Proposed Oak Ridge General Aviation Airport

Preliminary Planning Study Phase II - Programming Report

Prepared for:

Metropolitan Knoxville Airport Authority

MARCH, 2012

CROET

THE LPA GROUP TRANSPORTATION CONSULTANTS

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Table of Contents

List of Tables

List of Figures

Appendices

Section 1: Introduction

The town of Oak Ridge, Tennessee was established by the U.S. Army Corps of Engineers in 1942 as Clinton Engineering Works, a top-secret government initiative to create nuclear weapons during World War II. Extensive industrial production facilities were built around Oak Ridge to enrich uranium and plutonium for *The Manhattan Project*. The area of Oak Ridge was selected for such use because the relatively low population in the vicinity at the time enabled easier land acquisition; existing rail, road, and utilities access were available from nearby Tennessee Valley Authority (TVA) projects; and hilly terrain provided extensive cover from aerial view and natural barriers where facilities could be segregated from each other. Oak Ridge grew to a population of 75,000 industrial workers and their families, who lived in neighborhoods that had schools, churches, recreation, and retail shops created specifically for them in a secure compound in support of war efforts. The town and its mission were effectively kept secret until the war ended. The town became open to the public and transferred to civilian control in 1949 and was incorporated in 1959. The industrial facilities were decommissioned from military use after the war ended, and currently are part of the Oak Ridge Reservation (ORR) administered by the U.S. Department of Energy (DOE).

The ORR encompasses 35,000 acres located within and adjacent to the city of Oak Ridge and Roane and Anderson counties, as shown on **Figure 1.** It is home to a world-leading research and manufacturing park, with federal programs in the areas of science, environmental management, nuclear fuel supply, reindustrialization and national security.[1] Several areas of ORR remain contaminated from historical industrial activities and have extensive clean-up activities underway. Still, some areas of ORR are considered underutilized, based on a 2005 land use study by the DOE, and have been, or are projected to be, transferred to civilian entities for private use.

Today, Oak Ridge is a city of 29,330 residents (per the 2010 U.S. Census), located 25 miles west of Knoxville, Tennessee. The major employers and economic contributors to the area include Oak Ridge National Laboratory (ORNL), a leading chemical and energy research facility and former location of the X-10 plutonium production plant, DOE, and environmental clean-up contractors.

[1] U.S. Department of Energy, Oak Ridge Office Website: www.oakridge.doe.gov

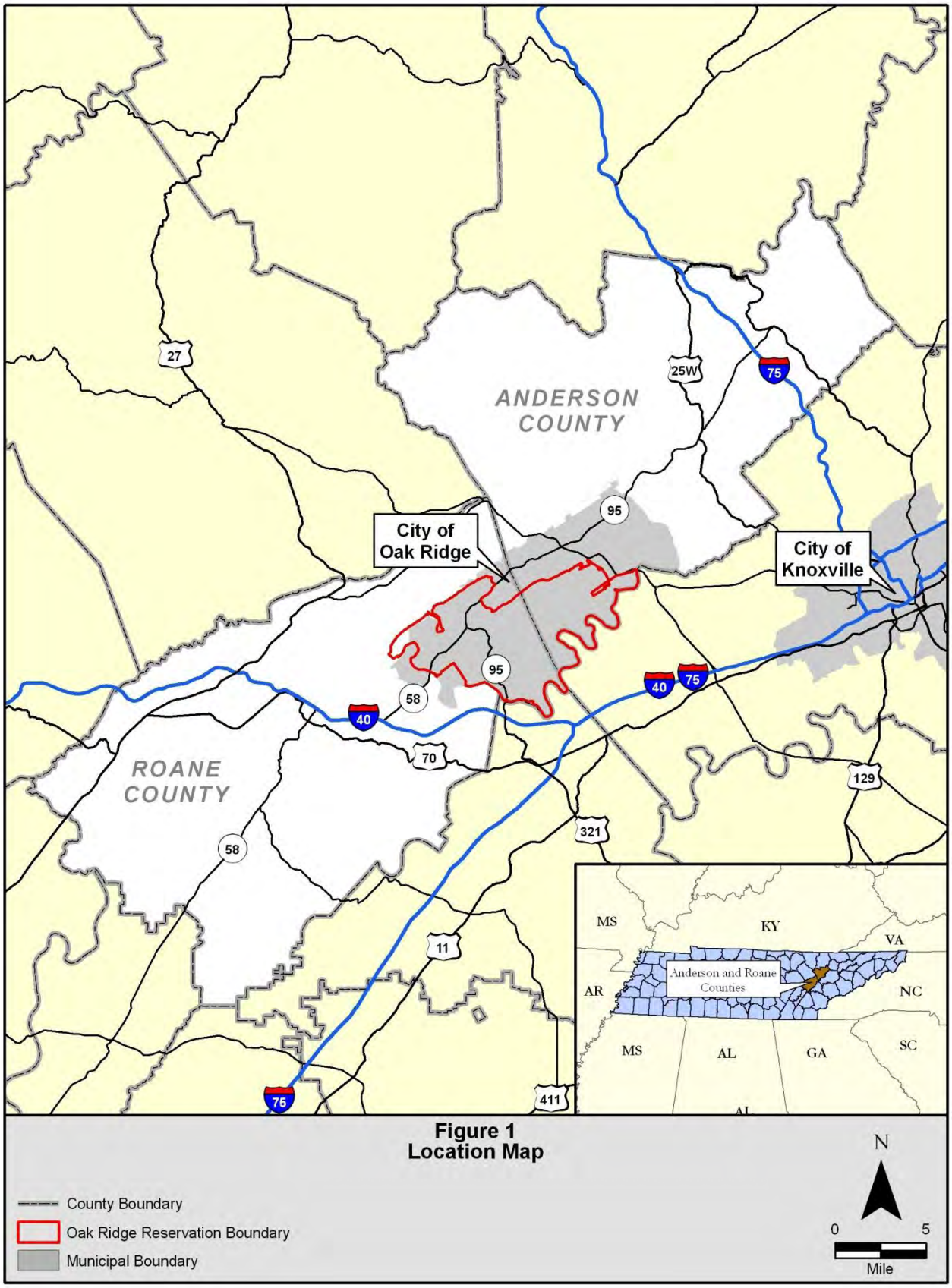


Figure 1
Location Map

In September of 2009, the Metropolitan Knoxville Airport Authority (MKAA), being the established aviation entity for the region, agreed to sponsor a study (Phase I) to conduct a preliminary assessment of the potential to construct a new general aviation airport on one of three sites on the ORR. These sites are referred to in this report as Heritage Center Site, ED-3 Site and Horizon Center Site (refer to **Figure 2**). The preliminary study was prepared in coordination with DOE and a local civilian industrial recruitment organization, Community Reuse Organization of Eastern Tennessee (CROET).

CROET is an Oak Ridge-based economic development organization. Its primary role is acquiring and leasing former DOE property for commercial and industrial development, recruiting tenants for its facilities and administering federal grants for reindustrialization of surplus federal property. The three proposed sites considered in this study have been or are planned to be transferred to CROET by the DOE. The leadership of CROET provided the impetus for this study, seeking guidance for this project from MKAA for a possible general aviation airport in Oak Ridge on future underutilized surplus DOE property.

At the conclusion of Phase I, it was determined that constructing a general aviation airport at one of the three locations may be feasible. Phase I noted significant terrain issues at each site, potential operational issues, such as obstructions, roadway and existing building impacts and potential environmental concerns. The results of this analysis were published in July of 2010, in the *Proposed Oak Ridge Airport Preliminary Planning Study*, prepared by THE LPA GROUP INCORPORATED.

In October 2010, MKAA again agreed to be the sponsor of Phase II of the preliminary planning study. The purpose of Phase II was to examine in further detail the anticipated costs to develop the airport. Specifically, Phase II's objectives were as follows:

- Develop detailed airport templates based on a selection of near-term and long-term facility requirements for the potential airport sites recommended in Phase I;
- Refine airport layout concepts for each site based on known constraints and selected facility requirements;
- Prepare programming cost estimates for each of the possible airport sites, so that a determination can be made regarding the financial planning of the airport; and
- Submit a programming report that summarizes the results of Phase II.

The following sections present the results of the Phase II analysis.

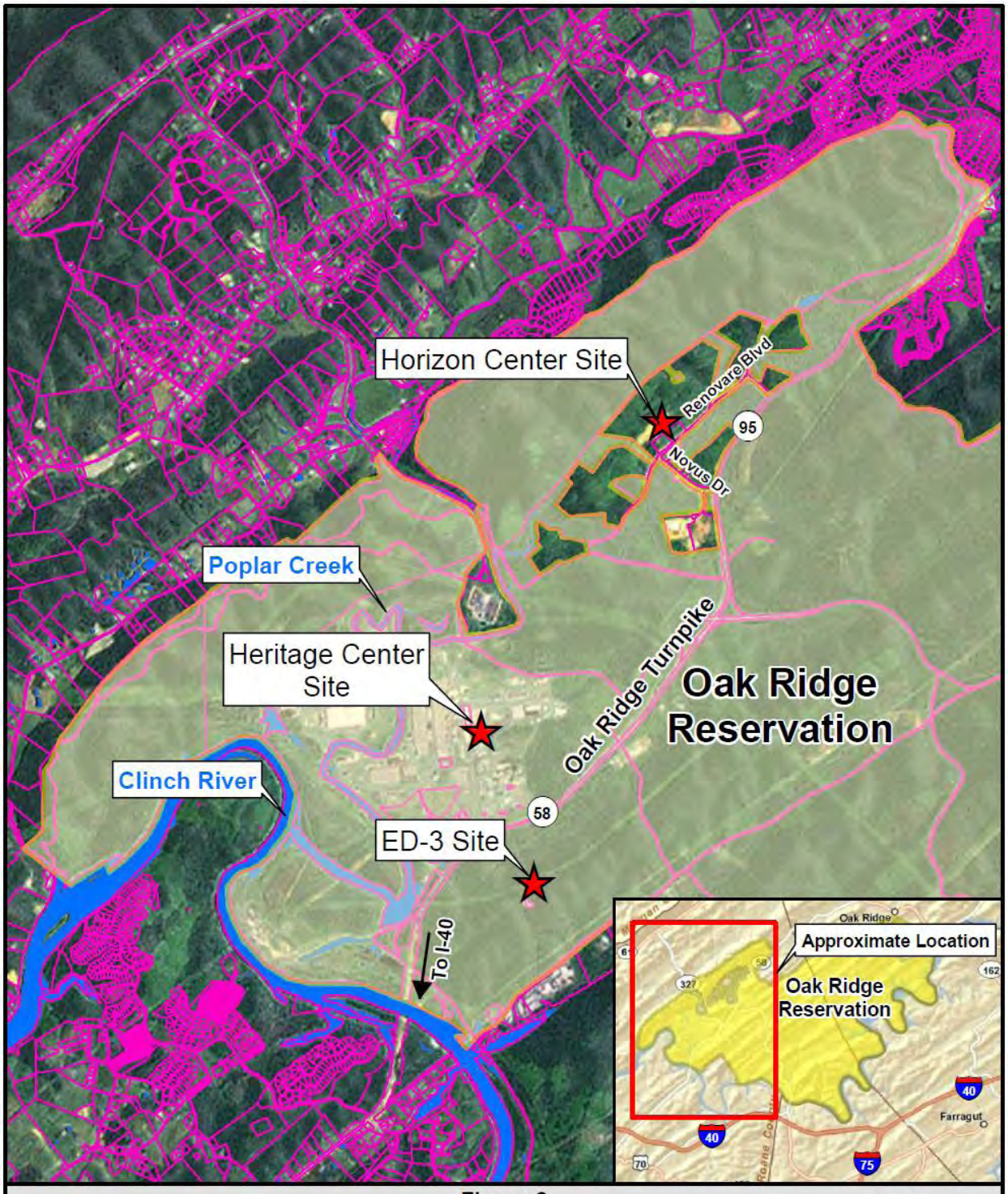


Figure 2
Potential Site Locations

Section 2: Facility Requirements

During Phase I, generalized airport layouts, comprised of a minimum 5,000-foot runway with a parallel taxiway and setbacks for ramps and terminal area space were created. A wind analysis was prepared to determine desired runway alignment. Airspace surfaces were defined and joined to the templates to allow identification of potential operational hazards. Templates were overlaid on each of the three sites and an assessment of feasibility was provided.

The purpose of the Phase II facility requirements analysis is to provide an Initial Airport Development Plan and then a long-term Future Airport Development Plan of the airport as it grows over time. Using each scenario, the initial and future program costs of the proposed airport can be estimated.

The facility requirements prepared in Phase II are based upon the desired airport role within the federal and state air transportation systems. It is important to note that in Tennessee, federal grants to general aviation airports are administered by TDOT under the federal Vision 100 State Block Grant Program. Since funding for construction would be requested from the TDOT, and indirectly, the FAA, it is important that the airport meet state and federal requirements.

2.1 Projected Airport Role

The proposed Oak Ridge airport is intended to be an airport supporting the needs of the general aviation community in the Oak Ridge and Knoxville region. The term *General Aviation* refers to all flights other than military, scheduled airline service and regular cargo flights. General aviation covers a broad range of activities, including flight training, law enforcement, air charters, corporate travel, aerial firefighting and air ambulance. General aviation aircraft range from gliders and small single engine airplanes, to helicopters, business jets and non-scheduled cargo airplanes. The majority of the world's air traffic falls into this category and most of the world's airports serve general aviation exclusively. In the U.S., there are approximately 5,200 public general aviation airports compared to approximately 560 airports serving scheduled airlines.

It is the intent of the proposed Oak Ridge airport to be a public-use general aviation airport that is owned and operated by a local sponsor that would accept state and federal grants for construction of its facilities. At the state and federal level, airports eligible to accept public grants-in-aid are classified into specific airport roles that are designated for the purposes of identifying regional transportation needs.

On the federal side, these roles are defined within the FAA's *National Plan of Integrated Airport Systems* (NPIAS). The NPIAS identifies nearly 3,400 existing and proposed

airports that are significant to national air transportation and thus eligible to receive federal grants under the Airport Improvement Program (AIP). NPIAS airports fall into one of the following categories.

- *Commercial Airports* - are publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service.
- *Cargo Service Airports* - are airports that, in addition to any other air transportation services that may be available, are served by aircraft providing air transportation of only cargo with a total annual landed weight of more than 100 million pounds.
- *Reliever Airports* - are airports designated by the FAA to relieve congestion at Commercial Service Airports and to provide improved general aviation access to the overall community.
- *General Aviation Airports* - refers to all remaining airports not specifically described in the preceding NPIAS categories. It is also the largest single group of airport types in the United States.

Based on the federal roles described above, it is the intent to construct the proposed Oak Ridge airport as a *Reliever Airport* to the Knoxville area's McGhee Tyson Airport, the region's Commercial Service Airport. As a Reliever Airport, the proposed Oak Ridge facility would offer an alternative for general aviation aircraft over the use of McGhee Tyson. The proposed airport would also compliment McGhee Tyson's other general aviation reliever airport, Knoxville Downtown Island Airport.

At the State level, roles are defined by the *Tennessee State Airport System Plan* (System Plan). As the plan notes, its purpose is "to provide a framework for the orderly, ongoing, and timely development of a system of airports that is adequate to meet the current and future aviation needs of the state." A total of 83 airports are included in the System Plan and are classified according to the following four categories.

- *Commercial Service Airports* – are Tennessee public use airports with scheduled airline service and at least ten airline departures per day.
- *Regional Service Airports* – are Tennessee public use airports with strong population and employment growth within a 25-minute drive time of the airport.
- *Community Business Airports* – are Tennessee public use airports that serve an important role in business aviation within the state but community population and employment growth is not as significant as Regional Airports.

- *Community Service Airports* – are Tennessee public use airports not falling into the previous three categories. These airports generally provide facilities to accommodate light to mid-range performance aircraft.

Using the roles described above, the System Plan recommends specific attributes for each classification. These attributes include suggested runway length, taxiway configuration, navigational aids and weather reporting equipment. These attributes are guidelines only and it is recognized that individual airport requirements may vary. System Plan recommended attributes are presented below in **Table 1**.

Table 1
Tennessee State Airport System Plan
Recommended Airport Classifications and Attributes

Attribute	Commercial Service	Regional Service	Community Business	Community Service
Primary Runway Length (ft)	6,001 to 7,000	5,000 to 6,000	4,500 to 5,500	3,700 to 4,499
Primary Runway Width (ft)	150	100	75	60-75
Primary Runway Strength (lbs)	60,000 DWL	30,000 SWL, 60,000 DWL	30,000 SWL – 60,000 DWL	Less than 30,000 SWL
Taxiway	Full Parallel	Full Parallel	Partial Parallel	Partial Parallel or Stub
Taxiway Width (ft)	75	50-75	35-75	35
Weather Reporting (AWOS/ASOS)	If NWS Available	Yes	(Yes, as justified)	No
Instrument Approach	Precision	Non-precision	Non-precision	Non-precision or Visual
Lowest Approach Minima	200 ft & ½ mi	400 ft & 1 mi	400 ft & 1 mi	Non-Precision or Visual
Operating Organization	Airport Authority	Airport Authority	Airport Authority	Airport Board

Note: Acronym definitions are found in Appendix C of this report.
Source: Tennessee State Airport System Plan, November, 2001, HNTB Corporation.

Based on the State roles described above, it is the intent to construct the proposed Oak Ridge airport as a *Community Business Airport* with the potential to upgrade to a *Regional Service Airport* as the community grows. System Plan recommended attributes for Community Business airports were utilized as the starting point for identification of facility requirements for the proposed Oak Ridge airport on opening day, while the Regional Service attributes were consulted for long term facility needs.

2.2 Airport Geometrical Requirements

Airports receiving the State's Vision 100 funds are required to be built according to FAA airport design guidelines through grant assurances. These guidelines translate into geometrical requirements that are based upon the operating characteristics, sizes, and

weights of the airplanes expected to use the airport. A key to developing these requirements is selection of the airport's desired Airport Reference Code (ARC).

The ARC correlates airport activity to the appropriate airport design standards found in FAA Advisory Circular (AC) No. 150/5300-13, *Airport Design*. A two-part alphanumeric designation makes up the ARC. As shown in **Tables 2** and **3**, a letter designator is used to categorize the aircraft's approach speed and a Roman numeral groups the aircraft by tail height and wingspan**.** The ARC is based upon a design aircraft that was selected to represent the most demanding aircraft operating at the airport on a frequent basis; however, it does not mean that more demanding aircraft are prohibited from the airport. Approach speeds and wingspan for most aircraft are listed in FAA AC No. 150/5300-13, *Airport Design*.

Table 2
Airport Reference Code - Aircraft Approach Categories

Category	Approach Speed (kts)	Example Airplanes
A	Less than 90	Beech Bonanza, Beech Duchess, Cessna 150, Mitsubishi MU-2
B	91- <121	Beech Baron, Beech King Air, Cessna Citation I, Cessna 441
C	121- <141	Airbus A300, Learjet 25, Canadair Challenger, Gulfstream III
D	141- <166	Boeing 747, Boeing 777, DC-I0
E	166+	Lockheed SR-71 Blackbird, Tupolev TU-44

Source: FAA AC No. 150/5300-13, *Airport Design*.

Table 3
Airport Reference Code - Airplane Design Groups

Group	Tail Height	Wingspan	Example Airplanes
I	<20 ft	<49 ft	Beech Bonanza, Cessna 421, Cessna Citation
II	20- <30 ft	49- <79 ft	Falcon 50, Beech King Air, Gulfstream 2/3/4
III	30- <45 ft	79- <118 ft	Airbus A320, BAe 146, Boeing 737, DC-9
IV	45- <60 ft	118- <171 ft	Airbus A300, Boeing 757/767, Lockheed C-130
V	60- <66 ft	171- <214 ft	Boeing 747-400, Boeing 777
VI	60- <80 ft	214- <262 ft	Airbus A380, Boeing 747-800, Lockheed C-5B

Source: FAA AC No. 150/5300-13, *Airport Design*.

Based upon the desired role of the proposed airport, a broad range of general aviation aircraft, including business jets would be expected to operate from the facility. The ARC that is most typically associated with airports matching the desired role is B-II and C-II. Larger, commercial service airports are normally designed for ARC C-III and greater. It is therefore recommended that the airport be constructed to B-II design standards in the Initial Airport Development Plan, but plan for ultimately upgrading to C-II design standards as the complexity of the airplanes operating at the airport increases. It should be noted, however, that for some airport development components, C-II standards can be achieved during the initial development phase of construction, which will provide significant cost savings when future upgrades are implemented.

Table 4 presents the selected dimensional standards that will be applied to the proposed airport templates. As shown, B-II standards will be applied during initial design and C-II will be planned as the future configuration of the airport. In certain cases, C-II standards will be applied from the beginning. Runway-to-taxiway separation, for example, will be planned at C-II standards so that a parallel taxiway would not need to be rebuilt at greater separation in the future. Another area where C-II standards may take precedent over B-II standards would be grading of the Runway Safety Area (RSA). Should it be advantageous during initial construction to grade the RSA to meet C-II standards in terms of cost and practicality, this will be proposed. Setbacks of parking areas and buildings will also be shown to C-II standards.

Table 4
Selected Dimensional Standards
Proposed Oak Ridge Airport

Dimensional Standard	Initial	Future
Airport Reference Code (ARC)	B-II	C-II
Lowest Visibility Minimums	>¾ mile	½ mile
Runway Length	5,000’	6,000’
Runway Width	75’	100’
Taxiway Width	35’	35’
Runway Safety Area Width	150’	400’-500’*
Runway Safety Area Length Prior to Landing Threshold	300’	600’
Runway Safety Area Length Beyond Runway End	300’	1,000’
Obstacle Free Zone Width	400’	400’
Obstacle Free Zone Length	200’	200’
Runway Object Free Area Width	500’	800’
Runway Object Free Area Length Beyond Runway End	300’	1,000’
Runway Centerline to Taxiway Holdline	200’	250’
Runway Centerline to Taxiway/Taxilane Centerline	240’	400’
Runway Centerline to Aircraft Parking Area	200’	500’

*400’ allowable for C-II airports.
Source: FAA AC No. 150/5300-13, *Airport Design*.

2.3 Airspace and Runway Protection Zone Requirements

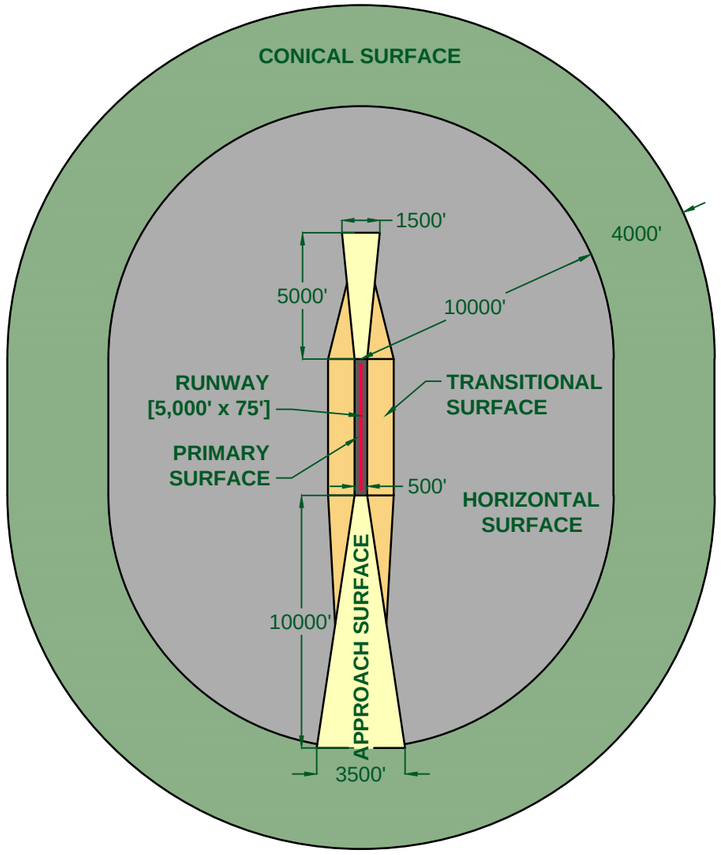
Airspace requirements begin with the establishment of civil airport imaginary surfaces as described in 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*. Part 77 regulations also explain notice requirements for proposed construction or alteration of existing structures and the process for conducting aeronautical studies related to potential airspace obstructions. Per FAA grant assurances, airports should implement local control such as ordinances to protect these surfaces. A penetration to a Part 77 imaginary surface does not necessarily create an airport hazard or impact airport operations; rather, each object must be evaluated by the FAA on a case-by-case basis to determine airspace impacts. Although the FAA may

decide a proposed object adversely impacts airspace, the jurisdiction to prevent or remove such hazards remains solely with local authorities.

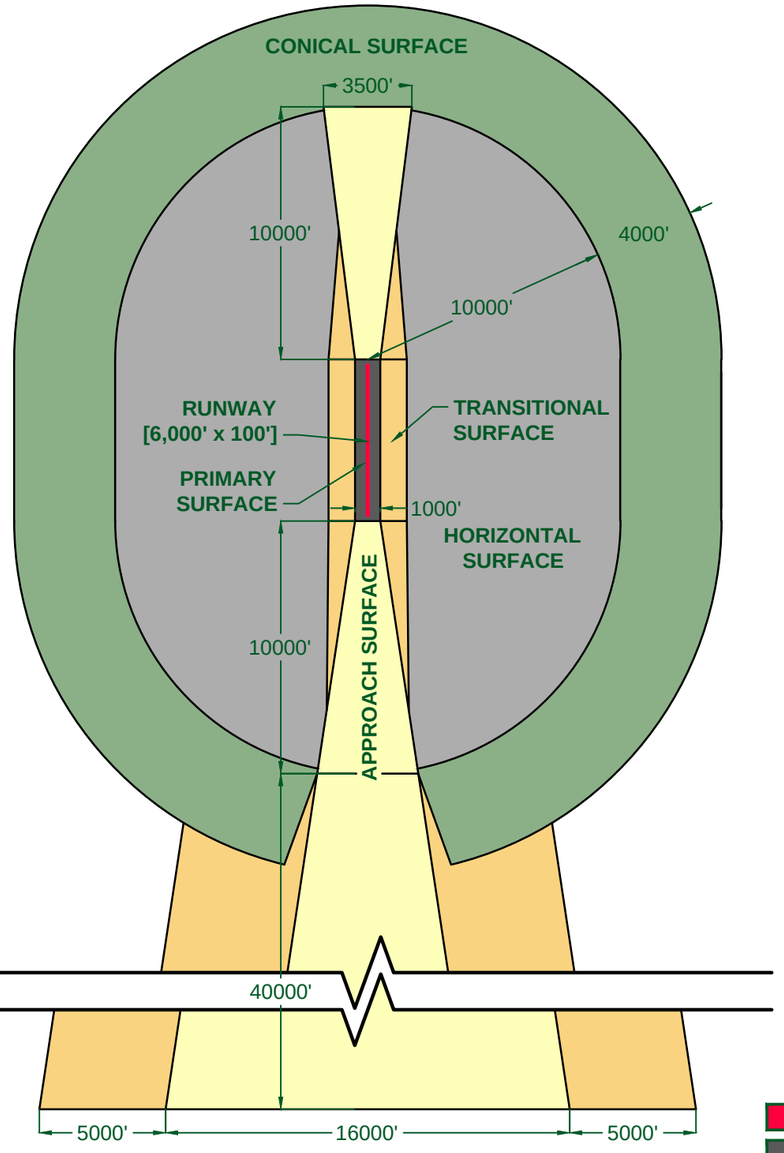
Composition of airspace surfaces is dependent upon the type of instrument approaches both existing and planned at an airport. For the Oak Ridge airport, non-precision instrument approaches are proposed upon opening day, followed by an upgrade to a precision approach to one runway end in the future. The precision approach may be an Instrument Landing System (ILS) approach, or a GPS-based "near-precision" LPV (Localizer Performance with Vertical Guidance) approach. LPV approaches offer similar attributes to an ILS at considerably less cost; however, many aircraft must upgrade avionics in order to fly them. In order to reserve the necessary airspace for a precision approach, clearing of this airspace surface will be planned from the beginning so that airspace can be protected from potential encroachment. Based upon the desired instrument approaches at the proposed Oak Ridge airport, **Figure 3** provides the planned dimensions of Part 77 airspace surfaces.

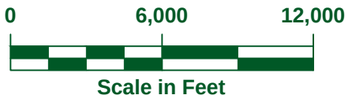
Runway Protection Zones (RPZs) are trapezoidal boundaries beyond the ends of each runway that are intended to protect encroachment by incompatible land uses that may be unsafe. Incompatible land uses within RPZs are those creating a congregation of people such as residential areas, churches, schools, hospitals and commercial development. It is desirable that the airport owns the RPZ in order to protect such encroachment. RPZ dimensions are dictated by the type of approaches planned to a runway and the lowest visibility minima of those approaches. Based on the desire to implement non-precision instrument approaches to each runway end at the Oak Ridge airport, followed by an upgrade to a precision ILS or LPV approach to one runway end, **Table 5** depicts the size and dimensions of the RPZs required at Oak Ridge.

Initial



Ultimate





Proposed Oak Ridge General Aviation Airport

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Planned Airspace Surfaces

Figure 3

Table 5
Runway Protection Zone Requirements
Proposed Oak Ridge Airport

Dimensional Standard	Initial Requirements (0-5 Years)		Future Requirements (6-20+ Years)	
	Preferred Runway End	Opposite Runway End	Preferred Runway End	Opposite Runway End
Approach Category	B	B	C	C
Distance From Runway End	200’	200’	200’	200’
Inner Width	1,000’	500’	1,000’	1,000’
Outer Width	1,510’	700’	1,750’	1,510’
Length	1,700’	1,000’	2,500’	1,700’
Acreage	48.978 ac	13.77 ac	78.914 ac	48.978 ac
Instrument Approach	Non-precision	Visual or Non-precision	Precision	Non-precision
Lowest Visibility Minimums	>¾ mile	1 mile	½ mile	>¾ mile
Part 77 Slope	34:1	20:1	50:1	34:1

Source: 14CFR, Part 77, *Safe, Efficient, Use, and Preservation of Airspace*.

2.4 Aeronautical Facilities

In addition to geometrical, airspace, and runway protection zone requirements, and based upon the stated role of the airport as a general aviation facility that meets or exceeds the attributes of a Community Business Airport initially within the Tennessee State Airport System Plan, a set of proposed aeronautical facilities has been created and added to the airport layout template. Suggested facilities were prepared for initial requirements (Initial Airport Development Plan) and future requirements (Future Airport Development Plan - improvements expected over the 6 to 20 year timeframe). As discussed previously, the airport would eventually grow to meet the role of Regional Service within the State airport system and facilities would be improved over time to meet this role as demand within the community warrants.

Table 6 provides a summary of the proposed aeronautical facilities that would be proposed for construction at the Oak Ridge airport. These facilities represent those commonly found at general aviation airports of similar size.

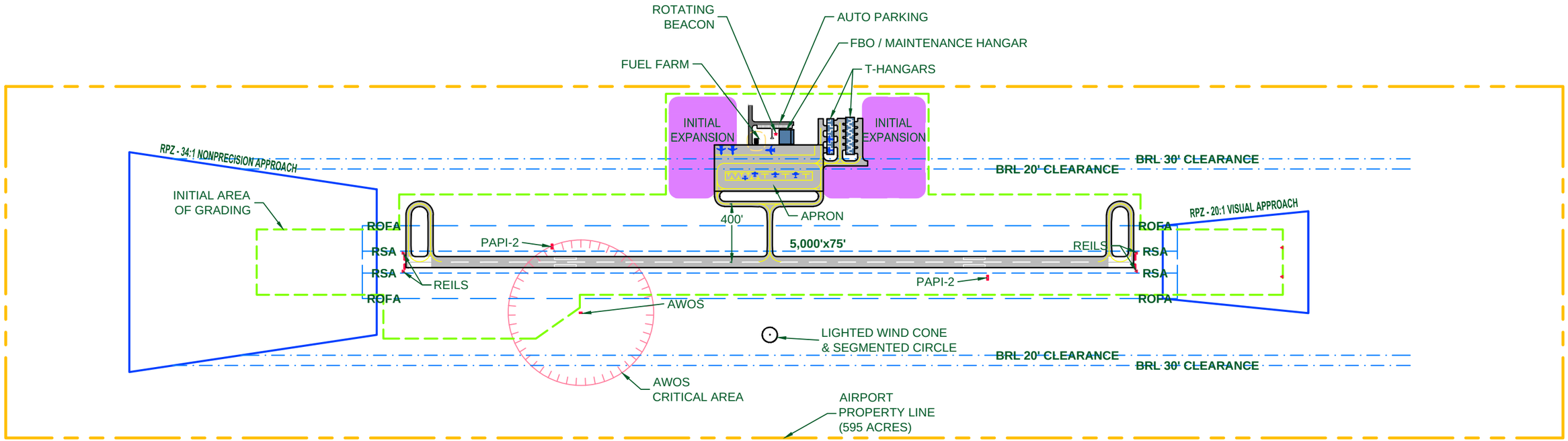
Table 6
Recommended Aeronautical Facilities
Proposed Oak Ridge Airport

Dimensional Standard	Initial Requirements (0-5 Years)	Future Requirements (6-20+ Years)
Runway	– 5,000' x 75' Runway – ARC B-II – Grade RSA to C-II if practical	– 6,000' x 100' Runway – ARC C-II
Taxiways	– Apron Access near Centerfield – Turnaround/Bypass Each End	– Full Parallel Taxiway
Apron Space	– 26,412 sy Local/Itinerant Apron – 15 Tiedown Positions	– Additional Apron with Tiedowns as Demand Requires
Lighting and NAVAIDS	– Non-precision Approach to Preferred Runway End – Airport Rotating Beacon – Automated Weather Observing System – Medium Intensity Runway Lights – Medium Intensity Taxiway Lights – Lighted Wind Cone & Segmented Circle – Precision Approach Path Indicators	– Precision Approach to Primary Runway End – Non-precision Approach to Opposite Runway End – Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights to Primary Runway End
Buildings	– Fixed Base Operator with Public Space and Maintenance Hangar – Two T-Hangar Rows (16 units) – Auto Parking and Entrance Road	– Airport Terminal Building (3,000 sf) – Additional Hangars as Demand Requires
Fuel Farm	– 10,000 gal AvGAS and Jet A – Self Service Fueling	– Additional Tanks as Required

Source: THE LPA GROUP INCORPORATED, 2012.

2.5 Facility Templates

Based upon the assumptions developed in previous subsections, facility templates were prepared to form a basis of site refinements and cost estimates. These templates depict proposed airport facilities of the Initial Airport Development Plan (0-5 years) and the Future Airport Development Plan (6-20+ years). **Figure 4** depicts the initial layout and **Figure 5** depicts the future layout.



- **Runway (5,000'x75') B-II standards**
- **Bypass Taxiway (400' separation)**
- **Apron (26,411 sy)**
- **Maintenance Hangar (100' x 80') with Office (2,000 sf)**
- **2 T-Hangars (16 units)**
- **Fuel Farm (10,000 gal. AVGAS & 10,000 gal. Jet A)**
- **GPS Approach to one Runway end ($\frac{3}{4}$ Mile Visibility)**
- **Airport Rotating Beacon**
- **Automated Weather Observation Station (AWOS)**
- **Precision Approach Path Indicator 2 Light Unit (PAPI-2)**
- **Medium Intensity Runway Lights (MIRL)**
- **Medium Intensity Taxiway Lights (MITL)**
- **Lighted Wind Cone & Segmented Circle**

Layout could change due to site constraints/characteristics.

Proposed Oak Ridge General Aviation Airport

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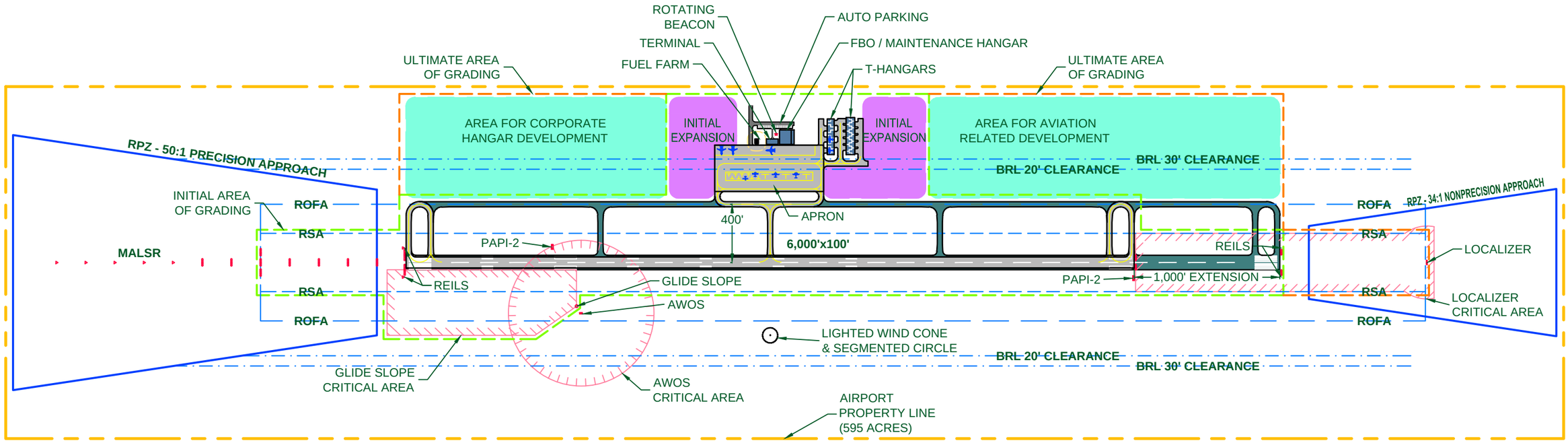
Initial Airport Development Template

Figure 4



- **Runway Widening (5,000'x100') C-II standards**
- **Runway Extension (6,000'x100')**
- **Full Parallel Taxiway (400' separation)**
- **Terminal (3,000 sf)**
- **Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR)**
- **Precision Instrument Approach Upgrade ($\frac{1}{2}$ Mile Visibility)**

Layout could change due to site constraints/characteristics.

Section 3 – Refined Layouts

Utilizing the initial and future templates created in Section 2, detailed airport layouts were prepared for each of the three sites (Heritage Center Site, ED-3 Site and Horizon Center Site). Each layout was tailored to meet the specific constraints of the three sites. The following sections present the results of the site refinements. To consolidate a large number of graphics, all figures in this section are presented in **Appendix A**.

3.1 – Heritage Center Site

A total of three alternative airfield concepts (Concept 1, 2 and 3) were considered for the Heritage Center Site. These three concepts represent the top three layouts from a total of eleven alignments that were evaluated. The eleven alignments are depicted in **Figures 29** to **31**, with the top 3 concepts noted as such. Concept 1 was derived from several initial concepts and reflects the design team's effort to avoid the Inactive Waste Disposal Area and minimize the impacts to existing buildings given the confined area of the Heritage Site. Concept 2 is a refinement of Concept 1 with the intent of achieving a more balanced earthwork situation. Concept 3 evolved from the desire to further minimize existing building impacts and avoid the Inactive Waste Disposal Area with the understanding that some road relocation could be permitted in the future development concept only. The layout of each concept, preliminary grading limits, anticipated building impacts and airspace overlays are shown on **Figures 6** through **20**.

Heritage Center Site – Concept 1 is located near the southern portion of the Heritage Center complex, immediately north of Oak Ridge Turnpike. This site spans from Poplar Creek at its west boundary to Blair Road along its east boundary and partially overlaps the Inactive Waste Disposal Area to the north. The initial/future airport construction footprint for Concept 1 encompasses approximately 211 acres.

Figures 6 and **7** depict the Initial Airport Development Plan and airspace for Concept 1 based upon the initial facility template. The 5,000-foot runway is situated in an east-west alignment with a magnetic runway heading of 060°/240° (Runway 6-24). A non-precision approach (34:1 approach slope) is planned to Runway 6 and a visual approach (20:1 approach slope) is planned to Runway 24. Terminal area facilities would be constructed south of the runway with direct access to Oak Ridge Turnpike.

Figures 8 and **9** depict the Future Airport Development Plan and airspace for Concept 1 based upon the future facility template. Runway 6-24 is extended 1,000 feet to the east and widened from 75 feet to 100 feet. The Runway 6 instrument approach would be upgraded to a precision approach (50:1 approach slope) and Runway 24 would be upgraded to a non-precision approach (34:1 approach slope). A full parallel taxiway is constructed south of the runway and connected to the central aircraft parking apron. The ARC is upgraded from B-II to C-II requiring larger runway safety areas. A

retention pond (west of Building K-1007) would be impacted by the need for a longer safety area at the approach end of Runway 6 and to the east, Runway 24 safety area improvements will terminate very close to the historic Wheat Church. Blair Road would also need to be relocated to accommodate the eastern runway extension. Due to the multiple buildings within and around this site, utilities (i.e. water, gas, electric, tele-communications) are available in close proximity.

As shown in **Figures 7** and **9,** the terrain surrounding Concept 1 is characterized by numerous ridgelines running parallel to the proposed runway alignment that penetrate into the proposed airport's Part 77 airspace surfaces of both the Initial and Future Airport Development Plans. Immediately north of Concept 1, McKinney Ridge penetrates the Horizontal and Transitional surfaces up to 182 feet. A tower located on a peak of McKinney Ridgeline penetrates the Horizontal surface by 354 feet. Directly east of McKinney Ridge, a small portion of East Fork Ridge penetrates the Conical Surface by 176 feet. Further north, Black Oak Ridge penetrates the Horizontal surface by up to 170 feet. Two additional ridgelines south of Concept 1, Pine Ridge and Chestnut Ridge penetrate the Horizontal and Conical surfaces by up to 157 feet. A tower located on Pine Ridge penetrates the Horizontal surface by 325 feet. All of these penetrations are found in varying degrees in both the initial and future plans.

The Runway 6 Approach surface in both the Initial and Future Airport Development Plans of Concept 1 remains clear of terrain penetrations and existing towers. The Runway 24 Approach surface remains clear of similar penetrations in the initial plan; however, McKinney Ridge penetrates the 34:1 approach slope in the future plan and may cause the need for a 1,000-foot displaced threshold on this end; therefore, if the terrain concerns are not mitigated in the future plan, Runway 24 may only have 5,000 feet of landing length, as opposed to 6,000 feet of landing length on Runway 6. In the initial plan, 1,181 acres of terrain penetrates airspace surfaces and increases to a total of 1,418 acres in the future plan.

It should be noted that the Part 77 airspace evaluation was based upon USGS topographic maps and does not include tree elevations. Penetrations to Part 77 surfaces may be allowable by the FAA with certain stipulations, such as marking, lighting and/or increases to instrument flight procedure minimums. A detailed airspace feasibility study is planned to be conducted by the FAA later this year to evaluate the potential operational effects, if any, of these penetrations.

The implementation of Concept 1 will likely require the relocation of several businesses and the demolition of several buildings within the Heritage Center complex due to the preliminary grading limits. Buildings that would be impacted are depicted in **Figure 10.**

Heritage Center Site – Concept 2 shifts the airport location further north of Concept 1 in order to achieve a more balanced earthwork condition. By shifting the site north, earthwork quantities are significantly lower than Concept 1. Total earthwork to construct the Initial Airport Development Plan totals roughly 3.3 million cubic yards, increasing by another 0.7 million cubic yards in Future Airport Development Plan; a net savings of 1.9 million cubic yards of earthwork when compared to Concept 1. The shifted site however does impact two additional buildings by the airport footprint and the majority of the Inactive Waste Disposal Area would need to be relocated. Geotechnical investigations reveal less probability for rock at Concept 2 when compared to Concept 1 and the initial/future airport construction footprint for Concept 2 is 180 acres. **Figures 11** and **12** depict Concept 2's Initial Airport Development Plan and airspace surfaces.

Concept 2's Future Airport Development Plan and airspace surfaces are depicted in **Figures 13** and **14**. Like Concept 1, Runway 6-24 is shown extended 1,000 feet to the east and widened from 75 feet to 100 feet in the future. Runway 6 instrument approach would be upgraded to a precision approach (50:1 approach slope) and Runway 24 would be upgraded to a non-precision approach (34:1 approach slope). A full parallel taxiway is constructed south of the runway and connected to the central aircraft parking apron. The ARC is upgraded from B-II to C-II requiring larger runway safety areas. In comparison to Concept 1, the retention pond (K-1007 Pond) would no longer be impacted by the need for a longer safety area at the approach end of Runway 6 and, due to the northern shift of the runway alignment, construction limits would not impact the historic Wheat Church. Blair Road would still need to be relocated on the east side of the site to accommodate the eastern runway extension. As with Concept 1, utilities (i.e. water, gas, electric, tele-communications) are available in close proximity to Concept 2.

Similar to Concept 1, the terrain surrounding Concept 2 is characterized by numerous ridgelines running parallel to the proposed runway alignment that penetrate into the proposed airport's Part 77 airspace surfaces of both the Initial and Future Airport Development Plans as shown on **Figures 12** and **14**. Immediately north of Concept 2, McKinney Ridge penetrates the Horizontal and Transitional surfaces up to 134 feet. A tower located on a peak of McKinney Ridge penetrates the Horizontal surface by 339 feet. Directly east of McKinney Ridge, a small portion of East Fork Ridge penetrates the Conical Surface by 160 feet. Further north, Black Oak Ridge penetrates the Horizontal surface by up to 160 feet. Two additional ridgelines south of Concept 2, Pine Ridge and Chestnut Ridge penetrate the Horizontal and Conical surfaces by up to 143 feet. A tower located on Pine Ridge penetrates the Horizontal surface by 312 feet. All of these penetrations are found in varying degrees in both the initial and future plans.

In Concept 2, the Runway 6 Approach surface in both the Initial and Future Airport Development Plans remains clear of terrain penetrations and existing towers. Except

for a very small terrain penetration, the Runway 24 Approach surface remains clear of obstructions in the initial plan; however, McKinney Ridge penetrates the 34:1 approach slope in the future plan and may cause the need for a 1,000-foot displaced threshold on this end; therefore, if the terrain concerns are not mitigated in the future plan, Runway 24 may only have 5,000 feet of landing length, as opposed to 6,000 feet of landing length on Runway 6. In the initial plan, 1,032 acres of terrain penetrates airspace surfaces and increases to a total of 1,152 acres in the future plan.

It should be noted that the Part 77 airspace evaluation was based upon USGS topographic maps and does not include tree elevations. Penetrations to Part 77 surfaces may be allowable by the FAA with certain stipulations, such as marking, lighting and/or increases to instrument flight procedure minimums. A detailed airspace feasibility study is planned to be conducted by the FAA later this year to evaluate the potential operational effects, if any, of these penetrations.

The implementation of Concept 2 will likely require the relocation of several businesses and the demolition of several buildings within the Heritage Center complex due to the preliminary grading limits. Buildings that would need to be demolished are depicted in **Figure 15.**

Heritage Center Site – Concept 3 places the initial runway alignment as far southeast as possible without requiring the relocation of the Oak Ridge Turnpike in the initial development. It is noted that the turnpike would have to be relocated if the future development plans are realized; however, the initial alignment moves the Runway 24 threshold further east than any of the previous Heritage Center alignments and shifts the initial terminal area north of the runway and further east toward Blair Road. The key advantage of this concept is that it minimizes the number of initial building impacts within the K-25 campus. Another advantage is the elimination of impacts to the Inactive Waste Disposal Area. The initial and future airport construction footprints for Concept 3 is 132 and 56 acres respectively, for a total of 188 acres.

In comparison to Concept 1 and 2, earthwork quantities are roughly the same as Concept 1, and higher than in Concept 2. Total earthwork to construct the Initial Airport Development Plan totals roughly 3.4 million cubic yards, increasing by another 2.0 million cubic yards in Future Airport Development Plan; a net savings of 0.5 million cubic yards of earthwork when compared to Concept 1 and approximately 1.4 million higher than Concept 2. Geotechnical investigations reveal the probability for rock roughly equal to that of Concept 1. Blair Road would require relocation during construction of the initial layout, as opposed to Concept 1 and 2, which do not relocate Blair Road until the "future" timeframe. **Figures 16** and **17** depict Concept 3's Initial Airport Development Plan and airspace surfaces.

Concept 3's Future Airport Development Plan and airspace surfaces are depicted in **Figures 18** and **19**. Runway 6-24 is shown extended 1,000 feet to the west and widened from 75 feet to 100 feet in the future. Runway 6 instrument approach would be upgraded to a precision approach (50:1 approach slope) and Runway 24 would be upgraded to a non-precision approach (34:1 approach slope). A full parallel taxiway is constructed north of the runway and connected to the aircraft parking apron that is located in the northeast quadrant of the airport layout. The ARC is upgraded from B-II to C-II requiring larger runway safety areas. In comparison to Concept 1, the retention pond (west of Building K-1007) would not be impacted by the need for a longer safety area at the approach end of Runway 6. Concept 3 is the only concept that would require relocation of Oak Ridge Turnpike Relocation which would be a tradeoff in order to minimize impacts to existing buildings on the K-25 campus in the initial timeframe. An approximate total of 6,000 linear feet of Oak Ridge Turnpike would be relocated. As with Concept 1 and 2, utilities (i.e. water, gas, electric, tele-communications) are available in close proximity to Concept 3.

Similar to Concept 1 and 2, the terrain surrounding Concept 3 is characterized by numerous ridgelines running parallel to the proposed runway alignment that penetrate into the proposed airport's Part 77 airspace surfaces of both the Initial and Future Airport Development Plans as shown on **Figures 17** and **19**. Immediately north of Concept 3, McKinney Ridge penetrates the Horizontal surface up to 135 feet. A tower located on a peak of McKinney Ridge penetrates the Horizontal surface by 305 feet. Directly east of McKinney Ridge, a small portion of East Fork Ridge penetrates the Horizontal and Conical surfaces by 126 feet. Further north, Black Oak Ridge penetrates the Horizontal and Conical surfaces by up to 109 feet. Two additional ridgelines south of Concept 3, Pine Ridge and Chestnut Ridge penetrate the Horizontal and Conical surfaces by up to 109 feet. A tower located on Pine Ridge penetrates the Horizontal surface by 278 feet. All of these penetrations are found in varying degrees in both the initial and future plans.

In Concept 3, the Runway 6 and Runway 24 Approach surfaces in both the Initial and Future Airport Development Plans remain clear of terrain penetrations and existing towers. In both Concept 1 and 2, penetrations to the Runway 6 approach surfaces would likely require a displaced threshold to Runway 6 which is a major drawback when compared to Concept 3 which remains clear in both the initial and future time frames. In the initial plan for Concept 3, 515 acres of terrain penetrates airspace surfaces and increases to a total of 520 acres in the future plan. The total acreage of land penetrating the airspace surfaces in Concept 3 is lower than the other concepts. Concept 1 has 898 additional acres of penetrations and Concept 2 has 632 additional acres of penetrations when compared to Concept 3.

It should be noted that the Part 77 airspace evaluation was based upon USGS topographic maps and does not include tree elevations. Penetrations to Part 77 surfaces may be allowable by the FAA with certain stipulations, such as marking,

lighting and/or increases to instrument flight procedure minimums. A detailed airspace feasibility study is planned to be conducted by the FAA later this year to evaluate the potential operational effects, if any, of these penetrations.

The implementation of Concept 3 will require the relocation commercial businesses located in two buildings currently within the development footprint. The grading requirements will necessitate the demolition of these two buildings (K-1330 and K-1580) and these impacts are depicted in **Figure 20.**

3.2 – ED-3 Site

The ED-3 Site measures approximately 595 acres and is located immediately south the Heritage Center and Oak Ridge Turnpike along a ridge top of Pine Ridge. The site is bounded by the Clinch River to the west, Flannigan Loop Road to the east and Bear Creek Road to the south. Heavily wooded, the site has few significant man-made features except for TVA power lines and a water storage facility. The Initial/Future Airport Development Plans and Initial/Future Airspace are presented in **Figures 21** to **24**.

Figures 21 and **22** depict the Initial Airport Development Plan and airspace for the ED-3 Site based upon the initial Airport Development template. The 5,000-foot runway is situated in an east-west alignment with a magnetic runway heading of 050°/230° (Runway 5-23). A non-precision approach (34:1 approach slope) is planned to Runway 5 and a visual approach (20:1 approach slope) is planned to Runway 23. Terminal area facilities would be constructed north of the runway with an airport access road connecting to Oak Ridge Turnpike.

Figures 23 and **24** depict the Future Airport Development Plan and airspace for the ED-3 Site based upon the future Airport Development template. Runway 5-23 is extended 1,000 feet to the east and widened from 75 feet to 100 feet. The Runway 5 instrument approach would be upgraded to a precision approach (50:1 approach slope) and Runway 23 would be upgraded to a non-precision approach (34:1 approach slope). A full parallel taxiway is constructed north of the runway and connected to the central aircraft parking apron. The ARC is upgraded from B-II to C-II requiring larger runway safety areas.

Compared to the other sites in this study, the ED-3 Site topography has the largest elevation changes across the proposed site. An estimated 6.5 million cubic yards of earthwork will be required to grade the initial layout, followed by an additional 2.6 million cubic yards of earthwork to complete the future layout. Earthwork estimates do not include full expansion of landside facilities which would add significant additional costs. Geotechnical investigation has revealed a high probably of rock within the site. The alignment of the airport closely follows a TVA transmission line

and will require the relocation of approximately 14,000 feet of the transmission line facilities. Further, the location of the ED-3 Site requires that a City of Oak Ridge water storage facility (two towers with a cumulative storage capacity exceeding 1 million gallons) be demolished and possibly relocated to a location outside of the development area of the airport site. Construction of the future layout will require closure or relocation of Flanigan Loop Road; it is anticipated that the road would be closed. Given that the location of this site resides adjacent to the Heritage Center Site just south of the Oak Ridge Turnpike (Hwy 58), access to needed utilities (i.e. water, gas, electric, tele-communications) should be available within close proximity.

The ED-3 Site's initial and future airspace surfaces are shown on **Figures 22** and **24**. Due to its ridge top location, the ED-3 Site has the least amount of Part 77 airspace penetrations of all three sites. A total of 104 acres of terrain penetrate the airspace surfaces in the initial layout and a total of 144 acres of terrain penetrate in the future layout. In both the Initial and Future airspace surfaces, a hilltop north of the proposed airport on McKinney Ridge penetrates the Horizontal surface by 90 feet and a tower located along the same ridge line penetrates by 263 feet. South of the site, portions of Pine Ridge penetrate the Transitional and Horizontal surfaces up to 57 feet. Further south, an additional six terrain penetrations to the Horizontal and Conical surfaces penetrate from 7 to 63 feet. Immediately adjacent to the Runway 23 Approach Surface a tower penetrates the Horizontal surface by 236 feet; due to its proximity to the Approach surface, this tower may require removal. Further, within the future Runway 5 Approach surface, a tower penetrates by 50 feet and may also require removal. One additional tower penetration of 30 feet to the Conical surface is found much further south of the proposed airport site along a bend in the Clinch River.

Additional terrain penetrations to the Runway 23 34:1 approach slope are found in the future plan and may cause the need for a 1,000-foot displaced threshold; therefore, if the terrain concerns are not mitigated in the future plan, Runway 23 may only have 5,000 feet of landing length, as opposed to 6,000 feet of landing length on Runway 5.

As is the case with the Heritage Center Site, it should be noted that the Part 77 airspace evaluation was based upon USGS topographic maps and does not include tree elevations. Penetrations to Part 77 surfaces may be allowable by the FAA with certain stipulations, such as marking, lighting and/or increases to instrument flight procedure minimums. A detailed airspace feasibility study is planned to be conducted by the FAA later this year to evaluate the potential operational effects, if any, of these penetrations.

3.3 – Horizon Center Site

The Horizon Center Site is north of the Oak Ridge Turnpike, and approximately 2.5 miles northeast of the Heritage Center. Horizon Center was transferred to CROET by DOE in 2003 and has been developed into a commercial and industrial park. Currently there are two private sector tenants located at the Horizon Center.

Figures 25 and **26** depict the Initial Airport Development Plan and airspace for the Horizon Center Site based upon the initial facility template. The 5,000-foot runway is situated in an east-west alignment with a magnetic runway heading of 060°/240° (Runway 6-24). A non-precision approach (34:1 approach slope) is planned to Runway 6 and a visual approach (20:1 approach slope) is planned to Runway 24. Terminal area facilities would be constructed south of the runway and a new access road would be created between Novus Drive and Renovare Boulevard.

Figures 27 and **28** depict the Future Airport Development Plan and airspace for the Horizon Center Site based upon the future facility template. Runway 6-24 is extended 1,000 feet to the east and widened from 75 feet to 100 feet. The Runway 6 instrument approach would be upgraded to a precision approach (50:1 approach slope) and Runway 24 would be upgraded to a non-precision approach (34:1 approach slope). A full parallel taxiway is constructed south of the runway and connected to the central aircraft parking apron. The ARC is upgraded from B-II to C-II requiring larger runway safety areas.

The existing topography at the Horizon Center Site contains the most level terrain of the three sites for the development of the airport. It is estimated that 3.0 million cubic yards of grading is necessary to prepare the Initial Airport Development Plan, followed by an additional 0.6 million cubic yards in the Future Airport Development Plan. These values are lower than the other two sites. Except for one existing business, the site is reasonably clear of any development that would require demolition or relocation. As there is already two tenants within the Horizon Center complex, utilities (i.e. water, gas, electric, telecommunications, etc.) will be accessible within close proximity to the site. The geotechnical investigation has revealed minimal probability of rock within the site.

The Horizon Center Site's initial and future airspace surfaces are shown on **Figures 26** and **28**. Although the constructability of the Horizon Center Site appears less complex than the other sites, the Horizon Center has the greatest number of airspace penetrations compared to the other sites. In the initial layout, 2,178 acres of terrain penetrates Part 77 airspace surfaces; this area grows to 2,352 acres in the future configuration. The Horizon Center Site is situated in the East Fork Valley and is surrounded by mountain ridges running parallel to the runway alignment. Furthest northeast, Dicky Ridge penetrates the Horizontal surface up to 150 feet. Immediately

northeast of the airport site, Black Oak Ridge has significant Horizontal and Conical surface penetrations of up to 223 feet. South of the airport site, McKinney Ridge penetrates the Horizontal surface by 194 feet and southeast of the site, East Fork Ridge penetrates by 202 feet. Further southeast, Pine Ridge penetrates the Horizontal and Conical surfaces by up to 182 feet.

Additional terrain penetrations by Black Oak Ridge to the Runway 23 34:1 approach slope are found in the future plan and may cause the need for a 1,000-foot displaced threshold; therefore, if the terrain concerns are not mitigated in the future plan, Runway 23 may only have 5,000 feet of landing length, as opposed to 6,000 feet of landing length on Runway 5. Portions of Black Oak Ridge in this area are populated by residential land uses.

Three towers are known to penetrate the proposed airspace surfaces. A tower south of the airport site on Pine Ridge penetrates the Horizontal surface by 339 feet. Another tower located near the Heritage Center penetrates the horizontal surface by 366 feet. Of most concern is a tower located in the future 34:1 Approach surface to Runway 24; this tower is along the runway centerline and penetrates the surface by 286 feet and must be relocated.

As the case with all three sites, it should be noted that the Part 77 airspace evaluation was based upon USGS topographic maps and does not include tree elevations. Penetrations to Part 77 surfaces may be allowable by the FAA with certain stipultations, such as marking, lighting and/or increases to instrument flight procedure minimums. A detailed airspace feasibility study is planned to be conducted by the FAA later this year to evaluate the potential operational effects, if any, of these penetrations.

Section 4: Programming Cost Estimates

The previously cited Phase I report, *Proposed Oak Ridge Airport Preliminary Planning Study,* was undertaken to verify the feasibility of locating an airport on any of the three sites provided by CROET. The main considerations when analyzing the sites during Phase I were potential terrain issues, operational issues due to obstructions, as well as impacts to surrounding buildings, roadways, and the environment.

As stated in the Introduction, one of the main goals of this report is to provide some order of magnitude opinions of cost to develop an airport for each site. This information will assist federal, state and local officials, as well as the community at large, in selecting an airport site and beginning the financial planning of its development.

4.1 Cost Factors

Several factors were considered and assumptions made in order to prepare development cost ranges for the three sites. The unit prices utilized, as well as the contingency factors applied, are based on experience with similar projects and bid tabulations of recent airfield construction projects in Tennessee and neighboring states. The quantities represented are estimated and derived solely from information/data collected from existing sources and the limited amount of physical investigation undertaken (see section 4.2). As such, the cost figures presented in Section 4.3 should be considered as order of magnitude opinions of cost for the development of an airport at these sites.

Some of the specific factors and/or assumptions associated with the estimates are as follows:

- *Balancing Earthwork*: An attempt was made to balance the earthwork on each site where practicable to minimize the costs of offsite borrow or waste. Generally speaking, these estimates reflect the most economical development cost with regards to earthwork for the Initial Airport Development Plan.
- *Earthwork – Rock Excavation*: Section 4.2 will describe in greater detail the findings of the geotechnical investigation in regards to the potential rock excavation. However it should be noted in this section that the design team needed to make some judgments on the amount of rock excavation likely to be encountered at each site. Since rock excavation requires specialized equipment (i.e. hoe rams) and methods (i.e. blasting), its excavation price is significantly higher than typical earth/dirt excavation. Typically, the excavation price per cubic yard for rock is 2 to 4 times that of dirt. That being said, since earthwork is one of the largest cost contributors to the development of the sites, the amount of rock excavation encountered could have significant impacts to the overall development cost of the airport. For example, the Horizon Site has approximately 3**.0** million cubic yards of earthwork necessary to construct the Initial Airport Development Plan. If 15

percent of the earthwork was classified as rock excavation at $14/cubic yard and the balance of the earthwork was classified as dirt excavation at $5/cubic yard, then the total earth moving construction activity would cost $19.0 million dollars. However, if 30 percent of the earthwork were classified as rock then the earth moving construction activity would cost $23.1 million dollars, given that all other factors remained the same. As this study is intended to provide order of magnitude costs for site development, only a limited amount of soil borings were obtained. Based on the boring information and engineering judgment, at this time the amount of rock excavation anticipated has been estimated at 20%.

- *Business Relocation*: The capital development costs associated for business relocation, aside from that of demolition, are not accounted for in the current development estimates. As demolition is a construction item, its cost is accounted for under the "Unique Site Preparation Work" item within the Heritage Center estimates (Tables 7, 9, and 11) and footnoted as such. Heritage Center business relocation is discussed further in Section 4.5 of this report. Additionally, only the demolition costs of the water storage facility are accounted for in the ED-3 estimates under the "Unique Site Preparation Work" descriptor.
- *Construction Unit Prices:* As stated earlier, the construction unit prices used within this report's estimates are based mainly on recent bid tabulations of related projects in this region of the country and correspond to "present day" dollars (2012).
- *TVA Transmission Line Relocation:* The ED-3 site will require the relocation of a TVA transmission line. Through previous coordination with TVA representatives, it is understood that preliminary engineering by TVA personnel will be required for them to develop budgetary costs for the proposed utility relocation work. The relocation of approximately 14,000' of the transmission line is anticipated to be a significant cost associated with the development at the ED-3 Site. Therefore an estimated value has been included in the cost estimate for the ED-3 Site at this time within the value for "Unique Site Preparation Work". This estimated value will be replaced with a more refined value prepared by TVA at a future date should the ED-3 Site ultimately be selected as the preferred airport site.
- *Inactive Waste Disposal Area:* Representatives of DOE and CROET have identified an area of roughly 21.5 acres within the Heritage Center that will require relocation in the event that the Heritage Center Site - Concept 2 is ultimately selected as the preferred airport site. The work to relocate the disposal of materials is expected to occur as a part of the development of the airport. Close coordination with government officials will need to take place during any excavation in this area. These activities are expected to be above and beyond what is considered typical excavation and is priced as such in the cost estimates within the value for "Unique Site Preparation Work". The estimated value will be replaced with a more refined value by stakeholder input at a future date should the Heritage Center Site – Concept 2 ultimately be selected as the preferred airport site.

Given these factors and assumptions, the accuracy of the presented estimates can only

be that of a planning level. As additional studies are completed, and as detailed design of the preferred site begins, then more refined development cost values will be generated.

4.2 – Mapping Verification and Geotechnical Investigation Results

Mapping Verification

The main source of information used by the design team to formulate a preliminary estimate of earthwork was the USGS topographic mapping database. While these 1:24,000 scale maps are useful for planning level estimating, the design team recommended some small amount of ground survey be conducted to verify the general accuracy of these sources. By conducting two days of GPS based ground survey, the team acquired some actual ground shots to compare with the digital terrain model rendered from the USGS mapping. Any severe deviations in elevation between the mapping source and the ground survey were investigated further and subsequent engineering judgments offered.

On average, the difference between the USGS maps and that of the physical ground survey was 12'-18'. The important observation, however, was that was the general topography in section view was fairly consistent. For example, a ridge might have a peak elevation of 900' and a toe of slope elevation of 825' on the USGS map. The same peak and toe might have elevations of 885' and 810' respectively according to the GPS ground survey. Although the elevation difference between the two sources is 15' in this example, the general topography of the USGS source can be trusted since the "degree of variation" is uniform. The engineering team was able to determine that the USGS mapping was consistent with the ground survey from a general topography perspective, and therefore could be treated as an acceptable source for the basis of earthwork calculations.

Geotechnical Investigation

The subsoil characteristics of each of the three sites can potentially have significant impacts to their development costs. This study utilized existing sources of data in order to make some assumptions for cost estimating purposes. By utilizing publicly available information sources, as well as consulting with soils engineers familiar with the Oak Ridge area, the design team arrived at some conclusions regarding soil characteristics likely to be encountered during construction activities. For example, areas known to have underlying rock formations or saturated clayey soils would likely need blasting and sub-grade preparation activities, respectively, to facilitate construction activities. Despite this knowledge, the design team recommended that some limited field tests be taken to verify and/or eliminate some assumptions. The design team contracted with an experienced geotechnical firm to explore the sites with borings in strategic locations to better understand their subsoil conditions.

Additional geotechnical investigation will be required for the selected preferred airport site design.

The following general assumptions were made regarding likely subsoil characteristics:

- Pinnacle rock formations are likely to be encountered on the Heritage Center and ED-3 sites. These rock formations are anticipated to have significant variation. A detailed geotechnical design investigation of the sites was not warranted in developing magnitude of costs. The excavation of these formations will require blasting and specialty construction equipment and therefore has a premium unit cost in this report's estimates.
- Due to the clayey soils prevalent in this East Tennessee Region, it is assumed some site preparation activities will need to occur to stabilize the existing soils, particularly in areas of future pavement construction. All 3 sites have an assumed "Site Preparation" activity included in their respective cost estimates.
- Based on the data obtained from the geotechnical firm after their site investigation and subsequent boring logs, it was determined by the design team that rock was likely to be encountered approximately 18 feet below the existing surface. This depth is merely an average derived from the boring logs, and was used by the design team as a basis for the rock excavation quantities.

4.3 – Cost Estimates

A summary of the cost estimates are presented below in Section 4.3.1 through 4.3.3.

The first series of tables shown in each of Sections 4.3.1 through 4.3.3 illustrates the Initial Airport Development Plan cost estimate. The second table within each of the referenced sections conveys the Future Airport Development Plan's *additional* cost. Adding the Initial Airport Development Plan estimate to the Future Airport Development Plan estimate renders a total projected cost of the entire program in *2012 dollars*.

It should be noted that 5 items of work in particular have the greatest impact on the overall costs for each site. These particular items of work are: Dirt Excavation, Rock Excavation, Waste/Borrow Excavation, Pavement Base (Crushed Aggregate Base Course), and Asphalt Surface. For this reason, rather than illustrate the project costs as one estimate per site, the design team has presented a cost range per site. The Low Cost Scenario for each site will reflect unit prices for the 5 items listed above at very competitive values, whereas the High Cost Scenario will contain the same 5 items at more conservative values.

A second cost consideration the design team used on the estimates related to "Contingency". As is customary for planning level cost estimates, a contingency factor of 20 percent was applied to the total program cost estimate. This same

factor was applied to both the Low and High Cost Scenarios, respectively, in this study, and is consistent with the Metropolitan Knoxville Airport Authority *Design Guidelines* for project development.

Sections 4.3.1 through 4.3.3 contain the summary development cost estimates for the low and high end scenarios. Section 4.4 illustrates these development cost estimates in a consolidated comparison.

4.3.1 – Heritage Center Opinion of Cost

Tables 7 to **12** provide the programming cost estimates for Heritage Center Concepts 1, 2, and 3.

Table 7
Opinion of Cost
Heritage Center Site - Concept 1

Initial Airport Development Plan

Item Description	*Low Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation	$22,670,296.00	$41,921,358.00
Unique Site Preparation Work*	$3,402,000.00	$3,402,000.00
Airfield Pavements	$3,059,675.00	$3,328,047.00
Taxilanes, T-Hangar	$231,174.00	$252,234.00
Auto Parking	$68,375.00	$72,101.00
Entrance Road	$49,982.00	$52,196.00
Fuel Farm	$340,524.00	$340,524.00
NAVAIDS	$312,795.00	$312,795.00
FBO Maintenance Hangar	$972,000.00	$972,000.00
T Hangars (16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$31,970,821.00	$51,517,255.00
Architectural, Engineering and Planning Consulting Services	$4,795,623.00	$7,727,588.00
Program Contingency (20%)	$7,353,300.00	$11,849,000.00
Grand Total Cost	**$44,120,000.00**	**$71,100,000.00**

Source: THE LPA GROUP INCORPORATED 2012

*This item includes Utilities (Gas, Electrical, Water, Sewer, Phone, etc.) installation and/or relocation; Building Demolition (8)

Table 8

Opinion of Cost

Heritage Center Site - Concept 1

Future Airport Development Plan

Item Description	*Low-Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation for Runway Extension	$6,192,270.00	$9,486,941.00
Airfield Pavement Expansions	$4,135,244.00	$4,525,664.00
Taxilane Extensions, T-Hangar	$231,174.00	$252,234.00
Auto Parking Expansion	$68,375.00	$72,101.00
Perimeter Road Relocation	$459,340.00	$509,047.00
Fuel Farm Expansion	$340,524.00	$340,524.00
NAVAIDS (ILS, MALSR)	$1,375,000.00	$1,375,000.00
GA Terminal	$583,200.00	$583,200.00
Corporate/Individual Hangars	$972,000.00	$972,000.00
T Hangars (Additional 16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$15,221,127.00	$18,980,711.00
Architectural, Engineering and Planning Consulting Services	$2,283,000.00	$2,847,000.00
Program Contingency (20%)	$3,500,800.00	$4,365,500.00
Grand Total Cost	**$21,000,000.00**	**$26,190,000.00**

Source: THE LPA GROUPINCORPORATED 2012

Table 9

Opinion of Cost

Heritage Center Site - Concept 2

Initial Airport Development Plan

Item Description	*Low Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation	$15,961,972.00	$28,301,427.00
Unique Site Preparation Work*	$10,530,000.00	$10,530,000.00
Airfield Pavements	$3,059,289.00	$3,328,047.00
Taxilanes, T-Hangar	$231,174.00	$252,234.00
Auto Parking	$68,375.00	$72,101.00
Entrance Road	$49,982.00	$52,196.00
Fuel Farm	$340,524.00	$340,524.00
NAVAIDS	$312,795.00	$312,795.00
FBO Maintenance Hangar	$972,000.00	$972,000.00
T Hangars (16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$32,390,111.00	$45,025,324.00
Architectural, Engineering and Planning Consulting Services	$4,858,517.00	$6,753,799.00
Program Contingency (20%)	$7,449,700.00	$10,355,800.00
Grand Total Cost	**$44,700,000.00**	**$62,130,000.00**

Source: THE LPA GROUP INCORPORATED 2012

*This item includes: Utilities (Gas, Electrical, Water, Sewer, Phone, etc.) installation and/or relocation; Building Demolition (10); Removal and Relocation of Inactive Waste Disposal Area materials

Table 10
Opinion of Cost
Heritage Center Site - Concept 2

Future Airport Development Plan

Item Description	*Low-Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation for Runway Extension	$5,437,680.00	$8,888,103.00
Airfield Pavement Expansions	$4,135,244.00	$4,525,664.00
Taxilane Extensions, T-Hangar	$231,174.00	$252,234.00
Auto Parking Expansion	$68,375.00	$72,101.00
Perimeter Road Relocation	$459,340.00	$509,047.00
Fuel Farm Expansion	$340,524.00	$340,524.00
NAVAIDS (ILS, MALSR)	$1,375,000.00	$1,375,000.00
GA Terminal	$583,200.00	$583,200.00
Corporate/Individual Hangars	$972,000.00	$972,000.00
T Hangars (Additional 16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$14,466,537.00	$18,381,873.00
Architectural, Engineering and Planning Consulting Services	$2,170,000.00	$2,757,000.00
Program Contingency (20%)	$3,327,300.00	$4,227,800.00
Grand Total Cost	**$19,960,000.00**	**$25,370,000.00**

Source: THE LPA GROUPINCORPORATED 2012

Table 11

Opinion of Cost

Heritage Center Site - Concept 3

Initial Airport Development Plan

Item Description	*Low Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation	$16,188,642.00	$28,761,631.00
Unique Site Preparation Work*	$1,123,000.00	$1,123,000.00
Airfield Pavements	$3,228,425.00	$3,517,675.00
Taxilanes, T-Hangar	$231,174.00	$252,234.00
Auto Parking	$68,375.00	$72,101.00
Entrance Road	$49,982.00	$52,196.00
Fuel Farm	$340,524.00	$340,524.00
NAVAIDS	$312,795.00	$312,795.00
FBO Maintenance Hangar	$972,000.00	$972,000.00
T Hangars (16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$23,378,917.00	$36,268,156.00
Architectural, Engineering and Planning Consulting Services	$3,506,838.00	$5,440,223.00
Program Contingency (20%)	$5,380,000.00	$8,340,000.00
Grand Total Cost	**$32,270,000.00**	**$50,050,000.00**

Source: THE LPA GROUP INCORPORATED 2012

*This item includes: Utilities (Gas, Electrical, Water, Sewer, Phone, etc.) installation and/or relocation; Building Demolition (2)

Table 12
Opinion of Cost
Heritage Center Site - Concept 3

Future Airport Development Plan

Item Description	*Low-Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation for Runway Extension	$8,328,754.00	$16,615,682.00
Airfield Pavement Expansions	$3,565,125.00	$3,891,735.00
Taxilane Extensions, T-Hangar	$231,174.00	$252,234.00
Auto Parking Expansion	$68,375.00	$72,101.00
Perimeter Road Relocation	$459,340.00	$509,047.00
Turnpike Relocation	$7,000,000.00	$10,000,000.00
Fuel Farm Expansion	$340,524.00	$340,524.00
NAVAIDS (ILS, MALSR)	$1,375,000.00	$1,375,000.00
GA Terminal	$583,200.00	$583,200.00
Corporate/Individual Hangars	$972,000.00	$972,000.00
T Hangars (Additional 16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$23,787,492.00	$35,475,523.00
Architectural, Engineering and Planning Consulting Services	$3,568,000.00	$5,321,000.00
Program Contingency (20%)	$5,471,100.00	$8,159,300.00
Grand Total Cost	**$32,830,000.00**	**$48,960,000.00**

Source: THE LPA GROUPINCORPORATED 2012

4.3.2 – ED-3 Site Opinion of Cost

Table 13 and **14** provides the programming cost estimates for the ED-3 Site.

Table 13
Opinion of Cost
ED-3 Site

Initial Airport Development Plan

Item Description	*Low Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation	$27,541,283.00	$51,393,659.00
Unique Site Preparation Work*	$11,070,000.00	$11,070,000.00
Airfield Pavements	$3,059,675.00	$3,328,525.00
Taxilanes, T-Hangar	$231,174.00	$252,234.00
Auto Parking	$68,375.00	$72,101.00
Entrance Road	$49,982.00	$52,196.00
Fuel Farm	$340,524.00	$340,524.00
NAVAIDS	$312,795.00	$312,795.00
FBO Maintenance Hangar	$972,000.00	$972,000.00
T Hangars (16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$44,509,808.00	$68,658,034.00
Architectural, Engineering and Planning Consulting Services	$6,676,000.00	$10,299,000.00
Program Contingency (20%)	$10,237,200.00	$15,791,400.00
Grand Total Cost	**$61,420,000.00**	**$94,750,000.00**

Source: THE LPA GROUP INCORPORATED 2012

* This item includes: Relocation of 10,000' of 161-KV TVA Transmission Lines; Demolition of Water Storage Facility (2 Towers, >1M Gallons)

Table 14

Opinion of Cost

ED-3 Site

Future Airport Development Plan

Item Description	*Low Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation	$10,300,712.00	$20,262,269.00
Unique Site Preparation Work*	$4,320,000.00	$4,320,000.00
Airfield Pavements Expansion	$4,135,244.00	$4,525,664.00
Taxilane Extensions, T-Hangar	$231,174.00	$252,234.00
Auto Parking Expansion	$68,461.00	$72,101.00
Fuel Farm Expansion	$340,537.50	$340,524.00
NAVAIDS (ILS, MALSR)	$1,375,000.00	$1,375,000.00
GA Terminal	$583,200.00	$583,200.00
Individual/Corporate Hangar	$972,000.00	$972,000.00
T Hangars (Additional 16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$23,190,329.00	$33,566,992.00
Architectural, Engineering and Planning Consulting Services	$3,479,000.00	$5,035,000.00
Program Contingency (20%)	$5,333,900.00	$7,720,400.00
Grand Total Cost	**$32,000,000.00**	**$46,320,000.00**

Source: THE LPA GROUP INCORPORATED 2012

*This item includes Utilities (Gas, Electrical, Water, Sewer, Phone, etc.) installation and/or/relocation;

4.3.3 – Horizon Center Site Opinion of Cost

Table 15 to **16** provides the programming cost estimates for Horizon Center Site.

Table 15

Opinion of Cost

Horizon Center Site

Initial Airport Development Plan

Item Description	*Low Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation	$10,730,686.00	$19,596,902.00
Airfield Pavements	$3,059,289.00	$3,059,289.00
Taxilanes, T-Hangar	$231,174.00	$252,234.00
Auto Parking	$68,375.00	$72,101.00
Entrance Road	$196,144.00	$214,213.00
Fuel Farm	$340,524.00	$340,524.00
NAVAIDS	$312,795.00	$312,795.00
FBO Maintenance Hangar	$972,000.00	$972,000.00
T Hangars (16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$16,774,987.00	$25,952,816.00
Architectural, Engineering and Planning Consulting Services	$2,516,248.00	$3,893,000.00
Program Contingency (20%)	$3,858,200.00	$5,969,200.00
Grand Total Cost	**$23,150,000.00**	**$35,820,000.00**

Source: THE LPA GROUP INCORPORATED 2012

*This item includes Utilities (Gas, Electrical, Water, Sewer, Phone, etc.) installation and/or/relocation

Table 16
Opinion of Cost
Horizon Center Site

Future Airport Development Plan

Item Description	*Low-Cost Scenario* Total	*High Cost Scenario* Total
Site Preparation for Runway Extension	$5,288,106.00	$8,094,459.00
Airfield Pavement Expansions	$4,135,244.40	$4,525,430.00
Taxilane Extensions, T-Hangar	$231,174.00	$252,234.00
Auto Parking Expansion	$68,375.00	$72,101.00
Entrance Road Extension	$267,122.00	$267,122.00
Fuel Farm Expansion	$340,524.00	$340,524.00
NAVAIDS (ILS, MALSR)	$1,375,000.00	$1,375,000.00
GA Terminal	$583,200.00	$583,200.00
Corporate/Individual Hangars	$972,000.00	$972,000.00
T Hangars (Additional 16 Units - 2 Buildings)	$864,000.00	$864,000.00
Total Construction	$14,124,431.00	$17,346,070.00
Architectural, Engineering and Planning Consulting Services	$2,119,000.00	$2,602,000.00
Program Contingency (20%)	$3,248,700.00	$3,989,600.00
Grand Total Cost	**$19,490,000.00**	**$23,940,000.00**

Source: THE LPA GROUPINCORPORATED 2012

4.4 – Consolidated Cost Comparison

To better illustrate and compare the development cost summaries presented in Sections 4.3.1 through 4.3.3, a consolidated matrix was created. The following matrix gives the low and high scenarios of each site, as well as the Initial Airport Development Plan and Future Airport Development Plan cost figures. All cost values shown in the following tables correspond to present day (2012) dollars.

Table 17
Consolidated Cost Comparison
Low Cost Scenario (More Favorable Bid Prices)
Summary of All Sites

Site	Initial Airport Development Plan	Future Airport Development Plan	Total
Heritage Center			
Concept 1	$ 44,120,000.00	$ 21,000,000.00	$ 65,120,000.00
Concept 2	$ 44,700,000.00	$ 19,960,000.00	$ 64,660,000.00
Concept 3	$ 32,270,000.00	$ 32,830,000.00	$ 65,100,000.00
ED-3	$ 61,420,000.00	$ 32,000,000.00	$ 93,420,000.00
Horizon Center	$ 23,150,000.00	$ 19,490,000.00	$ 42,640,000.00

Source: THE LPA GROUP INCORPORATED, 2012.

Table 18
Consolidated Cost Comparison
High Cost Scenario (Less Favorable Bid Prices)
Summary of All Sites

Site	Initial Airport Development Plan	Future Airport Development Plan	Total
Heritage Center			
Concept 1	$ 71,100,000.00	$ 26,190,000.00	$ 97,290,000.00
Concept 2	$ 62,130,000.00	$ 25,370,000.00	$ 87,500,000.00
Concept 3	$ 50,050,000.00	$ 48,960,000.00	$ 99,010,000.00
ED-3	$ 94,750,000.00	$ 46,320,000.00	$ 141,070,000.00
Horizon Center	$ 35,820,000.00	$ 23,940,000.00	$ 59,760,000.00

Source: THE LPA GROUP INCORPORATED, 2012.

4.5 – Airport Property Considerations

The construction cost estimates presented in the preceding **Tables 7** through **16** provide the foundation for the overall airport development program estimates found in **Tables 19** and **20**. That being said, and as previously noted in Section 4.1 under *Business Relocation*, portions of some of the proposed airport sites are currently occupied by various buildings. Some of these buildings are vacant, while others are currently occupied. The existing buildings, which are expected to be impacted by the airport development plans for the Heritage Center Site, are depicted on **Figures 10, 15** and **20**, and can be further identified as follows:

- Building **K-1006**: This building can generally be described as a multi-story masonry structure of office space that occupies a footprint of approximately 25,000 square feet;
- Building **K-1007**: This building can generally be described as a 2 story masonry structure with an approximate 70,000 square feet footprint, privately owned and currently operating as office space;
- Building **K-1034/K-1650**: This area can generally be described as single and multi-story structures occupying a footprint of approximately 17,000 square feet and currently houses the Oak Ridge Fire Department, Station 4.
- Building **K-1037**: This facility can generally be described as a multi story structure with a footprint of over 300,000 square feet and maintains a secure status.
- Building **K-1039**: These buildings can generally be described as masonry structures of approximately 5,000 square feet that currently operates as a site communications hub;
- Building **K-1200**: This facility can generally be described as multi-story industrial structures that occupy a footprint of over 150,000 square feet and are currently occupied by an environmental clean-up firm.
- Building **K-1210** & **K-1220**: These facilities can generally be described as former centrifuge buildings with a combined footprint exceeding 100,000 square feet;
- Building **K-1225**: This building can generally be described as a multi-story structure with a footprint in excess of 15,000 square feet, privately owned and currently operating as office space;
- Building **K-1330**: This building can generally be described as a 2 story masonry structure with a footprint of approximately 7,000 square feet and that currently operates as privately owned office space.
- Building **K-1414**: This structure can generally be described as a multi-story site garage with a footprint of approximately 16,000 square feet and is currently utilized as a vehicle maintenance/fueling area.
- Building **K-1435**: This facility can generally be described as an incinerator for toxic substances that occupies an approximate footprint of 140,000 square feet.

- Building **K-1580**: This building can generally be described as a 3 story structure with an approximate footprint of 12,000 square feet and that currently operates as privately owned office space.
- Building **Spec-1**: This building can generally be described as office/warehouse space with a footprint of approximately 50,000 square feet and occupied by a private tenant.
- Building **Spec-2**: This building can generally be described as a 1 story office/warehouse space with a footprint of approximately 20,000 square feet and is currently unoccupied.

In order for the overall airport development program to account for these above mentioned property considerations, an assessment was made with the input of some of the project stakeholders regarding the existing buildings assumed to be impacted by the initial and future airport development plans. It should be noted that this property assessment was not based on formal real estate appraisals for each of the potentially affected properties, but rather this assessment was based on the opinions of the stakeholders most knowledgeable with the existing buildings and their current leasehold/ownership provisions. This more informal approach was adopted due to the planning nature of this study, with the understanding that formal real estate procedures would need to be followed in the future for the preferred airport site.

Based on the informal methods used at this time, the cost range associated with the relocation of businesses for the Heritage Center Site is as follows:

- Heritage Center Site – Concept 1: A cumulative total in the range of $5 million to $7 million dollars of additional cost may be incurred to acquire and/or relocate the impacted facilities per **Figure 10** (K-1006, K-1007, K-1580, K-1330, K-1225, K-1039, K-1210 and K-1220).
- Heritage Center Site – Concept 2: A cumulative total in the range of $20 million to $50 million dollars of additional cost may be incurred to acquire and/or relocate the impacted facilities per **Figure 15** (K-1225, K-1210, K-1220, K-1037, K-1200, K-1414, K-1435, K-1034/1650, Spec-1, and Spec-2).
- Heritage Center Site – Concept 3: A cumulative total in the range of $1.5 million to $2.0 million dollars of additional cost may be incurred to acquire and/or relocate the impacted facilities per **Figure 20** (K-1330 and K-1580).

It should be noted that the intent of the federal regulations associated with real estate, as it pertains to commercial properties, is to address such relocation-related costs, such as searching for suitable replacement facilities, relocation and moving expenses, equipment set-up and calibration expenses, and re-establishment allowance (i.e. letterhead, change of address notifications, etc.). The responsibility for said relocation-related costs can be closely governed by the terms and conditions of the lease agreements in effect at the time of acquisition/relocation.

That being said, these Regulations do not imply that a new facility will be constructed specifically to accommodate the affected party.

Section 5 – Summary of Findings and Recommendation

As a result of the initial analysis conducted during the preceding *Proposed Oak Ridge Airport Preliminary Planning Study*, as amended, as well as the subsequent refinements accomplished during this Phase 2 – Programming Report, a significant amount of information has been compiled and evaluated related to the design, construction, environmental, airspace, and property related factors associated with the development of a new airport to serve Oak Ridge and the surrounding communities. **Table 19** presents a summary of the major factors evaluated during Phase II, including the noted design, construction, environmental, airspace, and property factors.

In order to establish a priority ranking of the airport sites under consideration, a matrix of the most relevant factors associated with the Initial Airport Development Plan was generated, and each factor was rated on a scale of 1 through 5, with a value of 1 being associated with the most favorable rating and a value of 5 being associated with the least favorable rating. The most relevant factors related to design, construction, environmental, airspace, and property, are presented in **Table 20**. It is noted that the factors listed in **Table 20** are not identical to those presented in **Table 19** to avoid "double-counting" of closely-related factors.

As shown in **Table 20**, the priority ranking of the airport sites under consideration is as follows:

1. Heritage Center Site – Concept 3
2. Heritage Center Site – Concept 2
3. Heritage Center Site – Concept 1
4. ED-3 Site
5. Horizon Center Site

It should be noted that this ranking has been based on the information collected and compiled to date by the various stakeholders of the project, and may be adjusted in the future as additional information is gathered by the stakeholders. For instance, and as noted previously in this report, the results of the FAA's airspace feasibility study could have an effect on the priority rankings as presented herein.

Table 19
Comparison of Proposed Airport Sites
Proposed Oak Ridge Airport

	Heritage Center Concept 1		Heritage Center Concept 2		Heritage Center Concept 3		ED-3 Site		Horizon Center Site	
	Initial	**Future**	**Initial**	**Future**	**Initial**	**Future**	**Initial**	**Future**	**Initial**	**Future**
Design/Construction										
Estimated Construction Cost	$44.1M–$71.1M	+$21M-$26.2M	$44.7M-$62.1M	+$19.9M-$25.4M	$32.3M-$50M	+$32.8M-$48.9M	$61.4M-$94.7M	+$32M-$46.3M	$23.1M-$35.8M	+$19.5M-$23.9M
Earthwork Quantities	5.2M CY	+0.7M CY	3.3M CY	+0.7M CY	3.4M CY	+2M CY	6.5M CY	+2.6M CY	3.0M CY	+0.6M CY
Building Impacts	8 Bldgs.	None	11 Bldgs.	None	2 Bldgs.	None	None	None	None	None
Unusual Construction Factors	5 acres of the 24 acre Inactive Disposal Area Disturbed	7 acres of the 23 acre West End Pond Disturbed	21 acres of the 24 acre Inactive Disposal Area Disturbed	None	Road Relocation	Realignment of Oak Ridge Turnpike	TVA Lines Relocation; Water Towers Demo	Road Relocation	None	None
Geotechnical Issues	High Rock Possibility	High Rock Possibility	Limited Rock Possibility	Limited Rock Possibility	High Rock Possibility	High Rock Possibility	High Rock Possibility	High Rock Possibility	Minimal	Minimal
Landside Expansion	Fair	Fair	Good	Good	Good	Good	Poor	Poor	Fair	Fair
Environmental										
Water Resource Impacts	K-1007 Pond	K-1007 Pond	No	No	No	No	No	No	Poplar Creek	Poplar Creek
NRHP	Main Plant Historical District	Wheat Church	Main Plant Historical District	Wheat Church	Main Plant Historical District, Wheat Church	None	Former work camp potentially eligible	None	One NRHP-eligible site (40RE195) and the protected McKamey-Carmichael Cemetery	None
Federally Protected Species	None	None	None	None	None	None	None	None	None	None
Section 4(f)	None	None	None	None	None	None	None	None	USDOE Protected Natural Areas	None
Landfills within 6 Miles	No	No	No	No	No	No	No	No	No	No
Airspace										
Clear Approach – Primary Runway End	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No (minor terrain)
Clear Approach – Secondary Runway End	Yes	No (Terrain)	Yes	No (terrain)	Yes	Yes	Yes	No (terrain)	No (tower must be removed)	No (tower and terrain)
Tower Part 77 Penetrations – Horizontal and Conical	2 Towers (+325',+354')	No new Towers	2 Towers (+312',+339')	No new Towers	2 Towers (+305', +278')	No new Towers	4 Towers (+30', +50',+236',+263')	No new Towers; 1 Initial Tower moves into approach surf.	2 Towers (+366,+339')	No new Towers
Tower Part 77 Penetrations – Approach and Transitional	0	0	0	0	0	0	0	1 Tower (+50')	1 Tower (+186')	Initial Tower must be removed
Total Horizontal Acreage of Terrain Penetrations	1,181 acres	+237 acres	1,032 acres	+120 acres	515 acres	+5 acres	104 acres	+40 acres	2,178 acres	+174 acres

Source: THE LPA GROUP INCORPORATED, 2012.

Table 20
Priority Ranking of Proposed Airport Sites
Proposed Oak Ridge Airport

	Heritage Center Site – Concept 1	Heritage Center Site - Concept 2	Heritage Center Site - Concept 3	ED-3 Site	Horizon Center Site
	Design/Construction (1=Most Favorable, 5=Least Favorable)				
Estimated Construction Cost	3	3	2	5	1
Unusual Construction Factors	4	5	3	3	1
Site Constraints	3	1	1	5	3
Design/Construction Sub-Total	**10**	**9**	**6**	**13**	**5**
	Environmental (1=Most Favorable, 5=Least Favorable)				
Water Resource Impacts	2	1	1	1	2
NRHP Concerns	1	1	1	2	5
Section 4(f) Concerns	1	1	1	1	4
Environmental Sub-Total	**4**	**3**	**3**	**4**	**11**
	Airspace (1=Most Favorable, 5=Least Favorable)				
Clear Runway Approaches	2	2	1	2	5
Nearby Tower Part 77 Penetrations	1	1	1	4	5
Surrounding Part 77 Terrain Penetrations	3	3	2	1	5
Airspace Sub-Total	**6**	**6**	**4**	**7**	**15**
	Property (1=Most Favorable, 5=Least Favorable)				
Building Impacts	4	5	3	1	1
Property Sub-Total	**4**	**5**	**3**	**1**	**1**
	Summary of Ratings				
Sum of above Ratings	**24**	**23**	**16**	**25**	**32**

Source: THE LPA GROUP INCORPORATED, 2012.

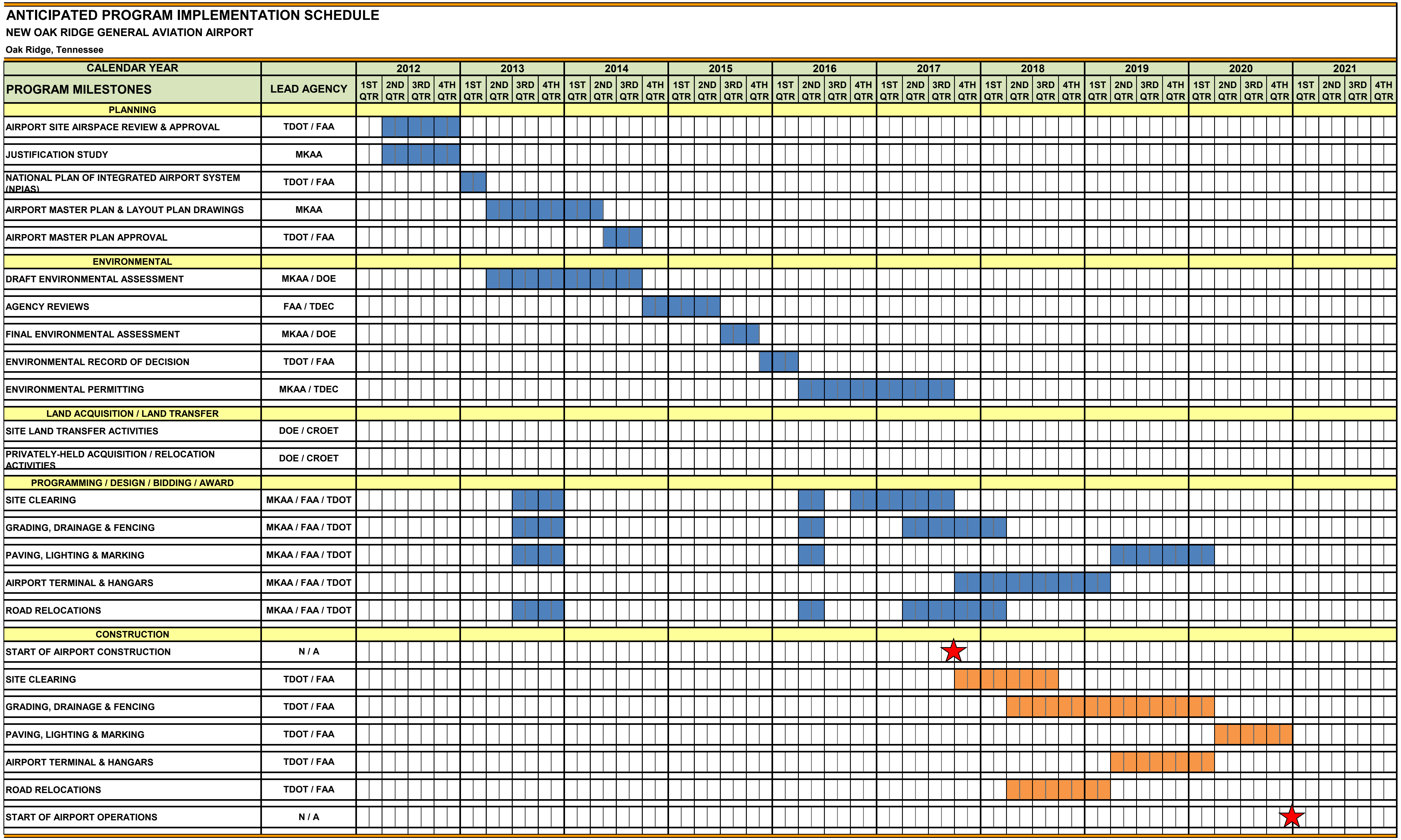
Section 6 – Next Steps

Now that detailed facility layouts and cost estimates have been prepared for both initial and future scenarios, further discussions should be held with MKAA, CROET, DOE and TDOT regarding the suitability of these layouts and their intention to move forward. Next steps would include discussions with TDOT regarding suitability of the sites, potential funding and community support. A justification document will likely be required to document the purpose and need for the airport and to establish its inclusion within the TDOT System Plan. Inclusion within the System Plan would allow the airport to be included within the federal NPIAS and eligible for federal grants from the Vision 100 State Block Grant Program. The justification document should include copies of community support letters. A very important next step is to have FAA review airspace suitability of the proposed sites and provide written determination regarding noted Part 77 penetrations. In general, the anticipated steps moving forward, along with their estimated durations, are as follows:

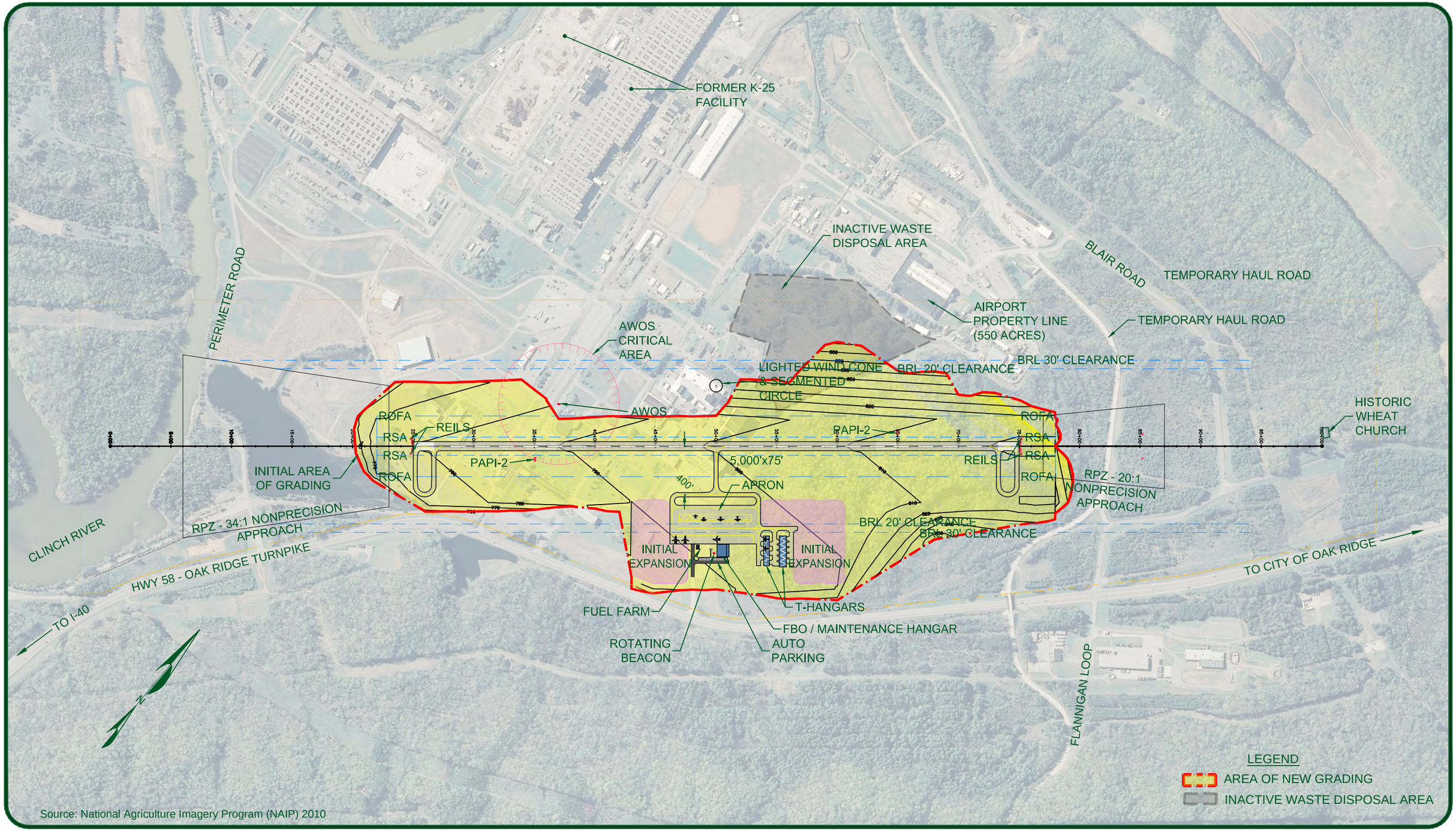
- MKAA, CROET, DOE, TDOT discussion regarding sites, funding and decision to move forward with a preferred site; (Estimated Duration: 1-2 months)
- FAA airspace review and approval; (Estimated Duration: 6-8 months)
- Prepare justification study for TDOT System Plan/NPIAS inclusion; (Estimated Duration: 6-12 months)
- Prepare Environmental Assessment/Environmental Impact Statement and Airport Master Plan; (Estimated Duration: 12-36 months)
- Environmental permitting and preliminary design; (Estimated Duration: 12-18 months)
- Conduct land transactions, including tenant relocation, DOE permitting and building demolition; (Estimated Duration: 12-24 months)
- Airport design; (Estimated Duration: 12-18 months) and
- Airport construction. (Estimated Duration: 2-4 years)

It should be noted that the estimated durations presented above are for the performance of the steps themselves, and some of these steps will likely occur concurrently. The rate of progress of these steps is very dependent on consistent project funding and thoughtful program management. The bar chart schedule presented on the following page as **Figure 32** illustrates the anticipated implementation program based on information available at this time.

Figure 32 – Program Milestone Schedule



Appendix A: Section 3 Figures

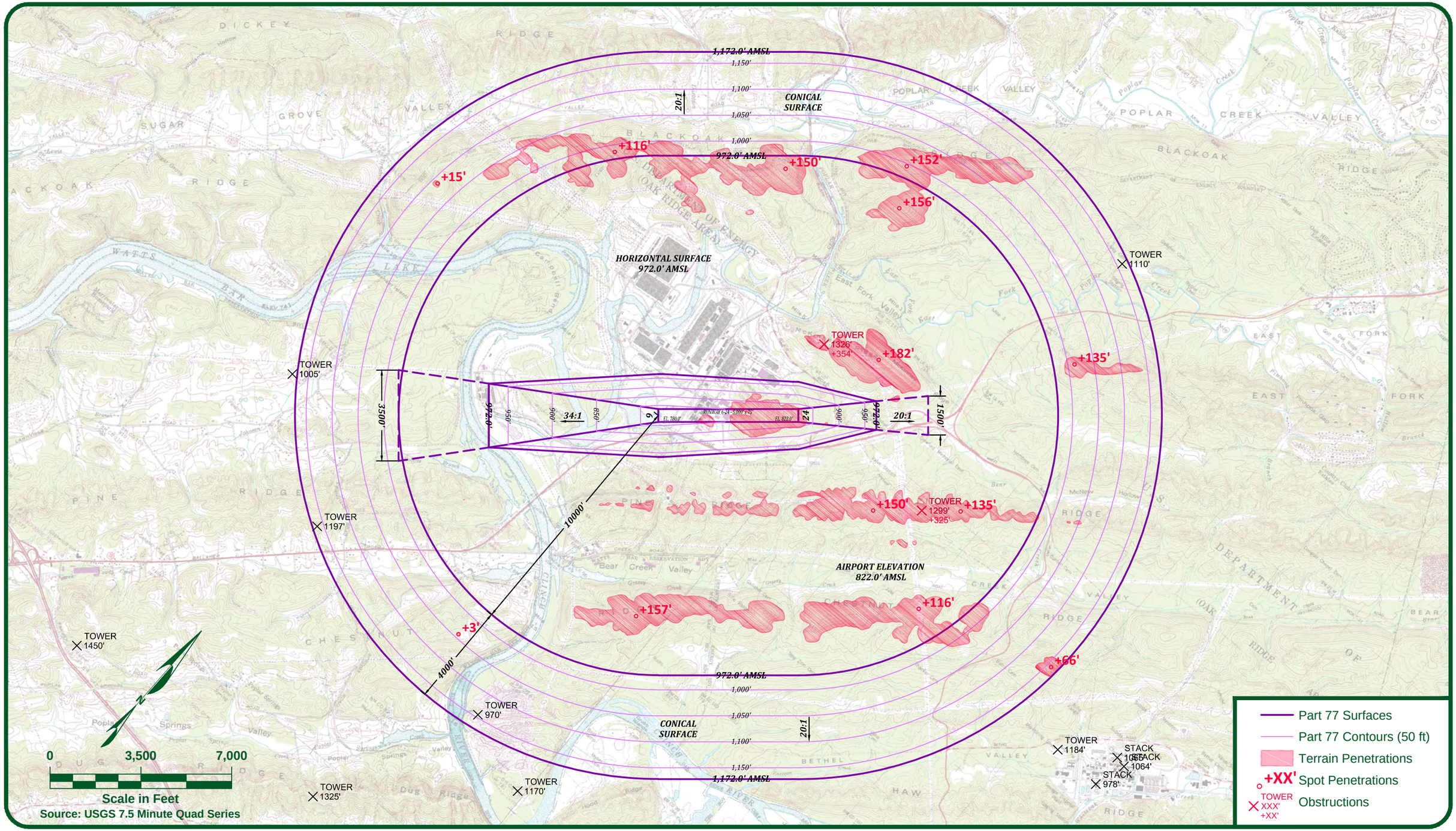


Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Heritage Center Site - Concept 1
Initial Airport Development Plan

Figure 6

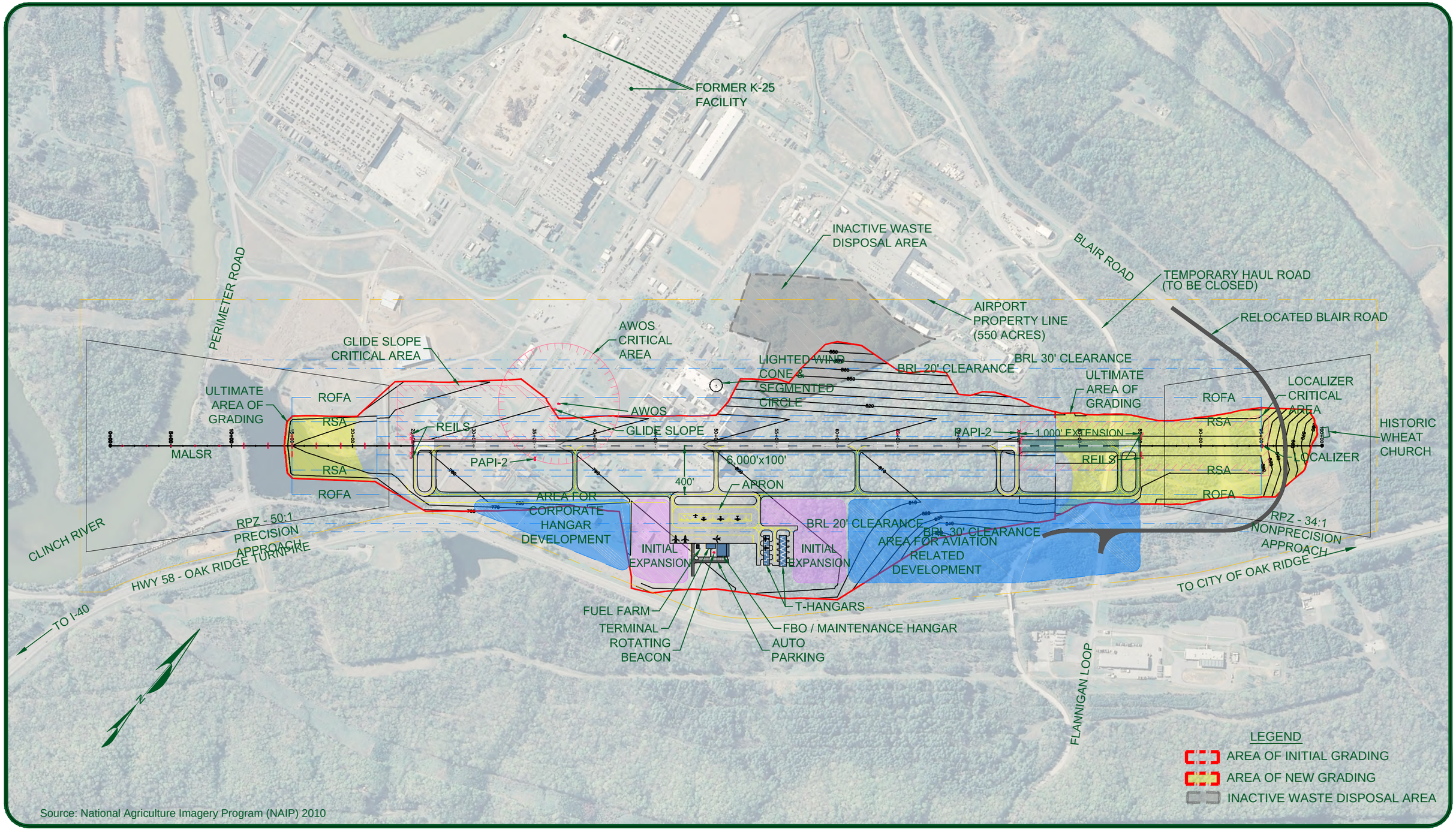


Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Heritage Center Site - Concept 1 Initial Airspace

Figure 7

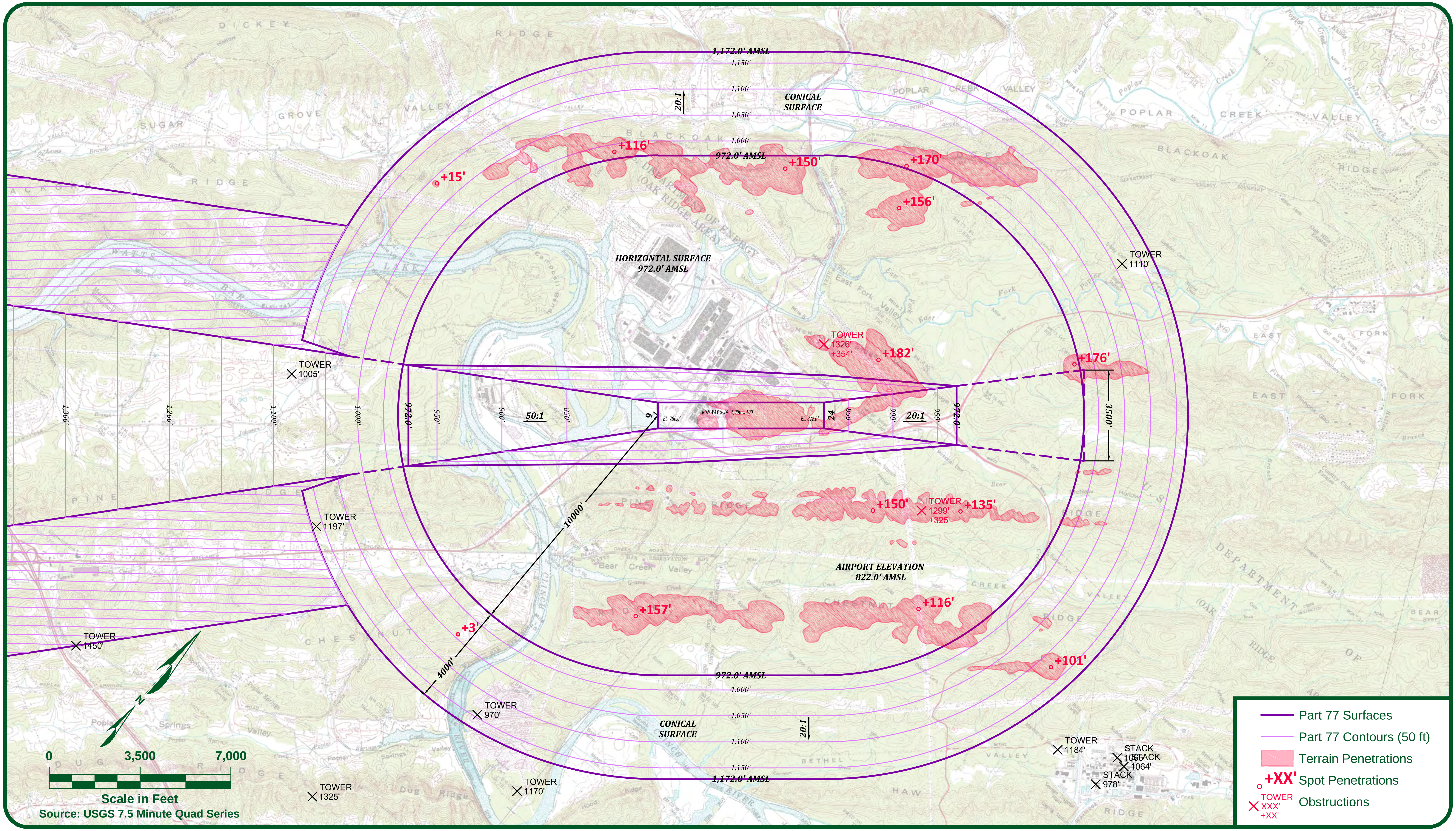


Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Heritage Center Site - Concept 1
Future Airport Development Plan

Figure 8



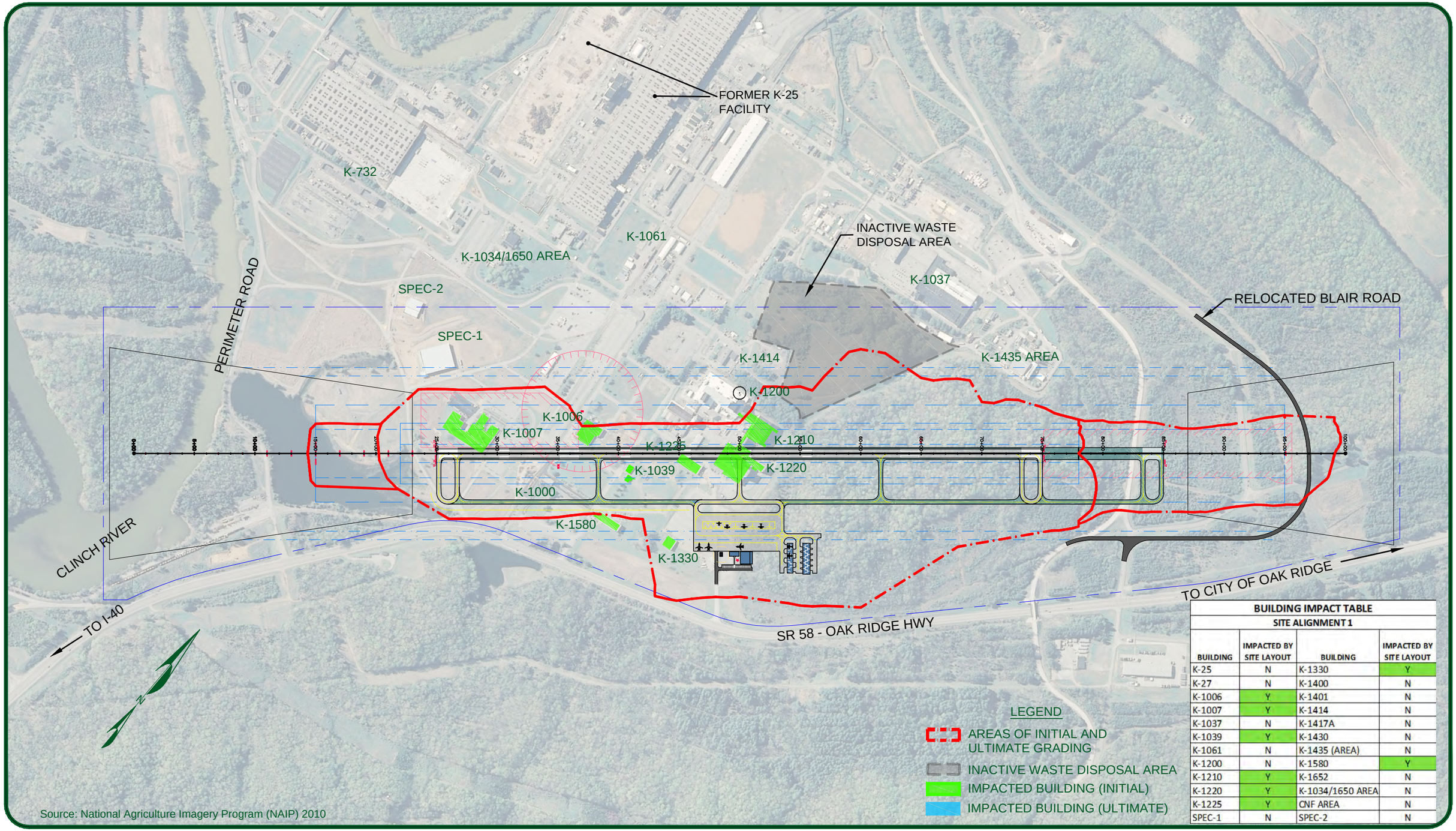
1,172.0' AMSL
CONICAL SURFACE
20:1
972.0' AMSL
HORIZONTAL SURFACE
972.0' AMSL
+116'
+150'
+170'
+156'
+15'
TOWER
1110'
TOWER
1326'
+354'
+182'
+176'
TOWER
1005'
50:1
20:1
3500'
10000'
4000'
TOWER
1197'
+150'
TOWER
1299'
+325'
+135'
AIRPORT ELEVATION
822.0' AMSL
+157'
+116'
+3'
TOWER
1450'
+101'
972.0' AMSL
CONICAL SURFACE
20:1
1,172.0' AMSL
TOWER
970'
TOWER
1170'
TOWER
1325'
TOWER
1184'
STACK
1064'
STACK
978'
0
3,500
7,000
Scale in Feet
Source: USGS 7.5 Minute Quad Series
Part 77 Surfaces
Part 77 Contours (50 ft)
Terrain Penetrations
+XX' Spot Penetrations
TOWER XXX' +XX' Obstructions

Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Heritage Center Site - Concept 1 Future Airspace

Figure 9



Source: National Agriculture Imagery Program (NAIP) 2010

BUILDING IMPACT TABLE
SITE ALIGNMENT 1

BUILDING	IMPACTED BY SITE LAYOUT	BUILDING	IMPACTED BY SITE LAYOUT
K-25	N	K-1330	Y
K-27	N	K-1400	N
K-1006	Y	K-1401	N
K-1007	Y	K-1414	N
K-1037	N	K-1417A	N
K-1039	Y	K-1430	N
K-1061	N	K-1435 (AREA)	N
K-1200	N	K-1580	Y
K-1210	Y	K-1652	N
K-1220	Y	K-1034/1650 AREA	N
K-1225	Y	CNF AREA	N
SPEC-1	N	SPEC-2	N

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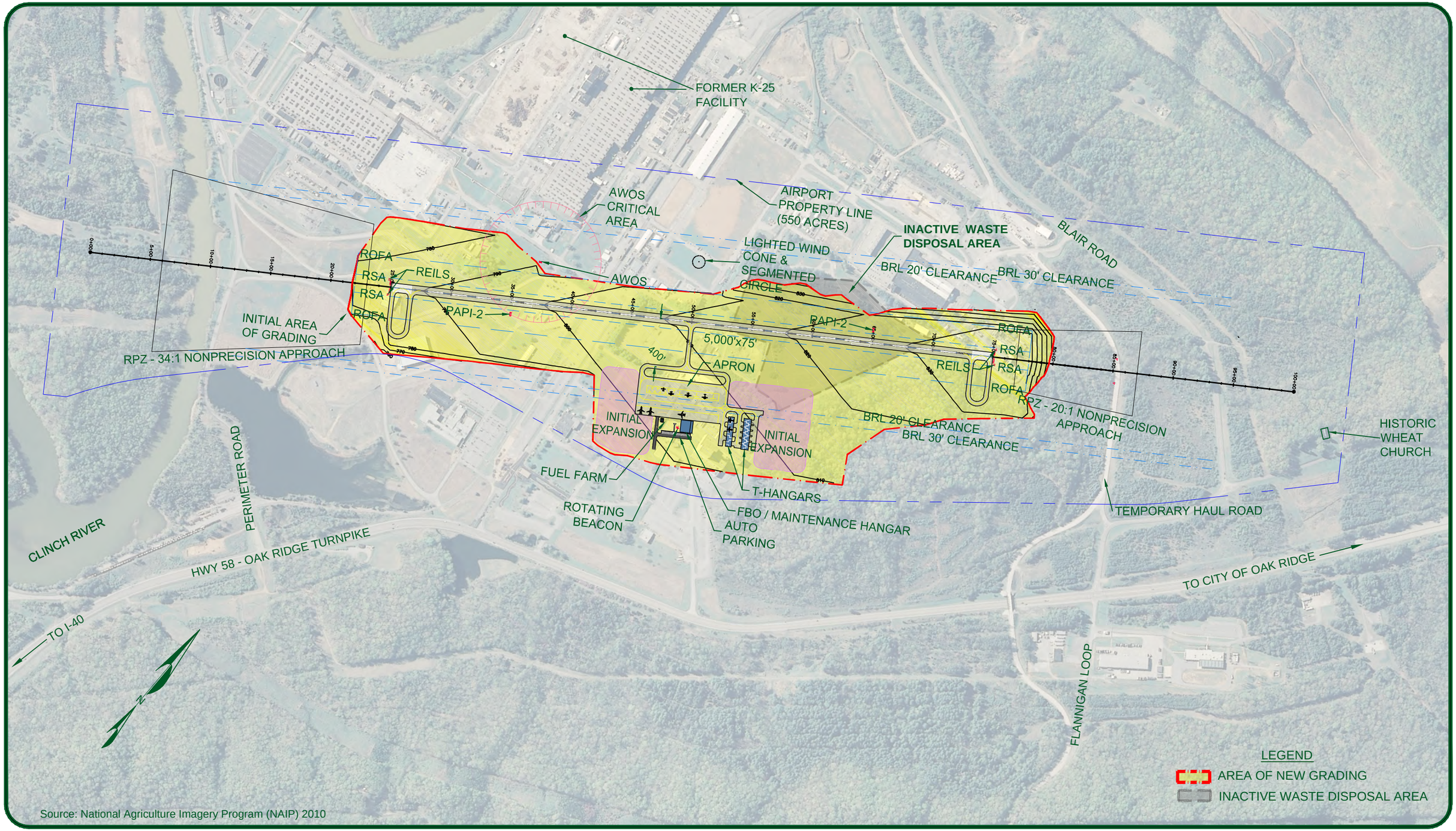
Heritage Center Site - Concept 1 Building Impacts

Figure 10



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Heritage Center Site - Concept 2
Initial Airport Development Plan

Figure 11

1,187.3' AMSL
1,150'
1,100'
1,050'
20:1
CONICAL SURFACE
987.3' AMSL
+50'
+52'
+115'
+134'
+160'
+142'
HORIZONTAL SURFACE
987.3' AMSL
TOWER 1110'
+114'
TOWER 1326' +339'
+134'
3500'
9000'
950'
34:1
900'
850'
9
RUNWAY 6-24 - 5000 X 75'
EL. 787.3'
EL. 837.3'
24
900'
950'
9000'
20:1
1500'
TOWER 1005'
10000'
TOWER 1197'
4000'
+135'
TOWER 1299' +312'
+120'
AIRPORT ELEVATION
837.3' AMSL
+101'
+143'
987.3' AMSL
1,050'
CONICAL SURFACE
1,100'
20:1
1,150'
1,187.3' AMSL
TOWER 970'
TOWER 1184'
STACK 1065'
STACK 1064'
STACK 978'
TOWER 1450'
N
0
3,500
7,000
Scale in Feet
Source: USGS 7.5 Minute Quad Series

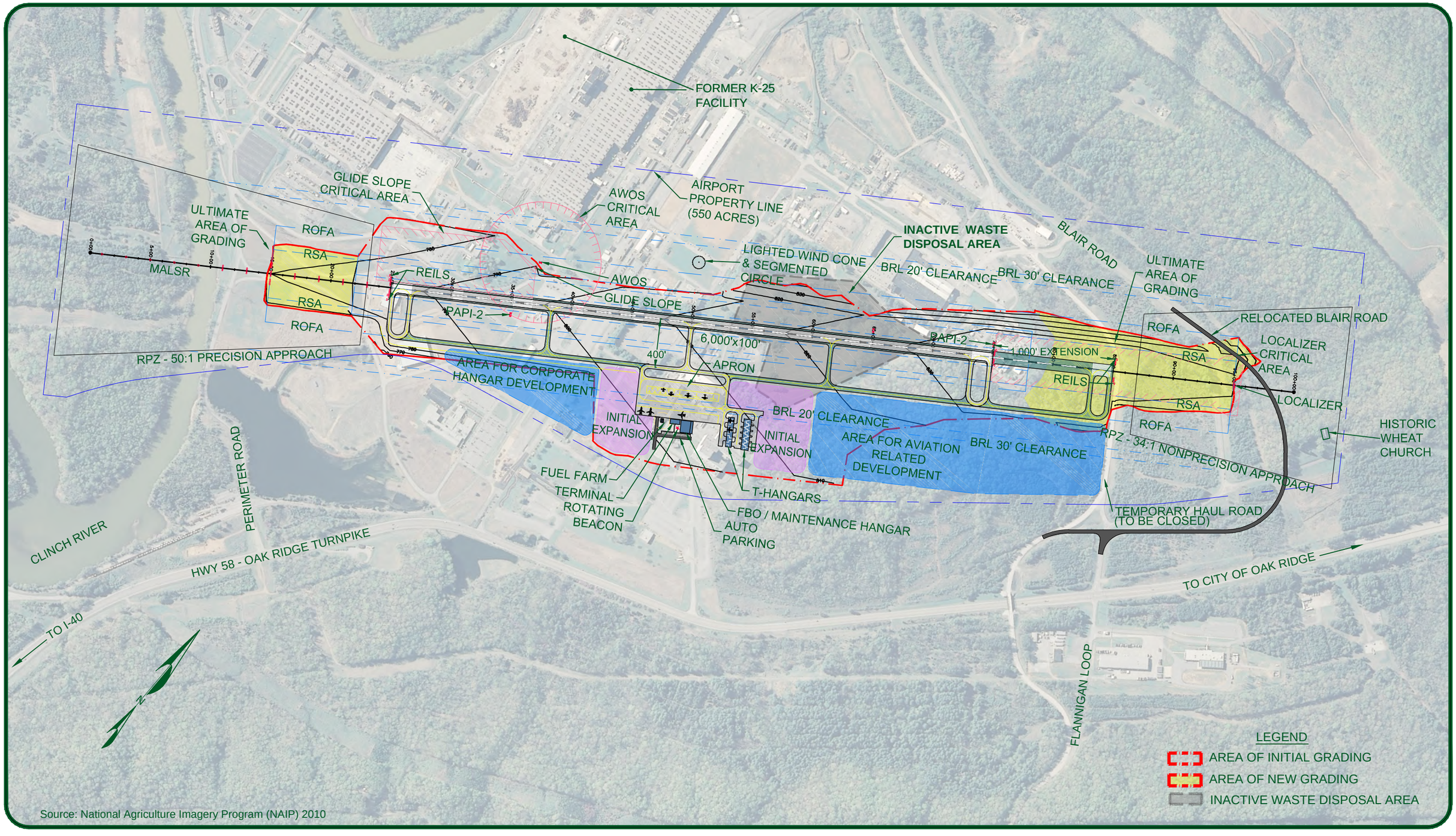
Part 77 Surfaces
Part 77 Contours (50 ft)
Terrain Penetrations
+XX' Spot Penetrations
TOWER XXX' +XX' Obstructions

Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Heritage Center Site - Concept 2 Initial Airspace

Figure 12



Source: National Agriculture Imagery Program (NAIP) 2010

Proposed Oak Ridge General Aviation Airport

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Heritage Center Site - Concept 2 Future Airport Development Plan

Figure 13

1,187.3' AMSL
1,150'
1,100'
1,050'
20:1
CONICAL SURFACE
987.3' AMSL
HORIZONTAL SURFACE 987.3' AMSL
AIRPORT ELEVATION 837.3' AMSL
987.3' AMSL
CONICAL SURFACE
1,050'
1,100'
1,150'
1,187.3' AMSL
20:1
50:1
34:1
RUNWAY 6-24 : 6000 x 100'
EL. 787.3'
EL. 837.3'
9
24
10000'
4000'
3500'
1,300'
1,200'
1,100'
1,000'
950'
900'
850'
+50'
+52'
+115'
+134'
+160'
+142'
+160'
+134'
+135'
+120'
+143'
+101'
TOWER 1005'
TOWER 1197'
TOWER 1450'
TOWER 970'
TOWER 1326' +339'
TOWER 1110'
TOWER 1299' +312'
TOWER 1184'
STACK 1064'
STACK 978'
0
3,500
7,000
Scale in Feet
Source: USGS 7.5 Minute Quad Series
Part 77 Surfaces
Part 77 Contours (50 ft)
Terrain Penetrations
+XX' Spot Penetrations
TOWER XXX' +XX' Obstructions

Proposed Oak Ridge General Aviation Airport

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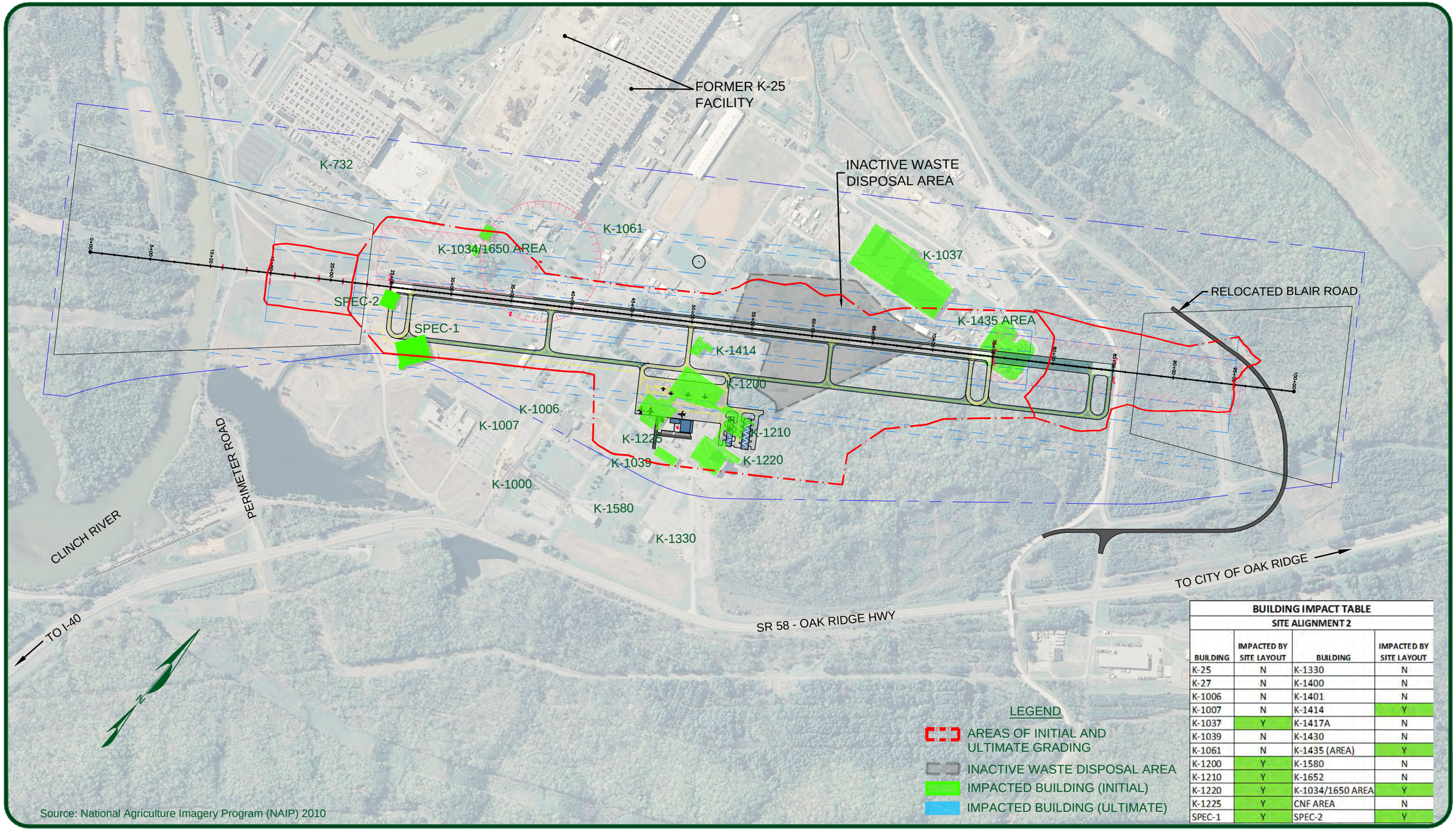
Heritage Center Site - Concept 2 Future Airspace

Figure 14



Source: National Agriculture Imagery Program (NAIP) 2010

BUILDING IMPACT TABLE
SITE ALIGNMENT 2

BUILDING	IMPACTED BY SITE LAYOUT	BUILDING	IMPACTED BY SITE LAYOUT
K-25	N	K-1330	N
K-27	N	K-1400	N
K-1006	N	K-1401	N
K-1007	N	K-1414	Y
K-1037	Y	K-1417A	N
K-1039	N	K-1430	N
K-1061	N	K-1435 (AREA)	Y
K-1200	Y	K-1580	N
K-1210	Y	K-1652	N
K-1220	Y	K-1034/1650 AREA	Y
K-1225	Y	CNF AREA	N
SPEC-1	Y	SPEC-2	Y

Proposed Oak Ridge General Aviation Airport

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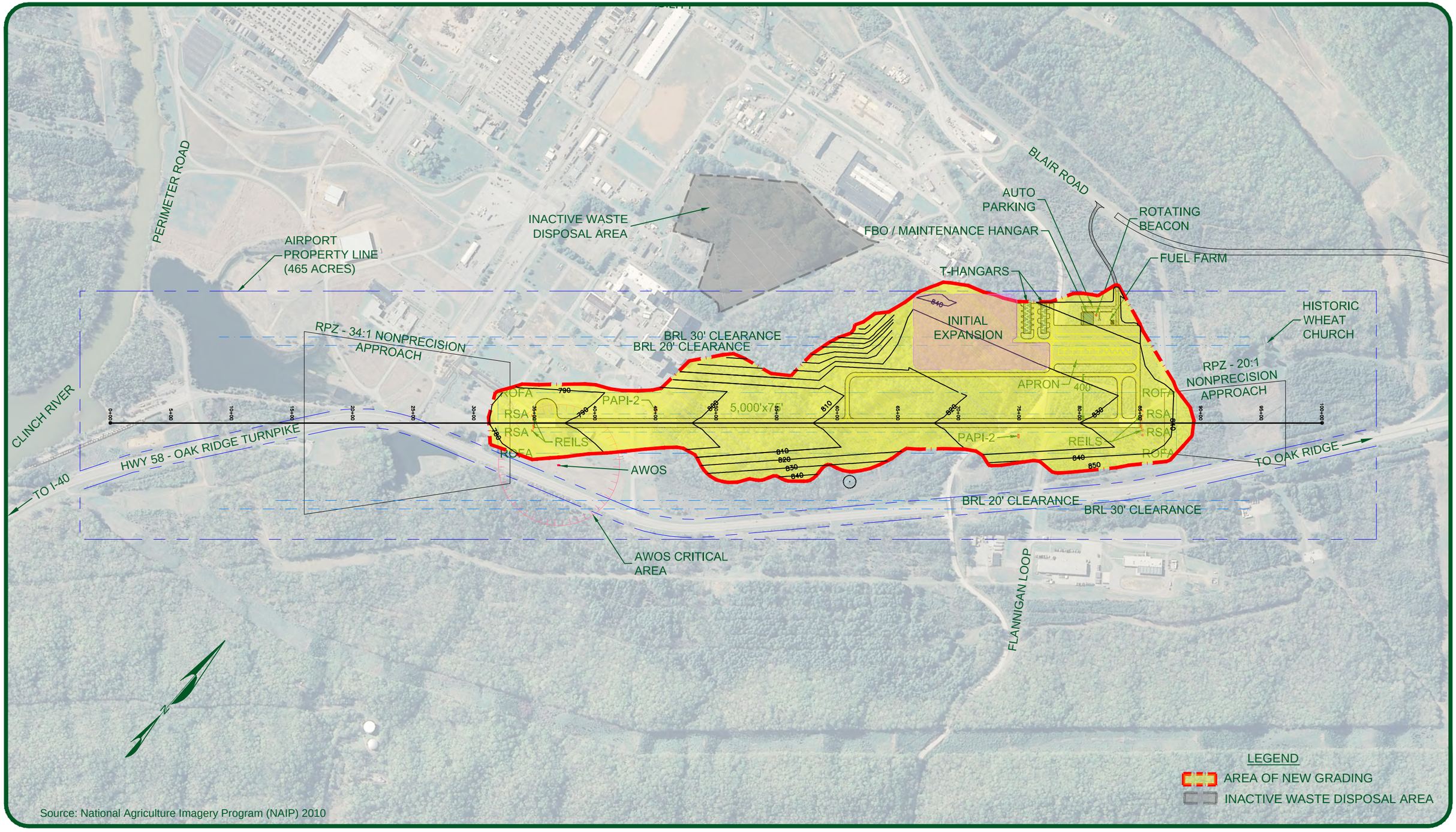
Heritage Center Site - Concept 2 Building Impacts

Figure 15



Source: National Agriculture Imagery Program (NAIP) 2010

Proposed Oak Ridge General Aviation Airport

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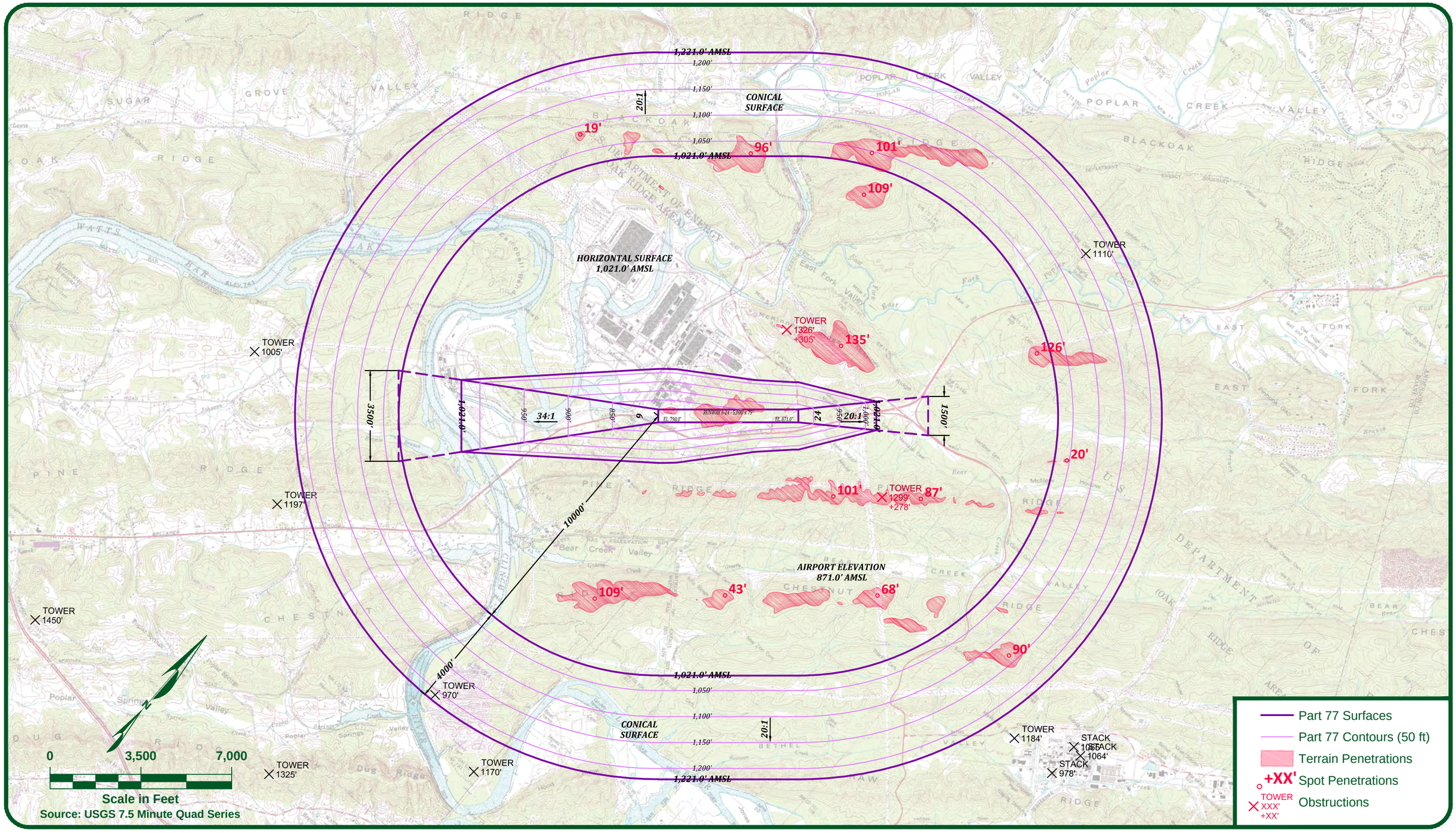
Heritage Center Site - Concept 3
Initial Airport Development Plan

Figure 16



Proposed Oak Ridge General Aviation Airport

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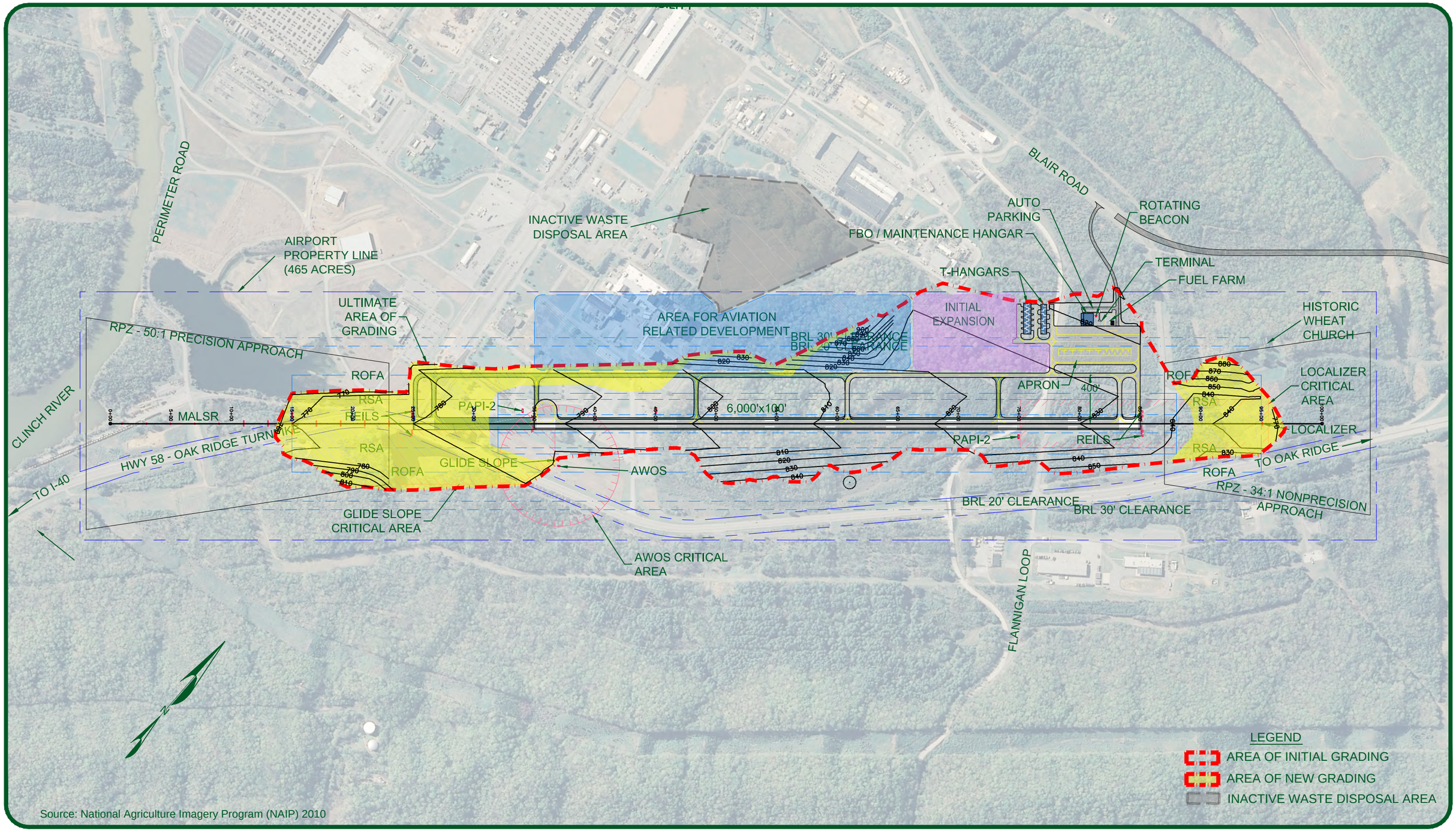
Heritage Center Site - Concept 3 Initial Airspace

Figure 17



Proposed Oak Ridge General Aviation Airport

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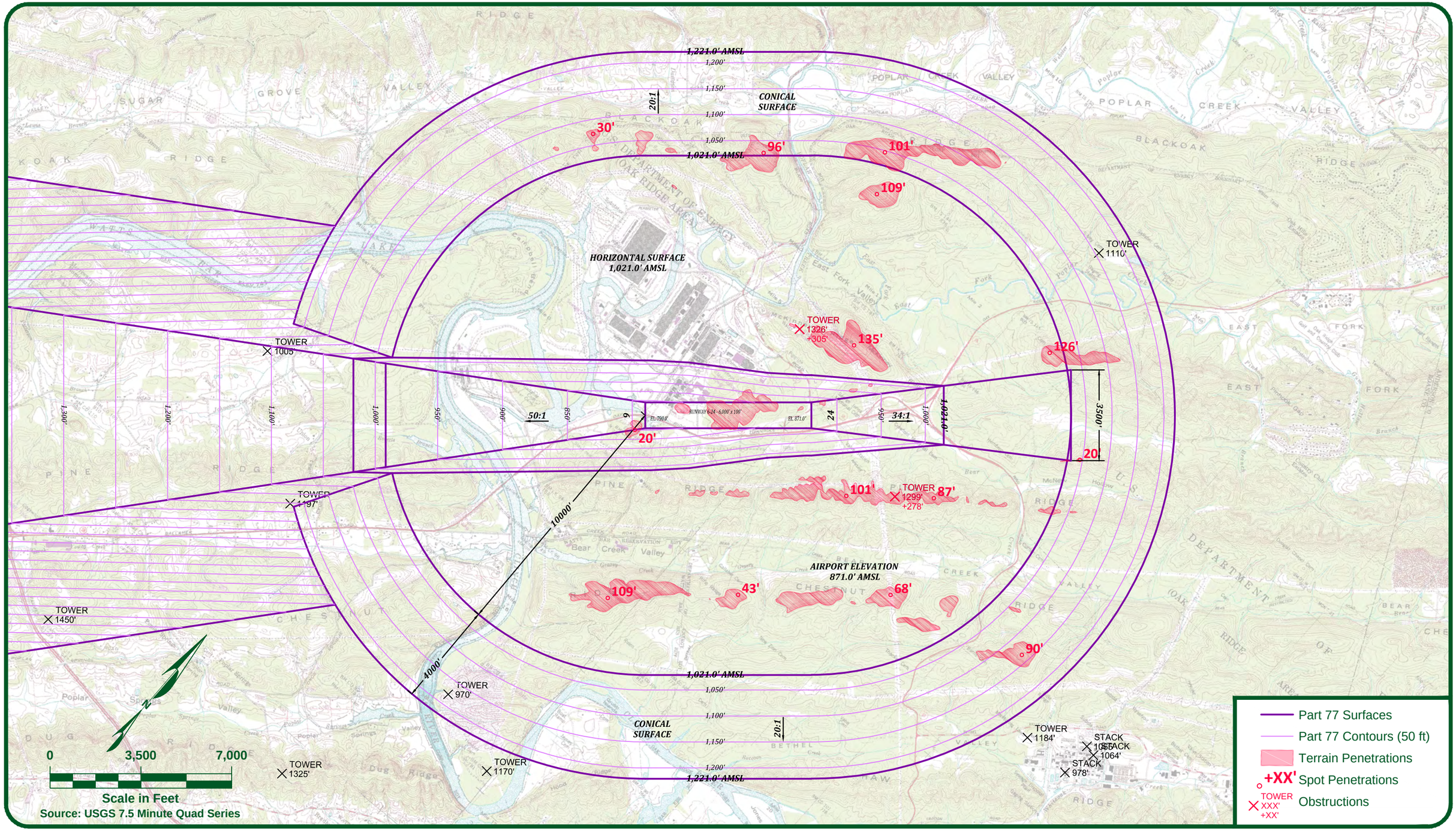
Heritage Center Site - Concept 3
Future Airport Development Plan

Figure 18



Proposed Oak Ridge General Aviation Airport

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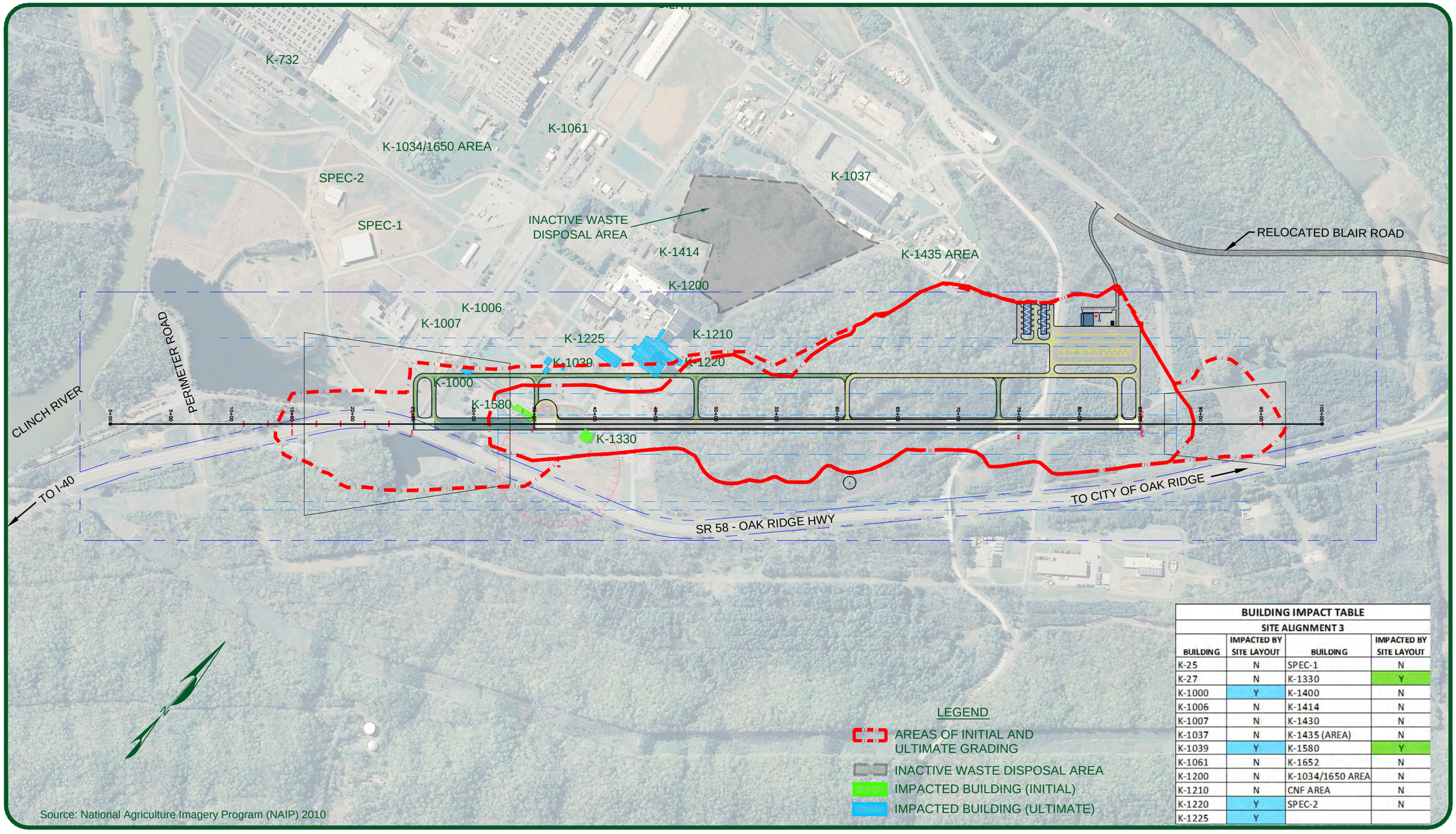
Heritage Center Site - Concept 3 Future Airspace

Figure 19



LEGEND

- AREAS OF INITIAL AND ULTIMATE GRADING
- INACTIVE WASTE DISPOSAL AREA
- IMPACTED BUILDING (INITIAL)
- IMPACTED BUILDING (ULTIMATE)

BUILDING IMPACT TABLE
SITE ALIGNMENT 3

BUILDING	IMPACTED BY SITE LAYOUT	BUILDING	IMPACTED BY SITE LAYOUT
K-25	N	SPEC-1	N
K-27	N	K-1330	Y
K-1000	Y	K-1400	N
K-1006	N	K-1414	N
K-1007	N	K-1430	N
K-1037	N	K-1435 (AREA)	N
K-1039	Y	K-1580	Y
K-1061	N	K-1652	N
K-1200	N	K-1034/1650 AREA	N
K-1210	N	CNF AREA	N
K-1220	Y	SPEC-2	N
K-1225	Y		

Proposed Oak Ridge General Aviation Airport

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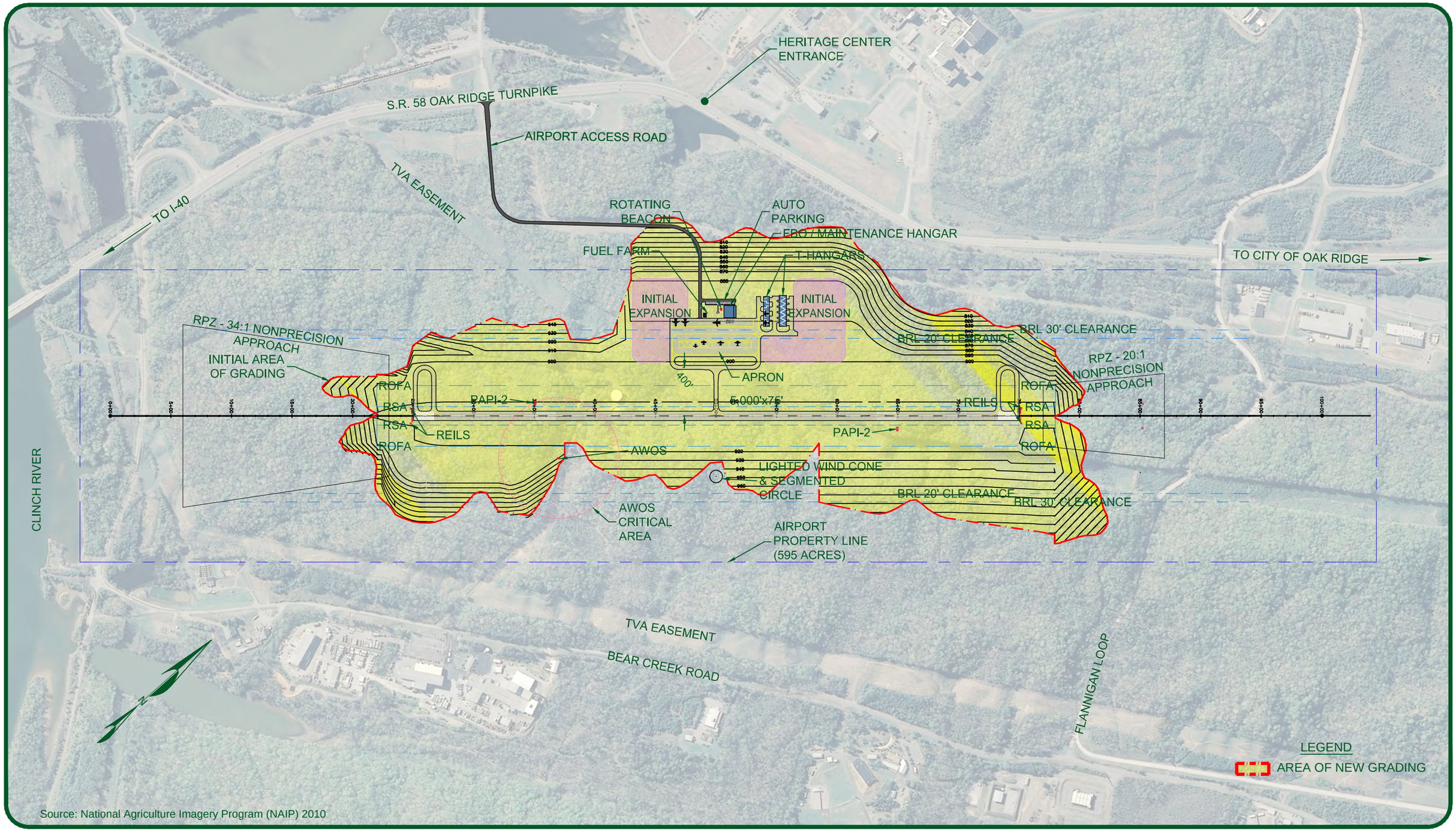
Heritage Center Site - Concept 3 Building Impacts

Figure 20



Source: National Agriculture Imagery Program (NAIP) 2010

Proposed Oak Ridge General Aviation Airport

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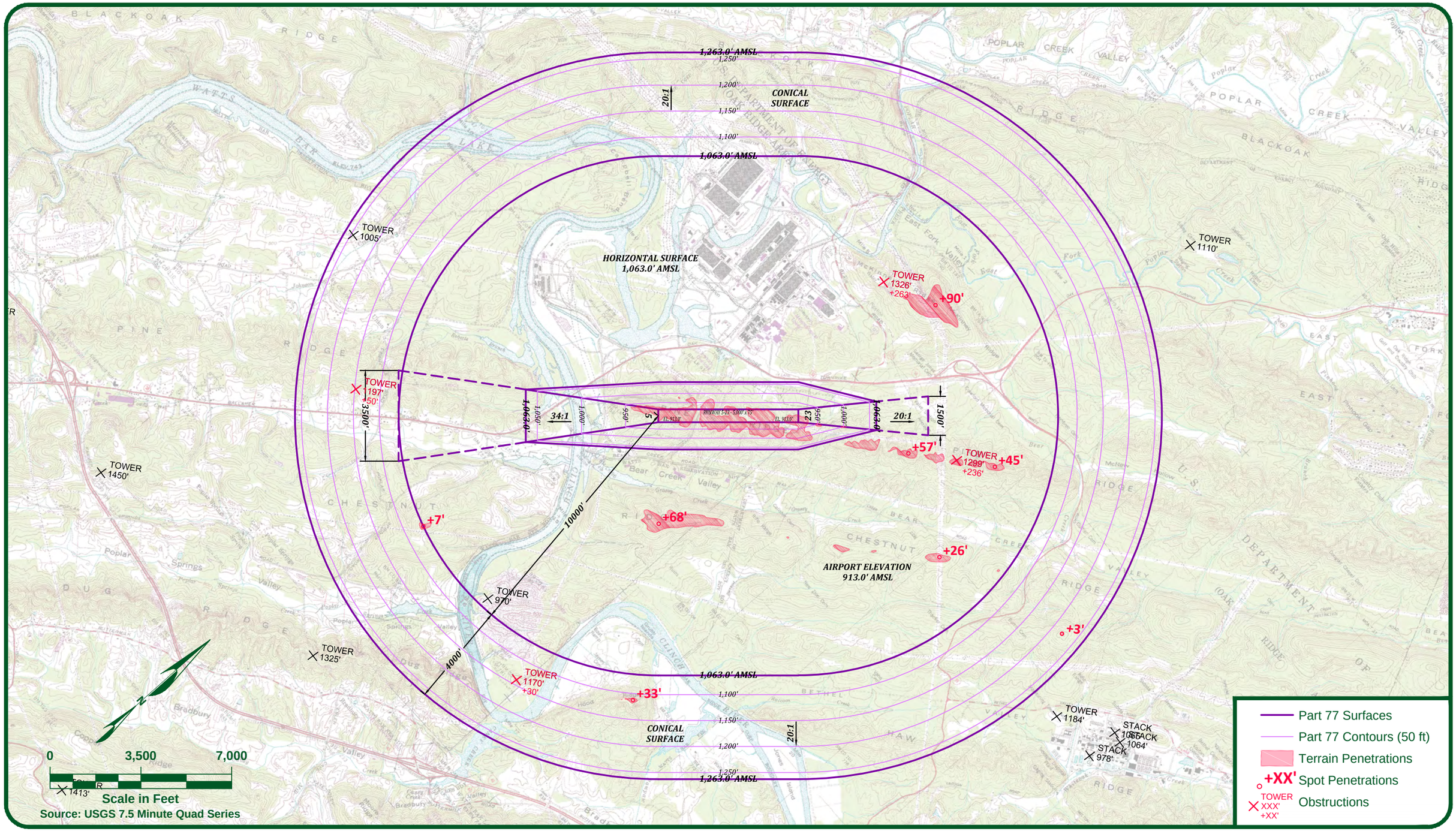
ED-3 Site
Initial Airport Development Plan
Figure 21

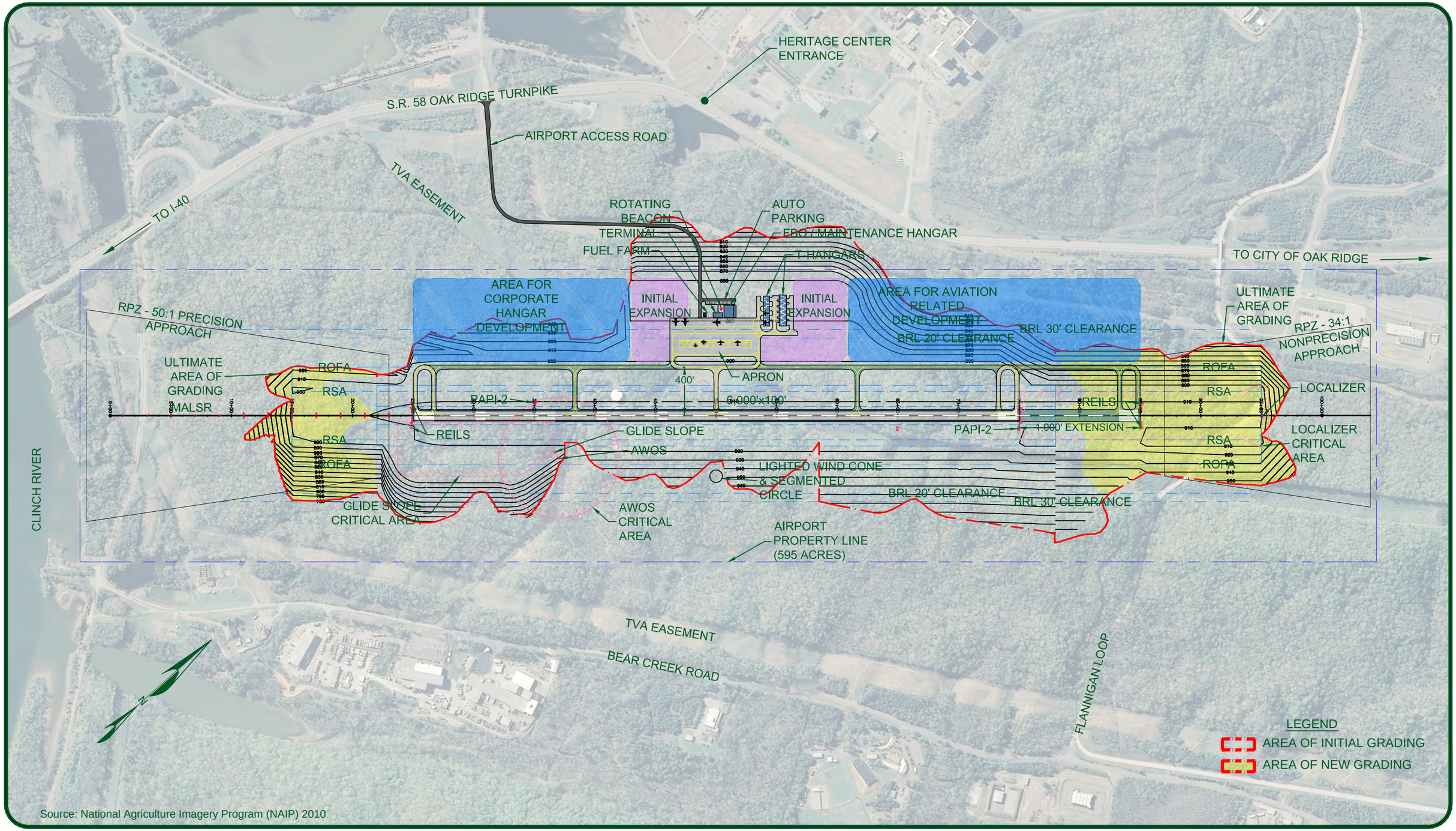


Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

ED-3 Site Initial Airspace

Figure 22



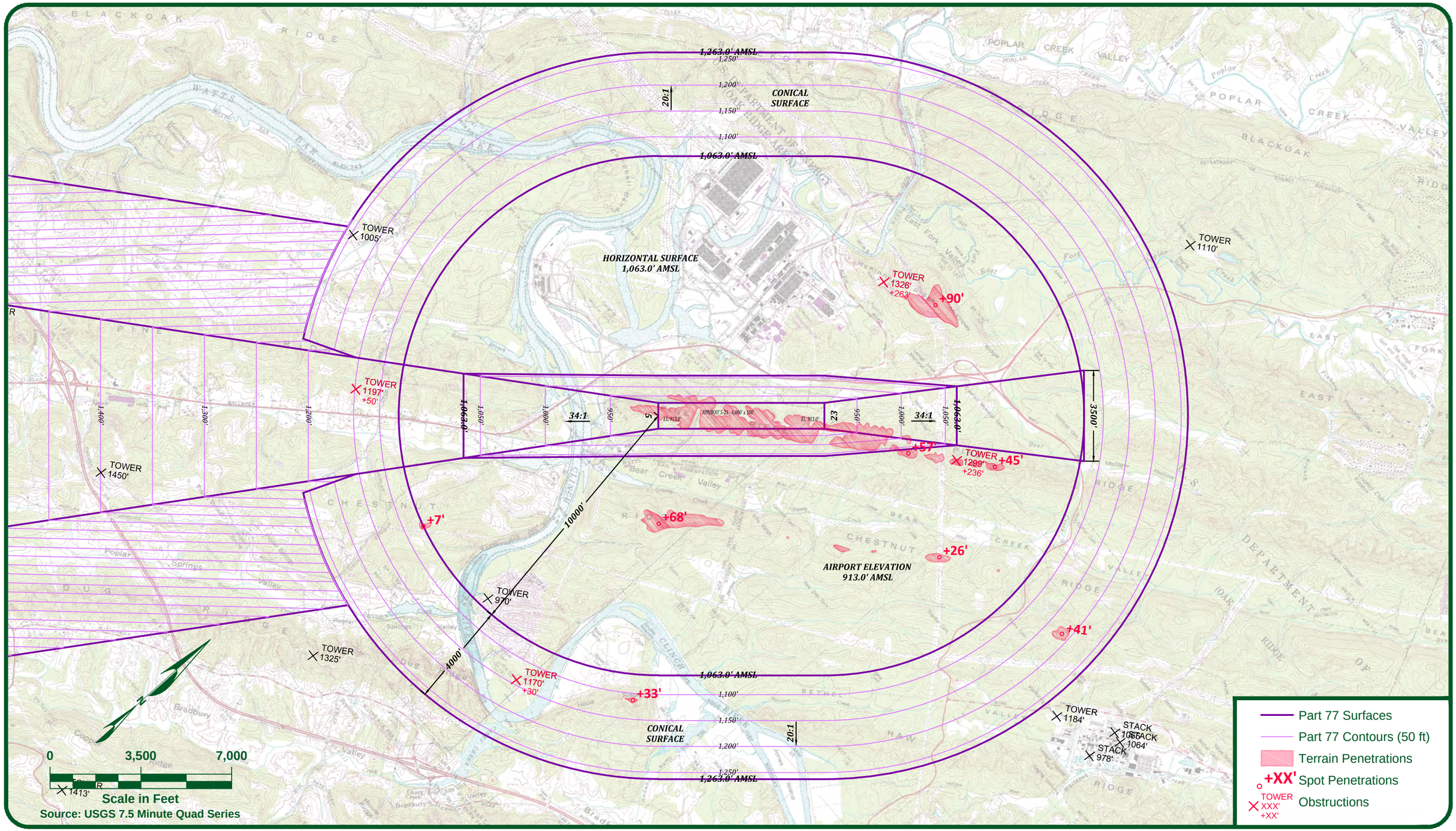
Source: National Agriculture Imagery Program (NAIP) 2010

Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

ED-3 Site
Future Airport Development Plan

Figure 23

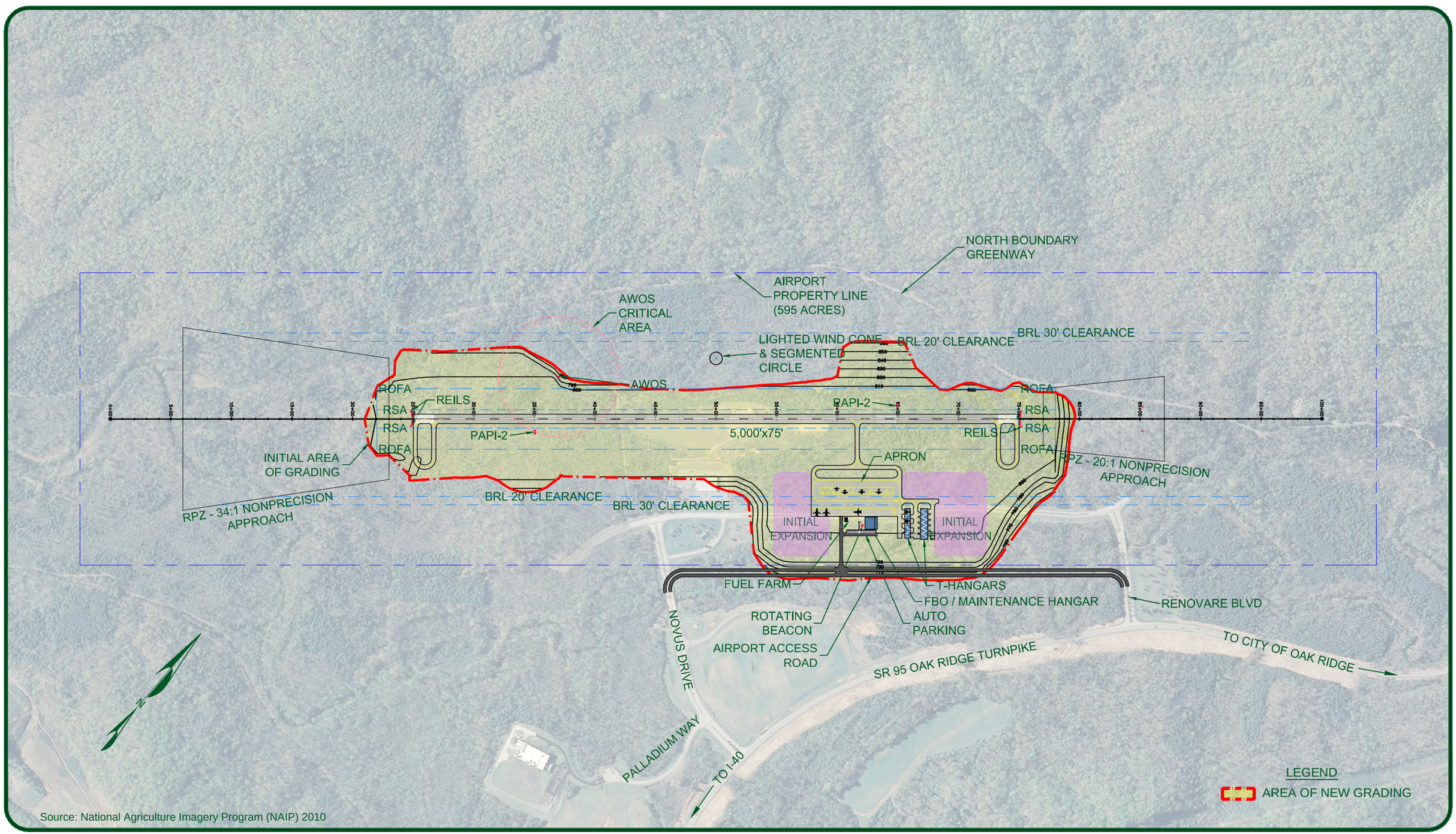


Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

ED-3 Site
Future Airspace

Figure 24

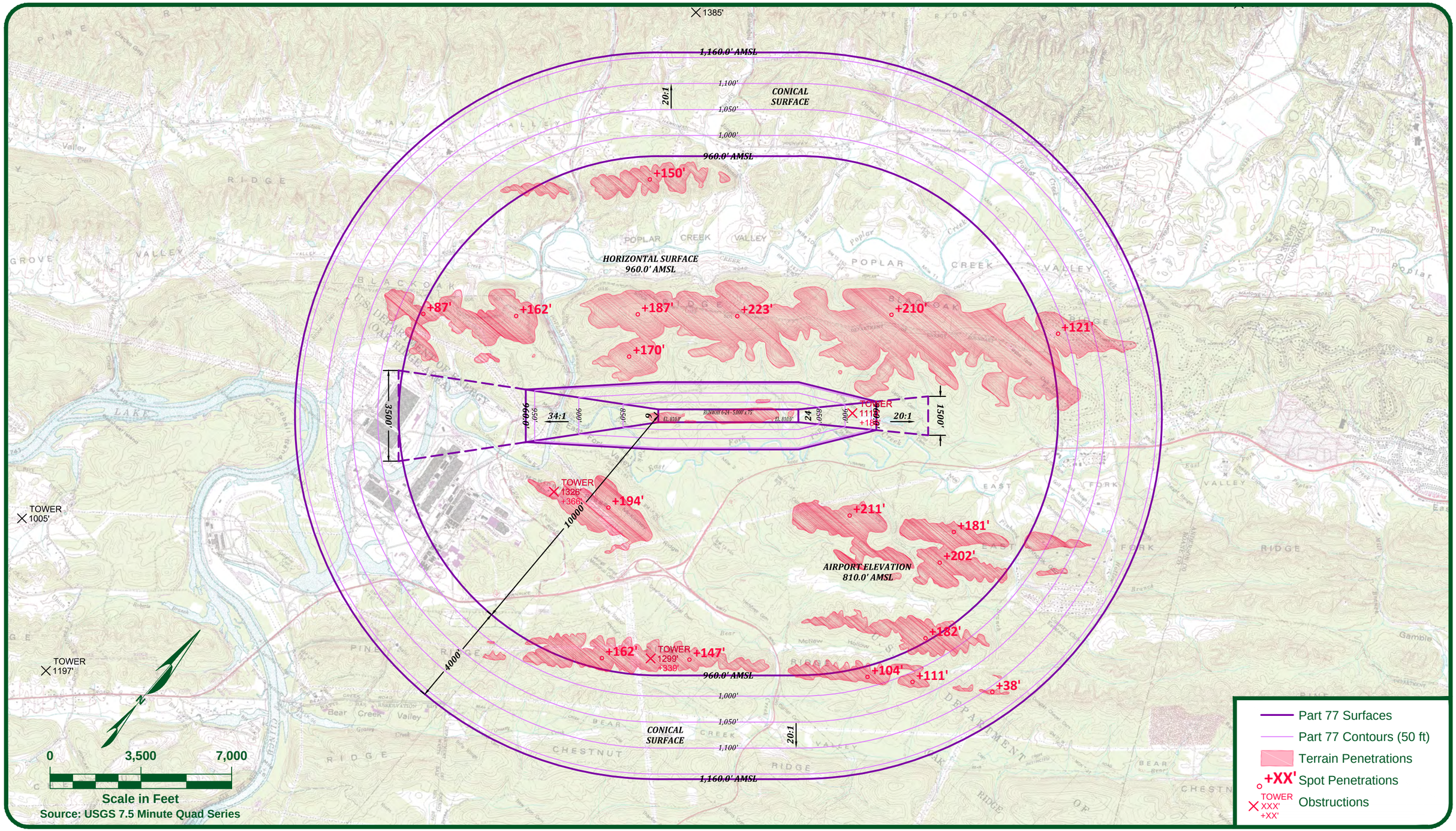


Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Horizon Center Site
Initial Airport Development Plan

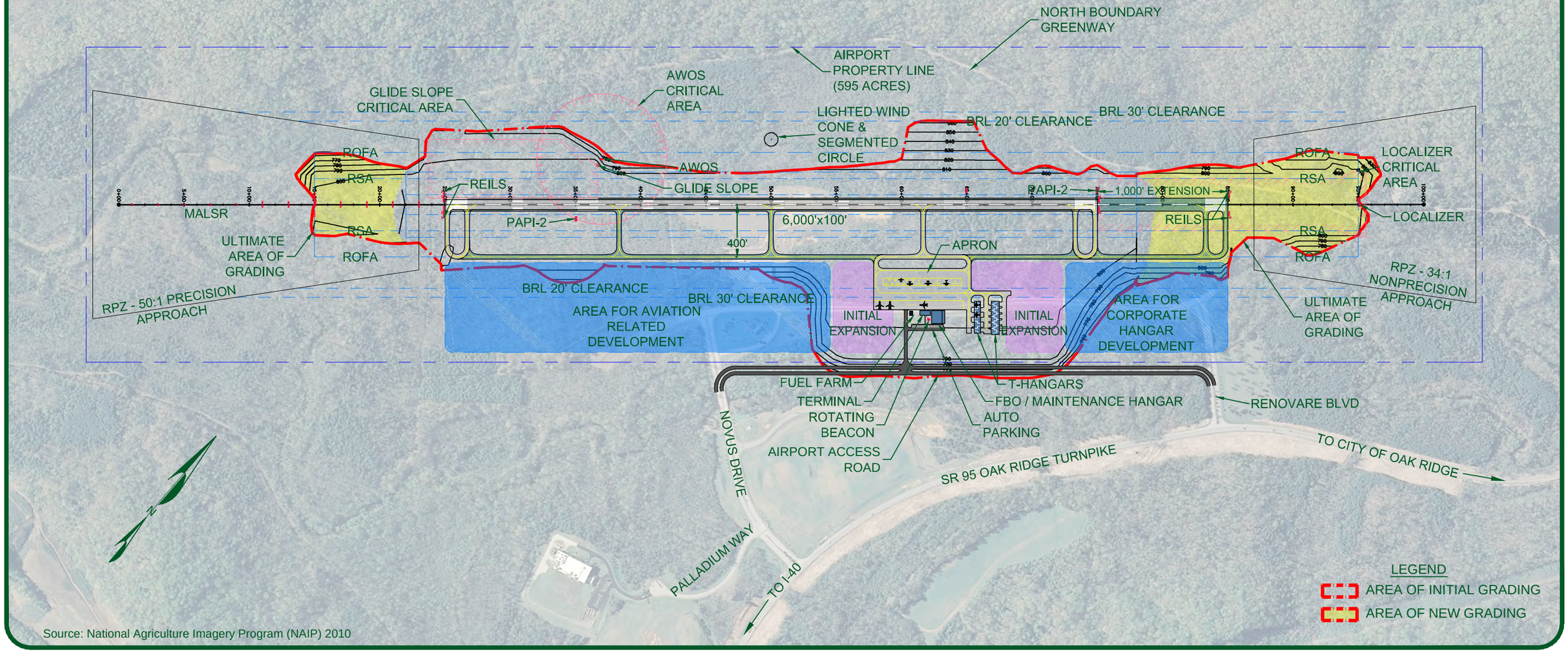
Figure 25



Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Horizon Center Site
Initial Airspace
Figure 26



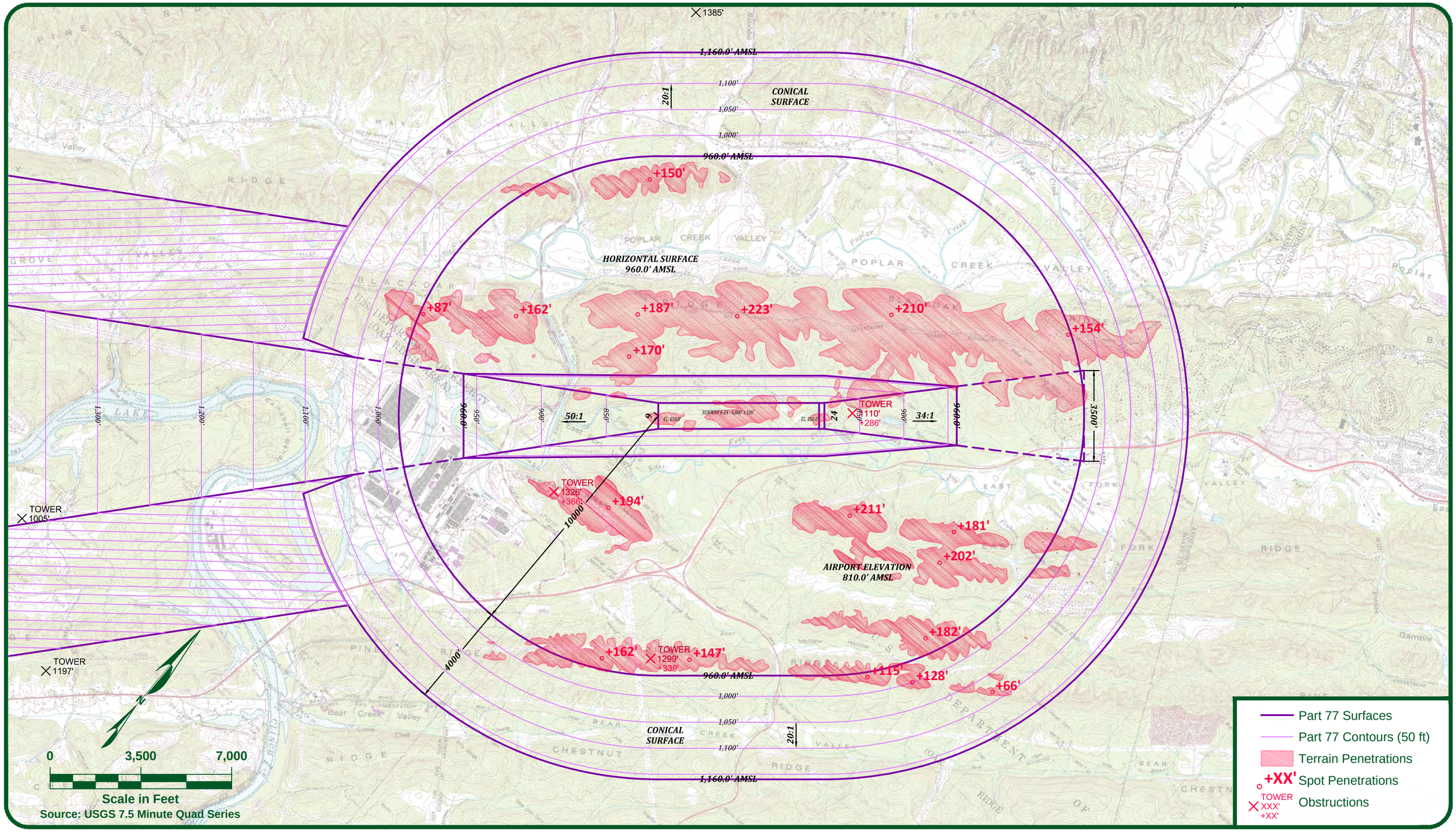
Source: National Agriculture Imagery Program (NAIP) 2010

Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Horizon Center Site
Future Airport Development Plan

Figure 27



Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Horizon Center Site Future Airspace

Figure 28

Preliminary Concept 1

Preliminary Concept 2

Preliminary Concept 3

Preliminary Concept 4

N

0 2,500 5,000

Scale in Feet

Runway

Runway Safety Area

Runway Object Free Area

Runway Protection Zone

Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Heritage Center Site Preliminary Concepts 1-4

Figure 29

Preliminary Concept 5
(Carried Forward as Concept 1)

Preliminary Concept 6
(Carried Forward as Concept 2)

Preliminary Concept 7

Preliminary Concept 8

N

0 2,500 5,000

Scale in Feet

Runway
Runway Safety Area
Runway Object Free Area
Runway Protection Zone

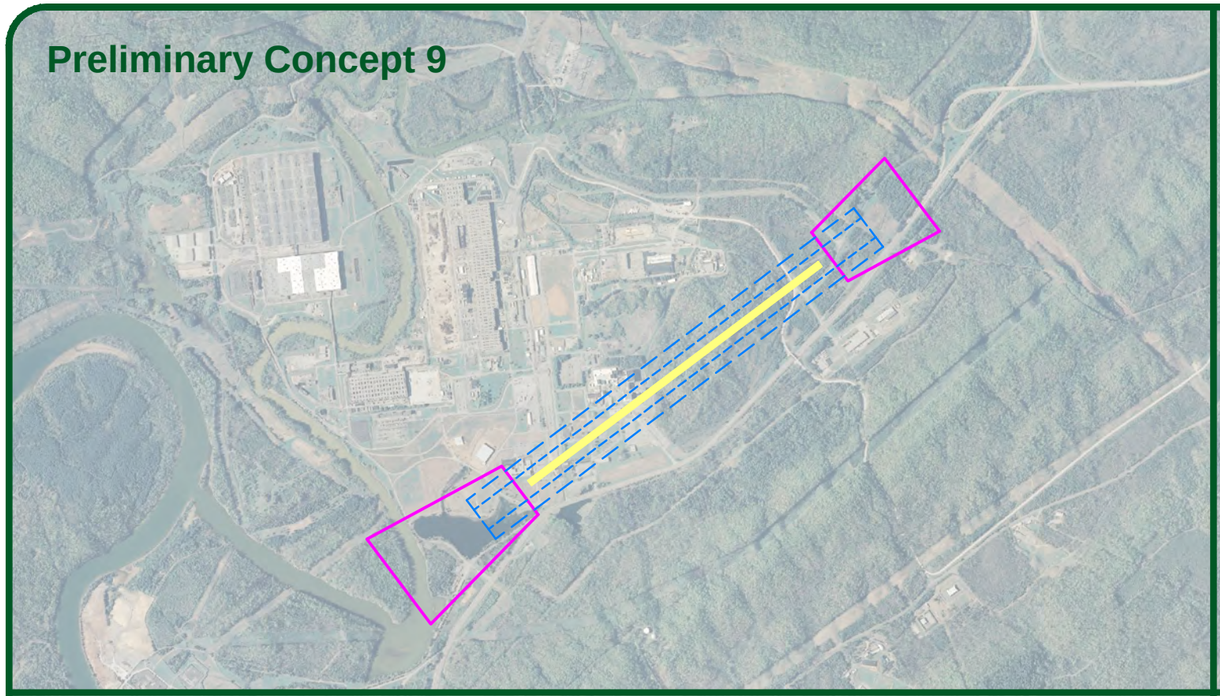
Proposed Oak Ridge
General Aviation
Airport

Draft and Deliberative

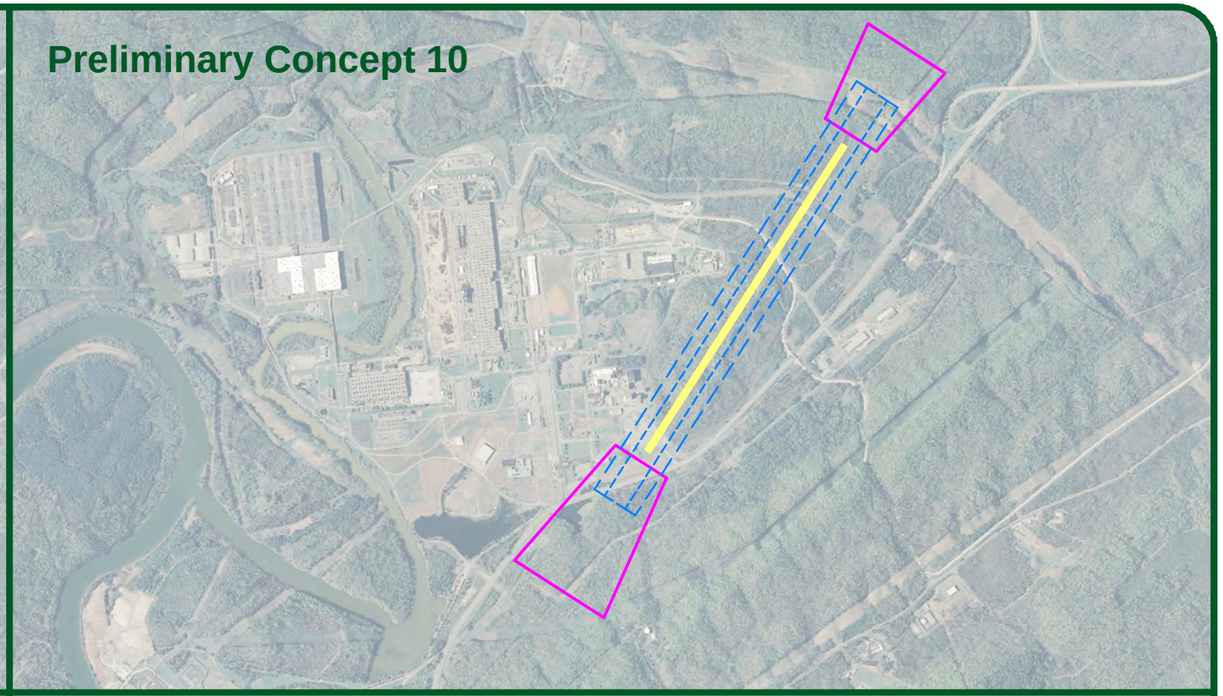
Heritage Center Site
Preliminary Concepts 5-8

Figure 30

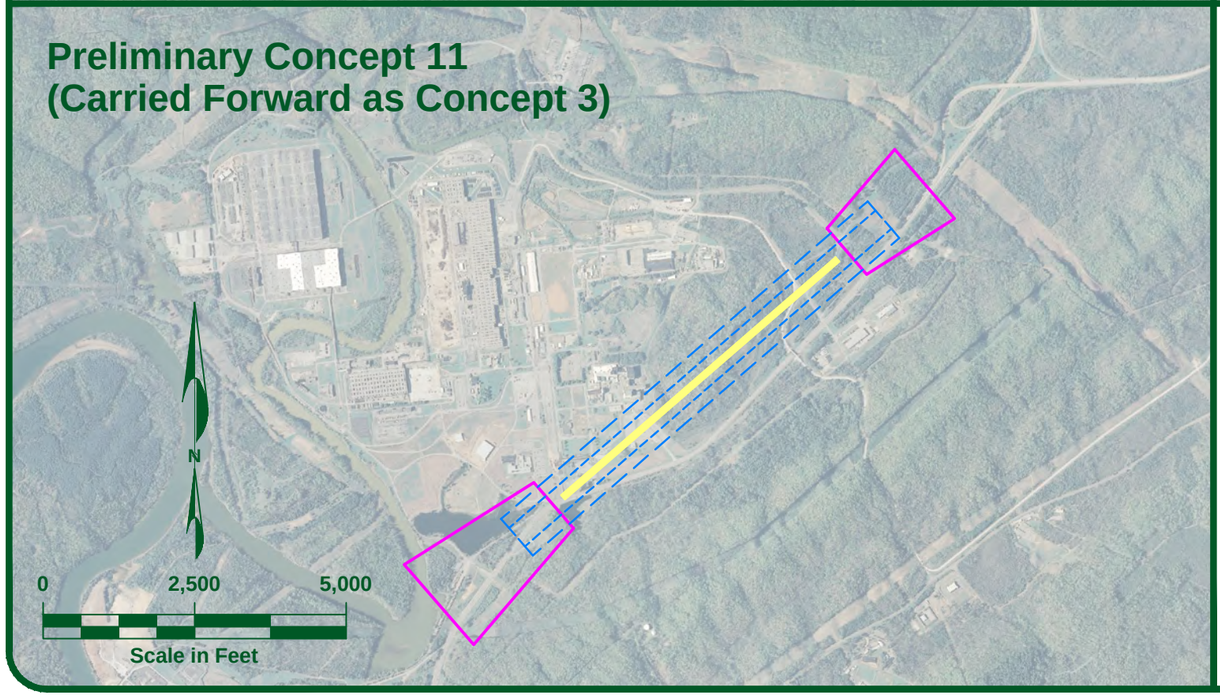
Preliminary Concept 9



Preliminary Concept 10



Preliminary Concept 11 (Carried Forward as Concept 3)



Runway
Runway Safety Area
Runway Object Free Area
Runway Protection Zone

Proposed Oak Ridge General Aviation Airport

Draft and Deliberative

Heritage Center Site
Preliminary Concepts 9-11
Figure 31

Appendix B: Stakeholder Meeting Materials and Minutes

STAKEHOLDERS AND LOCAL CONTACTS

Bill Biloski, UT-Battelle
Lydia Birk, Bechtel Jacobs Corporation
Sherry Browder, CROET President, SAIC
Robert Brown, DOE
Sue Cange, DOE
John Eschenberg, DOE
Jeff Deardorff , CROET
Bill Greenwell, Consultant - CROET
Bob Greenwell, CROET
Joe Lenhard, CROET
Tammy Sullivan, CROET
Lawrence Young, CROET
Gary Cinder, City of Oak Ridge
Charlie Hensley, Oak Ridge City Council
Tom Beehan, Oak Ridge Mayor
Mark Watson, Oak Ridge City Manager
Randy McNally, State Senator, Oak Ridge
John Reagan, State Representative, Oak Ridge
Parker Hardy, President, Oak Ridge Chamber of Commerce
Myron Iwanski, Anderson County Mayor
Ron Woody, Roane County Mayor
Jennifer Palmer, ORNL
Tom Rogers, ORNL
Jim Campbell, President, East Tennessee Economic Council
Mark Valenti, Navarro, Inc.
Walter Lounsbery, W & L Software Services
Tim Thompson, President, Anderson County Economic Development Board
Scott Peters
Kim K. Denton, Oak Ridge Economic Partnership
Leslie Henderson, President/CEO, Roane County Alliance
Jean-Francois P. Reat, MD
David Keim, Y-12
Jule Doering, Fluor
Stan Mitchell, Oak Ridge Observer
Billy Stair
Helen Hardin, Congressman Fleischman's Oak Ridge Office
Travis Witherington, Pilot, Flight Instructor, Business Owner

THE LPA GROUP INCORPORATED

Jim Duguay, Manager of Aviation Planning
Jim Hall, Associate, Aviation Design
Amanda Hill, Aviation Planner
Skip Johnson, Principal, Environmental Planning
Jeff Pike, Manager of Aviation Design
Mike Reiter, Principal, Aviation Design

METROPOLITAN KNOXVILLE AIRPORT AUTHORITY (MKAA)

Bill Marrison, President
Bryan White, Vice President of Engineering and Planning
Becky Huckaby, Vice President of Public Relations

Appendix C: Acronyms

This section includes all acronyms used in this summary report.

ACRONYMS

ASOS – Airport Surface Observing System

AWOS – Airport Weather Observing System

CFR – Code of Federal Regulations

CROET - Community Reuse Organization of Eastern Tennessee

DOE – U.S. Department of Energy

DWL – Dual Wheel Landing Gear Configuration

FAA – Federal Aviation Administration

FAR - Federal Aviation Regulations

FBO – Fixed Base Operator

GIS - Geographic Information System

GPS – Global Positioning System

IFR - Instrument Flight Rules

MKAA - Metropolitan Knoxville Airport Authority

NAVAIDS – Navigational Aids

NEPA - National Environmental Policy Act

NERP - National Environmental Research Park

NPIAS – National Plan of Integrated Airport Systems

NRHP - National Register of Historic Places

NWS – National Weather Service

ORR - Oak Ridge Reservation

RPZ – Runway Protection Zone

RSA – Runway Safety Area

SWL – Single Wheel Landing Gear Configuration

TVA - Tennessee Valley Authority