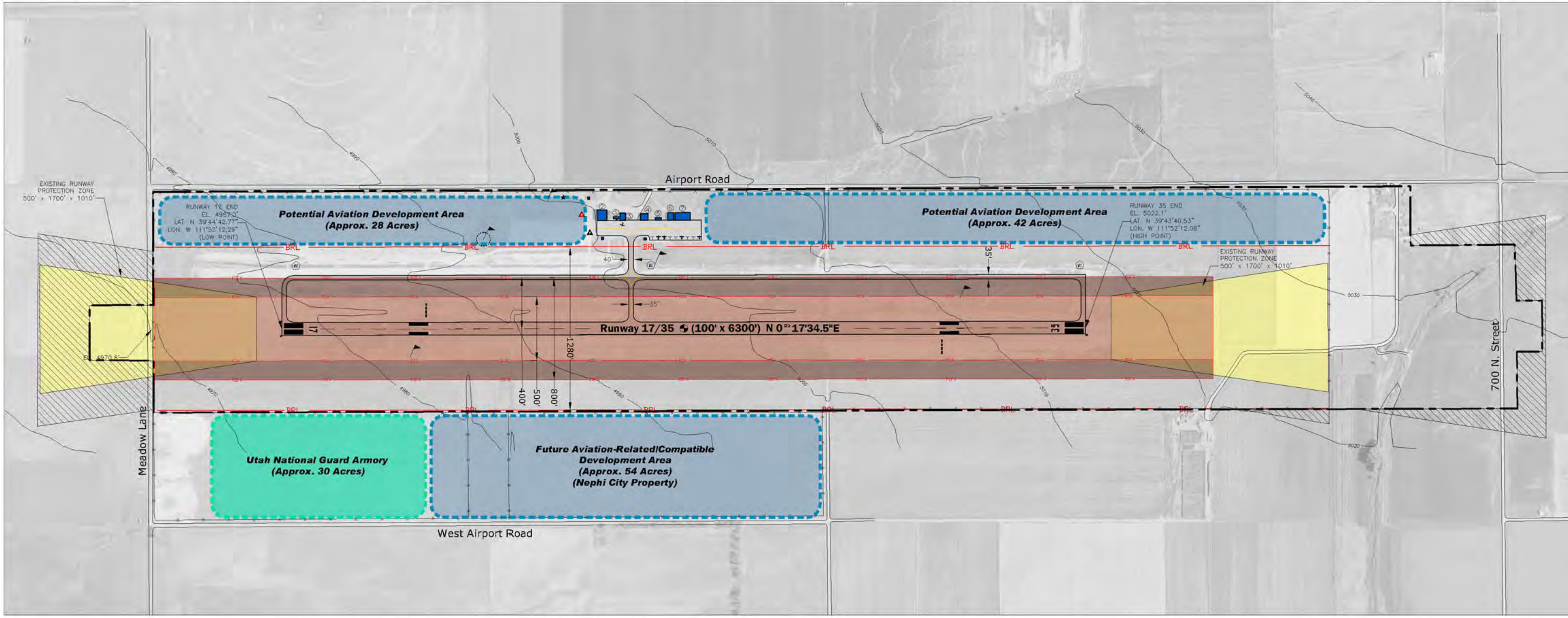
The previously referenced aircraft is the *Design Aircraft* to establish dimensional criteria only (i.e., runway/taxiway separation, runway/taxiway safety areas, aircraft parking separation, etc.) and is not intended to be used solely to dictate runway length requirements, although, it may be used in determining runway length. The following table, entitled *ARC C-II DIMENSIONAL STANDARDS FOR RUNWAY 17/35 (In Feet)*, presents a side-by-side comparison of the existing criteria dimensions with the dimensional design requirements that apply to Nephi Municipal Airport, for the specified ARC, depending on the two optional approach visibility minimum designations that are possible in the future.

Table C2
ARC C-II DIMENSIONAL STANDARDS FOR RUNWAY 17/35 (In Feet)

Item	**Existing Dimension** [1]	**ARC C-II with Visual & ≥ ¾ Mile Visibility Minimums**	**ARC C-II with < ¾ Mile Visibility Minimums**
Runway			
Runway Width	100	100	100
Runway Centerline to Parallel Taxiway Centerline (Taxiway "A")	400	300	400
Runway Centerline to Aircraft Parking	785	400	500
Runway Centerline to Holdline	250	250	250
Runway Safety Area Width	500[2]	500[2]	500[2]
Runway Safety Area Length beyond Runway End			
Runway 17	1,000	1,000	1,000
Runway 35	1,000	1,000	1,000
Runway Safety Area Length Prior to Landing Threshold			
Runway 17	600	600	600
Runway 35	600	600	600
Runway Object Free Area Width	800	800	800
Runway Object Free Area Length Beyond RW End			
Runway 17	1,000	1,000	1,000
Runway 35	1,000	1,000	1,000
Runway Obstacle Free Zone Width	400	400	400
Runway Obstacle Free Zone Length Beyond Runway End	200	200	200
Taxiway			
Taxiway Width	50	35	35
Taxiway Safety Area Width	79	79	79
Taxiway Object Free Area Width	131	131	131
Taxilane Object Free Area Width	115	115	115
Threshold Siting Surface Criteria Runway 17 & 35 [3]	---	Criteria Met	(Criteria Compliance To be Determined)

Source: AC 150/5300-13, Federal Aviation Administration.

Notes: Existing dimensions delineated in **bold** text reflect potential non-standard criteria.
[1] The Airport currently does not have any published instrument approach procedures.
[2] An RSA width of 400 feet is permissible to comply with ARC C-II dimensional standards.
[3] Applies existing Runway Type 3 criteria for Appendix 2, AC 150/5300-13 Change 14.



DESIGN AIRCRAFT

CESSNA CITATION X
ARC C-II
WEIGHT
EMPTY : 20,200 LBS.
TAKEOFF : 34,500 LBS.
LANDING : 31,000 LBS.

BUILDING LEGEND

NO.	DESCRIPTION	TOP ELEVATION
1	PILOTS LOUNGE	---
2	CORPORATE STORAGE/MAINTENANCE HANGAR	5025.9'
3	FBO MAINTENANCE HANGAR	5024.0'
4	HANGAR	5020.2'
5	HANGAR	---
6	HANGAR	---
7	HANGAR	---

DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT PROPERTY LINE		
AIRPORT SECURITY FENCE	X	
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
AVIGATION EASEMENT		
BUILDING RESTRICTION LINE	BRL	
RUNWAY SAFETY AREA	RSA	
RUNWAY OBJECT FREE AREA	ROFA	
FUEL STORAGE AREA		
AIRPORT BEACON		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		
AIRPORT REFERENCE POINT (ARP)		

Figure C3 Existing ARC-II Dimensional Criteria Map (Visual and Not Lower than 3/4-Mile Visibility Minimums

As can be noted in the above table and delineated in the previous illustration, Runway 17/35 at Nephi Municipal Airport is in compliance with all of the FAA specified ARC C-II design standards for both, the not lower than and the lower than ¾-mile visibility minimums. In addition, various development alternatives have been evaluated in the following *Alternatives Analysis* chapter of this document to identify/confirm the preferred recommendations needed to comply with potential future design criteria.

Objects Affecting Navigable Airspace. The criteria contained in Federal Aviation Regulations (FAR) Part 77, *Objects Affecting Navigable Airspace*, apply to existing and proposed man-made objects and/or objects of natural growth and terrain (i.e., obstructions). These guidelines define the critical areas in the vicinity of airports, which should be kept free of obstructions. Secondary areas may contain obstructions if they are determined to be non-hazardous by an aeronautical study and/or if they are marked and lighted as specified in the aeronautical study determination. Airfield navigational aids, as well as lighting and visual aids, by nature of their location, may constitute obstructions. However, these objects do not violate FAR Part 77 requirements, as they are essential to the operation of the Airport.

The current approach surfaces for each end of Runway 17/35 at Nephi Municipal Airport are classified as visual. The dimensions for a visual approach surface measure 500 feet at its inner width and 1,500 feet at its outer width and extend for a distance of 5,000 feet at an approach slope of 20:1. There is no published obstruction chart for the Airport, but according to the current Airport Master Record/Form 5010-1 for the facility, there are no *close-in* obstructions identified, and the 50:1 obstruction clearance slope is noted as clear off each end of the runway. It should be noted that any new potential obstructions identified through the preparation of this Master Plan will be evaluated in consideration of the ultimate planned approaches and associated FAR Part 77 surfaces. These obstructions will also include possible recommendations for disposition.

Runways

In consideration of the forecasts of future aviation activity, the adequacy of the runway system must be analyzed from several perspectives. These include runway orientation and airfield capacity, which were analyzed in the previous section, as well as runway length, pavement strength, and runway visibility, which will be evaluated in the following text. The analysis of these various aspects pertaining to the runway system will provide a basis for recommendations of future improvements.

Runway Orientation. Nephi Municipal Airport currently operates with one runway, Runway 17/35, which provides a generally north-south orientation. As presented in a previous section, the existing runway configuration provides excellent wind coverage (i.e., in excess of 98%) for the 10.5-knot crosswind component. Therefore, no additional runways need to be evaluated from a *wind coverage* standpoint.

Runway Length. The determination of runway length requirements for Nephi Municipal Airport is based on several factors. These include:

- **Airport elevation;**
- **Mean maximum daily temperature of the hottest month;**
- **Runway gradient;**
- **Critical aircraft type expected to use the Airport; and,**
- **Stage length of the longest nonstop trip destination.**

Therefore, the calculations for runway length requirements at Nephi Municipal Airport are premised on the following airport/runway specific data:

- **Airport Elevation at 5,005 feet AMSL;**
- **Mean Normal Maximum Temperature (NMT) at 93.0 degrees Fahrenheit; and,**
- **Maximum difference in runway centerline elevation at 35 feet.**

Generally, for design purposes, runway length requirements at general aviation airports are premised upon a combination of the most demanding aircraft within the general aviation fleet that are operating, or are projected to operate, at the Airport in the future. For the proposed Nephi Municipal Airport, this fleet would likely be dominated by small aircraft weighing 12,500 pounds maximum takeoff weight (MTOW) or less, with a few larger aircraft (i.e., the business jets that operate at the Airport) weighing less than 60,000 pounds MTOW. It should also be noted that pilots are able to adjust the operating weight of their aircraft based upon the specific payload requirements of their flight and the runway length available for takeoff. The specific performance capabilities of general aviation aircraft are documented through the aircraft certification process and defined by Federal Aviation Regulation (FAR) Part 23, *Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes*. Thus, both takeoff and landing procedures conducted at an airport must comply with these regulations to ensure the safety of these operations.

Runway length requirements for this study were derived from the guidance provided by AC 150/5325-4B, entitled *Runway Length Requirements for Airport Design*, which specifies the use of the 5-Step procedure for determining runway length requirements for purposes of airport design. It should also be noted that, for small aircraft having maximum certificated takeoff weights (MTOW) of 12,500 pounds or less or larger aircraft with an MTOW of more than 12,500 pounds (up to and including 60,000 pounds), use of the runway length curves specified by AC 150/5325-4B generates runway lengths equivalent to those generated using the computer-based FAA Airport Design Software, supplied in conjunction with Advisory Circular 150/5300-13, *Airport Design.* Using this software, four values, which include the airport elevation Above Mean Sea Level (AMSL), the Mean Normal Maximum Temperature (NMT) in degrees Fahrenheit, length of haul in miles, and the maximum difference in runway elevation at the centerline, are entered into the program. As can be seen in the following table, entitled *RUNWAY 17/35 TAKEOFF LENGTH REQUIREMENTS*, there are four runway lengths shown for small aircraft type runways. Each of these provides the required length to accommodate a certain type of aircraft that will utilize the runway. The specified lengths for Nephi range from 4,680 to 6,440 feet in length.

For comparison purposes, there are also four different lengths given for large aircraft (i.e., aircraft weighing between 12,500 pounds and 60,000 pounds). The specified large aircraft runway lengths pertain to those general aviation aircraft, generally jet-powered, of 60,000 pounds or less maximum certificated takeoff weight. The runway length requirements for large aircraft range from 7,130 to 11,350 feet for Nephi Municipal Airport.

Table C3
RUNWAY 17/35 TAKEOFF LENGTH REQUIREMENTS

Runway Requirements	Runway Takeoff Length (Feet) Dry Pavement	Runway Takeoff Length (Feet) Wet Pavement
Existing Condition		
Runway 17/35[1]	6,298	6,298
Small Aircraft with less than 10 seats [2]		
75% of Small Aircraft	4,680	4,680
95% of Small Aircraft	6,260	6,260
100% of Small Aircraft	6,440	6,440
Small Aircraft with more than 10 seats	6,440	6,440
Large Aircraft less than 60,000 pounds		
75% of fleet/60% useful load	7,130	7,130
100% of fleet/60% useful load	11,350	11,350
75% of fleet/90% useful load	8,950	8,950
100% of fleet/90% useful load	11,350	11,350
Large Aircraft more than 60,000 pounds	6,770	6,770

Source: FAA Advisory Circular, 150-5300-13, *Airport Design.*

Notes: Runway lengths based on 5,005 feet AMSL, 93.0˚F NMT, and maximum difference in runway end of 35 feet.
[1] The majority of aircraft operating at the Airport are contained within the Small Aircraft Category (i.e., ≤12,500 lbs.).

The runway length requirements shown in Table C3 are dependent upon meeting the operational requirements of a certain percentage of the fleet at a certain percentage of the useful load, (i.e., 75% of the fleet at 60% useful load). The useful load of an aircraft is defined as the difference between the maximum allowable structural gross weight and the operating weight empty. In other words, it is the load, composed of passengers, fuel, and cargo, that can be carried by the aircraft.

Runway Length Findings. Following an examination of the various runway lengths provided in the previous table, it can be noted that the existing runway length of 6,298 feet can accommodate between 95 and 100% of the Small Aircraft Fleet. In consideration of larger aircraft (i.e., aircraft weighing between 12,500 pounds and 60,000 pounds) it should be noted that this family of aircraft could be restricted at times from operating at the Airport at the longer stage lengths. As noted in the *1995 ALP Update*, the preparers and City Staff also recognized the importance of preserving the ability to construct additional runway length for the future condition to accommodate the operation of a more demanding aircraft.

Therefore, this current Master Plan will continue to illustrate a potential future runway extension of approximately 900 feet to the south, for an overall length of 7,200 feet, in consideration of the forecast increase in larger business jet aircraft operations through the planning period. From Table C3, it can also be noted that a proposed 7,200-foot runway could accommodate approximately 75% of the fleet (i.e., aircraft weighing between 12,500 pounds and 60,000 pounds) at a 60% useful load.

Runway Pavement Strength. As identified in the *Inventory of Existing Conditions* chapter of this document, Runway 17/35 is rated in good condition[3], with an existing gross weight bearing capacity of 21,000 pounds single wheel main landing gear configuration, and 30,000 pounds dual wheel main landing gear configuration. In addition, all existing airfield pavement should be tested periodically to properly ascertain existing pavement strengths.

Runway Line-of-Sight and Gradient. According to existing runway line-of-sight standards, any two points located five feet above the runway centerline must be mutually visible for the entire length of the runway. If the runway has a full-length parallel taxiway, the visibility requirement is reduced to a distance of one-half the runway length. Nephi Municipal Airport complies with the runway line-of-sight standards for the entire length of the runway.

Threshold Siting and Departure Surface Clearance Criteria. According to Appendix 2 information presented in AC 150/5300-13, "the standard shape, dimensions, and slope of the surface used for locating a

[3] A runway overlay project was completed at the Airport in 2003.

threshold are dependent upon the type of aircraft operations currently conducted or forecast, the landing visibility minimums desired, and the types of instrumentation available or planned for that runway end." For Runway 17/35 at Nephi Municipal Airport, the following threshold siting and departure surfaces were identified for evaluation:

- **Runway Type "3" [Approach end of runways expected to serve large airplanes (visual day/night); or instrument approach minimums ≥ 1 statute mile, day only].**
- **Runway Type "11" (Departure runway ends for all instrument operations)[4].**

For reference purposes, the Runway Type "3" threshold siting surface applies a 20:1 slope ratio for the obstruction clearance surface (OCS). The Runway Type "11" departure surface applies a 40:1 slope ratio for the OCS. When a penetration to a specified threshold siting surface is identified, one or more of the following steps must be implemented:

1. **The obstacle is removed or lowered to comply with specified criteria.**
2. **The runway landing threshold is displaced to comply with specified criteria.**
3. **The glide path angle (GPA) and/or threshold crossing height (TCH) is/are modified to comply with specified criteria.**
4. **Instrument approach visibility minimums are raised to comply with specified criteria.**

When a penetration to a specified departure surface is identified, one or more of the following steps must be implemented:

5. **The obstacle is removed, lowered, or relocated to comply with specified criteria. Also, within 6,000 feet of the origin of the departure surface, obstacles can be evaluated for compliance using the formula E+(0.025 x D), where E = DER elevation and D = Distance from OCS origin to object in feet.**
6. **Reduce the Takeoff Distance Available (TODA) to comply with specified criteria, resulting in a shorter operational runway length for takeoffs.**
7. **Modify standard instrument departure procedures by raising departure minimums and/or increasing specified climb gradients.**

The results of the threshold siting and departure surface screening analysis are presented in the

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[4] The departure surface criteria only apply to runways with instrument operations. With only existing visual approaches to Runway 17/35, an evaluation of these surfaces has been provided for future reference purposes.

following table, entitled *RUNWAY 17/35 APPROACH/DEPARTURE CRITERIA*. As can be noted from the table, each end of Runway 17/35 was assessed independently for both threshold siting and departure surface terrain and tree penetrations.

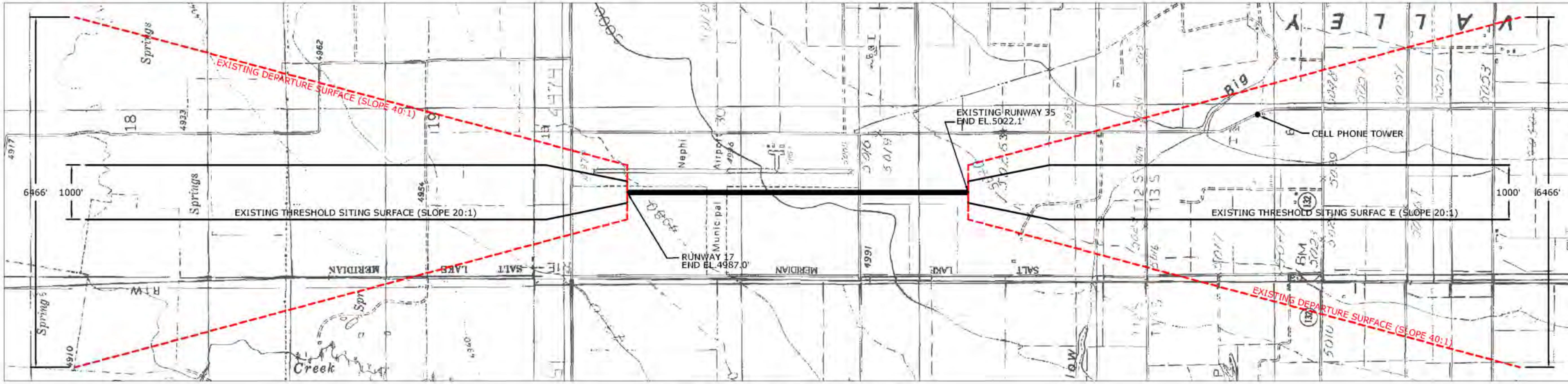
Table C4
RUNWAY 17/35 THRESHOLD SITING APPROACH & DEPARTURE SURFACE CRITERIA

Airport Site Alternatives	Threshold Siting Criteria Clearance (Terrain/Vegetation [1])	Departure Surface Clearance (Terrain/Vegetation[1])
Runway 17	Yes/Yes[2]	Yes/Yes[2]
Runway 35	Yes/Yes[2]	Yes/Yes[2]

Source: Threshold siting and departure surface evaluation prepared by BARNARD DUNKELBERG & COMPANY.

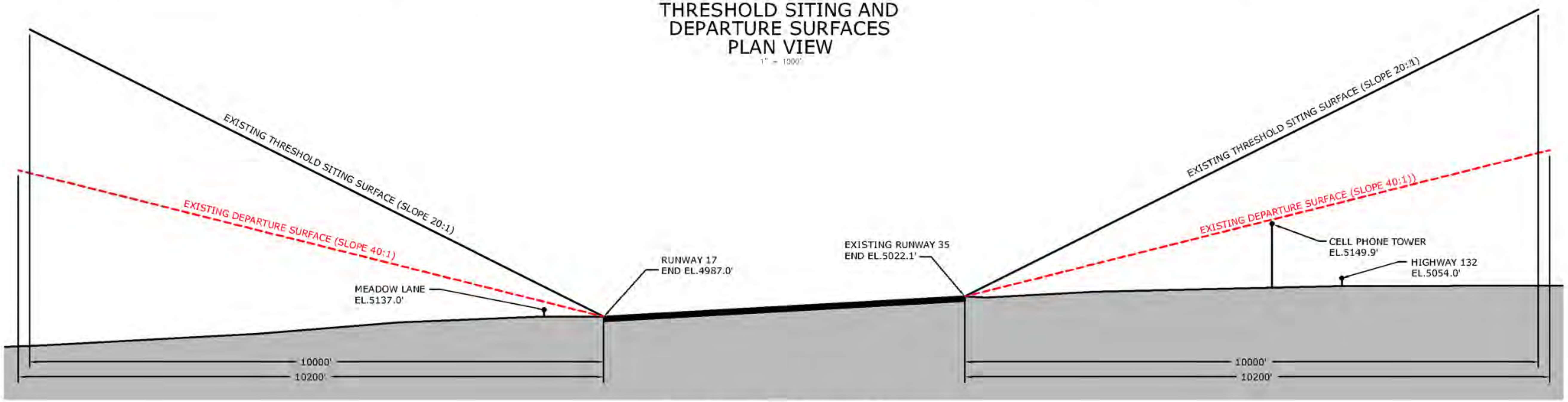
Notes:
(1) Assumes 100-foot tree heights.
(2) Clearances to be confirmed with detailed obstruction survey.

The following illustration, entitled *RUNWAY 17/35 THRESHOLD SITING & DEPARTURE SURFACES,* presents an application of the specified Airport Design screening criteria (both threshold siting and departure surfaces) for Runway 17/35. As can be noted, the existing visual approach threshold siting surfaces are clear, as well as the potential departure surfaces in consideration of the implementation of future instrument operations at the Airport.



THRESHOLD SITING AND DEPARTURE SURFACES PLAN VIEW

1" = 1000'



THRESHOLD SITING AND DEPARTURE SURFACES PROFILE VIEW

HORIZONTALLY 1" = 1,000'
VERTICALLY 1" = 100'

Figure C4 Runway 17/35 Threshold Siting and Departure Surfaces

Taxiways

Taxiways are constructed primarily to enable the movement of aircraft between the various functional areas on the Airport and the runway system. Some taxiways are necessary simply to provide access between aircraft parking aprons and runways, whereas, other taxiways become necessary to provide more efficient and safer use of the airfield. As described earlier, the taxiway system at Nephi Municipal Airport meets the required standards.

Taxiway improvements that were considered for development at Nephi Municipal Airport include the future extension of access taxiways and/or taxilanes to serve additional hangar development and expansion areas on the Airport. In addition, the existing access taxiway system has been evaluated with respect to existing and future departure ends of the runway. Every effort should be made to physically separate the airport roadways from taxiways, to prohibit unauthorized vehicles from accessing the Airport's aircraft movement areas, which will assist in the safety and security monitoring of the Airport.

Instrumentation and Lighting

Electronic landing aids, airport lighting, and weather/airspace services were detailed in the *Inventory of Existing Conditions* chapter of this Master Plan. As mentioned previously, the Airport currently offers only visual approaches and is not equipped with an instrument approach procedure. However, in 2002 the UDOT Division of Aeronautics contracted with Airspace Safety Analysis Corporation (ASAC) to examine the feasibility of establishing satellite-based Area Navigation (RNAV) instrument approach procedures (IAPs) at Nephi Municipal Airport. A copy of this 2002 Study is presented for reference in Appendix Four of this document. The IAP design standards that were used in this study utilized FAA criteria from Order 8260.3B Change 19, *United States Standard for Terminal Instrument Procedures*, which were applied to the original runway location that was later reconstructed approximately 400 feet to the west of the original runway. Based upon these criteria and the previous runway location, it was determined that a straight-in procedure could likely be developed to Runway 17. However, due to existing terrain constraints, which would affect final course alignment, only a circling procedure would be available for development to Runway 35.

At present, GPS approaches are anticipated to be the FAA's standard approach technology. With GPS, the cost of establishing new or improved instrument approaches at many airports can be significantly reduced. However, one of the tasks of this Master Plan is to examine the feasibility of implementing a precision approach at Nephi Municipal Airport in consideration of the *latest* FAA Order guidance for constructing and evaluating IAPs. This feasibility analysis is also based on several other factors, which include obstructions and terrain in the area, NAVAIDS, existing airspace requirements, and Air

Traffic Control Regulations and procedures. Each of these factors will be evaluated in greater detail during the final design/development of the procedure.

Instrument Approach Screening Criteria

The instrument approach screening criteria that have been utilized for this evaluation are contained in FAA Order 8260.54A, entitled *The United States Standard for Area Navigation (RNAV)* for procedures offering Localizer Performance with Vertical Guidance (LPV) minimums, and FAA Advisory Circular (AC) 150/5300-13, entitled *Airport Design*. The approach evaluation for each runway end proceeded using the following three (3) criteria evaluations:

- **Glidepath Qualification Surface (GQS) Evaluation**
- **Final & Straight Missed Approach Segment Obstacle Assessment**
- **Turning Missed Approach Segment Obstacle Assessment**

In order to create an accurate representation of the obstacle assessment surfaces, three-dimensional wireframes were created in AutoCAD, which allowed for exact XYZ coordinates and measurements of the specified FAA evaluation criteria. These wireframes were then imported to Google SketchUp and placed on geodetically- referenced aerial photography from Google Earth. The wireframes were then traced to create transparent surface models that could be overlayed on Google Earth topography and imagery to show approximate terrain penetrations. It should also be noted that Google Earth topography is based on USGS Digital Elevation Models (DEMs), which have an elevation accuracy of +/- 10 to 30 meters. As with the previous 2002 Feasibility Study, an adverse assumption estimate of 100 feet was applied for the height of trees for the evaluation of tree penetrations to the obstacle evaluation surfaces.

Glidepath Qualification Surface (GQS) Evaluation

As specified in FAA Order 8260.54A, “the GQS extends from the runway threshold along the runway centerline extended to the decision altitude (DA) point. It limits the height of obstructions between the DA and runway threshold (RWT). When obstructions exceed the height of the GQS, an approach procedure with positive vertical guidance (ILS, MLS, TLS, LPV, Baro-VNAV, etc.) is not authorized”. Therefore, the first level of instrument approach screening for this analysis applied the GQS criteria using a 3.0° glide path angle. It should be noted that this GQS analysis focused primarily on existing terrain for penetrations, and there could be additional obstacle penetrations due to existing tree cover that was not visible on the existing aerial photograph.

In consideration of the existing runway end elevations at Nephi, the results of the GQS screening analysis are presented in the following table, entitled *RUNWAY 17/35 GLIDEPATH QUALIFICATION SURFACE (GQS) EVALUATION* and delineated on the following illustration, entitled *RUNWAY 17/35 GLIDEPATH QUALIFICATION SURFACE (GQS).*

Table C5
RUNWAY 17/35 GLIDEPATH QUALIFICATION SURFACE (GQS) EVALUATION

Airport/Runway	3.0° Glide Path Angle GQS Clearance	Advance Runway to Initial TERPs Analysis
Nephi Municipal Airport Runway 17 (4,987.0' MSL)	yes	yes
Nephi Municipal Airport Runway 35 (5,022.1' MSL)	yes	yes

Source: GQS evaluation prepared by BARNARD DUNKELBERG & COMPANY.

200' DA - 3.0° Glidepath

200' DA - 3.0° Glidepath

Figure C5 Runway 17/35 Glidepath Qualification Surface (GQS)

Source: Google Earth, 2009 Tele Atlas, State of Utah

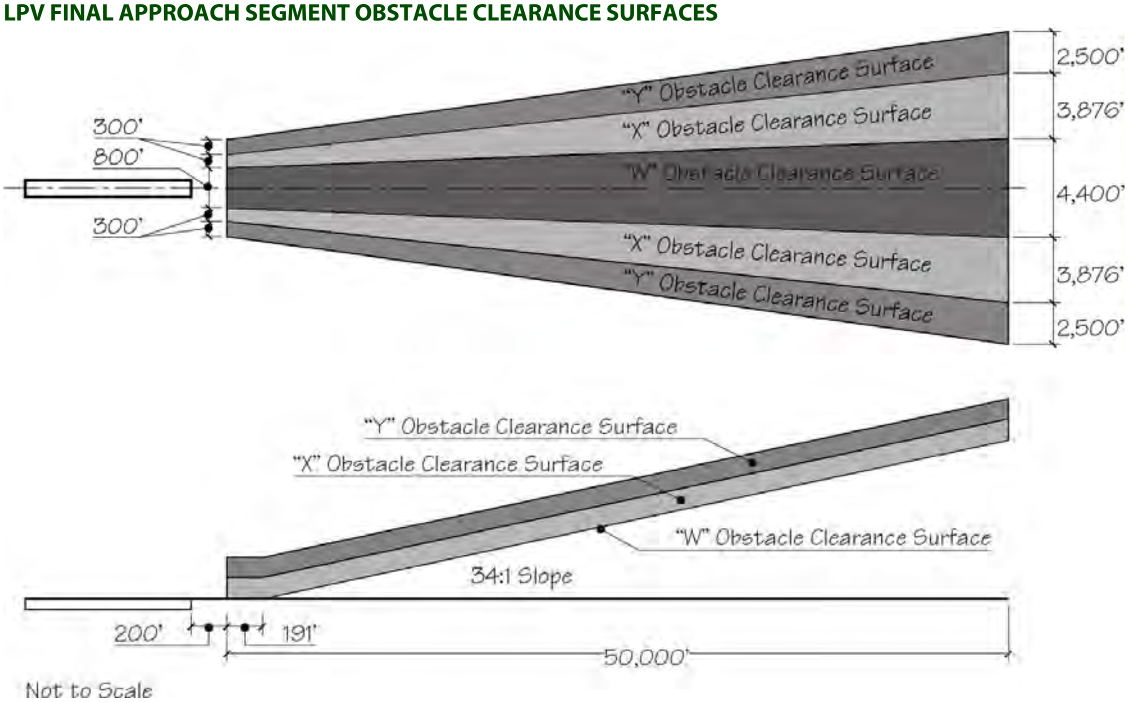
Final & Straight Missed Approach Segment Obstacle Assessment

The second level of screening for this instrument approach capability assessment includes the application of criteria for the LPV Final Approach Segment (FAS)/Obstruction Evaluation Area and Straight-Out Missed Approach Segment (MAS)/Obstruction Evaluation Area. The details of these criteria are also specified in FAA Order 8260.54A.

For the LPV Final Approach Segment, the primary area obstacle clearance surface (OCS) consists of the W and X surfaces, with the Y surface being an early missed approach transitional surface. The W surface slopes longitudinally at a slope ratio of 34:1 along the final approach track and is level perpendicular to the track. The X and Y surfaces slope upward from the edge of the W surface perpendicular to the final approach track at a slope ratio of 4:1 and 7:1, respectively. Obstacles located in the X and Y surfaces are adjusted in height to account for perpendicular surface rise and evaluated under the W surface. The following figure illustrates the FAS OCS in plan and profile view as used in this evaluation.

Figure C6

LPV FINAL APPROACH SEGMENT OBSTACLE CLEARANCE SURFACES



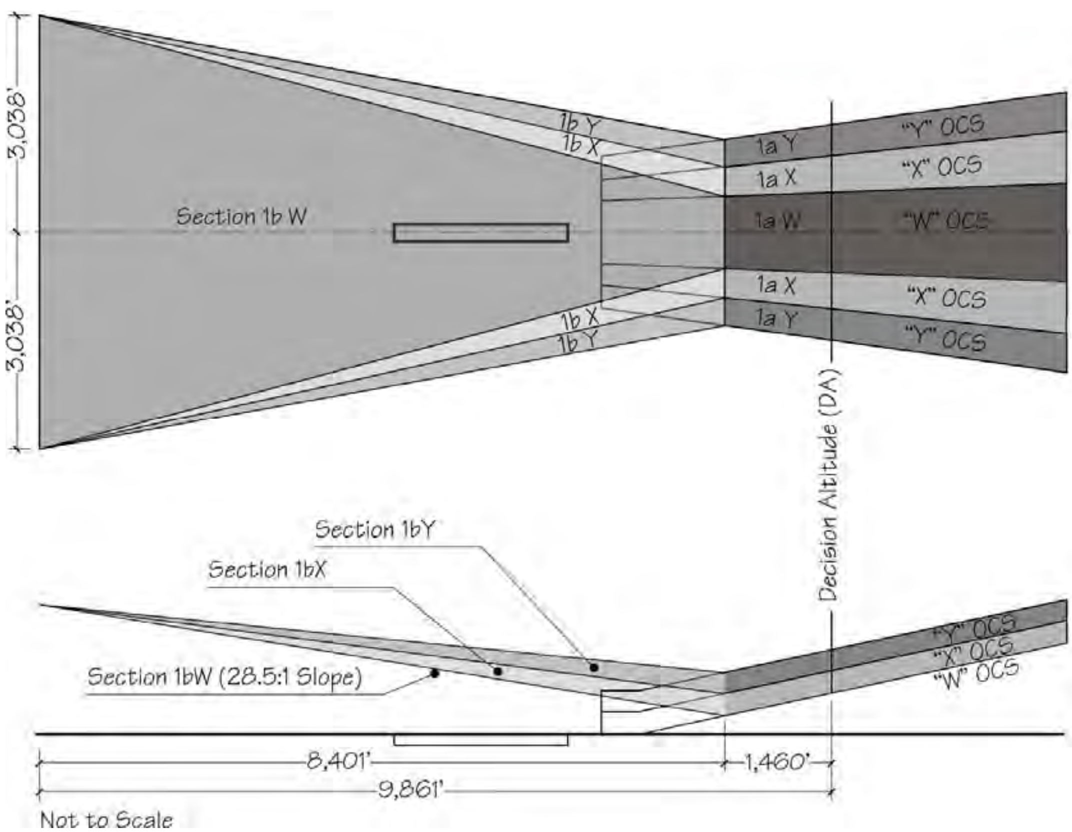
Source: Diagram prepared by BARNARD DUNKELBERG & COMPANY using information obtained from FAA Order 8260.54A, *The United States Standard for Area Navigation (RNAV).*

In consideration of the Straight-Out MAS, Section 1a is a 1,460-foot continuation of the Final Approach Segment beginning at the DA point. Section 1b begins at the end of Section 1a, extends for a distance of approximately 8,400 feet and rises at a slope ratio of 28.5:1.

The following illustration, entitled *LPV SECTION 1 MISSED APPROACH SEGMENT OBSTACLE CLEARANCE SURFACES*, provides the specifics of the Section 1 MAS OCS.

Figure C7

LPV SECTION 1 MISSED APPROACH SEGMENT OBSTACLE CLEARANCE SURFACES

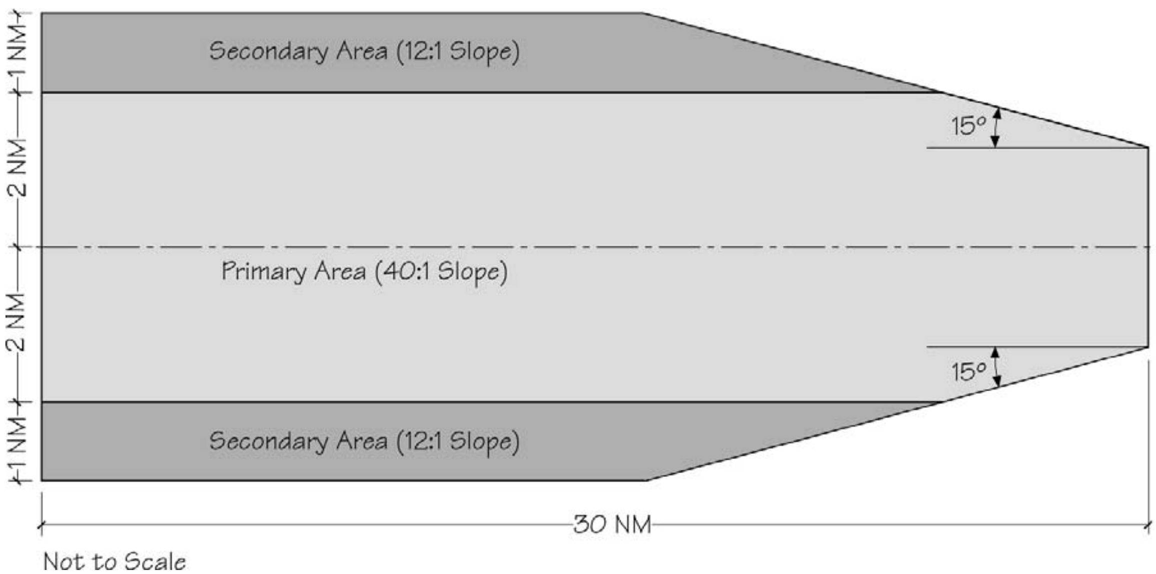


Source: Diagram prepared by BARNARD DUNKELBERG & COMPANY using information obtained from FAA Order 8260.54A, *The United States Standard for Area Navigation (RNAV).*

Section 2 of the MAS begins at the end of 1b, utilizing a splay of 15°, and extends with a slope ratio of 40:1 until reaching a full width of 6 NMs within a length of up to 30 NMs. Figure C8, entitled

LPV SECTION 2 MISSED APPROACH SEGMENT OBSTACLE CLEARANCE SURFACES, illustrates the details of the Section 2 Missed Approach Segment OCS.

Figure C8
LPV SECTION 2 MISSED APPROACH SEGMENT OBSTACLE CLEARANCE SURFACES



Source: Diagram prepared by BARNARD DUNKELBERG & COMPANY using information obtained from FAA Order 8260.54A, *The United States Standard for Area Navigation (RNAV).*

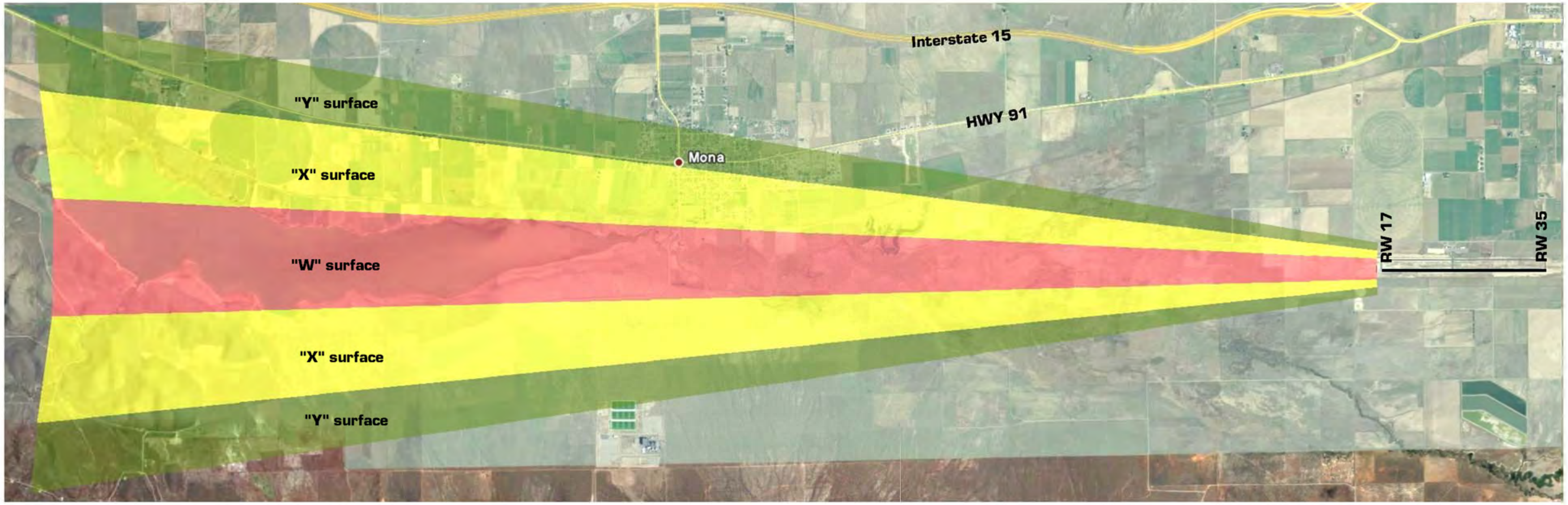
The results of the final approach and straight missed approach segment screening analysis are presented in the following table, entitled *FINAL & STRAIGHT MISSED APPROACH SEGMENT OBSTACLE ASSESSMENT (200-FOOT DA)*. It should also be noted that the evaluation of a 200-foot DA was selected based upon the scope of services for this project to evaluate a future precision instrument approach procedure at the Airport. As can be determined from the table, each end of Runway 17/35 was carried forward for this second level of screening and assessed independently for both the final approach and missed approach segments. The final approach segment for each runway end, as well as the Runway 35 straight missed approach segment, appears to be clear and free of terrain/tree obstructions. However, there are some potential terrain/tree obstructions identified within the *Section 2 Transitional Surface* of the Runway 17 straight missed approach surface.

Table C6
FINAL & STRAIGHT MISSED APPROACH SEGMENT OBSTACLE ASSESSMENT (200-FOOT DA)

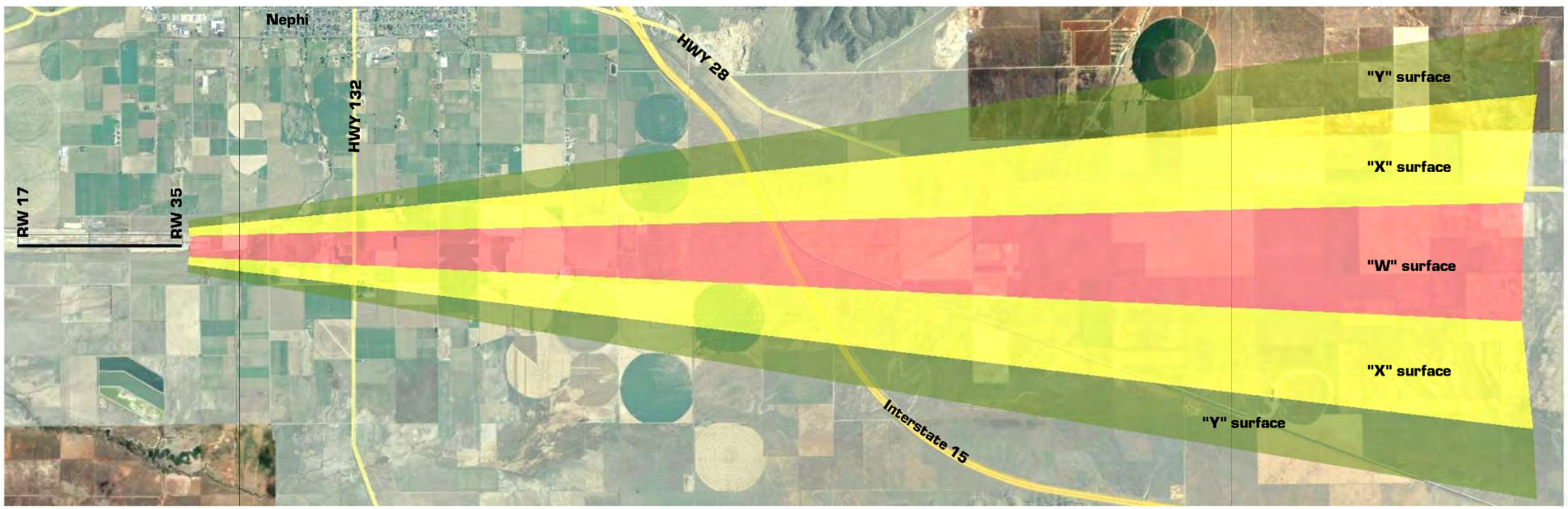
Airport/Runway	Final Approach Segment Obstacle Assessment (Terrain/Vegetation[1] Area)	Straight Missed Approach Segment Obstacle Assessment (Terrain/Vegetation[1] Area)
Nephi Municipal Airport Runway 17	none/none	yes/yes
Nephi Municipal Airport Runway 35	none/none	none/none

Source: Final & straight-out missed approach evaluation prepared by BARNARD DUNKELBERG & COMPANY.
[1] Assumes 100-foot tree heights.

The following illustrations, entitled *RUNWAY 17/35 FINAL APPROACH SEGMENT OBSTACLE CLEARANCE SURFACES (OCS)* and *RUNWAY 17/35 STRAIGHT MISSED APPROACH SEGMENT OBSTACLE CLEARANCE SURFACES (OCS),* present an application of the specified OCS screening criteria for Nephi Municipal Airport.



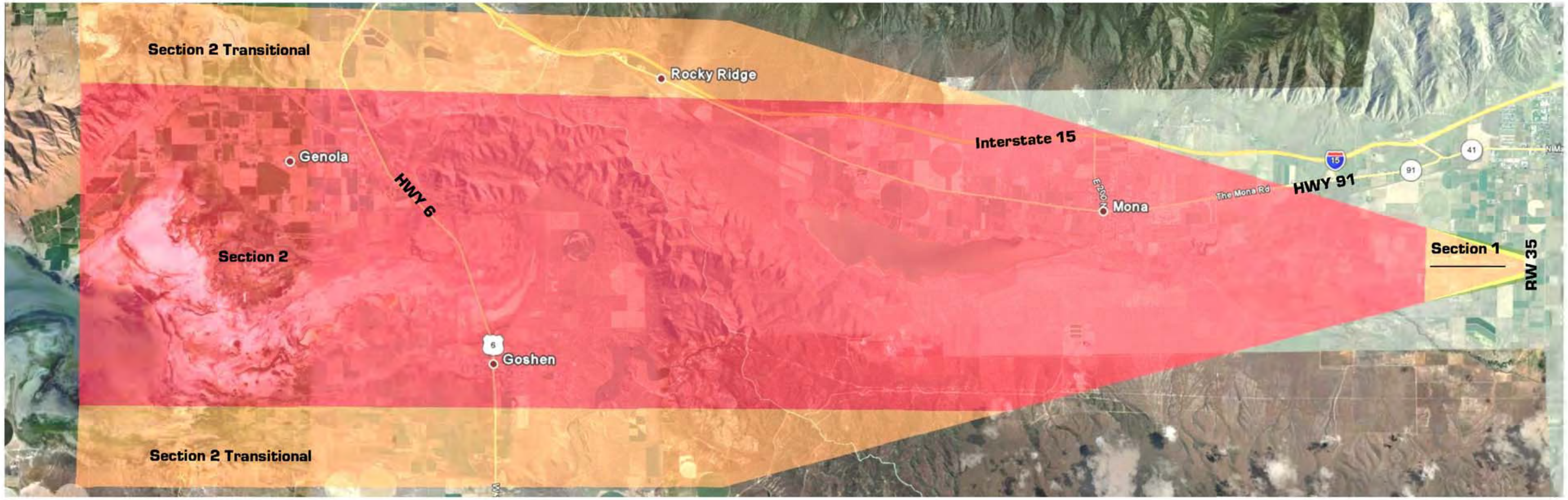
RW 17 Final Approach
Obstacle Clearance Surfaces (WXY)



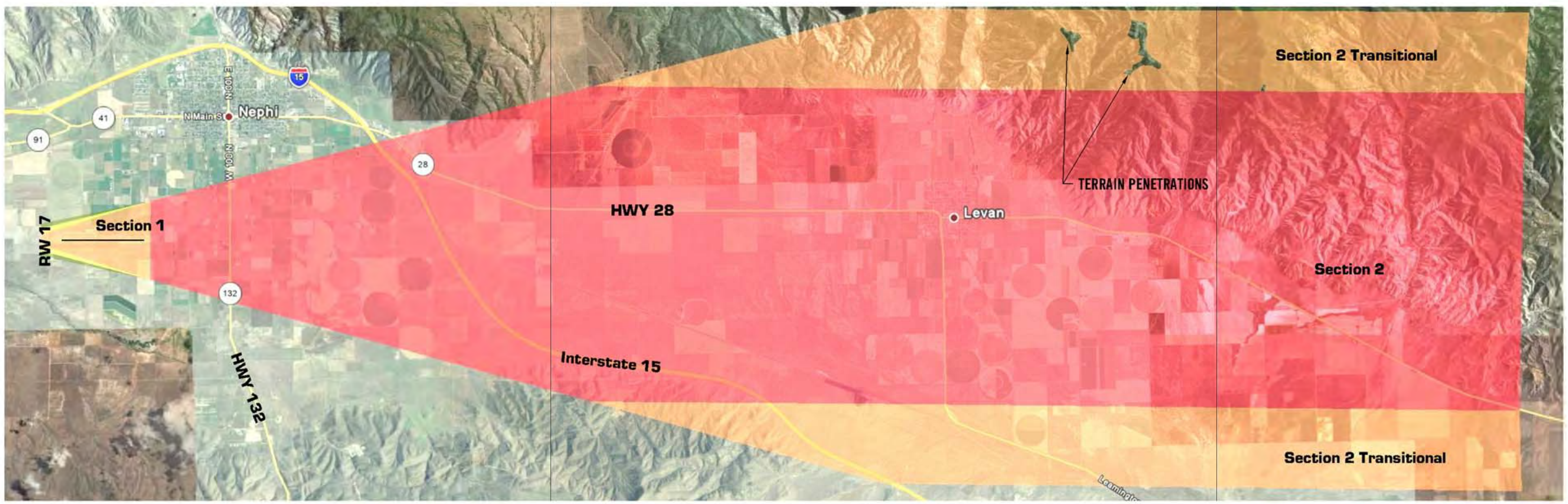
RW 35 Final Approach
Obstacle Clearance Surfaces (WXY)

Figure C9 **Runway 17/35 Final Approach Segment Obstacle Clearance Surfaces ((OCS)**

Source: Google Earth, 2009 Tele Atlas, State of Utah



RW 35 Straight-out
Missed Approach
Obstacle Clearance Surfaces (Section 1 & 2)



RW 17 Straight-out
Missed Approach
Obstacle Clearance Surfaces (Section 1 & 2)

Figure C10 Runway 17/35 Straight: Missed Approach Segment Obstacle Clearamce Surfaces (OCS)

Source: Google Earth, 2009 TeleAtlas, State of Utah

Turning Missed Approach Segment Obstacle Assessment

For Runway 17, which has been carried forward to this third level of screening for the instrument approach capability assessment, it has been shown that a straight-out missed approach would not likely be feasible due to the positioning of the mountainous terrain located southeast of the Airport. Therefore, the criteria for a turning missed approach procedure, which is also specified in FAA Order 8260.54A, are available for evaluation in conjunction with the specified approach procedures. In consideration of the Turning Missed Approach Segment, the Section 1a and 1b areas are the same as those described previously for the Straight-Out Missed Approach Segment. There is an additional straight segment of Section 2, which represents the balance of the Turn Initiation Area (TIA) that must be accommodated prior to the boundary of the turning portion of Section 2, and all obstacles within Section 2 are to be evaluated with a slope ratio of 40:1.

Based upon the findings of the obstacle assessment for the straight-out missed approach procedure defined previously, and the results of the 2002 Instrument Approach Feasibility Study (see Appendix Four for reference), it was determined that a future missed approach to Runway 17 could likely be accommodated with the use of a 180° turning missed approach procedure, and thus avoid the obstructing terrain to the southeast of the Airport. In addition, it was specified in the 2002 Feasibility Study that a DA of 5,598 feet AMSL (i.e., a 611-foot height-above-threshold) would be required for the Runway 17 approach to mitigate the obstructing terrain within the turning missed approach obstacle clearance surfaces.

Instrument Approach Evaluation Findings. The initial LPV instrument approach screening indicates that there are no known obstructions within the GQS for each end of Runway 17/35; however, this fact will still need to be confirmed with a detailed obstruction survey in accordance with criteria specified in Advisory Circular 150/5300-16A, *Geodetic Control*. Subsequent screening indicates various obstructions are located within the Runway 17 missed approach surface; however, potential terrain or vegetation obstructions do not necessarily preclude establishing an LPV approach. Any trees located on or in close proximity to airport property can be removed or trimmed to mitigate the obstruction. Options available to mitigate other obstructions within the MAS OCS include one or more of the following actions:

- **Raise the glide path angle.**
- **Increase the threshold crossing height.**
- **Increase the decision altitude.**

Additionally, another option available for mitigating obstructions within Section 2 of the missed approach surface OCS is to implement a turning missed approach course (this is the procedure that was identified for possible implementation in the 2002 Instrument Approach Feasibility Study). As identified previously, a turn at altitude or turn at fix missed approach course can likely be implemented that will mitigate the existing terrain/tree obstructions. The greater the distance from the airport facility an obstruction is located, the more likely it is that a turning missed approach procedure can be used to avoid the obstruction. Therefore, it is recommended that the airspace be protected for an instrument approach procedure with vertical guidance (APV), providing ½-mile approach visibility minimums at the Airport to each runway end (both Runways 17 & 35).

According to Appendix 16 of AC 150/5300-13, an APV with these specified minimums would also require an Approach Lighting System (ALS), and, therefore, the siting requirements for a potential ALS should be protected for implementation on the Airport Layout Plan. In addition, the runway should comply with standard runway markings and standard holding position signs, provide clear obstacle free zones, and have imaginary surfaces free of obstructions. As noted in the previous section, Runway 17/35 does comply with current ARC C-II standards.

Visual Landing Aids/Lighting. Presently, the runway at Nephi Municipal Airport is equipped with Medium Intensity Runway Lights (MIRLs), with both Precision Approach Path Indicators (PAPIs) and Runway End Identifier Lights (REILs) serving each runway end. The MIRLs should be maintained in conjunction with the existing/proposed instrument approach procedures. In addition, Medium Intensity Taxiway Lights (MITLs), which are presently in place on Taxiway "A" should also be maintained.

Glide path indicator lights are a system of lights that provides visual vertical approach slope guidance to aircraft during an approach to the runway. Precision Approach Path Indicators (PAPIs) or Visual Approach Slope Indicators (VASIs) are designed for day and nighttime use during VFR (i.e., good weather) conditions. The existing Precision Approach Path Indicators (PAPIs) are recommended to be retained at each runway end.

Runway End Identifier Lights (REILs) are a system of lights that provide an approaching aircraft a rapid and positive identification of the approach end of the runway. At present, each runway end is equipped with REILs and it is recommended that the Runway 17 REILs be maintained until the need for a future Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) is confirmed, contingent upon the visibility minimums that can be achieved with the future instrument approach procedures at the Airport.

Runway Protection Zones (RPZs). The function of the Runway Protection Zone (RPZ) is to enhance the protection of people and property on the ground off the end of runways. This is achieved through airport control of the property within the RPZ area. This control can be exercised through either fee-simple ownership or the purchase of an RPZ easement. The RPZ is trapezoidal in shape and centered about the extended runway centerline. Its inner boundary begins 200 feet beyond the end of the area usable for takeoff or landing. The dimensions of the RPZ are functions of the type of aircraft that regularly operate at the Airport, in conjunction with the specified visibility minimums of the approach (if applicable).

In regards to the existing visual approaches for each runway end, and the type of aircraft the runway is currently accommodating, the existing RPZ dimensions can be maintained in consideration of the ARC C-II dimensional criteria. However, the RPZ dimensions would have to be enlarged to accommodate the implementation of instrument approach procedures offering visibility minimums lower than ¾-mile. The larger RPZ dimensions may also necessitate additional RPZ easement or property acquisition, with the required acreage being dependent upon the ultimate location of the Runway 35 threshold and the specified visibility minimums of the approach. The following table, entitled *RUNWAY PROTECTION ZONE DIMENSIONS*, lists the existing RPZ dimensions, along with the dimensional requirements for improved approach capabilities and/or more demanding approach category aircraft.

Table C7
RUNWAY PROTECTION ZONE DIMENSIONS

Item	Width at Runway End (feet)	Length (feet)	Width at Outer End (feet)	Airport Controls Entire RPZ
Existing RPZ Dimensional Requirements:				
Runway 17	500	1,700	1,010	Yes[1]
Runway 35	500	1,700	1,010	Yes
Required RPZ Dimensions for Various Visibility Minimums:				
Visual and not lower than 1-mile, Small Aircraft Only	250	1,000	450	---
Visual and not lower than 1-mile, Approach Categories A & B	500	1,000	700	---
Visual and not lower than 1-mile, Approach Categories C & D[2]	500	1,700	1,010	---
Not lower than 3/4-mile, all aircraft	1,000	1,700	1,510	---
Lower than 3/4-mile, all aircraft	1,000	2,500	1,750	---

Source: FAA Advisory Circular 150/5300-13, *Airport Design*.

Notes:
[1] Property interests include RPZ Easements.
[2] The existing RPZs as delineated on the current ALP are sized in accordance with Approach Category A & B aircraft.
--- Data not applicable.

Landside Requirements

Landside facilities are those facilities that support the airside facilities but are not actually a part of the aircraft operating surfaces. These consist of such facilities as terminal buildings, hangars, aprons, access roads, and support facilities. Following a detailed analysis of these facilities, current deficiencies can be noted in terms of accommodating both existing and future aviation needs at the Airport.

General Aviation Requirements

Aircraft based at Nephi Municipal Airport are stored in one of four areas: executive hangars, FBO storage hangars, or apron tiedowns. Currently, there are ten aircraft based at the Airport. Over the course of the 20-year planning period, the number of based aircraft is forecast to increase to 20, indicating that an increase in storage facilities to accommodate approximately ten new aircraft may be required. It is assumed that future storage spaces will reflect many of the same characteristics of current storage patterns, with the majority of the based aircraft fleet being stored in hangars. It should be noted that future storage facility projections have only been generated for the civilian aircraft category.

For the military category, preliminary planning is underway for the possible future development of a new National Guard Armory adjacent to the Airport, which could potentially require the basing of military aircraft, both helicopters and fixed wing aircraft. However, since the new Armory is in the preliminary planning phase, no estimates of based military aircraft have been developed for this master planning effort. It should also be noted that the ultimate development and operation of the Armory facility would be separate from the Airport and likely be operated as a *through-the-fence* operation.

Tiedown Storage Requirements/Based Aircraft. Aircraft tiedowns are provided for those aircraft that do not require or desire to pay the cost for hangar storage. Space calculations for these areas are based on 300 square yards of apron for each aircraft tiedown. This amount of space allows for aircraft parking and circulation between the rows of parked aircraft. Based upon existing aircraft storage practices and strong demand for new hangar facilities, it is projected that a significant number of new aircraft, as well as existing based aircraft that are currently stored on the apron, would prefer to have enclosed hangar storage. With the excess-based aircraft apron then being available for transition to use as either itinerant aircraft apron and/or possibly T-hangar facilities, it is projected that the based aircraft apron requirements will generally decline through the planning period at the Airport.

Tiedown Storage Requirements/Itinerant Aircraft. In addition to the needs of the based aircraft tiedown areas addressed in the preceding section, transient aircraft also require apron parking areas at Nephi Municipal Airport. This storage is provided in the form of transient aircraft tiedown space. In calculating the area requirements for these tiedowns, an area of 500 square yards per aircraft has been used. As previously described, it is anticipated that the forecast decreasing demand for the based aircraft apron would be available for use to accommodate a portion of the forecast increase in demand for itinerant aircraft apron and T-hangars through the planning period. The development plan for the Airport will designate adequate areas for future apron development to satisfy the additional demand.

The accompanying table shows the type of facilities and the number of units or acres needed for that facility in order to meet the forecast demand for each development phase. It is expected that most of the owners of aircraft that will be newly based at the Airport will desire some type of indoor storage facility. The actual type of hangar storage facility to accommodate based aircraft has been identified as T-hangars, executive hangars, and larger corporate and/or FBO-type hangars, although, the actual number, size, and location of the larger hangar types will depend on user needs and financial feasibility. In addition, access and perimeter roadway locations and auto parking requirements are not included in this tabulation, because the amount of land necessary for these facilities will be a function of the location of other facilities, as well as the most effective routing of roadways. The following table, entitled *GENERAL AVIATION FACILITY REQUIREMENTS, 2008-2028,* depicts the area required for general aviation landside facilities during all stages of development. This will assist in the development of detailed facility staging discussed in later chapters of this document.

Table C8
GENERAL AVIATION FACILITY REQUIREMENTS, 2008-2028

	Total Number Required (In Acres)				
Facility	**2008** (1)	**2013**	**2018**	**2023**	**2028**
Itinerant/GA Apron	0.2	0.2	0.3	0.4	0.5
Based A/C GA Apron	---	1.0	0.9	0.9	1.2
Total Apron (acres)	**0.2**	**1.2**	**1.2**	**1.3**	**1.7**
Hangar Space					
T-Hangars (no./acre)	0/0	1/0.2	1/0.2	1/0.2	1/0.2
Exec./Corp. (no./acre)	4/0.8	6/1.2	8/1.6	10/2.0	13/2.6

Source: BARNARD DUNKELBERG & COMPANY projections based on FAA AC 150/5300-13.

Potential Utah Army National Guard Armory Facility

As identified in the *Inventory* chapter, preliminary planning has been underway between the Utah National Guard and Nephi City for the possible future development of a new National Guard Armory on approximately 30 acres adjacent to the northwest boundary of the Airport. The first official steps in this process have been concluded with a property exchange between Nephi City and the Utah National Guard. In the exchange agreement that was signed in May of 2009, the Utah National Guard exchanged five acres highway frontage property in Nephi City for thirty (30) acres of property adjoining the northwest corner of airport property.

Though no development timeframe has been established, a possible development scenario could include the relocation/dispersal of some of the aviation assets (i.e., a percentage of the of AH-64 Apache and/or UH-60 Blackhawk helicopters and their associated support functions) from South Valley Regional Airport to Nephi Municipal Airport, which would provide an alternate basing/staging location for response to natural disasters and/or security threats. The new Armory facility would likely necessitate the development of hangars, operations buildings, maintenance facilities, and various support facilities. In addition, vehicular access to the Armory would be provided from the existing county road that parallels the northern boundary of the Airport.

Single-Engine Air Tanker (SEAT) Firefighting Base

Also as identified in the *Inventory* chapter, Nephi Municipal Airport is currently designated by the Bureau of Land Management as a temporary location for a SEAT firefighting base. When activated on an as-needed basis during the summer fire season (i.e., June-September), the Nephi SEAT firefighting base operation consists of two to four Air Tractor 802 tanker aircraft that are staged from the existing general aviation apron and managed from the existing office/trailer that is leased from the Airport's current Aviation Service Operator (i.e., Mt. Nebo Aviation). The tanker aircraft are refueled on the Airport from the existing self-service fueling facility and re-loaded with water or retardant from two 6,000 gallon above ground storage tanks that are located adjacent to the general aviation apron and central connector taxiway. In addition, the Nephi Volunteer Fire Department currently provides a support role to the SEAT Base when in operation by trucking in water from an offsite location to replenish the water storage supplies. This required fire department support role could be eliminated with the extension of City water service lines to the Airport, which currently relies upon wells for its water supply.

The BLM has expressed some interest in establishing a permanent SEAT Base installation at the Airport that would likely be activated on a seasonal basis. Therefore, a potential SEAT Base development area will be identified on the east side of the Airport to accommodate their specified operational requirements. It is also recommended that a written agreement be established between Nephi City and the BLM for the use of the Airport during the summer fire season.

Support Facilities Requirements

In addition to the aviation facilities described above, there are several airport support facilities, which have quantifiable requirements and which are vital to the efficient and safe operation of the Airport. The support facilities at Nephi Municipal Airport that require further evaluation include the fuel storage facility and airport infrastructure development.

Fuel Storage Facility. According to fuel sale data provided by airport management, there has been an average of 9,847 gallons of AVGAS and Jet A fuel sold per year at Nephi Municipal Airport over the past three years to aircraft operators. Based on 2008 total operation counts, this equates to just under two and one-half gallons per operation. Typically, as operations increase, fuel storage requirements can be expected to increase proportionately. By increasing the ratio of gallons sold per operation, an estimate of future fuel storage needs can be calculated as a two-week supply during the peak month of operations. As can be seen in the following table, entitled *FUEL STORAGE REQUIREMENTS, 2008-2028*, it appears that the Airport's fuel storage requirements can be accommodated through the year 2028 utilizing existing storage facilities. However, this projection will be dependent upon the percentage breakdown of fuel types sold at the Airport over the planning period and may necessitate additional fuel storage capacity of either fuel type. Therefore, adequate expansion area will be reserved in the vicinity of the existing fuel farm to accommodate additional fuel storage tanks.

Table C9

FUEL STORAGE REQUIREMENTS, 2008-2028

	2008[1]	2013	2018	2023	2028
Average Daily Operations in Peak Month	19	23	28	33	39
Two-Week Operations	273	325	386	460	547
Gallons per Operation	2.4	3	4	5	6
Fuel Storage (Gallons)	12,000 [2]	974	1,545	2,298	3,282

Source: BARNARD DUNKELBERG & COMPANY.

Notes:
[1] Base year estimates.
[2] Existing fuel storage is represented by 50% AVGAS and 50% Jet A.

Airport Infrastructure Development. Future development of both aviation and/or aviation-related development areas within the northwest and east sides of the Airport will require the extension of access roadways and utilities (e.g., electricity, water, sanitary sewer, etc.), and the projected cost of this infrastructure development should be incorporated into the future development costs for this area.

Planning Issues Identification/Verification

Identification of the current and future airport planning issues, which may influence the use of a public facility, is an important step in the planning process. A preliminary list of these issues has been identified to assist in the key decision points of this Master Plan.

The following list identifies those issues that were considered in the preparation of the airside and landside development plan alternatives for Nephi Municipal Airport, and will ultimately provide the basis for the formulation of the future recommended plan for this facility. These issues, which have been organized into airside, landside and airport management categories, are referenced in more than one category, due to their connectivity or boundary relationships.

Airside Issues:

- Confirm Appropriate Future Airport Design Standards
- Prevent Future Non-Standard Design Criteria
- Identify/Confirm Future Instrument Approach Procedure Development Recommendations
- Maintain Existing Airport Infrastructure Development
- Expand Airport Infrastructure Development as Needed
- Recognize Environmental Issues in Consideration of Future Airport Development (i.e., Aircraft Noise, Aircraft Overflights, Land Use Compatibility with Surrounding Development, etc.)

Landside Issues:

- Confirm Appropriate Future Airport Design Standards
- Identify Future General Aviation Development Areas to Accommodate Existing/Future Demand (Hangars and Tiedown Apron)

- Verify Future Roadway Improvements Surrounding Airport to Coordinate Design and Development Considerations
- Maintain Existing Airport Infrastructure Development
- Expand Airport Infrastructure Development as Needed
- Identify Future Development Area for the SEAT firefighting base
- Maintain Aviation Security
- Promote Financial Self-Sufficiency for the Airport
- Recognize Environmental Issues in Consideration of Future Airport Development (i.e., Aircraft Noise, Aircraft Overflights, Land Use Compatibility with Surrounding Development, etc.)

Airport Management Issues:

- Identify Future General Aviation Development Areas to Accommodate Existing Demand (Hangars and Tiedown Apron)
- Coordinate Future Operational Agreements with the Proposed Utah National Guard Armory Facilities
- Coordinate Future Operational Agreements with the BLM for the Proposed SEAT firefighting base in the form of written agreements
- Maintain Aviation Security
- Promote Airport Compatibility with Surrounding Community
- Promote Financial Self Sufficiency of the Airport
- Recognize Environmental Issues in Consideration of Future Airport Development (i.e., Aircraft Noise, Aircraft Overflights, Land Use Compatibility with Surrounding Development, etc.)

Summary

The need for facilities, which have been identified in this chapter, can now be utilized to formulate the overall future Development Plan of the Airport. The following table summarizes the projected facility requirements necessary to accommodate the projected operational demands through 2028. The formulation of this plan will begin by establishing goals for future airport development and an analysis of development alternatives, whereby demand for future airport facilities can be accommodated. These alternatives are presented in the following chapter, entitled *DEVELOPMENT CONCEPTS AND RECOMMENDATIONS*.

Table C10
FACILITY REQUIREMENTS SUMMARY, 2008-2028

Facility	2008[1]	2013	2018	2023	2028
Dimensional Standards					
Runway 17/35	ARC C-II	same	same	same	same
Runway Width/Length					
Runway 17/35	100′ x 6,298′	same	same	same	100′ x 7,200′
Instrument Approach Enhancement					
Runway 17 APV [2]	none	≥ ¾-mile	same	same	same
Runway 35 APV [2]	none	≥ ¾-mile	same	< ¾-mile	same
Approach Lighting System					
Runway 35	none	MALSR	same	same	same
General Aviation Apron Requirements (In Acres)					
Itinerant	0.2	0.2	0.3	0.4	0.5
Based	---	1.0	0.9	0.9	1.2
Total	*0.2*	*1.2*	*1.2*	*1.3*	*1.7*
General Aviation Aircraft Storage Facilities (No./Acres)					
T-Hangars	0/0	1/0.2	1/0.2	1/0.2	1/0.2
Exec./Corp.	4/0.8	6/1.2	8/1.6	10/2.0	13/2.6
Support Facilities					
Fuel Storage (gallons)	12,000	same	same	same	same

Source: BARNARD DUNKELBERG & COMPANY.

Notes:
[1] Actual.
[2] Potential instrument approach development capability [i.e., approach with vertical guidance (APV)] will be preserved on the ALP and within the master planning document. However, recommendation for improvement will be dependent upon completion of an FAA instrument approach study for each end of Runway 17/35.