Chapter 3 – Airside Facility Requirements and Developments

I. Airfield Requirements

Introduction

Airfield requirements are the essential items, or facilities, for the operation of aircraft. These essential items include:

◊ Runways
◊ Taxiways
◊ Navigational Aides
◊ Support Facilities

Airfield design is based primarily on the characteristics of the aircraft operating at the airport. The Airport Reference Code (ARC) is a coding system used to relate airport design criteria to operational and physical characteristics of the airplanes intended to operate at the airport. Airport dimensional standards, such as runway length and width, separation standards, surface gradients, etc., are selected for the critical aircraft that will make substantial use of the airport in the planning period. Substantial use means either 500 or more annual operations, or scheduled commercial service. The critical aircraft may be a single aircraft or a composite of the most demanding characteristics of several aircraft. The critical aircraft (or composite aircraft) is used to identify the appropriate ARC for airport design criteria. For airports with two or more runways it is generally most practical to design some components for a less demanding ARC. For example, at Gallatin Field, Runway 12-30 has a more demanding ARC than Runway 3-21. The ARC has two components relating to the design aircraft. The first component is the Aircraft Approach Category. The Approach Category relates to the aircraft approach speed. Approach Categories are represented by a letter and are as follows:

◊ Category A: Speed less than 91 knots.
◊ Category B: Speed 91 knots or more but less than 121 knots.
◊ Category C: Speed 121 knots or more but less than 141 knots.
◊ Category D: Speed 141 knots or more but less than 166 knots.
◊ Category E: Speed 166 knots or more.

The approach category is then broken down based on the weight of the aircraft. Small aircraft are defined as having a maximum take-off weight of less than 12,500 pounds.

The second component of an ARC is the Airplane Design Group (ADG). The ADG relates to the airplane wing span and tail height. The ADG is represented by a roman numeral and is listed below:

◊ Group I: Wingspan up to but not including 49 feet; Tail height up to but not including 20 feet.
◊ Group II: Wingspan 49 feet up to but not including 79 feet; Tail height 20 feet up to but not including 30 feet.
◊ Group III: Wingspan 79 feet up to but not including 118 feet, Tail height 30 feet up to but not including 45 feet.
◊ Group IV: Wingspan 118 feet up to but not including 171 feet; Tail height 45 feet up to but not including 60 feet.
◊ Group V: Wingspan 171 feet up to but not including 214 feet; Tail height 60 feet up to but not including 66 feet.
◊ Group VI: Wingspan 214 feet up to but not including 262 feet; Tail height 66 feet up to but not including 88 feet.

Prior to the selection of the ARC an observation of the type of aircraft utilizing the airport must be made. **Figure 3-1** shows typical aircraft using Gallatin Field and their associated ARC. **Table 3-1** shows the existing and ultimate ARC for each Runway at Gallatin Field.

Table 3-1 Airport Reference Code by Runway

	Existing	Ultimate
Runway 12-30	C-III	C-IV
Runway 3-21	B-I (small)	B-II
Runway 11-29	B-I (small)	B-I (small)

Runway design standards are based on both the aircraft approach category and its ADG. By applying the ARC of the critical aircraft in conjunction with the lowest designated or planned approach visibility for a runway, the design standards can be determined. Taxiway and apron design standards are based only on aircraft wingspan or ADG.

In addition to meeting the necessary design standards, airfield facilities are also designed to meet the demand at the airport. Demand is simply a measure of the number of aircraft utilizing the airport. The supply, or capacity, is measured by the number of aircraft operations the runway configuration can support while keeping delays reasonably short. This chapter will address Gallatin Field's current and future facility requirements. Also addressed in this chapter are several development alternatives to meet the future airfield requirements.

Less than 12,500 lbs.

Beech Baron 55
Beech Bonanza
Cessna 150
Cessna 172
Piper Comanche
Piper Cub

Less than 12,500 lbs.

Beech Baron 58
Beech King Air 100
Cessna 402
Cessna 421
Piper Navajo
Piper Cheyenne
Cessna Citation I

Less than 12,500 lbs.

Super King Air 200
Cessna 441
DHC Twin Otter

Over 12,500 lbs.

Super King Air 300
Beech 1900
Jetstream 31
Falcon 10, 20, 50
Falcon 200, 900
Citation II, III, IV, V
Saab 340
Embraer 120

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

Lear 25, 35, **55**
Israeli Westwind
HS 125

Gulfstream II, **III**, IV
Canadair 600, 700
Lockheed JetStar
Super King Air 350

B-727-200
B737-300, 400, 500, **800**
DC-9
Fokker 70
MD-80
A319, A320

B-757
B-767
DC-8-70
DC-10
MD-11
L1011

Aircraft pictured is identified in bold.

Gallatin Field Airport Master Plan

Figure 3-1 Airport Reference Code

II. Runway Requirements

The capability of existing and future runway facilities to meet the facility requirements has been evaluated in several areas including capacity, runway length, runway orientation, and pavement strength. From this the facility requirements have been determined and several development solutions have been presented to meet the requirements.

Airport Capacity

Airfield and airspace requirements are determined in part by an assessment of the airport's ability to support the future levels of aviation activity. In addition, safety and design standards need to be evaluated to ensure compliance as the sizes and types of aircraft change over time.

The following paragraphs describe Gallatin Field's current and future capacity. Capacity can be defined as the maximum number of aircraft operations which can be accommodated on the airport per the FAA advisory circular 150/5060-5 "Airport Capacity and Delay." Several factors affect the airport's capacity. Factors include the number and layout of runways along with the size and weight of aircraft using the airport. The number of departures, arrivals, touch and go operations, weather conditions, and visual or instrument flight rules also influence the airport's capacity. Additionally, having an Instrument Landing System (ILS) and radar coverage increases capacity.

The capacity of an airport is measured by the Annual Service Volume (ASV). It represents the maximum number of aircraft operations that can reasonably be accommodated in a year. Annual service volume is determined by the FAA's Advisory Circular for Airport Capacity and Delay. In determining ASV, several assumptions are made. The percentage of departures is assumed to be equal to the percentage of arrivals at 50% of total operations. It is also assumed that Instrument Flight Rules (IFR) weather exists 10% of the time. Furthermore, the runway use and configuration is assumed to be operated 80% of the time in the configuration that produces the greatest hourly capacity.

Hourly Capacity and Annual Service Volume

In determining the ASV for an airport, the hourly capacity of the runway configuration must be determined. FAA Advisor Circular 150/5060-5 provides several methods for determining the hourly capacity. The long range planning method selects a runway use configuration and an aircraft mix index. There are four aircraft classifications defined for the aircraft mix, Class A through D. The aircraft mix classifications are shown in **Table 3-2**.

Table 3-2 Aircraft Mix

Aircraft Class	Maximum Certified Takeoff Weight (lbs)	Number of Engines
A	12,500 or Less	Single
B		Multi
C	12,500 - 300,000	Multi
D	Over 300,000	Multi

The aircraft mix defines the mix index value. The mix index is calculated by adding the percentage of Class C aircraft with 3 times the percentage of Class D aircraft. Gallatin Field currently does not have any aircraft with a maximum certified takeoff weight greater than 300,000 pounds and none of these aircraft are expected to use the airport on a regular basis during the planning period. The mix index for Gallatin Field is then the percentage of Class C aircraft that use the airport. The number of Class C aircraft has ranged from 22% to 29% from 2000 to 2005. Projected operations forecast this figure being 25% by 2025. A mix index of 27% was assumed for the capacity calculations. By applying the mix index to several runway configurations, the annual service volume can be calculated.

The hourly capacity and ASV was calculated based on Gallatin Field's current runway configuration and historic operations. This detailed method takes into account the number of exit taxiways available, weather conditions, and the percent of use on each runway. The current runway capacity was calculated as a single runway configuration without radar system. Turf Runway 11-29 was not considered in current capacity calculations as it is not available all year. Crosswind Runway 3-21 also was not included in capacity calculations due to its short length. The hourly capacity of the existing runway is 61 operations in VFR conditions and 27 operations in IFR conditions for an annual service volume of 135,000 operations. For the year 2005, the runway was at 53% capacity.

Gallatin Field has recently experienced delays prior to the commissioning of local radar. Salt Lake Center could not see aircraft below 12,000 feet with the existing radar due to terrain obstructing the radar's line of sight. Previously, while an aircraft was on the ILS approach to Runway 12 and below 12,000 feet, no other aircraft could occupy the airspace. The Air Traffic Control Beacon Interrogator-6 (ATCBI-6) radar was recently commissioned at Gallatin Field will increase the annual service volume of Runway 12-30 to 199,000 operations, with 61 and 49 hourly operations in VFR and IFR conditions. After air traffic controllers become comfortable with the new radar, the single runway configuration will be at 38% capacity. The airport is projected to be at 69% capacity by the end of the planning period year 2025 with the radar in operation and one runway. FAA order 5090.3C, *Field Formulation of the National Plan of Integrated Airport*

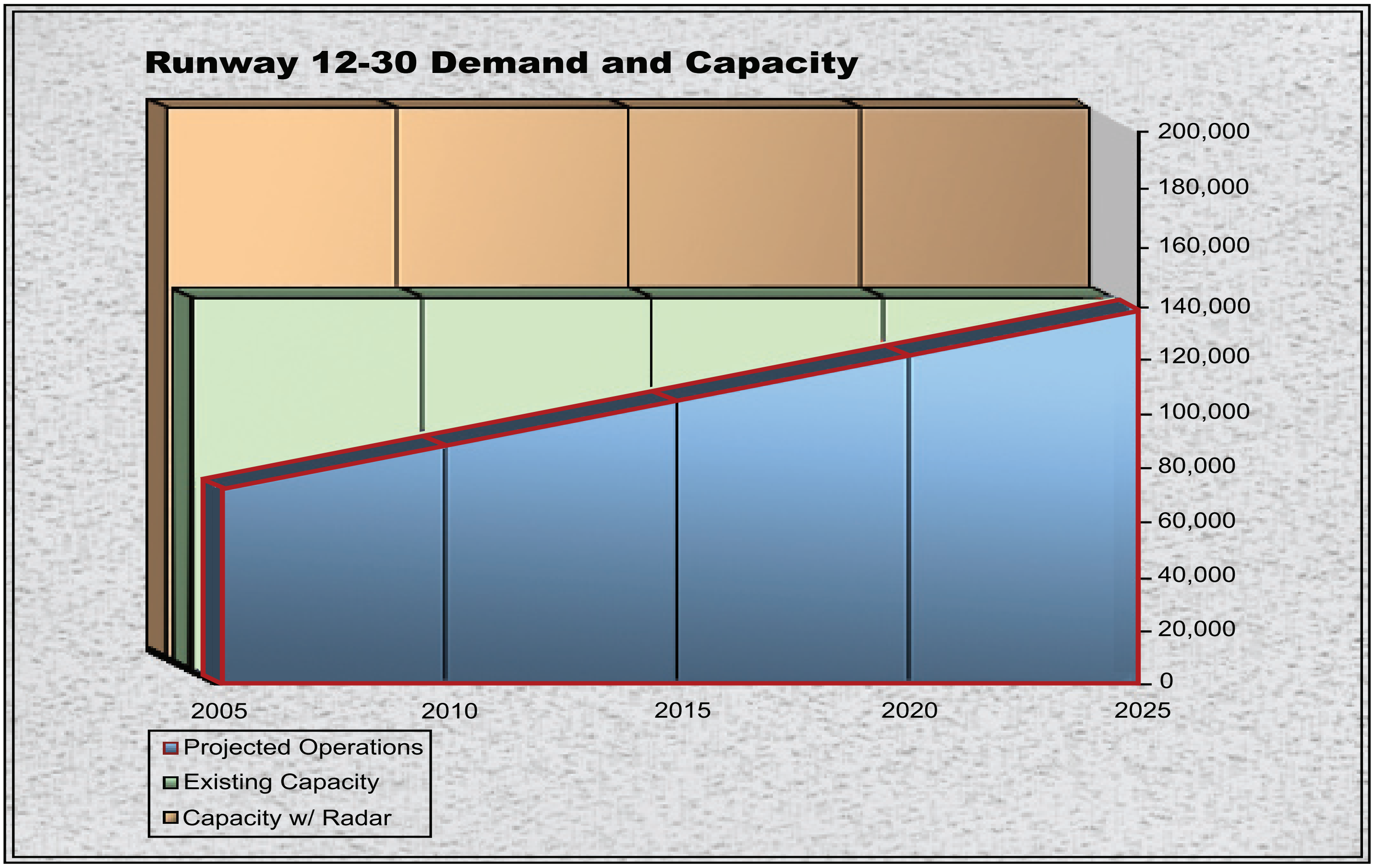
Systems (NPIAS), identifies the 60% capacity level as the point that planning for additional runways, or changes in runway configurations to improve capacity, should start. To start this process, capacity was calculated considering a full length crosswind runway and an all-weather parallel runway for small aircraft.

When an airport is at its capacity, delays are typically between 4 to 6 minutes per aircraft. Under all runway configurations, the average delay per aircraft is less than 1 minute. The hourly capacity, ASV and percent of capacity results are displayed in **Table 3-3. Figure 3-2** graphically displays the current runway configuration and forecast demand.

Table 3-3 Annual Service Volume Comparisons

Description	Annual Operations	Hourly Capacity VFR	Hourly Capacity IFR	Annual Service Volume	Percent Capacity	Hours of Annual Delay
Current 2005 Single Runway Without Radar	71,526	61	27	135,000	53%	415
Single Runway 2006, w/ Radar	74,800	61	49	199,000	38%	239
Single Runway 2025, w/ Radar	136,624	61	49	199,000	69%	1,479
Two Runways 2025, Runways 12-30 & 11-29	136,624	135	56	287,000	48%	774
Two Runways 2025, Runways 12-30 & 3-21	136,624	78	58	232,000	59%	1,025
Three Runways 2025	136,624	135	56	287,000	48%	774

Figure 3-2 Demand vs. Capacity



Capacity Summary

Gallatin Field, with ATCBI-6 radar, will not have capacity or delay problems. With the completion of the new ATCBI-6 radar station, Gallatin Field will have sufficient capacity with minimal delays for the planning period. Operations are projected to exceed 60% of the single Runway 12-30 capacity toward the end of the planning period. Therefore, two alternatives for increasing capacity have been reviewed and include the construction of an all weather parallel runway located 700 to 2,500 feet north of Runway 12-30 serving Class A and B aircraft and the extension of the crosswind runway. Both options increase capacity with the parallel runway configuration providing the largest increase in capacity. Construction of both the parallel runway and expansion of the crosswind runway does not increase the capacity of the airport beyond the capacity of the two parallel runway configuration. Therefore, expanding the crosswind runway for capacity reasons is not recommended if a parallel runway can be established. Five alternatives are included at the end of this chapter to determine the optimum location of a parallel runway at Gallatin Field.

Navigational Aids and Approach Procedures

There are a number of navigational aids in service at Gallatin Field to assist pilots in locating and landing at Gallatin Field Airport. The VOR, Runway 12 Glide Slope Antenna Runway 12 localizer, and GPS assist pilots when flying in poor visibility due to weather. Navigational aids allow for lower visibility minimums and decision height altitudes. By providing lower visibility minimums there are fewer delays caused due to poor weather. Precision instrument approaches provide horizontal and vertical guidance to pilots and also offer the lowest approach visibility minimums. The current precision instrument approach for Runway 12 provides visibility minimums of ½ mile and a decision height of 200 feet above the ground level. Conversely, the approach to Runway 30 with the aide of GPS provides visibility minimums of 3 miles for faster jets and 1 ¼ miles for the smaller, slower planes. The decision height for this approach is 1,906 feet above the airport elevation.

Often during ILS conditions, the wind favors the use of Runway 30. With limited instrument procedure and higher visibility minimums to Runway 30 pilots use the ILS approach to Runway 12. Incidents have occurred where aircraft landing on Runway 12 have overrun the runway on roll out. An improved instrument procedure to Runway 30 would improve operational efficiency and safety of the airport by reducing landing minimums to Runway 30 and allowing aircraft to land into the wind. The existing Airport Layout Plan shows Runway 30 ultimately having a precision instrument approach. The approach slopes for Part 77 Objects Affecting Navigable Airspace require a 50:1 slope for the inner 10,000 feet and a 40:1 slope for 40,000 feet. There are no known penetrations to these surfaces for runway 30 at this time. A precision instrument approach to Runway 30 would require horizontal and vertical guidance from a ground based instrument landing system or a microwave landing system. An approach lighting system would also be required.

A non-precision instrument approach that provides horizontal guidance without vertical guidance could also reduce approach visibility minimums to Runway 30. Improved GPS technology will allow non-precision instrument approach visibility minimums to be reduced to levels which are currently associated only with instrument approaches. GPS precision instrument approaches cost less that traditional instrument approaches because there is less ground-based equipment that needs to be installed and maintained. **Table 3-4** outlines the requirements for non-precision GPS approaches.

Table 3-4 Non-Precision GPS Approach Requirements

Visibility Minimums	< 3/4 - Statute Mile	< 1 - Statute Mile	1 - Statute Mile
Height Above Touchdown	300	340	400
Runway Markings	Precision	Non-Precision	Non-Precision
Runway Edge Lights	HIRL/MIRL	HIRL/MIRL	MIRL/LIRL
Parallel Taxiway	Required	Required	Recommended
Approach Lights	MALSR	ODALS	Recommended
HIRL - High Intensity Runway lighting		MIRL - Medium Intensity Runway lighting	
LIRL - Low Intensity Runway Lighting			
MALSR - Medium Intensity Approach Lighting System with Runway Alignment Lighting			
ODALS - Omni-Directional Approach Lighting System			
Source: Appendix 16 FAA AC 150/5300-13, Airport Design, Change 10			

Runway Dimensional Criteria

The dimensional criteria were evaluated for each of the three (3) existing runways at the airport. Dimensional requirements are derived from FAA Advisory Circular 150/5300-13, "Airport Design". Airfield capacity calculations have demonstrated that planning for an additional parallel runway should start late in the planning period given the forecast operations. In addition to the existing runways, dimensional criteria for an additional all weather runway will be addressed.

The dimensional requirements defined in FAA Advisory Circular 150/5300-13, "Airport Design" includes:

◊ Runway Width

◊ Runway Safety Area (RSA) Width – The surface surrounding the runway prepared or suitable for reducing the risk of damage to airplanes in the event of an undershoot or excursion from the runway.

◊ Runway Object Free Area (OFA) – The area on the ground centered on a runway provided to enhance the safety of aircraft operations by having the area free of objects, except for objects that need to be located in the OFA for air navigation or aircraft ground maneuvering purposes.

◊ Runway Obstacle Free Zone (OFZ) – The OFZ is the airspace below 150 feet of the established airport elevation and along the runway and extended runway centerline that is required to be clear of all objects, except for frangible visual NAVAIDs that need to be located in the OFZ.

◊ Runway Protection Zone (RPZ) – The areas off the runway end to enhance the protection of people and property on the ground.

By applying the lowest approach visibilities for each runway and their associated ARC the dimensional requirements were determined. The existing and proposed dimensional requirements of each runway are displayed in **Table 3-5.**

Table 3-5 Runway Dimensional Criteria

	Required Runway					
	Runway 3-21		**Runway 12-30**		**Runway 11-29 Turf**	
	Existing	Ultimate	Existing	Ultimate	Existing	Ultimate
ARC	B-1 Small	B-II	C-III	D-IV	B-I Small	B-I Small
Approach Visibility Minimum	Visual	> 1 mile	< 3/4 miles	< 3/4 miles	Visual	Visual
Runway Width	60	75	100	150	60	60
Runway Safety Area Width	120	150	500	500	120	120
Runway Object Free Area Width	250	500	800	800	250	250
Runway Obstacle Free Zone Width	120	400	400	400	120	120

Runway Orientation

Runway orientation is determined to provide the maximum amount of wind coverage based on local prevailing wind conditions. Orienting a runway in the same direction decreases the impact of winds perpendicular to the direction of flight, known as crosswinds. FAA design standards recommend that if the primary runway provides less that 95% wind coverage for a 10.5 knot crosswind component for aircraft weighing 12,500 pounds or less, additional runway orientations are recommended. Aircraft of this size may not be able to safely operate in a crosswind greater than 10.5 knots, where heavier aircraft are able to operate safely in these crosswinds. A detailed wind analysis was conducted using wind data from 1989-1993. The results of the analysis determined that the winds are less than 10 knots 89.7% of the time and Runway 12-30 provides 94.91% wind coverage for a 10.5 knot crosswind. Additional review of crosswinds revealed that during times of strong winds, greater than 10.5 knots, the wind direction is parallel to Runway 12-30 50.4% of the time. This makes it usable to small aircraft half of the time during strong winds. The crosswind Runway 3-21 is necessary for the other 49.6% of the time during strong winds.

With the current configuration of Runway 12-30 and Runway 3-21, 99.8% wind coverage is provided. No additional runway orientations or configurations are required. While no additional runway orientations have been deemed necessary, it is important to recognize the necessity of the crosswind runway to small aircraft during high wind conditions.

In addition to the small aircraft fleet that currently utilizes crosswind Runway 3-21, microjets will also benefit from the runway in the near future. Microjets, also known as Very Light Jets (VLJs), are small jet aircraft weighing less than 10,000 pounds. Common traits of these jets include single and dual pilots with four to ten passenger seats and costing between $1 and $3 million dollars. These aircraft can operate on smaller paved runways of 3,000 to 5,000 feet. At the October 2005 TRB/FAA workshop, industry experts suggested the market for new microjets could add 500 aircraft a year to the active fleet by 2010. The FAA Aerospace Forecast for Fiscal Years 2006-2017 assumes that microjets will enter the active fleet in 2006 (100 aircraft) and grow by 400 to 500 aircraft a year after that, reaching 4,950 aircraft by 2017. The Cessna Mustang became the first FAA-certified VLJ on September 8, 2006. Several other manufacturers are expected to receive FAA certification in the future.

Runway Length

Runway length requirements are determined from information provided by aircraft manufacturers for large aircraft and FAA Advisory Circular 150/5325-4 Runway Length Requirements for Airport Design. Variables that affect the required runway length for takeoff include the airfield elevation, the maximum mean temperature of the hottest month, runway gradient, critical aircraft, and the stage length of the longest nonstop trip destinations. For calculating runway lengths for Gallatin Field, the Airport elevation of 4,475 feet above mean sea level (MSL) and a mean maximum temperature of 83.4º F was used.

Runway 3-21 is the crosswind runway. As noted before, Runway 3-21 is necessary for the operation of small aircraft during high crosswind conditions. Runway length requirements for general aviation airports serving small aircraft only are separated into four categories based on the type of aircraft and approach speed. These four types are:

- ◊ **Small airplanes with approach speeds of less than 30 knots:** Considered to be short take off and landing or ultra light planes. The recommended runway length for these aircraft is 300 feet + 0.03 times the airport elevation. At Gallatin Field, this equates to 435 feet.
- ◊ **Small airplanes with approach speeds greater than 30 but less than 50 knots:** The recommended runway length for these aircraft is 800 feet + 0.08 times the airport elevation. At Gallatin Field, this equates to 1,160 feet.
- ◊ **Small airplanes with approach speeds greater than 50 knots and having fewer than 10 passengers:** This category is further subdivided to 95% and 100% of the fleet with 95 percent of the fleet for medium size population communities and 100 percent of the fleet for communities located on the fringe of metropolitan areas or a relatively large population located remotely from a metropolitan area.
- ◊ **Small airplanes with approach speeds greater than 50 knots and having 10 or more passengers:** This category is also broken down further to 95 and 100 percent of the fleet.

Runway length requirements for aircraft weighing more than 12,500 pounds up to and including 60,000 pounds is determined according to a family grouping of airplanes having similar performance characteristics and operation weights. These are presented in two families described as 75 percent and 100 percent of the fleet. The planes considered to make up 75 percent of these large airplanes are presented in **Table 3-6** along with the airplanes that make up the remaining 25 percent. Runway lengths for these large airplanes are then determined for each family of airplanes at 60 percent and 90 percent useful load based on the haul length and service needs of the critical aircraft. Runway lengths for airplanes weighing 60,000 pounds and less are displayed in **Table 3-7**.

Table 3-6 Aircraft Fleet Mix - Large Airplanes

Airplanes that Make Up 75 Percent of the Fleet			
Manufacturer	**Model**	**Manufacturer**	**Model**
Aerospatiale	SN-601 Corvette	Dassault	Falcon 10
BAE	125-700	Dassault	Falcon 20
Beech Jet	400A	Dassault	Falcon 50/50 EX
Beech Jet	Premier I	Dassault	Falcon 900/900B
Beech Jet	2000 Starship	Israel Aircraft Industries (IAI)	Jet Commander 1121
Bombardier	Challenger 300	IAI	Westwind 1123/1124
Cessna	500 Citation/501 Citation SP	Learjet	20 Series
Cessna	Citation I/II/III	Learjet	31/31A/31AER
Cessna	525A Citation II (CJ-2)	Learjet	35/35A/36/36A
Cessna	550 Citation Bravo	Learjet	40/45
Cessna	550 Citation II	Mitsubishi	MU-300 Diamond
Cessna	551 Citation II/Special	Raytheon	390 Premier
Cessna	552 Citation	Raytheon Hawker	400/400 XP
Cessna	560 Citation Encore	Raytheon Hawker	600
Cessna	560/560 XL Citation Excel	Sabreliner	40/60
Cessna	560 Citation V Ultra	Sabreliner	75A
Cessna	650 Citation VII	Sabreliner	80
Cessna	680 Citation Sovereign	Sabreliner	T-39
Remaining 25 Percent of Airplanes that Make Up 100 Percent of Fleet			
Manufacturer	**Model**	**Manufacturer**	**Model**
BAE	Corporate 800/1000	Israel Aircraft Industries (IAI)	Astra 1125
Bombardier	600 Challenger	IAI	Galaxy 1126
Bombardier	601/601-3A/3ER Challenger	Learjet	45 XR
Bombardier	604 Challenger	Learjet	55/55B/55C
Bombardier	BD-100 Continental	Learjet	60
Cessna	S550 Citation S/II	Raytheon/Hawker	Horizon
Cessna	650 Citation III/IV	Raytheon/Hawker	800/800 XP
Cessna	750 Citation X	Raytheon/Hawker	1000
Dassault	Falcon 900C/900EX	Sabreliner	65/75
Dassault	Falcon 2000/2000 EX		

Table 3-7 Runway Lengths Less than 60,000 lbs

Runway Lengths in Feet for Small Airplanes	
Small Airplanes with Fewer than 10 Passengers	
95% of Fleet	5,400
100% of Fleet	5,700
Small Airplanes Having 10 or More Passengers	
95% of Fleet	5,700
100% of Fleet	5,700
Runway Lengths in Feet for Large Airplanes Weighing More Than 12,500 Pounds Up To and Including 60,000 Pounds	
75% of Fleet at 60% Useful Load	6,400
75% of Fleet at 90% Useful Load	8,600
100% of Fleet at 60% Useful Load	8,800
100% of Fleet at 90% Useful Load	10,300

The existing ALP shows a planned extension of Runway 3-21 to 5,700 feet, which would serve 100 percent of the small airplanes that require it during crosswind conditions. As discussed in the capacity section of this chapter, extending the runway does not provide additional capacity over a parallel runway; therefore, extending Runway 3-21 to lengths required to serve large airplanes is not recommended.

Runway length requirements for aircraft with a maximum certified takeoff weight of more than 60,000 pounds are determined according to the individual large aircraft utilizing the airport. These recommended lengths are provided by aircraft manufacturers. The ALP currently shows a runway extension for 12-30 of 1,500 feet to 10,500 feet. As shown above, this length will accommodate 100% of large airplanes weighing more than 12,500 pounds up to and including 60,000 pounds, as shown in **Table 3-7**.

Runway lengths for commercial aircraft using or expected to use the airport in the planning period were determined. Due to the airport elevation of 4,475 MSL and the maximum mean temperature of the hottest month of 83º F, most of the airplanes Maximum Take Off Weight (MTOW) is restricted. **Table 3-8** presents the maximum range for several airplanes based on a 9,000 foot runway and a 10,500 foot runway. If the distance to the destination airport is less than the aircraft's maximum range, additional payload can be carried. The MTOW for the runway length was calculated by assuming the maximum number of passengers the aircraft can seat with each passenger and their baggage weighing 200 pounds. Also listed are the lengths of haul to several common destination airports. The manufacturers' data is for planning purposes and recommends consultation with local commercial air carriers to determine actual aircraft operating weights and conditions prior to construction of a runway extension.

Results of the runway length requirements show that 9,000 feet of runway is acceptable for the aircraft operating or expected to operate at Gallatin Field with the maximum number of passengers on board. The planned extension of Runway 12-30 to 10,500 feet would increase payload capacity and the range of aircraft departing from Gallatin Field. The extension would also meet the required runway length for 100% of aircraft weighing more than 12,500 pounds and less than 60,000 pounds. It is recommended that planning for the extension of Runway 12-30 continue.

Table 3-8 Aircraft Range Based on Runway Length

Longest Haul in Nautical Miles at MTOW* for Airport Elevation		
Aircraft	**9,000' Runway**	**10,500' Runway**
737-800	1,500	2,000
737-500	2,300	2,750
CRJ-100ER	1,300	1,500
CRJ-200ER	1,500	1,500**
CRJ-900	1,500	1,650
* - Maximum Takeoff Weight (MTOW) based on maximum passengers @ 200 lb. ea.		
** - Due to operational conditions of CRJ at Airport Elevation, additional runway length beyond 9,000' for the CRJ 200 and 10,000' for the CRJ 100 does not increase MTOW or length of haul.		

Typical Length of Haul from Gallatin Field	
Salt Lake	300 nm
Denver / Seattle	470 nm
LA / Minneapolis	780 nm
Chicago	1,050 nm
Atlanta	1,420 nm

Runway Pavement Strength

It is essential that airfield pavements be capable of supporting repeated use by aircraft. Several factors affect the design strength of airfield pavements including the number of operations, maximum takeoff weight, and the landing gear configuration. Pavement strength for the runways at Gallatin Field are displayed in **Table 3-9** along with the weights of several typical aircraft utilizing the runways. The runways have adequate pavement strength to serve the current aircraft utilizing the airport and those aircraft expected to operate at Gallatin Field in the future.

Table 3-9 Runway Pavement Strength

	Runway 12-30	Runway 3-21	Runway 11-29
Single Wheel Gear (lbs)	75,000 +	65,000	< 12,500
Dual Wheel Gear (lbs)	200,000 +	110,000	-
Dual Tandem Gear (lbs)	360,000	-	-

Aircraft	Max Takeoff Weight (MTOW)	Gear Configuration
Boeing 737-800	172,000 lbs	Dual
Boeing 757-200	255,000 lbs	Dual Tandem
Airbus A319	140,095 lbs	Dual
Airbus A320-100	145,505 lbs	Dual
Airbus A320-200	162,040 lbs	Dual
CRJ-900	82,500 lbs	Dual
Gulfstream IV	73,200 lbs	Dual
Gulfstream II	65,300 lbs	Dual
Beech King Air B200	12,500 lbs	Dual
Cessna 172	2,450 lbs	Single

III. Taxiways

Taxiways are designed based on the ADG making use of the taxiway. Taxiways provide access routes between runways and aircraft parking aprons. The current taxiway configuration for Runway 12-30 consists of a parallel taxiway and five (5) exit/ entrance taxiways. The existing taxiway characteristics are displayed in **Table 3-10** along with the dimensional requirements for varying aircraft design groups. Currently, the parallel taxiway system is design Group III. No dimensional deficiencies exist with the current taxiway system serving the existing or ultimate design aircraft.

Table 3-10 Existing Taxiway Dimensions

	Existing	Group III Required	Group IV Required
Parallel Taxiway A	75'-90'	50'	75'
Exit Taxiways A,B,C,E	75'-90'	50'	75'

The entrance taxiways, located at the thresholds of Runways 12 and 30, can cause reduced airfield capacity by creating delays for airplanes trying to depart. Consultation with the Air Traffic Control Tower observed that, recently, there have been delay problems caused by the quantity and mix of aircraft utilizing the taxiway system for takeoff. Occasions where the preceding aircraft is not ready for takeoff or is waiting for final clearance from the Air Traffic Control Tower and blocks the entrance taxiway are increasing as the number of operations rise. Solutions to taxiway capacity problems include the construction of bypass taxiways, dual parallel taxiways, and holding aprons.

Bypass taxiways are constructed as a second entrance parallel to the existing entrance taxiway. Bypass taxiways provide flexibility in ground maneuvering and runway use. **Figure 3-3** displays a typical configuration of bypass taxiways that could be constructed near the thresholds of Runways 12 and 30.

Dual parallel taxiways increase ground maneuvering flexibility, thereby increasing taxiway capacity. High speed taxiways reduce the amount of time aircraft are on the runway and therefore increase capacity. Parallel taxiways provide multiple access ways to runways. **Figure 3-4** displays a dual parallel taxiway configuration and high speed taxiway at Gallatin Field. The construction of the parallel taxiway or high speed taxiways could be phased.

Holding aprons can also enhance capacity by providing a space for aircraft to wait for final takeoff clearance. Holding aprons of adequate size increase maneuverability and allow for bypass operations similar to exit taxiways. Gallatin Field has holding aprons near the thresholds of Runway 12 and 30. In addition to holding aircraft, it also provides an area for aircraft de-icing and run-up operations. Holding aprons are recommended when runway operations reach a level of 30 per hour. **Figure 3-5** displays the holding apron near the threshold of Runway 12 and a service road constructed in 2007 to provide vehicle access for maintenance and de-icing operations. The service road is located outside of the air movement area and does not require clearance from the Air Traffic Control Tower for vehicles to operate on it.

IV. Commercial Aircraft Parking Facilities

Currently, the commercial apron consists of 20,300 square yards of concrete apron and 30,000 square yards of asphalt apron. Of the asphalt portion of the apron, 6,750 square yards are available for the parking of large commercial airplanes when they are not docked at the boarding gate. The pavement strength and dimensions of the existing Commercial Apron are displayed in **Table 3-11.**

Table 3-11 Commercial Aircraft Parking Facilities

DESCRIPTION	WIDTH	LENGTH	SURFACE	SINGLE WHEEL (lbs)	DUAL WHEEL (lbs)	DUAL TANDEM (lbs)
CONCRETE	150'	730'	CONCRETE	75,000+	160,000	350,000
CONCRETE	162.5'	400'	CONCRETE	75,000+	200,000+	400,000+
ASPHALT	193'	930'	ASPHALT	75,000+	200,000+	400,000+
ASPHALT	140'	400'	ASPHALT	75,000+	200,000+	400,000+
ADDITIONAL PARKING APRON	300'	200'	ASPHALT	75,000+	200,000+	400,000+

The dimensions of the existing commercial apron are adequate for the current level of use. Additionally, the strength of the asphalt and concrete pavements are adequate to serve the largest anticipated regularly scheduled commercial aircraft. The concrete portion of the apron provides parking for the four existing boarding bridges.

Expansion of the apron was completed in 2007 to coincide with the expansion of the terminal building. Expansion for additional parking positions, not at boarding gates, was required prior to the terminal expansion as the numbers of overnight aircraft and peak hour operations are increasing. The apron expansion was required prior to the terminal expansion, and it was planned to work with the ultimate terminal design.

Long range planning for the replacement of the asphalt portion of the apron with concrete should be considered. Concrete has an assumed useful life of 50 years with little maintenance. Asphalt requires more maintenance at shorter intervals. Impacts to the terminal users during maintenance projects on the asphalt portion of the apron will increase as commercial aviation activity increases. Replacing the asphalt portion with concrete will reduce the impacts to the commercial carriers and their passengers throughout the apron's useful life. The proposed commercial apron expansion is displayed in **Figure 3-5.** The dimensions of the expansion should be reviewed based on the terminal expansion plans when expansion becomes necessary.

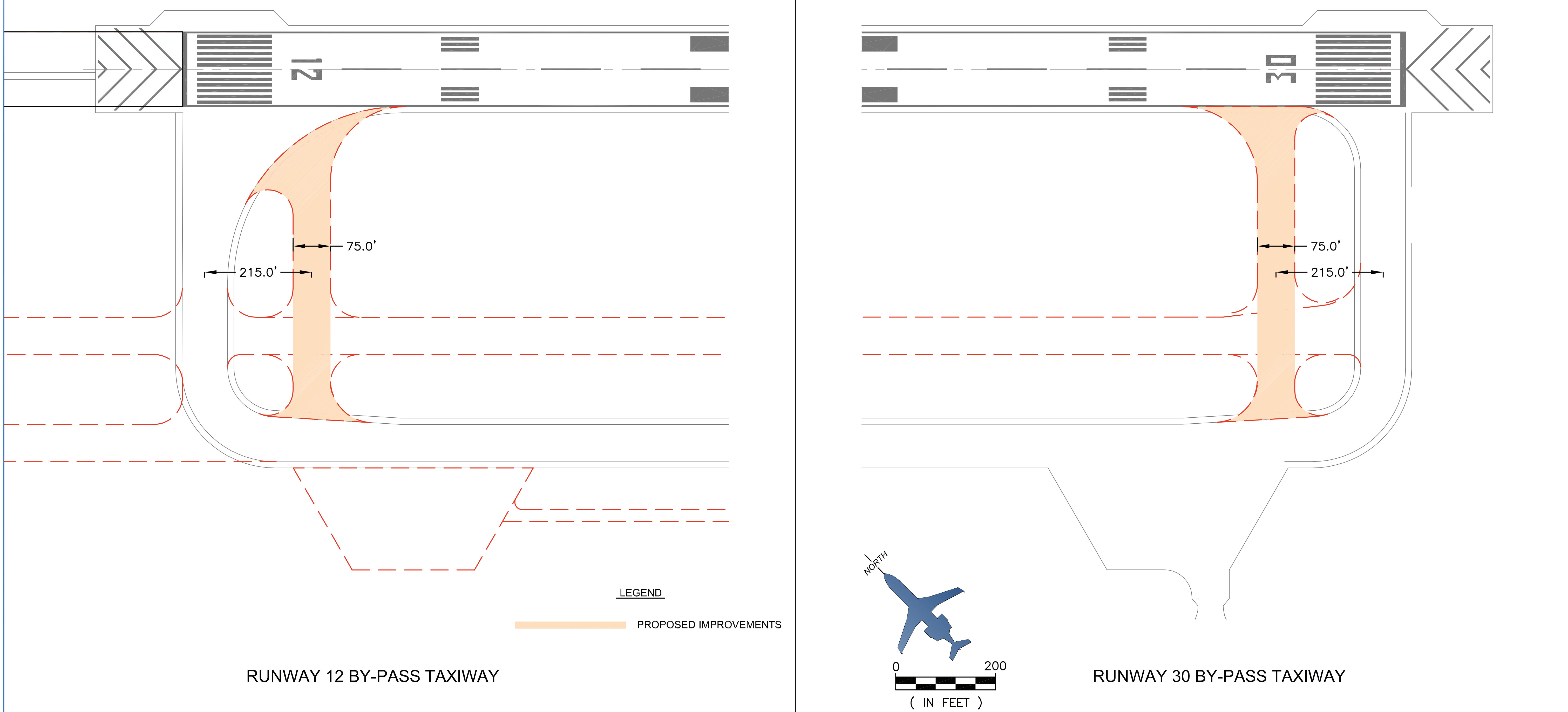
V. Aircraft Deicing

Currently, the majority of deicing operations are conducted on the Commercial Apron. Additional deicing can take place on the holding aprons along Taxiway "A" near the thresholds of Runway 12 and 30. Storage of deicing materials and equipment is provided at the east end of the Commercial Apron. The deicing agents most commonly used for aircraft operations are propylene glycol and ethylene glycol. The majority of runoff of deicing fluid from deicing operations at Gallatin Field is collected in the storm drainage system and then flows in an open grass-lined canal where it is exposed to ultra violet light and allowed to break down.

The Montana Department of Environmental Quality (MDEQ) and the Environmental Protection Agency (EPA) currently do not regulate the handling and management of deicing fluid effluent from airports. MDEQ would regulate discharge of deicing fluid if it were disposed of with storm water into surface waters. No storm water from Gallatin Field is discharged into surface waters.

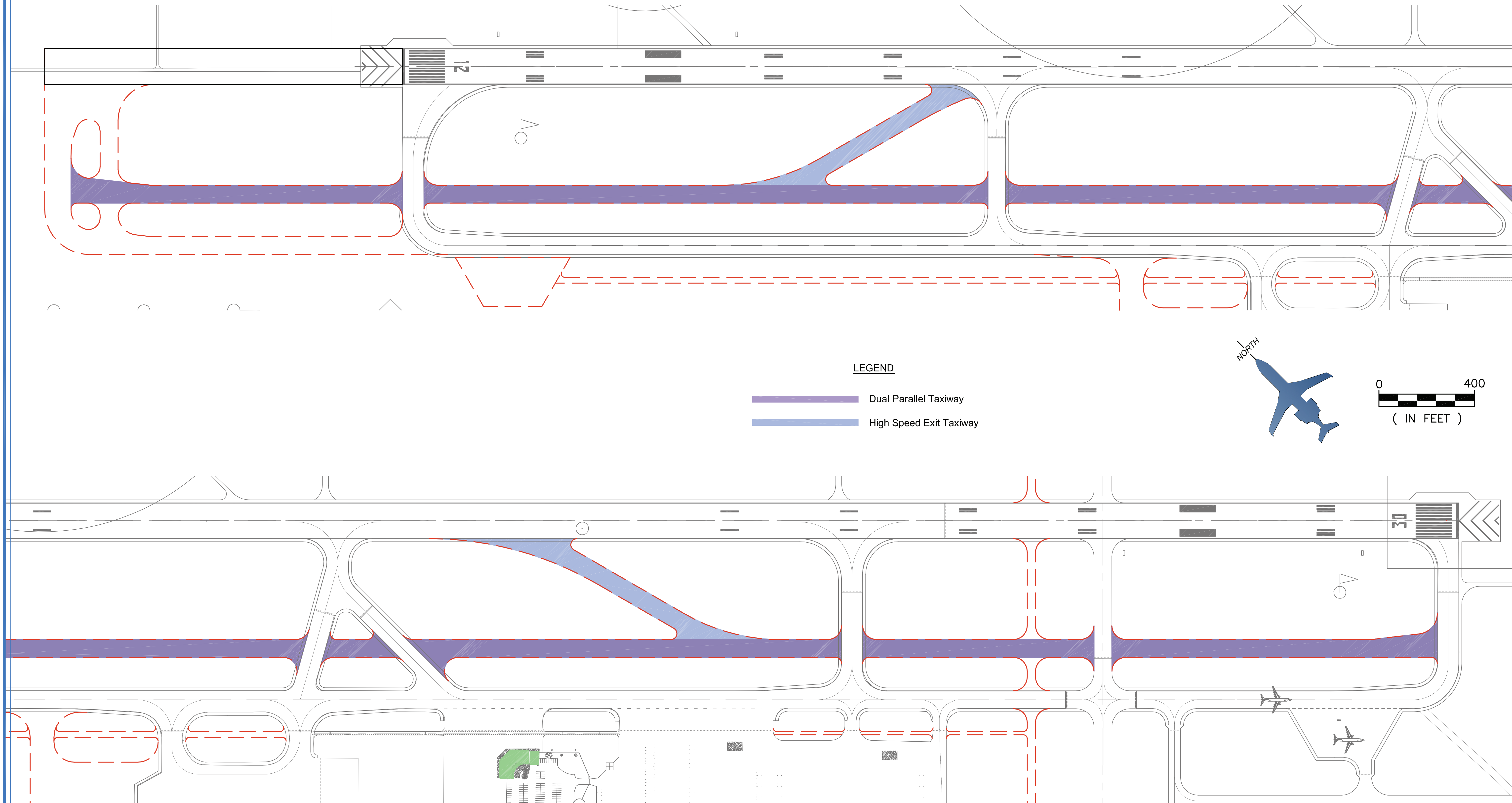
The EPA will publish the Effluent Guidelines Program Plan proposed rule for deicing regulations into the Federal Registrar in the near future. Following the public and industry comment period, a final rule will be published in September 2009. Currently, the EPA is in the data collection period of the rule-making process and can not provide guidance as to how deicing fluid will be regulated in the proposed rule. Specific numerical guidelines for deicing pollutants will be formulated in the proposed rule. In addition, guidance on treatment, mitigation, best management practices, and recycling options for deicing fluid will be presented in the proposed rule.

Gallatin Field's surface drainage and storm water system has been planned to allow for the capture of the majority of deicing fluid separate from storm water. If separation of deicing fluid is required under the 2009 ruling filed by the EPA, separators will need to be installed in the storm drainage system. Monitoring regulations of deicing fluid is recommended. New storm drain systems should be designed to allow separators for deicing fluid to be easily installed in the event that future regulations require separation.



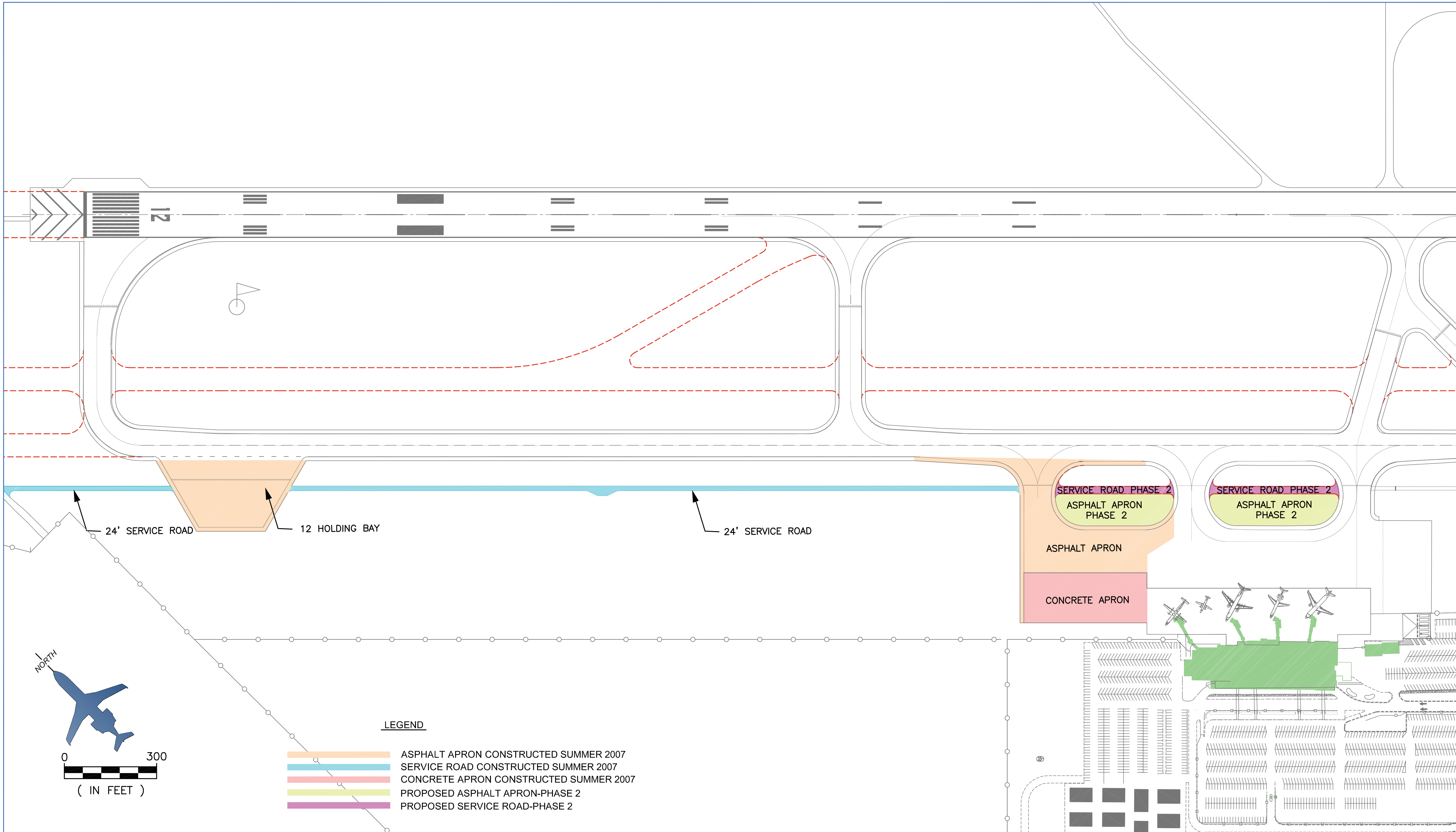
Gallatin Field Airport Master Plan

Figure 3-3 - By-Pass Taxiways



Gallatin Field Airport Master Plan

Figure 3-4 - Dual Parallel Taxiway



Gallatin Field Airport Master Plan

Figure 3-5 - Hold Bay, Service Road, Asphalt & Concrete Aprons

VI. General Aviation

Aprons

Aprons for general aviation aircraft include the GA apron, the based aircraft tie-down apron, and the East Ramp. The GA apron is used by the two fixed base operators (FBO) to provide service and maintenance of based and itinerant aircraft as well as two flight schools. The GA apron has 33 tie-down locations, two concrete hard stands, and 32,250 square yards of asphalt without designated tie-downs for large aircraft parking. The based aircraft tie-down apron includes a self-fueling AvGas facility utilized by both based and itinerant aircraft. The based aircraft apron is available for itinerant aircraft parking as well as local parking with 32 tie-down locations. The East Ramp includes 41,200 square yards of asphalt and concrete without any designated tie-downs for parking small aircraft.

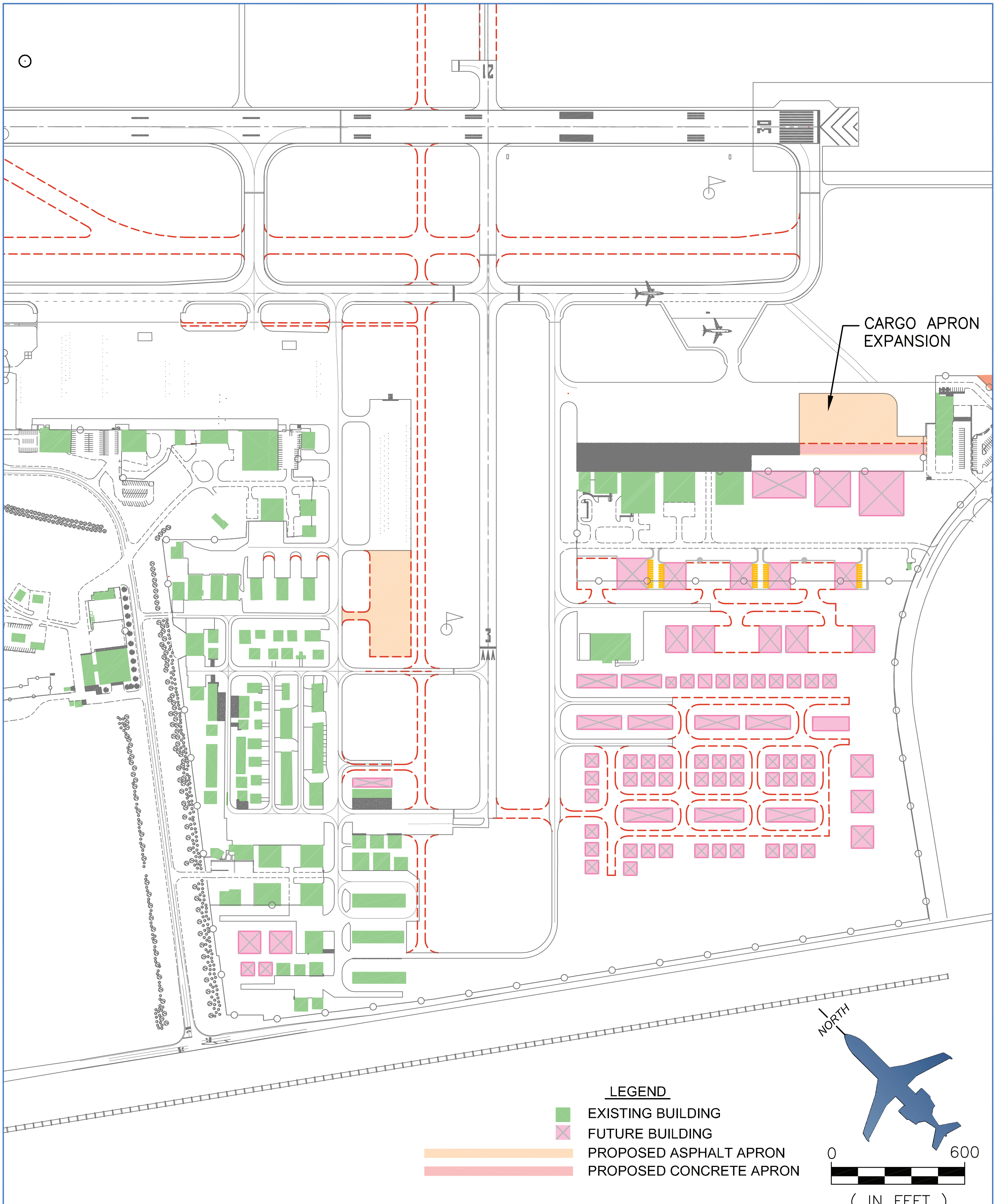
Enough parking for based aircraft stored outside should be provided as well as space for transient aircraft. Currently, only ten (10) based aircraft are stored outside with the remainder being stored in hangars. For planning, the percentage of based aircraft stored outside has been assumed to stay constant in the future. Itinerant general aviation operations account for 35% to 40% of total operations. GA landings greater than 12,500 lbs account for 8% to 9% of total GA landings. Itinerant parking positions were determined by providing parking for 30% of the peak day landings with 2/3 of the parking being for small aircraft tie downs. Apron planning was based on 500 square yards for based aircraft and 700 square yards for itinerant aircraft; these include areas for taxiing aircraft. The existing and forecast apron requirements are displayed in **Table 3-12**. Gallatin Field currently has enough paved apron to meet the needs of the aircraft throughout the planning period. If additional aircraft tie down locations are required in the future, these can be easily added strategically to the existing aprons.

Storage Facilities

Gallatin Field currently has 92 t-hangar spaces and 65 private hangars capable of storing one or more aircraft built on 51 acres. With 263 based aircraft, the private hangars are storing, on average, 3 aircraft per hangar. Trends in hangar construction are difficult to predict. The number of occupants and hangar use varies. The smaller square footage in t-hangars come with less cost but do not provide adequate space for the larger jet and multi-engine aircraft. T-hangars provide limited space for convenience items such as minor aircraft maintenance and bathrooms. Fixed base operators at Gallatin Field also own or lease several large hangars for storing transient aircraft. Current and forecast based aircraft show that 75% of the based aircraft are smaller single engine aircraft. However, the construction of larger, single door hangars capable of storing larger aircraft or multiple aircraft has outpaced the construction of t-hangars. Projections for hangar space requirements assume that 50% of the hangar doors available in the future will be t-hangars, with the remainder being private hangars capable of storing one or more aircraft. Projections of hangar space requirements are displayed in **Table 3-12**.

The existing Airport Layout Plan shows planned space for two t-hangars having 14 spaces, 11 individual hangars smaller than 3,600 square feet, and 28 locations for hangars larger than 3,600 square feet. Eleven of the twenty-eight large hangars are located along Aviation Lane providing access and parking outside of the security fence. These hangars may be used for operations of aviation related businesses or as private hangars. With these planned hangars, there will be 70 t-hangar doors and 96 individual hangar locations.

Future estimates show the need for additional t-hangar locations in the near term and additional space planning for individual hangars in the mid-term of the planning period. There is approximately 61 acres of hangar development space located east of Runway 3-21 and south of Aviation Lane. The current Airport Layout Plan shows the southern 34.5 acres of the development planned for large hangars, 40,000 square feet and a large apron designed to meet Design Group III standards. Additionally, hangars of these sizes are planned along the East Ramp. An alternative development layout is displayed in **Figure 3-6** along with the existing hangar areas. This layout could be phased in as development is needed and would meet the expected short and mid term hangar needs. It can easily be adjusted to allow for the construction of taxilanes and hangars capable of storing Design Group III aircraft when the hangar positions on the East Ramp become full.



Gallatin Field Airport Master Plan

Figure 3-6 Hangar Development

Table 3-12 General Aviation Facility Requirements

Transient GA Apron Space Required					
	2005	**2010**	**2015**	**2020**	**2025**
Peak Day Landings	**225**	280	340	395	450
Total Transient Positions Required	**68**	84	102	119	135
Transient Tie-down Positions Available	**33**	55	67	78	89
Apron Area (square yards) (1)	**113,940** (2)	58,800	71,400	82,950	94,500
(1) - Planned Apron based on 700 square yards per parking position (2) - Includes GA apron and East Ramp.					
Based Aircraft Space Required					
	2005	**2010**	**2015**	**2020**	**2025**
Based Aircraft Stored Outside	**10**	13	15	18	20
Tie-down Positions	**32**	13	15	18	20
Apron Area (square yards) (3)	**14,000**	6,500	7,500	9,000	10,000
(3) - Planned Apron based on 500 square yards per parking position					
Hangar Storage Space					
	2005	**2010**	**2015**	**2020**	**2025**
T-Hangar (Condo) Spaces	**66**	82	99	115	132
Single Unit Private	**66**	82	99	115	132
Based Aircraft	**263**	327	393	460	526

Public Vehicle Parking, Perimeter and Service Roads

Parking for general aviation is provided behind the current FBOs and in or adjacent to private storage hangars. Consultation with the fixed based operators and the local pilots has determined the need for additional parking areas. Currently there are 189 parking positions located adjacent to and behind the front line FBO buildings.

No parking is designated for the based aircraft apron. Parking adjacent to private hangars appears to be adequate. Public vehicle parking around the terminal will be addressed in Chapter 4 –Terminal Requirements.

Increased security requirements have made perimeter fence checks more frequent. Currently, a majority of the perimeter fence can be accessed from Highway 10, Airport Road, Lagoon Road, Baseline Road, and Tubb Road. A perimeter road along the security fence located southwest of Taxiway “A” and off the approach end of Runway 12 should be considered in the near term.

VII. Cargo Facilities

At the present time, there are three independent cargo operators at the airport: DHL, FedEx, and UPS. The east end of the East Ramp has been allocated for cargo operators. FedEx is the only cargo operator that occupies a building on the airport with the other operators only performing aircraft loading and unloading operations. FedEx’s facility includes a 4,650 square yard aircraft apron adjacent to the building. Based on cargo flight operation forecasts, this apron is sufficient for FedEx’s cargo operations for the foreseeable future. Currently, there is 8,300 square yards of asphalt and concrete aprons at the East Ramp available to DHL and UPS. If the need arises due to increased general aviation activity at the East Ramp or increased cargo operations, an additional 19,500 square yards of asphalt and concrete apron could be constructed adjacent to the East Ramp for the cargo operators. These existing and planned areas should meet or exceed the cargo facility requirements for the planning period.

VIII. Support Facilities

Aircraft Rescue and Firefighting (ARFF)

The requirements for Aircraft Rescue and Firefighting are listed in FAR Part 139. FAR part 139.315 Aircraft Rescue and Firefighting; Index Determination, sets the following indexes based on the length of the air carrier aircraft.

- ◊ Index A includes aircraft less than 90 feet in length.
- ◊ Index B includes aircraft at least 90 feet but less than 126 feet in length.
- ◊ Index C includes aircraft at least 126 feet but less than 159 feet in length.
- ◊ Index D includes aircraft at least 159 feet but less than 200 feet in length.
- ◊ Index E includes aircraft at least 200 feet in length.

The typical commercial aircraft operating at or expected to operate at Gallatin Field and their associated index are displayed in **Table 3-13**. The requirements for each group are as follows:

Index A requires one vehicle carrying at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent; or 450 pounds of potassium-based dry chemical and water with a commensurate quantity of Aqueous Film Forming Foam (AFFF) to total 100 gallons for simultaneous dry chemical and AFFF application.

Index B requires one vehicle carrying at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of AFFF for foam production; or two vehicles, one vehicle carrying the extinguishing agents as specified in the index A requirements and one vehicle carrying an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons.

Index C requires either two vehicles, one vehicle carrying at least 500 pounds of sodium-based dry chemical, halon 1211, or clean agent and 1,500 gallons of water and the commensurate quantity of AFFF for foam production and one vehicle carrying water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by both vehicles is at least 3,000 gallons; or three vehicles one vehicle carrying the extinguishing agents required by index A and two vehicles carrying an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by all three vehicles is at least 3,000 gallons.

Index D requires three vehicles, one vehicle carrying the extinguishing agents as specified in index A and two vehicles carrying an amount of water and the commensurate quantity of AFFF so the total quantity of water for foam production carried by all three vehicles is at least 4,000 gallons.

Table 3-13 ARFF Indexes

Aircraft	Length	Index
Boeing		
737-800	129’-1”	C
757-200	155’-4”	C
Airbus		
A319	111’-0”	B
A320	123’-4”	B
Bombardier		
CRJ 200	87’-10”	A
CRJ 700	106’-8”	B
CRJ 900	119’-4”	B
DHC-8-400	107’-9”	B

Gallatin Field currently has an ARFF index of B and can meet index C with the two ARFF vehicles having 1,500 gallons of usable water and 200 gallons of AFFF meeting the Part 135 requirements. The older truck was manufactured in 1990 by Oshkosh and the newer truck was purchased in 2005 from Emergency One. For Gallatin Field to move to the next ARFF index D the Airport would need five daily scheduled flights of aircraft 156’ to 200’ long. Typical aircraft in the D index are the Boeing 767 and the Airbus A330. Gallatin Field is expected to remain at or below index C throughout the planning period. Additional ARFF equipment will not likely be required through the planning period although the older Oshkosh truck should be expected to be replaced during the planning period.

The current ARFF storage facility was constructed in 2005 and provides sufficient warm storage for the existing equipment. Office space for ARFF personnel is provided in the Airport Safety Building (ASB) adjacent to the equipment storage and was remodeled for ARFF operations in 2005. The building is located adjacent to Taxiway “A” near mid-field and provides good response times to each runway threshold. The ASB has a viewing area of both thresholds of Runway 12-30 and the threshold of Runway 21. Additionally, it has training and meeting space available for up to 35 people and the basement provides adequate space for storage or future dormitories. The facility should meet the expected ARFF requirements for the planning period.

Maintenance Facilities and Equipment

The maintenance buildings are comprised of a maintenance shop, equipment storage building, storage garage, and two sand sheds. The 4,350 square foot maintenance shop has 1,700 square feet for office space, locker room and lunch room. The remainder of the building contains a wash bay, equipment maintenance bay, and project room. In 2000, a 21,000 Snow Removal Equipment Building (SRE) was added to the maintenance shop. The SRE building houses the snow removal and maintenance equipment. It also serves as storage for a variety of supplies. The SRE building contains a large wash bay for cleaning of snow plows and high speed brooms. The maintenance facilities are located adjacent to the existing access road making access for deliveries simple. No additions or relocation are expected in the planning period.

The current maintenance equipment owned by the Airport is listed in **Table 3-14**. Some of the equipment is getting older and should be considered for replacement during the planning period. The current Passenger Facility Charge (PFC) will replace several of the vehicles by November of 2007. The PFC application calls for the replacement of the 1982-18' sweeper broom with a new 20' broom. Additionally, the PFC will replace snowplows 7, 17, and 18. All of these snow plows are over 20 years old and have served their useful lives. After replacing these plows, the airport will have five (5) snowplows less than five years old. A pick-up broom sweeper was recently acquired with PFC funds.

Continued replacement of maintenance equipment should be expected in the planning period. Most notable is the 1976 Idaho Norland snow blower. As additional vehicle parking is constructed, the purchase of a large loader and dump truck may be considered for removing piles of snow. This purchase would likely come in the latter portion of the planning period. The current equipment storage facility has adequate space to store these additional pieces of equipment. No expansion to the equipment storage building is likely to be required.

Table 3-14 Airport Equipment Descriptions

Vehicle Make	Vehicle Year	Vehicle Description
Oshkosh	1991	ARFF Truck
E-One	2005	ARFF Truck
Gator		ATV
Ford	1986	Catering Truck
Dodge	1998	Minivan
Ford	2001	Minivan
John Deere F680		Mower
Whoopy		Open Bed Lift
Chevrolet	1983	Pickup
GMC	1992	Pickup
GMC	2001	Pickup
Chevrolet	2002	Pickup
Chevrolet	2005	Pickup
John Deere F932		Small Broom/ Mower
John Deere F932		Small Broom/ Mower
Idaho Norland	1976	Snow Thrower
Oshkosh	1991	Snow Thrower
Ford	**1983**	**Snowplow 12'**
Oshkosh	**1983**	**Snowplow 20'**
Oshkosh	**1982**	**Snowplow 20' Ramp**
Oshkosh	2002	Snowplow 20'
Oshkosh	2002	Snowplow 20'
Ford	1987	Sweeper Broom - 12'
SMI	**1982**	**Sweeper Broom - 18'**
Oshkosh	2000	Sweeper Broom - 20'
Tennant	2006	Street Sweeper
Massey Fergusson	1996	Tractor
Case	2002	Tractor

Equipment in bold planned to be replaced under current PFC application

Fuel Storage

The existing fuel storage is located west of the maintenance shop. It contains 11 fuel tanks, both above and below grade. In total, the fuel storage facility has capacity for 116,000 gallons of Jet A, 24,000 gallons of AvGas and 12,000 gallons of JP 8 fuel. Commercial operators sold an average 300,000 gallons of jet fuel monthly. As aircraft traffic increases, additional fuel storage should be provided. Planning for additional fuel storage in the east hangar area should be completed in the near future.

IX. Recommended Airport Development

Runways

Airfield capacity calculations indicate the need to start the planning for an additional runway by the end of the planning period to increase capacity. The existing Airport Layout Plan (ALP) shows two future runway developments. The first development is the extension of Runway 3-21 to 5,700 feet to serve 100% of the general aviation fleet and the second is the extension of Runway 12-30 1,500 feet to the west. Both runway developments will allow larger aircraft to use these runways.

To address future runway capacity, it is recommended to plan for an additional parallel runway. Five parallel runway alternatives were considered. They are displayed in **Figures 3-7** through **3-12**. Each option provides sufficient length to serve 75% of planes of 60,000 pounds or less at 60% useful load. The figures have been presented with dimensional standards for both ARC B-II and C-II. An assessment of the benefits and disadvantages of each alternative are also presented on each figure. Construction of a parallel runway for increased capacity will likely happen after the twenty-year planning period based on the forecast operations. However, planning to protect lands required for construction of such a runway should start in the near future.

The preferred parallel runway alternative is Option 1-2, displayed on **Figure 3-8**, for the following reasons:

◊ Allows for simultaneous VFR approaches;
◊ Eliminates wake turbulence delay on Runway 30;
◊ Tubb Road relocation is not required;
◊ Airport Road relocation is not required;
◊ Minimizes land acquisition;
◊ Allows taxiing to Runway 29 without crossing Runway 12-30.

The parallel runway development is displayed as a phased construction process. Phase one of construction would construct the runway to a length of 5,135 feet and would only require minor changes to the sprinkler system for the turf runway. The ultimate development of the runway to 6,890 feet would require the relocation of the VOR, the wind indicator, and portions of Baseline and Lagoon Roads. The Airport Authority currently owns the property required for the road relocation. There are fewer relocations and additional costs associated with this option than with other alternatives.

Planning for the extension of Runway 12-30 should continue. Dry Creek Road was relocated to allow for this extension and there are no known impacts to lands not owned or controlled by the Airport. Runway length requirements have shown that the existing runway length of 9,000 feet does support the existing commercial aircraft utilizing the airport with full passenger load during the hottest month of the year. The additional length would allow faster and larger aircraft to operate at Gallatin Field with fewer weight penalties. Currently, no faster approach category D aircraft operate on a regular basis at the airport. The regional jet fleet does have faster approach speeds than the larger commercial aircraft operating at the Airport and would benefit from the runway extension. The extension would allow for heavier loads and longer ranges for aircraft utilizing the airport. In order to complete the runway extension, the Medium Intensity Approach Lighting System with Runway alignment indicator lights (MALSR) and glide slope antenna would need to be relocated. In conjunction with the runway extension, Taxiway “A” would be extended as well. The estimated cost of completing the extension of Runway 12-30 and Taxiway “A” is $4,386,864. This includes $1,000,000 for the relocation of the MALSR and glide slope antenna. Additionally, the construction of the runway extension would require environmental review.

Planning should be continued for the extension of Runway 3-21. The planned extension of Runway 3-21 would allow larger aircraft to use the runway. Runway 3-21 is classified as a crosswind runway and its extension would allow more aircraft to utilize it during crosswind conditions. The extension of this runway would improve safety for small aircraft flying in crosswind conditions. The extension of Runway 3-21 increases the capacity of the Airport slightly, but only one third as much as a parallel runway would. If a parallel runway is constructed, the extension of Runway 3-21 does not increase the capacity at Gallatin Field. The majority of the land required for the extension has been purchased with the exception of one parcel. This parcel is shown on the existing Exhibit “A” drawing of the Airport Layout Plan as a future land acquisition. An additional impact as a result of the extension of Runway 3-21 includes the relocation of Tubb Road. Previous planning for the extension of Runway 3-21 included the acquisition of a 60’ strip of land for the relocated Tubb Road. In association with the runway extension, a parallel taxiway for Runway 3-21 north of Runway 12-30 would be constructed to eliminate the requirement to back taxi on the runway. The proposed development of Runway 3-21 and the associated taxiway, road relocation, and land acquisition is displayed on **Figure 3-13**. This runway extension would also require environmental reveiw prior to construction.

Estimates of the recommended runway developments are displayed in **Table 3-15**. All estimates are in year 2006 dollars and will be adjusted for inflation in Chapter 5, Financial Plan.

Table 3-15 Proposed Runway Development Estimates

Runway 12-30 1,500 Foot Extension and Parallel Taxiway	$4,386,864
Runway 3-21 Extension, Parallel Taxiway, & Tubb Road Relocation	$4,960,862
Parallel Runway Option 1-2	
Runway Phase I - 5,135 Foot Runway	$3,149,403
Taxiways Phase I	$1,623,301
Total Phase I	**$4,772,704**
Runway Phase II 1,755 Foot Extension	$1,057,774
Taxiways Phase II	$390,866
Relocate VOR and ASOS	$3,965,000
Relocate Lagoon and Base Line Road	$892,964
Fence Sande Property	$148,395
Total Phase II	**$6,454,999**
Total Parallel Runway	**$11,227,703**
Total Runway Developments	**$20,575,429**

Taxiways

Review of the taxiway system requirements identify no pavement strength or dimensional deficiencies. Current issues with the taxiway system for Runway 12-30 are traffic related. Delays associated with aircraft not being ready for departure or not having final clearance from the air traffic control tower can be attributed in part to increased traffic and the mix of aircraft using the airport. Taxiway improvements, and, in the long term, construction of a full length dual parallel taxiway, are recommended to increase ground maneuverability and operational efficiency. The recent construction of the holding bay near the threshold of Runway 12 allows for run-up operations and provides a means for aircraft ready for departure to pass holding aircraft. The holding bay provides a location for aircraft deicing operations. To provide access to the holding bay for deicing vehicles and snow removal equipment, a service road was recently constructed. The service road allows ground vehicles to access the holding bay without entering the aircraft movement area requiring clearance from the air traffic control tower.

As stated previously, bypass taxiways serve much the same purpose as a holding bay. It is recommended that when Runway 12-30 is extended, it should include a bypass taxiway as displayed in **Figure 3-13.** A bypass taxiway for Runway 30 could be constructed in association with the parallel runway as displayed in **Figures 3-8** and **3-13.** The bypass portion of the taxiway could be constructed prior to the parallel runway if operations show increased delay to aircraft trying to utilize Runway 30 for departure.

The construction of the dual parallel taxiway would not need to be constructed full length at one time; it would likely be constructed in phases. The dual parallel taxiway will increase ground mobility and allow aircraft taxiing to and from the runway to pass each other, increasing operational efficiency and reducing delays. No additional costs or land acquisition would be required to complete the dual parallel taxiway construction.

Additional taxiway developments include the construction of high speed exit taxiways for Runways 12 and 30. Advisory Circular 150/5060-5 Airport Capacity and Delay does not consider capacity increases for high speed exit taxiways over traditional right-angled exit taxiways. Advisory Circular 150/5300-13 Airport Design does address the reduction of time an aircraft occupies a runway as a result of properly placed exit taxiways and high speed exit taxiways. In general, a reduction of 100 feet to the available exit reduces the occupied time on the runway by ¾ of a second. By providing high speed exit taxiways in the proper locations, as displayed on **Figure 3-13**, occupancy time for Runway 12 could be reduced by 10 seconds for aircraft that use the high speed exit rather than taxiing an additional 1,400' to Taxiway "E" and 19 seconds for aircraft that would exit at Runway 3-21, an additional 2,500' of taxi. The construction of a high speed exit taxiway for Runway 30 would reduce runway occupancy time by 18 seconds for aircraft that could not exit at Taxiway "B" and would have to taxi approximately 2600' to the threshold of Runway 12 and exit. Additional benefits include reduced time of taxi on the parallel Taxiway "A" by providing exit locations closer to the General Aviation Apron and the Commercial Apron. Generally, these exits would be used by the larger and faster aircraft, with the existing right angled exit taxiways providing multiple exit locations for the smaller and slower aircraft.

In the near term, it is recommended that a parallel taxiway for Runway 3-21 south of Taxiway "A" be constructed, as displayed in **Figure 3-13**. This parallel taxiway would provide an additional route to the hangar areas other than Taxiway "H". Additionally, the taxiway would provide a direct route to the incursion road around the approach end of Runway 3 to the East Ramp and hangar area. Construction of the taxiway would better define the movement area for Runway 3-21 which should reduce confusion in ground maneuvering and decrease the likelihood of runway incursions on Runway 3-21.

Estimates of the recommended taxiway developments are displayed in **Table 3-16**. All estimates are in year 2006 dollars and will be adjusted for inflation in Chapter 5, Financial Plan.

Table 3-16 Proposed Taxiway Development Estimates

Runway 12 holding bay	$452,388
Service Road West of Terminal to Holding Bay	$298,019
Dual Parallel Taxiway Phase Full Length	$5,843,907
Runway 12 Exit Taxiway	$536,549
High Speed Exit Taxiway West	$527,970
High Speed Exit Taxiway East	$610,331
Parallel Taxiway Runway 3-21 Phase 1	$707,649
Total Taxiway Developments	**$8,976,813**

Aprons

Evaluation of existing apron space for local and transient general aviation aircraft did not determine a need for additional apron space. Additional fixed tie-down locations could be installed for small aircraft in the General Aviation Apron as required. The existing airport layout plan does show an expansion of the based aircraft tie down apron. Planning for this expansion should continue. The construction of such an expansion could take place when needed.

The Commercial Apron does not have any pavement strength deficiencies at this time. Expansion of the apron will likely coincide with the expansion of the terminal building. Expansion for additional parking positions, not at boarding gates, was required prior to the terminal expansion as the numbers of overnight aircraft and peak hour operations increased. This expansion, west of the existing apron, is displayed in **Figures 3-5** and **3-13**. The apron expansion was required prior to the terminal expansion, and was planned to work with the ultimate terminal design. In addition to an expansion to the west, the asphalt portion of the apron could be expanded to the north into the grass island. This expansion would provide additional ground maneuvering and parking of commercial aircraft.

Converting the asphalt portion of the apron into concrete should also be considered. Concrete has a longer useful life and requires less maintenance. Maintenance of the asphalt portion of the apron will require pavement overlays on a 15- to 20-year cycle. Increasing commercial traffic makes closing portions of the apron for maintenance projects more difficult and has greater impacts to passengers and air carriers alike. Converting the apron to concrete would reduce the impacts from maintenance projects to the users of the apron.

Review of the apron space and level of use for cargo operators did not provide reasons to expand these areas. The pavement strength at the East Ramp is adequate to support the weight of the size aircraft used by the cargo operators. The existing airport layout plan does show an expansion to the East Ramp for the cargo operators if it becomes necessary. While this is unlikely to be required in the planning period, planning for such an expansion is recommended to continue.

Estimates of the recommended apron developments are displayed in **Table 3-17** below. All estimates are in year 2006 dollars and will be adjusted for inflation in Chapter 5, Financial Plan.

Table 3-17 Proposed Apron Development Estimates

*Commercial Apron Expansion	$1,968,895
Commercial Apron Expansion Asphalt Phase 2	$479,572
Commercial Apron - Convert Asphalt to Concrete	$3,679,299
GA Tie-Down Apron Expansion	$470,508
East Ramp Cargo Apron Expansion	$1,048,321
Total Apron Developments	**$7,646,595**

* Completed in 2007

Hangar Area Developments

Review of the areas for private storage hangars and forecast based aircraft determined there is sufficient space available to support growth beyond the planning period. Areas available for development include 10 spaces within the current hangar area south and west of Runway 3-21 and 61 acres east of Runway 3-21 and south of Aviation Lane. A recommended layout of taxilanes and hangars is displayed on **Figures 3-6** and **3-13.** This layout can easily be adjusted to provide spaces for different sizes of hangars as determined by the local demand. Planning for hangar area development is recommended to be an ongoing process. As displayed in **Figure 3-13,** the construction of the hangar area, at 100% build out requires 42,000 square yards of taxilane and over 20,000 lineal feet of water and sewer lines. The estimated cost to develop 100% of the hangar area, including water and sewer improvements, are displayed in **Table 3-18.** All estimates are in year 2006 dollars and will be adjusted for inflation in Chapter 5, Financial Plan.

Table 3-18 Hangar Area Development Estimates

Hangar Taxilane Development	$2,211,435
Water & Sewer Improvements for Hangar Development	$1,545,201
Total Additional Developments	**$3,756,636**

Additional Developments

In addition to the previously recommended developments, there are several developments related to airport operations that should be considered. It is recommended to construct a service road across the General Aviation Apron to the planned parallel taxiway for Runway 3-21 south of Taxiway A. Construction of the service road would allow direct vehicle traffic across the GA Apron rather than having it cross at multiple locations. The service road, in association with the parallel taxiway for Runway 3-21, would provide an additional route to the incursion road and East Ramp area rather than using Taxiway H. With an additional route to these areas, the likelihood of vehicles having to drive in the aircraft movement area with clearance from ground traffic controllers would be reduced. The recommended service road layout is displayed on **Figure 3-13.**

Recent changes in security requirements have resulted in additional checks of the perimeter fencing of the airport. Gallatin Field's perimeter fencing follows existing public roads in many areas making the majority of the fencing easily accessible for inspection. There are two areas where the perimeter fencing is not easily accessible for inspection that should be considered for the construction of a perimeter road. The first area is north of Runway 12-30 and borders the City of Belgrade's sewer lagoons. This road is displayed on **Figure 3-13**. The second area is west of the commercial apron to Dry Creek Road. It is recommended that a perimeter road be constructed inside the existing security fence at both locations; approximately 3.5 miles of road would be constructed.

Planning for an additional fuel storage location in the East Ramp Area is recommended. The preferred location is displayed on **Figure 3-13**. This area located north of the FedEx facility and along Airport Road would allow easy access for the delivery of fuel. Additionally, it is recommended that access for fuel trucks be provided from within the airport property to the fuel storage location. Access for users from within the secured area of the airport would reduce the likelihood of breaches in security.

The recommended additional developments are displayed in **Table 3-19** below. All estimates are in year 2006 dollars and will be adjusted for inflation in Chapter 5, Financial Plan.

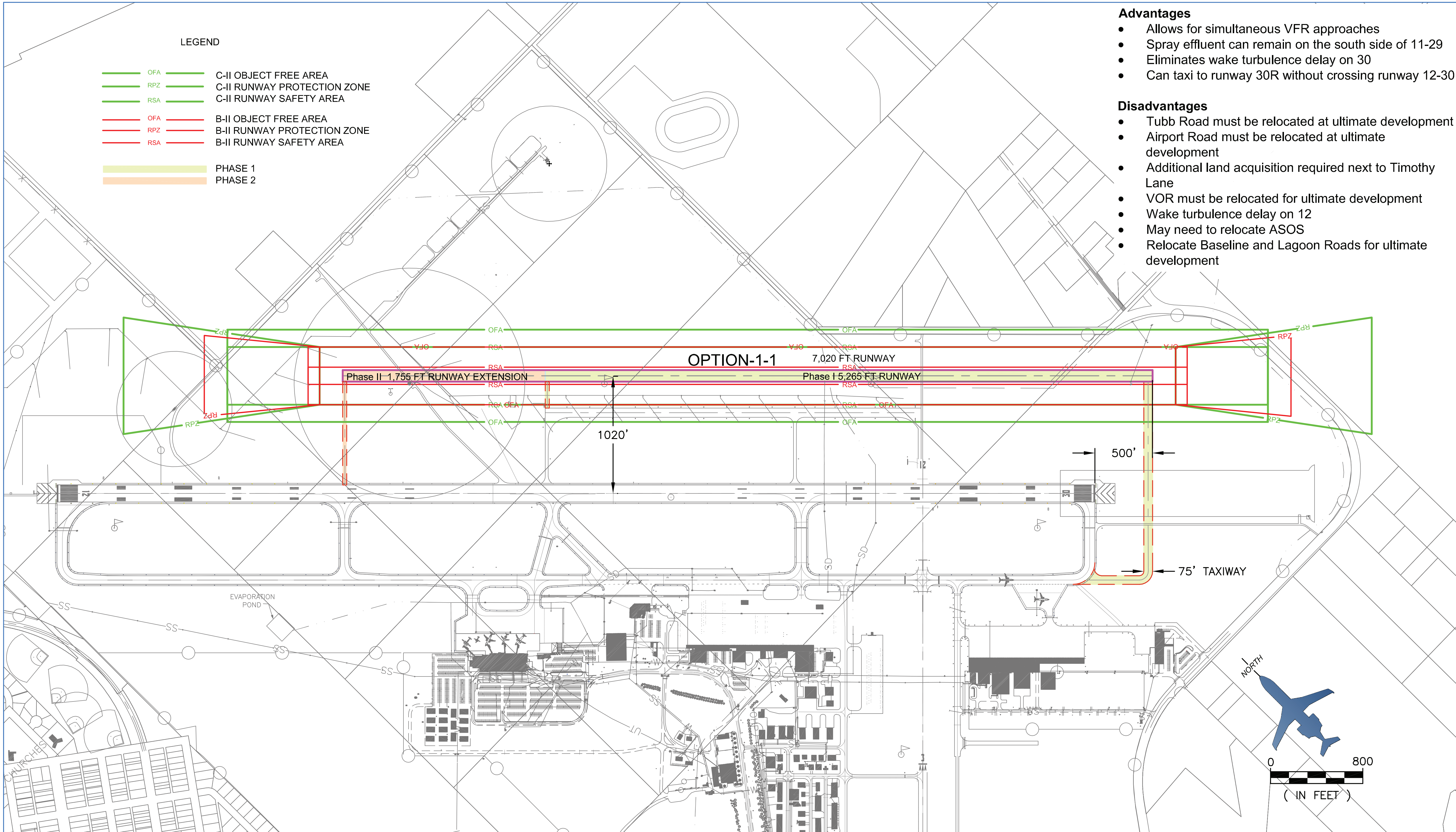
Table 3-19 Additional Development Estimates

Service Road East of Terminal	$50,172
Perimeter Road	$2,152,192
Total Additional Developments	**$2,175,364**

Table 3-20 provides a summary of the recommended airside development alternatives and their associated costs. The improvement projects are not prioritized at this time. A twenty year Capital Improvement Program (CIP) will be discussed in Chapter 5, Financial Plan, after the terminal building, access roads, and parking lot improvements are defined. All of the proposed improvements will not be included in the 20-year CIP as many of these developments will occur after the twenty year planning period.

Table 3-20 Proposed Development Alternatives

Runway 12-30 1,500 Foot Extension and Parallel Taxiway	$4,386,864
Runway 3-21 Extension, Parallel Taxiway, & Tubb Road Relocation	$4,960,862
Parallel Runway Option 1-2	
Runway Phase I - 5,135 Foot Runway	$3,149,403
Taxiways Phase I	$1,623,301
Total Phase I	**$4,772,704**
Runway Phase II 1,755 Foot Extension	$1,057,774
Taxiways Phase II	$390,866
Relocate VOR and ASOS	$3,965,000
Relocate Lagoon and Base Line Road	$892,964
Fence Sande Property	$148,395
Total Phase II	**$6,454,999**
Total Parallel Runway	**$11,227,703**
Runway 12 Holding Bay	$452,388
Service Road West of Terminal to Holding Bay	$298,019
Runway 12 Exit Taxiway	$536,549
Dual Parallel Taxiway Phase Full Length	$5,843,907
Parallel Taxiway Runway 3-21 Phase 1	$707,649
High Speed Exit Taxiway West	$527,970
High Speed Exit Taxiway East	$610,331
Commercial Apron Expansion	$1,968,895
Commercial Apron Expansion Asphalt Phase 2	$479,572
Commercial Apron - Convert Asphalt to Concrete	$3,679,299
East Ramp Cargo Apron Expansion	$1,048,321
GA Tie-Down Apron Expansion	$470,508
GA Tie-Down Apron Vehicle Parking	$126,824
Hangar Taxilane Development	$2,211,435
Water & Sewer Improvements for Hangar Development	$1,545,201
Service Road East of Terminal	$50,172
Perimeter Road	$2,152,192
Total All Developments	**$43,157,838**



Advantages

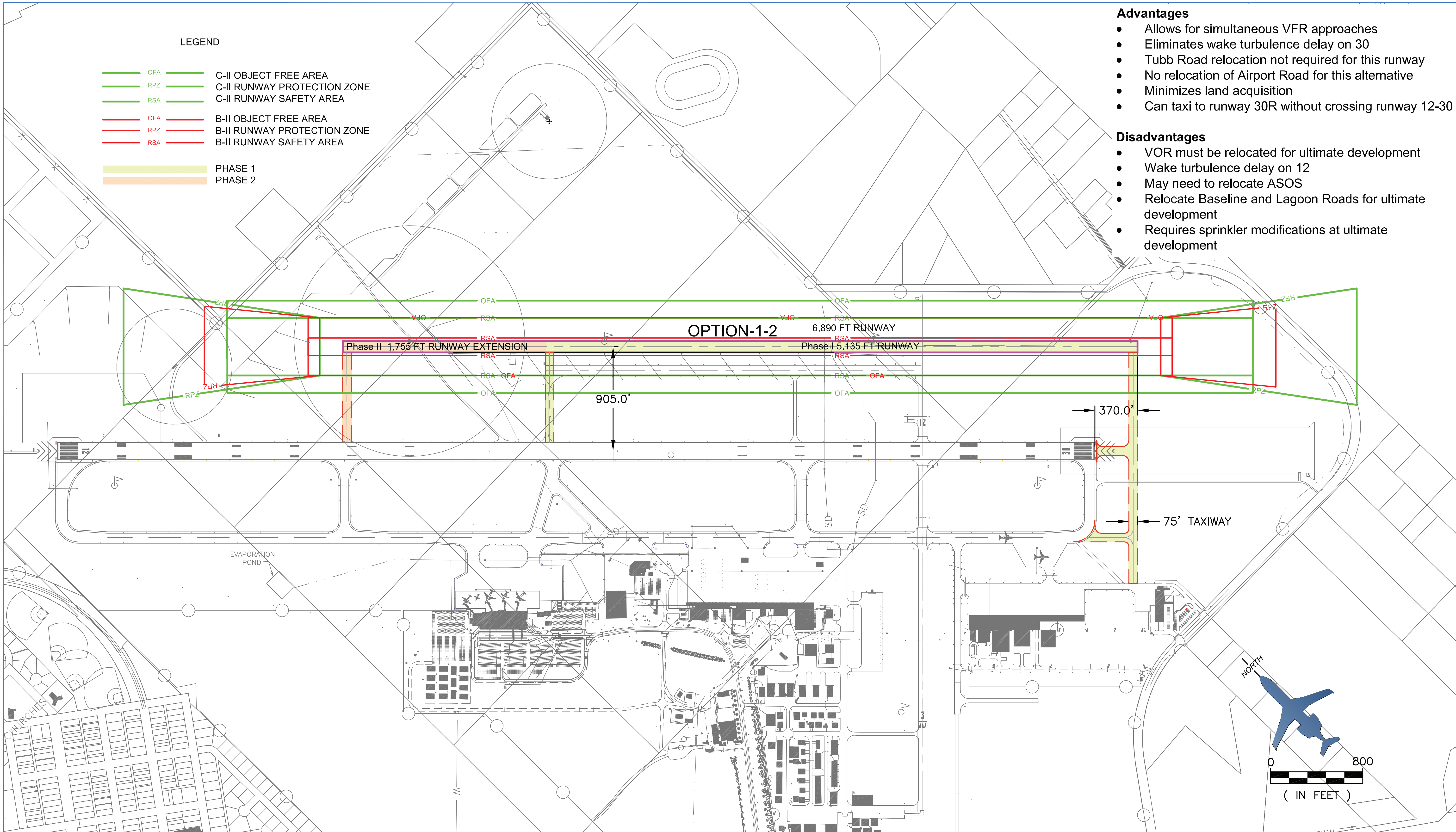
- Allows for simultaneous VFR approaches
- Spray effluent can remain on the south side of 11-29
- Eliminates wake turbulence delay on 30
- Can taxi to runway 30R without crossing runway 12-30

Disadvantages

- Tubb Road must be relocated at ultimate development
- Airport Road must be relocated at ultimate development
- Additional land acquisition required next to Timothy Lane
- VOR must be relocated for ultimate development
- Wake turbulence delay on 12
- May need to relocate ASOS
- Relocate Baseline and Lagoon Roads for ultimate development

Gallatin Field Airport Master Plan

Fig 3-7 Parallel Runway Option 1-1



Advantages

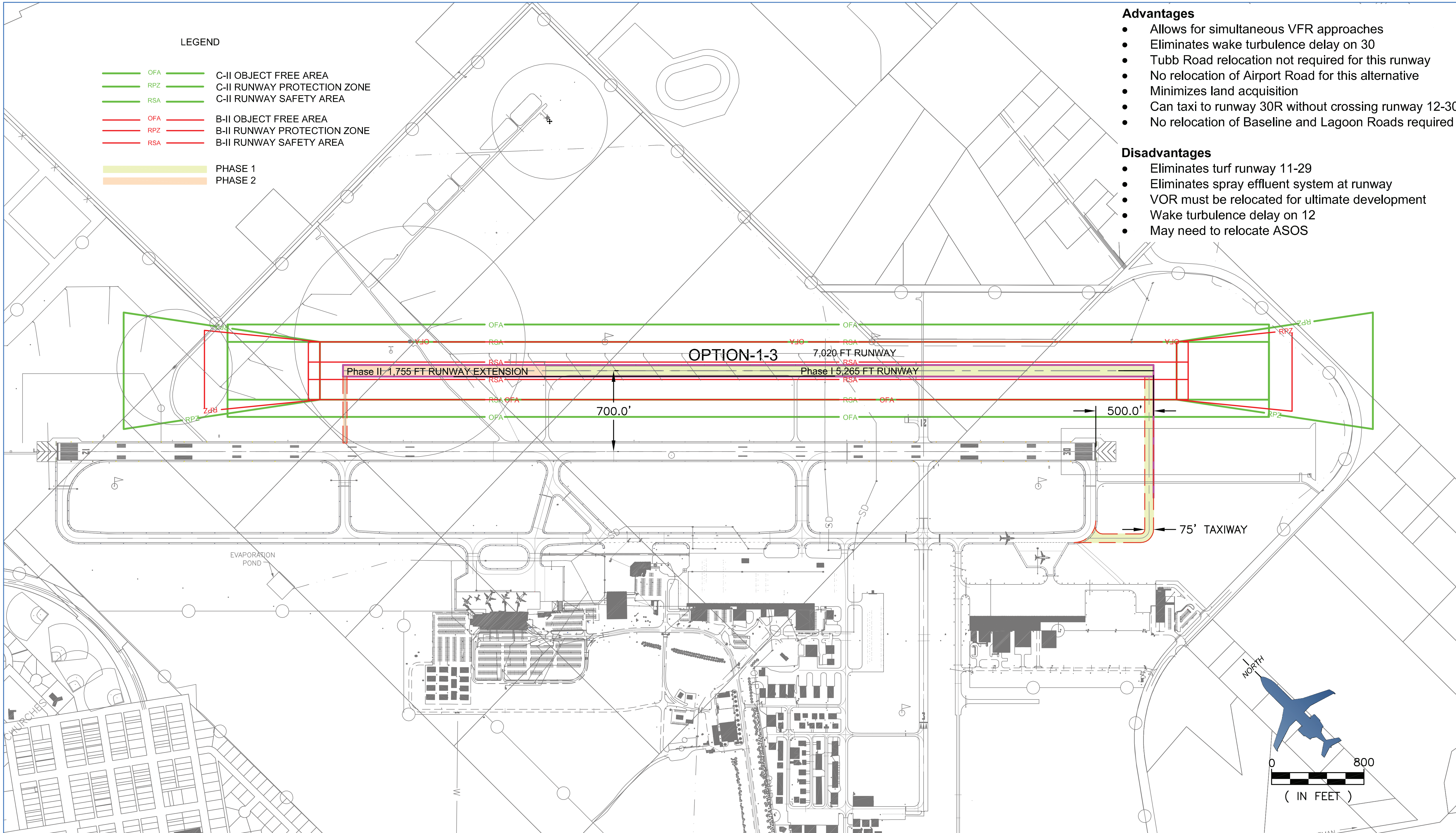
- Allows for simultaneous VFR approaches
- Eliminates wake turbulence delay on 30
- Tubb Road relocation not required for this runway
- No relocation of Airport Road for this alternative
- Minimizes land acquisition
- Can taxi to runway 30R without crossing runway 12-30

Disadvantages

- VOR must be relocated for ultimate development
- Wake turbulence delay on 12
- May need to relocate ASOS
- Relocate Baseline and Lagoon Roads for ultimate development
- Requires sprinkler modifications at ultimate development

Gallatin Field Airport Master Plan

Fig 3-8 Parallel Runway Option 1-2



Advantages

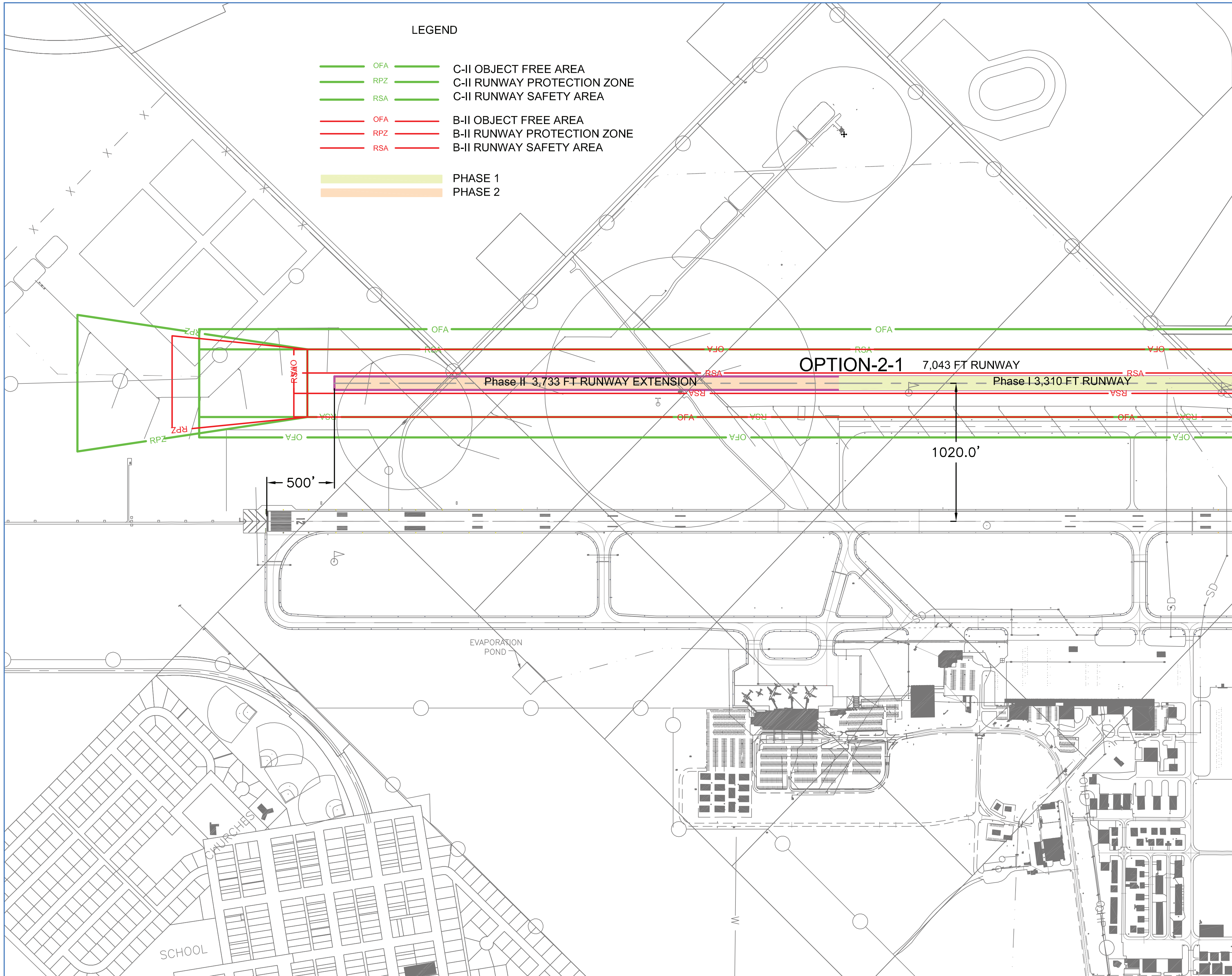
- Allows for simultaneous VFR approaches
- Eliminates wake turbulence delay on 30
- Tubb Road relocation not required for this runway
- No relocation of Airport Road for this alternative
- Minimizes land acquisition
- Can taxi to runway 30R without crossing runway 12-30
- No relocation of Baseline and Lagoon Roads required

Disadvantages

- Eliminates turf runway 11-29
- Eliminates spray effluent system at runway
- VOR must be relocated for ultimate development
- Wake turbulence delay on 12
- May need to relocate ASOS

Gallatin Field Airport Master Plan

Fig 3-9 Parallel Runway Option 1-3



Advantages

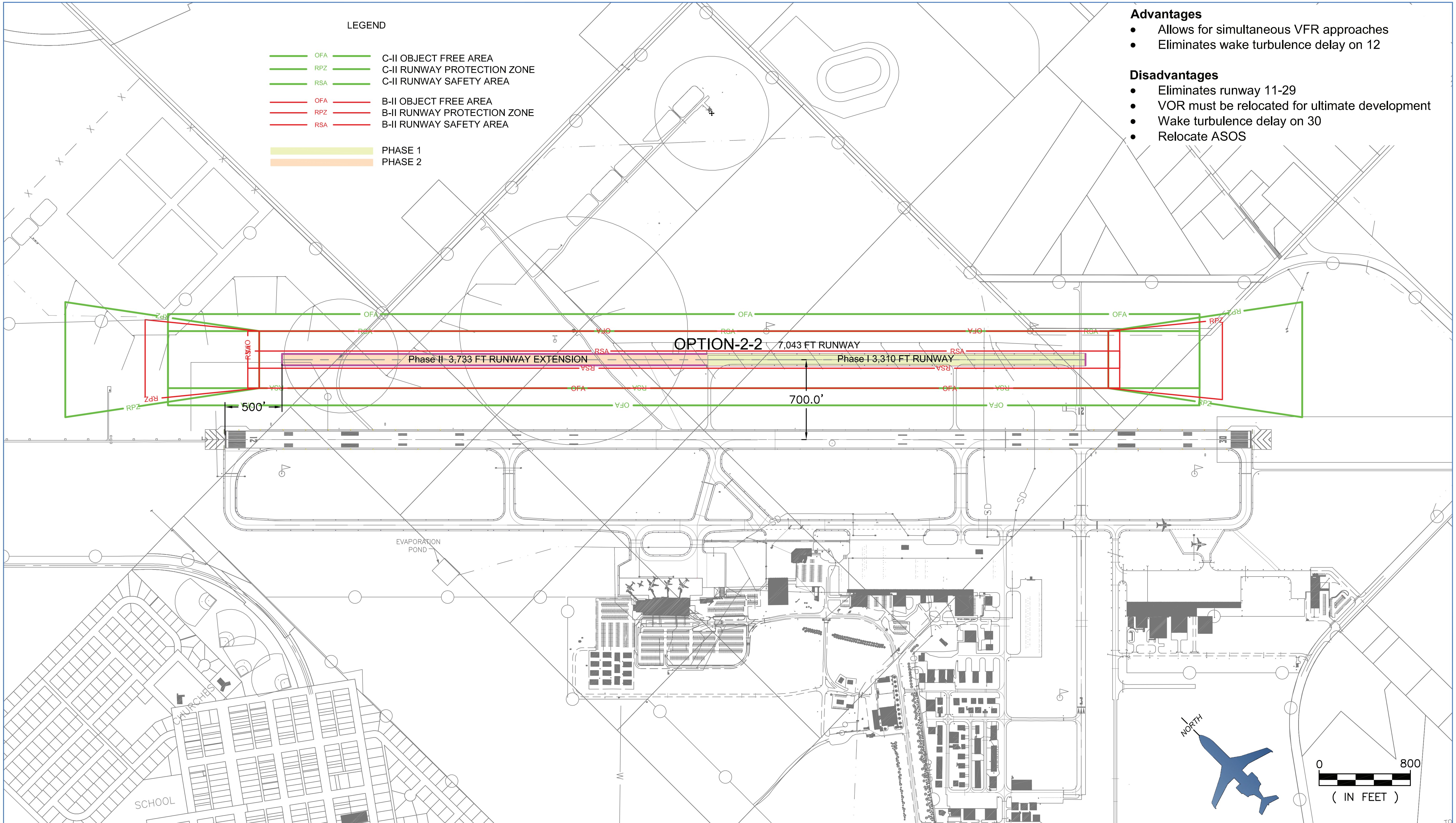
- Allows for simultaneous VFR approaches
- Spray effluent can remain on the south side of 11-29
- Eliminates wake turbulence delay on 12

Disadvantages

- Tubb Road must be relocated at ultimate development
- Additional land acquisition required next to Timothy Lane
- VOR must be relocated for ultimate development
- Wake turbulence delay on 30
- Relocate ASOS
- Relocate Baseline and Lagoon Roads for ultimate development
- Requires modifications to sewer lagoon

Gallatin Field Airport Master Plan

Fig 3-10 Parallel Runway Option 2-1



Advantages

- Allows for simultaneous VFR approaches
- Eliminates wake turbulence delay on 12

Disadvantages

- Eliminates runway 11-29
- VOR must be relocated for ultimate development
- Wake turbulence delay on 30
- Relocate ASOS

Gallatin Field Airport Master Plan

Fig 3-11 Parallel Runway Option 2-2

Advantages

- Allows for possible simultaneous IFR approaches

Disadvantages

- Major land acquisition
- Relocation of Baseline and Lagoon Roads
- Relocation of Tubb Road
- Increased taxi time from south side of the airport
- Greatly reduces land for north hangar area
- Relocate sewer IP bed
- Relocate race track
- Sewer lagoons in the approach and RPZ
- Relocate Radar

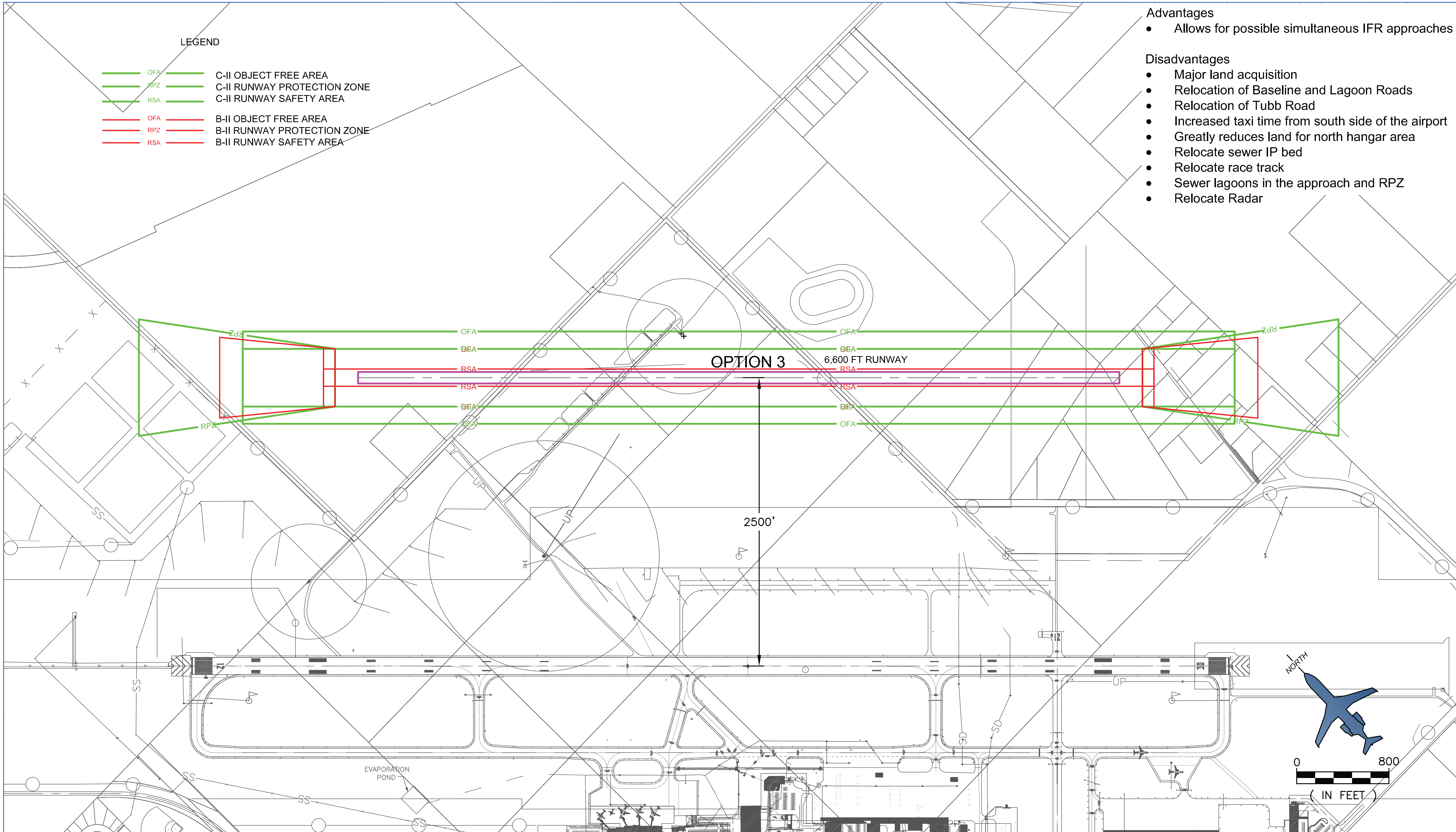


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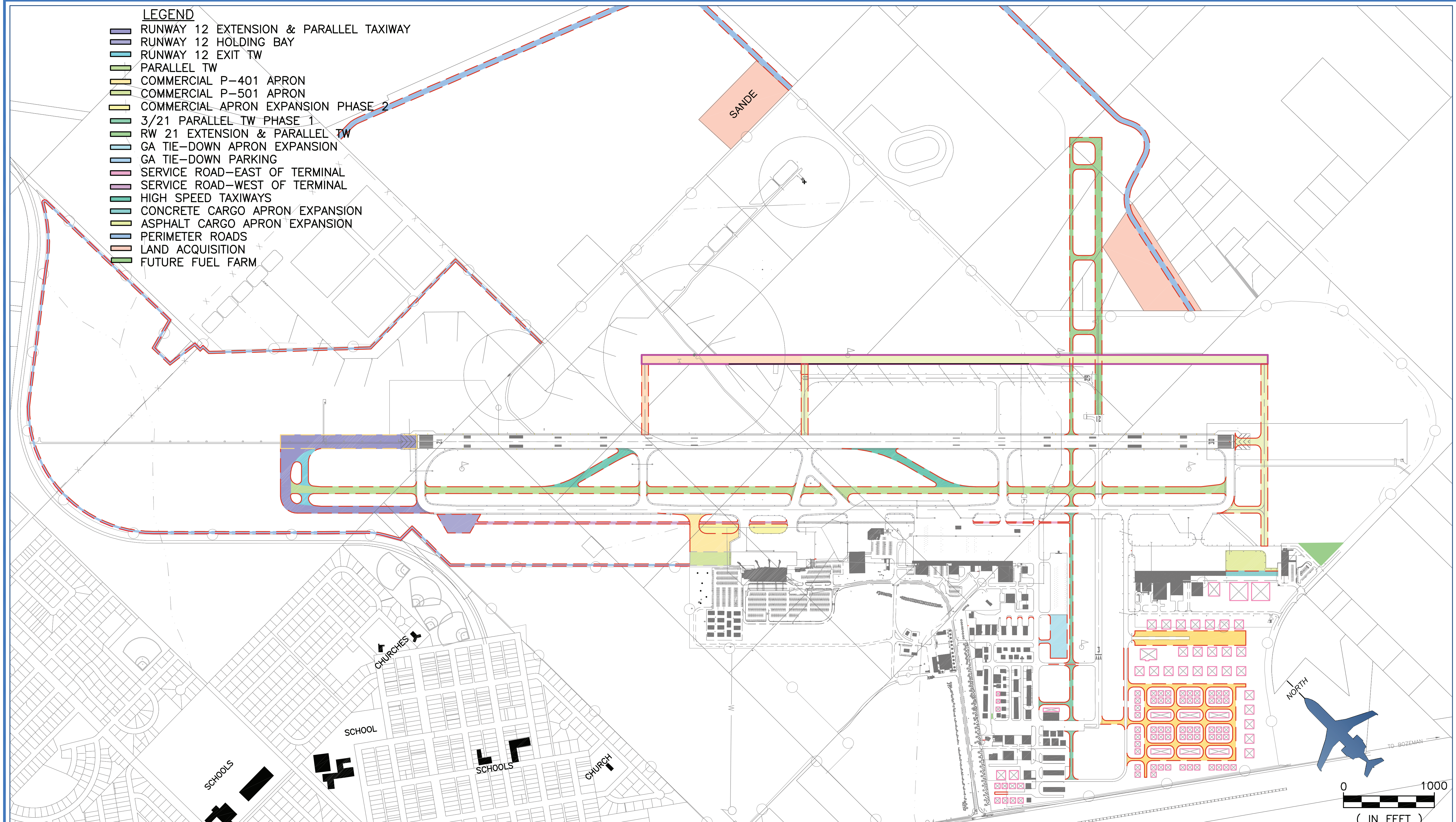
Fig 3-12 Parallel Runway Option 3



Gallatin Field Airport Master Plan

Figure 3-13 Proposed Developments