

# Chapter 6 -

## General Aviation Development

A key purpose of this update of the Airport Layout Plan (ALP) for Charles M. Schulz–Sonoma County Airport (STS) is to identify means to accommodate forecast growth in based aircraft. Most aircraft are currently based on the east side of the Airport, with limited numbers also based on the western and southern quadrants. The limited acreage available for development is in the eastern quadrant but is subject to competition for various uses, including passenger terminal expansion, fixed base operators (FBO), rental car facilities, a replacement aircraft rescue and firefighting (ARFF) facility, and auto parking. Additionally, some banks of hangars for small aircraft have reached the end of their useful life and need to be replaced. This working paper examines alternative means of providing storage space for new aircraft and replacing existing hangars. The goal of this analysis is to identify areas available for realistic hangar development and present concepts for each site.

### FORECAST DEMAND

An update of aviation activity forecasts was necessary as part of this ALP update to accurately conceptualize development. **Table 6-1** presents the ultimate (2038) forecast demand for additional based aircraft storage by aircraft type, which determines what type of hangar is needed. The number based on FBO leaseholds is an estimate based upon the current pattern of use.

**Table 6-1: Additional Based Aircraft Forecast (2038)**

Aircraft Type	Total Forecast	Number on FBO Leaseholds	Individual Hangar Demand
Single-Engine Piston	21	0	21
Multi-Engine Piston	12	2	10
Jet / Turboprop	11	5	6
Helicopter	2	2	0

Source: Mead & Hunt and FAA Approved Forecasts (Aug 2, 2021)

This analysis assumes that all aircraft will be stored in hangars. Piston aircraft will be in T-hangars or small conventional (box) hangars, and jets and turboprops in conventional hangars. These assumptions guide the design analysis, but actual hangar types and sizes correlate to actual demand.

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## ASSESSMENT OF DEVELOPMENT POTENTIAL

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The evaluation of possible GA development sites began by identifying areas on or planned to become part of STS that could plausibly be developed. Broadly this included all areas outside of critical runway and taxiway design surfaces (object free areas and runway protection zones), building restriction lines, and existing leaseholds. This area was then divided into development sites whose boundaries encompass an area with similar physical and operational characteristics. Existing taxiways, including abandoned ones, roads, and existing aviation uses (e.g., hangars areas) were used to define area boundaries. Areas were also defined by similar physical characteristics. Characteristics included: plant community, existing use (e.g., sprinkler fields), and prior use (i.e., former landfill). As a result, 25 potential GA development areas were defined.

### Initial Review

This section presents a summary of the key characteristics that shaped the evaluation of each of the 26 potential GA development sites (**Figure 6-1**). Sites with severe limitations were removed from further consideration. The key reasons for eliminating a site are noted following its description.

#### Site 1

In the northwest corner of STS in an area defined north of a sprinkler field with woods and two creeks. Development impacts the largest stand of oaks on STS. Taxiway access requires crossing two creeks and their tributaries, and road access is from Windsor Road. Sewer and water service are not currently available. This area falls within designated critical habitat for the California tiger salamander. The creeks and adjacent wetlands are formally designated as jurisdictional waters of the U.S.

This site was eliminated from further consideration because its development would impact numerous biological features including creeks, wetlands, and oak woodlands. Development would be disproportionately expensive because it would require provision of sewer and water, and bridging two creeks to provide taxiway and road access. This area could be used for nonaeronautical or low impact uses.

#### Site 2

North of the Experimental Aircraft Association (EAA) area and south of a creek and wooded area. The site is currently an open field that is relatively level. Four small wetlands have the potential to be impacted. Airfield access is via Taxiway C, and road access is from Windsor Road. Sewer and water service are not currently available. This area falls within designated critical habitat for the California tiger salamander. This site is classified for potential long-term development as GA Development Area Reserve.

### Site 3

North of Taxiway C and south of Ordinance Creek. Most of the site is currently used as a sprinkler field for disposal of treated effluent by the SCWA and two large wetlands are in the middle of the site. However, significant development is achievable without directly impacting the wetlands. Access to Windsor Road requires a road across Site 2. Sewer and water service are not currently available. This site falls within designated critical habitat for the California tiger salamander.

All sites on the west side would be burdened with the expense of providing sewer service and water service for domestic use and fire protection. This site was eliminated from further review because it would also have the expense of providing vehicle access from Windsor Road. This access road would be about 750 feet long.

### Site 4

South of EAA and west of Taxiway G. The site is mostly an open field with a vegetated mound in its center and two box hangars in the northeast corner. Wetlands exist in the form of three ditches and one isolated wetland. Significant development is possible with limited or no impact to these wetlands. Taxiways G or D offer airfield access, and road access is either via the existing entrance to EAA or a separate entrance from Windsor Road. Sewer and water service are not currently available. This area falls within designated critical habitat for the California tiger salamander. This site was retained for secondary evaluation and classified for GA Development Area Reserve.

### Site 5

East of Taxiway G and south of Taxiway C. The site is designated as an environmentally sensitive area with a Burke's goldfields preserve. This area falls within designated critical habitat for the California tiger salamander. Taxiways C and G offer airfield access, and road access is possible across Site 4 but requires severing the connection of Taxiway G to either Taxiway C or B. No sewer or water connections exist.

This site was eliminated from secondary review because of the presence of the Burke's goldfields preserve.

### Site 6

East of Taxiway G and north of Taxiway B. The parcel is currently used as a sprinkler field for disposal of treated effluent by the Town of Windsor. The site is generally level. Drainage ditches classified as wetlands exist on the western, southern, and eastern boundaries. This area falls within designated critical habitat for the California tiger salamander. Significant development is possible with limited or no impact to these wetlands. Access to Windsor Road is possible across Site 4, but requires severing the connection of Taxiway G to either Taxiway C or B. No sewer or water connections exist.

This site was eliminated from further review because its development would require severing of taxiways serving the west side. This would impede circulation and eliminate areas from potential aviation use.

## Site 7

Along STS's southwestern border. This is the site of a closed landfill. Although the site is generally level, the types of uses allowed atop the fill are limited by its former use. A ditch classified as a wetland passes through the middle of the site. The southern third has a wetland that is one of the largest on the Airport. This area falls within designated critical habitat for the California tiger salamander. Airfield access is possible using the abandoned Taxiway W to Taxiway D, and road access from Windsor Road exists in the southern half of the site. No sewer or water connections exist.

This site was eliminated from secondary review because it is the site of closed landfill.

## Site 8

West of abandoned Taxiway W. Law enforcement currently uses the site for driver training. The site is level. Drainage ditches classified as wetlands and isolated wetlands exist in the northern and central portions. Significant development is possible with limited or no impact to these wetlands. This area falls within designated critical habitat for the California tiger salamander. Use of the abandoned Taxiway W to Taxiway D provides airfield access, and road access exists from Slusser Road. No sewer or water connections exist.

All sites on the west side would be burdened with the expense of providing sewer service and water service for domestic use and fire protection. This site would also have the expense of reconstructing Taxiway W and demolition of the adjacent hardstands. However, development might be possible on the existing hardstands. This site is classified for potential long-term development as GA Development Area Reserve.

## Site 9

South of Taxiway B and east of abandoned Taxiway W. This generally level site is currently used as a sprinkler field for disposal of treated effluent by the SCWA. Drainage ditches classified as wetlands exist on the western, southern, and eastern boundaries. This area falls within designated critical habitat for the California tiger salamander. Significant development is possible with limited or no impact to these wetlands. Taxiway D provides airfield access, and road access exists at the intersection of Windsor Road and Mark West Station Road. No sewer or water connections exist.

All sites on the west side would be burdened with the expense of providing sewer service and water service for domestic use and fire protection. This site would also have the expense of extending a new taxiway from Taxiway D to serve this area. This site is classified for potential long-term development as GA Development Area Reserve.

## Site 10

In the center of the airfield north of Taxiway E and south of Taxiway D. Much of this generally level site is currently used as a sprinkler field for disposal of treated effluent by the SCWA. The site has an extensive network of wetlands. This area falls within designated critical habitat for the California tiger salamander. An occurrence of Lobb's aquatic buttercup, a California species of concern, exists on this site. Taxiway access is possible from Taxiways D or E, but vehicle access to this parcel could only occur if Taxiway E is severed or made a nonmovement area. No sewer or water connections exist.

This site was eliminated because its use would require severing of Taxiway E or its designation as a nonmovement area. This would complicate the ability of air traffic control to move aircraft from the west to east sides of the airfield.

### Site 11

Midfield north of Taxiway E. The site is classified as an environmentally sensitive area with a wetland preserve. This area falls within designated critical habitat for the California tiger salamander. Taxiway access is possible from Taxiway E, and vehicle access is only possible if Taxiway E is severed or made a nonmovement area. Sewer and water service are not currently available.

This site was eliminated because its use would require severing of Taxiway E or its designation as a nonmovement area. This would complicate the ability of air traffic control to move aircraft from the west to east sides of the airfield.

### Site 12

Southwest of the approach end of Runway 2 and south of Taxiway E. The site has three groups of wetlands. This area falls within designated critical habitat for the California tiger salamander. An easement with SCWA runs east-west through the middle of the parcel. Significant development is possible with little or no impact to the wetlands. Airfield access is from Taxiway E, and vehicle access is from Laughlin Road. The site has significant topographic variation. Extensive grading would be required to provide the shallow slopes that taxilanes and hangars require. Sewer and water service are not currently available.

All sites on the west side would be burdened with the expense of providing sewer service and water service for domestic use and fire protection. This site was eliminated from further review because it would also have the expense of extensive grading to meet slope requirements for taxilanes and hangars.

### Site 13

South of Taxiway E and west of Apron F. The site is designated as an environmentally sensitive area with a wetland preserve. This area falls within designated critical habitat for the California tiger salamander. A seasonal creek runs north-south through the center of the site. An easement with SCWA runs east-west through the middle of the parcel. Taxiway access is from Taxiway E, and road access is from Laughlin Road. Sewer and water service are not currently available.

This site was eliminated because it is a wetland preserve.

### Site 14

Between Apron F and Laughlin Road. The terrain rises from north to south but appears developable for aviation uses. The site is largely open grasslands, but a group of oak trees are on the eastern section of the site. A drainage ditch classified as a wetland exists in the northwestern corner of the site, and an isolated wetland exists on the southwest side.

This area falls within designated critical habitat for the California tiger salamander. An occurrence of Lobb's aquatic buttercup, a California species of concern, exists on this site. An easement with SCWA runs east-west at the north side of the parcel. Significant development is possible with limited or no impact to these wetlands. Airfield access is from Taxiway E across Apron F, and road access exists from Laughlin Road via the road that provides access to Apron F. No sewer or water connections exist. This site was retained for secondary review.

### Site 15

In the southern quadrant along Laughlin Road. This site became part of the Airport in 2019, and it contains a residence that may be eligible for inclusion in the National Register of Historic Places. The existing structure, a former officers' club, may be able to be restored and repurposed for an Airport-compatible use. Taxiway E access to the site would be through Apron F. No sewer or water connections exist.

This site was eliminated from GA development possibilities; however, this parcel may be redeveloped for non-aeronautical uses that incorporate the historic residence.

### Site 16

East of Apron F and south of Taxiway E. The terrain is gently rolling. Interconnected wetlands exist through the center of the site along with other isolated wetlands. A colony of Burke's goldfields exists in the northeast corner of the site. An easement with SCWA runs east-west through the middle of the parcel. Airfield access is from Taxiway E, and road access is either via the existing road providing access to Apron F or directly from Laughlin Road. No significant development is possible without impacting wetlands. However, the northern third of the site in the area encompassing the ex-military hard stands could be developed with limited wetland impacts and no direct impact on the known locations of the Burke's goldfields. No sewer or water connections exist. This site was retained for secondary review because the northern third of the site around the hardstands appears developable.

### Site 17

In the southeast corner of the Airport south of Apron F. A pond extends through the center of the site. A second wetland exists in the northeast corner of the site. The western half of this site lies within designated critical habitat for the California tiger salamander. The southern part of the site is possibly accessible from Laughlin Road, but the northern part is landlocked. Taxiway access is from Taxiway A. No sewer or water connections exist.

This site was eliminated from secondary review because development of structures would be limited to a confined area and additional development will require wetland mitigation.

### Site 18

West of Apron E and between Taxiways Q and R, and east of the service road. The site is level grassland, and no wetlands exist on the site. The western half of this site lies within designated critical habitat for the California tiger salamander. Airfield access is from Taxiway A and road access is from either Becker Boulevard or North Laughlin Road. This site is carried forward for secondary review.

### Site 19

East of Apron E and south of Becker Boulevard. Two parcels, a larger parcel adjacent to North Laughlin Road and one small parcel south of Becker Drive. The site is level grassland, and no wetlands exist on the site. The site is not within designated critical habitat for the California tiger salamander. Airfield access is from Apron E, and road access is from either Becker Boulevard or North Laughlin Road. No sewer or water connections exist on this site. However, sewer and water connections are available adjacent to the site. This site is carried forward for secondary review.

### Site 20

South of Apron D and west of North Laughlin Road. The undeveloped portions of the site are level grassland, and no wetlands exist on the site. Three buildings and abandoned pavement exist on the large parcel. The site is not within the designated critical habitat for the California tiger salamander. Airfield access is from Apron D, and road access is from North Laughlin Road. No sewer or water connections exist on the site. However, sewer and water connections exist in the vicinity of the site. This site is retained for further review.

### Site 21

East of Flightline Drive and north of Apron D. The site is level grassland. One wetland exists on the site. Burrowing owls have been found on this site. This site is not within the designated critical habitat for the California tiger salamander. The site is part of a leasehold developed with industrial uses that expires in 2036. To date, the leaseholder has not been willing to release the undeveloped parcel. Airfield access is from Apron E, and road access is from Flightline Drive. Sewer and water connections are available adjacent to the site.

This site is eliminated from further review because it is currently subject to a lease that will not expire for 15 years.

### Site 22

North of Airport Boulevard and east of Ordinance Road. This site is currently used as a corporation yard and leased by Sonoma County Transportation and Public Works. Providing airfield access requires relocation of Ordinance Road and provision of a new access route to KaiserAir's terminal. The taxiing route is through the parcel that contains the former Sheriff's garden. Existing road access is from Airport Boulevard. All utilities are available onsite. The site is not within the designated critical habitat for the California tiger salamander. No biological data is readily available for this site. However, the site has several buildings, and the balance is mostly paved. This site may be considered for non-aeronautical development which may require relocating the corporation yard.

The site is rejected from further review because of the circuitous taxiway route and need to relocate Ordinance Road.

### Site 23

West of Ordinance Road and east of KaiserAir's leasehold. The level site is currently occupied by the former Sheriff's garden and a parking lot serving the North County Detention Facility. The southern end of the parcel is the proposed location for long-term automobile parking. The narrowness of the parcel constrains development. Airfield access is through the KaiserAir leasehold, and road access is possible from either Airport Boulevard or Ordinance Road. All utilities are available adjacent to site. This site has previously been considered for FBO facilities. The site is not within the designated critical habitat for the California tiger salamander. No protected biological features are known to exist on this site. This site is selected for secondary review.

### Site 24

North of Taxiway J and east of the Remote Transmitter Receiver (RTR) facility. The site is a preserve where wetlands and Burke's Goldfields habitat were created to mitigate Airport project impacts. The site is not within the designated critical habitat for the California tiger salamander. Aircraft access the site from Taxiway J, and vehicles access the site from Ordinance Road near the Cal Fire Air Attack Base. Utilities connects may be available near the Cal Fire facility. However, if larger water lines are needed, a new connection is likely to need to be extended from further away.

This site is eliminated from secondary review because is a wetlands and Burke's Goldfields habitat preserve.

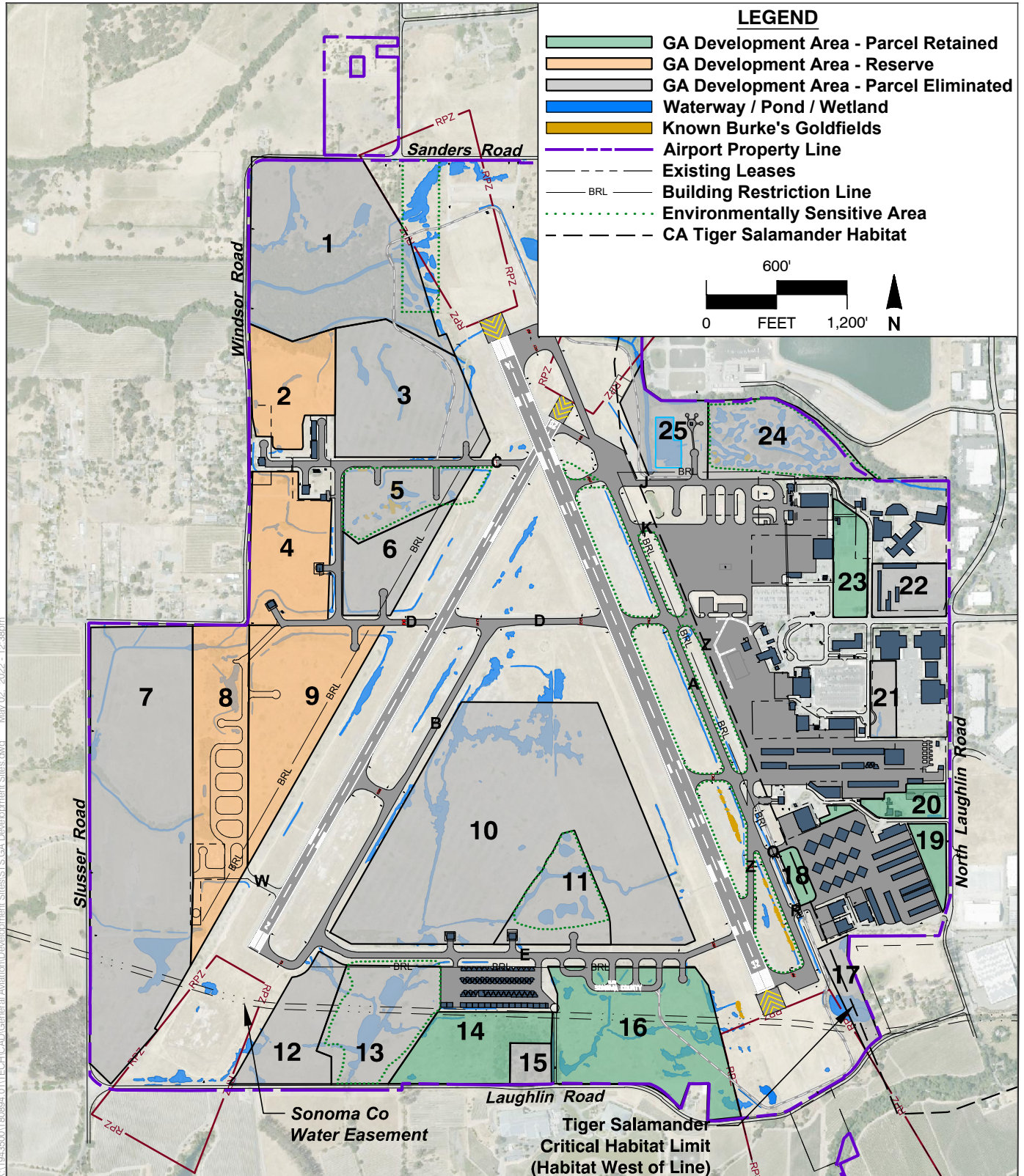
### Site 25

North of Taxiway J on the current RTR facility. The site is constricted by the RTR, detention pond, and creek. Airfield access is from Taxiway J, and public access is possible from Ordinance Road, but this may be difficult due to environmental impact on adjacent wetlands. Placing structures on this site impacts the RTR facility's functionality and likely requires the facility to be relocated. Utilities are nearby. The site within designated California tiger salamander habitat.

This site is removed from secondary review because it would require relocation of the RTR equipment. The cost to relocate the RTR equipment could exceed \$5 million.



Figure 6-1: Potential GA Development Sites



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## Infrastructure Development

A key difference between development options in the eastern quadrant and those in the southern and western quadrant is the existence of supporting infrastructure. Hangar development in the southern and western quadrants will require investment in supporting infrastructure such as utilities and taxiway access. The cost of providing this needed infrastructure affects the timing and viability of development options in these two quadrants. This section presents the three categories into which the principal infrastructure requirements fall: sewer service, water service, and taxiways.

### Sewer Service

Primarily aircraft storage is anticipated for hangar development in the southern and western quadrants. While some of the larger box hangars may be occupied by corporate flight offices or SASOs, they are not expected to have large staffs or large customer volumes. The remoteness of the sites and circuitous road access make more intensive development unlikely. This assumption guides the evaluation of sewer service needs.

The nature of the hangar use likely indicates low sewer demand. One public restroom constructed in each quadrant, with separate facilities for men and women, will serve users of the majority of hangars, which do not have restrooms. Some larger box hangars may have their own restrooms.

Two ways to provide sewer service are available to the west and south quadrants:

- ▶ Connect to the SCWA sewer main on North Laughlin Road or the sewage treatment facility northeast of STS
- ▶ Develop an onsite septic system.

### *Southern Quadrant*

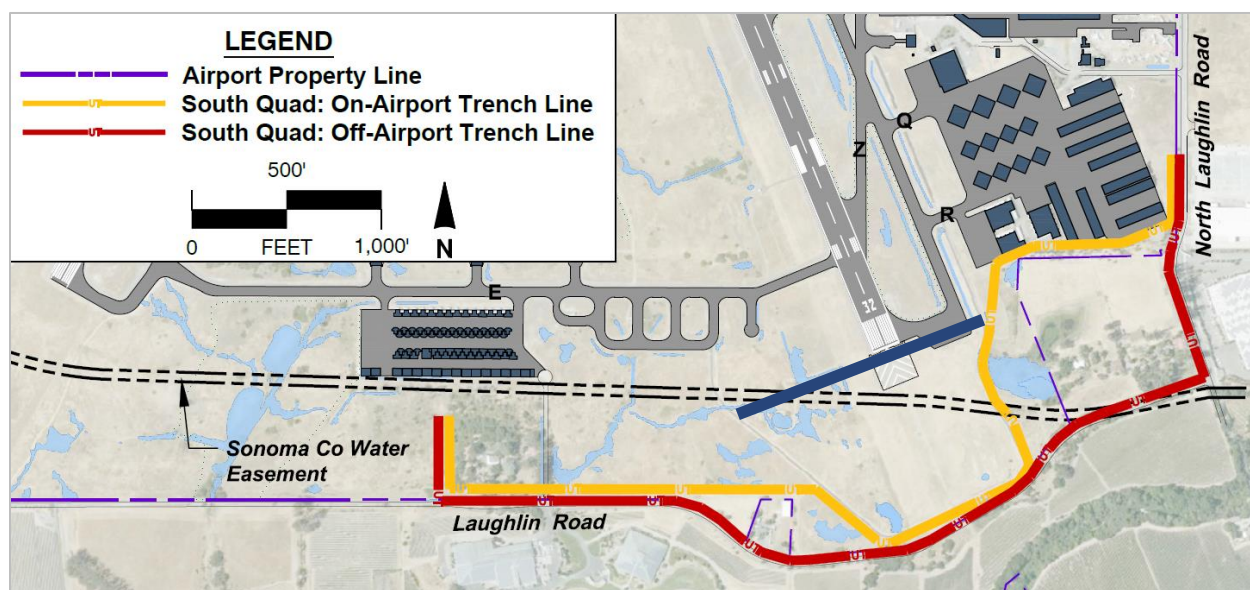
**Connect to sewer main:** Two routes for the sewer line underwent preliminary evaluation. These routes extend from the nearest point of connection to the center of the southern quadrant. This central location allows calculation of order-of-magnitude costs. The chosen routes minimize impacts to wetlands. Both on- and off-airport routes require about 6,100 feet of sewer line.

The off-airport route (red line, **Figure 6-2**) places the pipe within the right-of-way of Laughlin Road to its junction with North Laughlin Road. The line then continues north to a connection in North Laughlin Road.

The second route (gold in **Figure 6-2**) runs on the Airport, parallel to Laughlin Road and inside STS's fence, and loops around the service road and runway safety area for the approach to Runway 32. The sewer line then passes along the Airport property line south of Apron E. From there it connects to the main in North Laughlin Road. A third option (blue in **Figure 6-2**) that keeps the sewer on-Airport is a directional bore under Runway 14/32 to the hard stand areas.



**Figure 6-2: South Quadrant Conceptual Trench Lines**



The planning-level estimated cost to design and construct this length is about \$2.0 to \$2.3 million. There may be cost savings if the sewer and water lines (explained below) are extended concurrently. However, cost analysis to that degree of detail is beyond a planning level of analysis. The cost estimate does not include environmental review, mitigation, and connection fees.

Both proposed routes have potential biological impacts. The off-Airport route potentially requires use of the shoulder in areas with wetland features that may be jurisdictional. The on-Airport route avoids direct impacts to delineated wetlands but passes through California tiger salamander habitat.

Both routes have potential construction challenges as well. The proposed off-Airport route requires construction in sections that contain significant differences in elevation between the road and shoulder that are likely to require retaining walls. The on-Airport route passes near an FAA electrical building and through a narrow corridor where only a few feet separate the perimeter fence and the access road. None of these factors make either route infeasible.

**Septic system:** Given the low volume that hangars generate, a septic system could be developed to treat the wastewater. Wineries in the vicinity of the Airport already use this method of treating effluent. Installation of a septic system has the potential to address sewage treatment needs at substantially less cost than connection to the SCWA sewage treatment system. An engineered septic system, such as a mound system, is expected to be required. The cost to construct a mound system is estimated to be \$350,000 to \$450,000, based on recently constructed systems nearby. A mound system constructed at this price would accommodate 10 bathrooms. After analysis of the options, there are two feasible ways for providing wastewater utilities to the south quadrant, with substantial cost differential between the two options:

- Extension to the main sewer line on North Laughlin Road. This is the most expensive method, with an estimated cost of \$2.0 to \$2.3 million. The cost estimate does not include environmental review, mitigation, and connection fees.

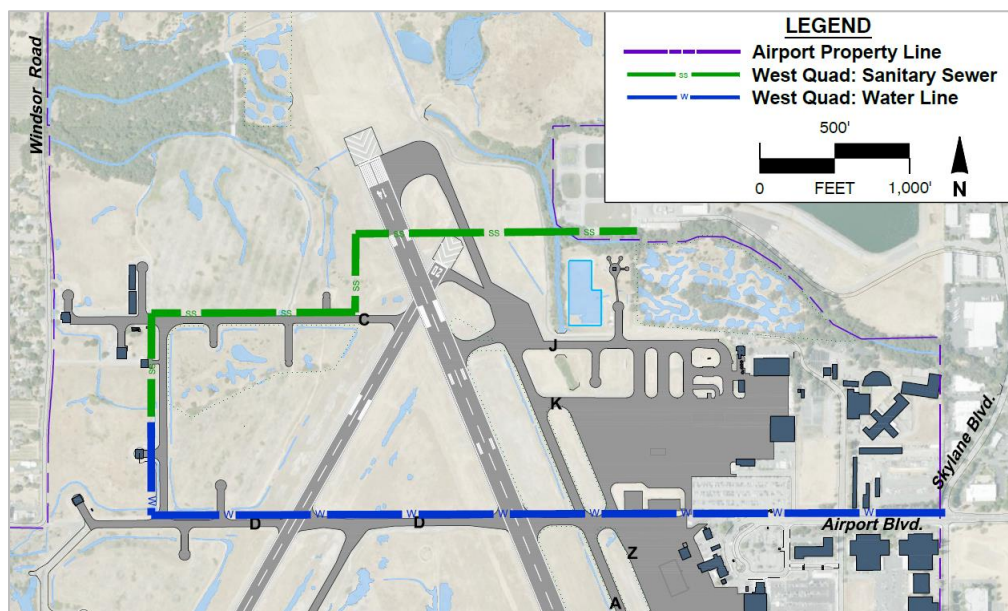
- Excavation for an onsite septic system, which is estimated to cost \$350,000 to \$450,000. The lower cost for a septic system significantly improves the feasibility of developing hangars in the southern quadrant.

### Western Quadrant

**Connect to sewer main:** One route consists of a line to connect to the sewage treatment facility adjacent to the east side of the Airport. This proposed route from the western quadrant is approximately 4,300 feet (green in **Figure 6-3**). The chosen route is intended to minimize wetland and other biological impacts as well as disruption to airfield operations. If this option is implemented, the use of adjustments to the route and directional boring are expected to reduce biological and operational impacts to the absolute minimum.

This was developed to establish order-of-magnitude costs for this connection. The planning-level estimate to design and construct this line is in the range of \$1.7 to \$2.0 million. The uncertainty over this estimate is greater than the estimate for the southern quadrant. Resolving uncertainties relating to the design of sewage transmission lines, the length of directional bores under runways and taxiways, and design changes needed to avoid existing underground utilities requires completion of a preliminary engineering design. The cost estimate does not include environmental review, mitigation, and connection fees.

**Figure 6-3: West Quadrant Conceptual Water and Sewer Lines**



**Septic System:** As with the southern quadrant, the use of a septic system to treat wastewaters generated by hangars in the western quadrant appears feasible. Based upon the experience with other uses in the vicinity, some form of engineered septic system, such as a mound system, is expected to be required. An order of magnitude cost to serve this hangar area is \$350,000 to \$450,000, based on recently constructed systems nearby. A mound system constructed at this price would accommodate 10 bathrooms. This does not include the cost of the associated collection system. Those costs are assumed to be borne by the hangar developer.

After analysis of the options, there are two feasible ways for wastewater utilities to the west quadrant, with substantial cost differential between the two options:

- ▶ Extension to the main sewer line to the sewage treatment facility. This is the most expensive method, with an estimated cost of \$1.7 to \$2.0 million. The cost estimate does not include environmental review, mitigation and connection fees. There is also greater uncertainty in this cost estimate.
- ▶ Excavation for an onsite septic system, which is estimated to cost \$350,000 to \$450,000.

## Water Service

Minimal daily water use is expected. The proposed banks of small hangars have neither restrooms nor landscaping. The larger hangars are likely to have modest landscaping around their associated parking lots, and most large hangars are expected to contain a single restroom. Fire sprinklers for the large hangars and a hydrant system for the hangar area represent the biggest water demand.

### ***Southern Quadrant***

Three ways to provide water service to the southern quadrant have potential:

- ▶ Connection to the SCWA water main on North Laughlin Road
- ▶ Connection to the Sonoma County Water Agency's (SCWA) transmission line
- ▶ Development of an onsite well and water storage system.

**Connection to water main:** The two connection routes described for water service (on- and off-Airport, shown in **Figure 6-2** above) are viable means to route connection to a water main. However, if the same general route for sewer and water is used, the two parallel lines must be in separate trenches to meet building code requirements. Like the sewer service, the connection point for water is in North Laughlin Road, and the length of the water line is about 6,100 feet.

Planning-level design and construction costs are estimated at \$1.5 to \$1.8 million, but extending the sewer and water lines concurrently may yield cost savings. However, analysis to that degree is beyond what is possible at this planning level of analysis. The cost estimate does not include environmental review, mitigation, and connection fees.

**Connection to SCWA transmission line:** A major water transmission line operated by the SCWA runs through the southern quadrant and serves communities in the western part of Sonoma County. There is currently a connection to the aqueduct that serves a fire hydrant on Apron F. Discussions with SCWA agency staff indicated that obtaining water service from this water line for additional fire protection may be possible. Because of the line's location, extension of service lines to hangars in the southern quadrant would be relatively short. SCWA staff indicated that providing domestic water from the aqueduct would be against agency policy. The proximity of the existing water line serving the hydrant on Apron F means that no extension would be required to serve hangars in this area. The additional connections would be associated with new development of hangars. The connections to the existing system are assumed to be funded by the hangar developers.

**Onsite water system:** Wineries in the vicinity of the Airport rely upon onsite wells for water. The creation of a similar system for hangars in the southern quadrant appears feasible. The cost to drill and install a well is estimated to be \$400,000 to \$500,000, based on recently constructed systems nearby. The well is expected to need to be drilled to a depth of 500 feet. The water will need to be filtered or treated to remove arsenic. If filter media is used, the media will need to be treated as hazardous material when it reaches the end of its useful life. Wells will also require water storage tanks. The cost for water storage is relative to development and domestic service demand. Storage requirements for fire protection will be greater than for domestic water.

The cost of extending service to individual hangars is assumed to be borne by the hangar developer. If fire flows cannot be met by connection to the SCWA transmission line (discussed above), then onsite storage is expected to be required. The costs for this have not been estimated.

After analysis of the options, there are three feasible ways to provide water for domestic use and fire protection to the south quadrant:

- ▶ Extension of a water main from North Laughlin Road. This is the most expensive method, with an estimated cost of \$1.5 to \$1.8 million plus environmental review, mitigation, and connection fees.
- ▶ Use of an onsite well with storage tanks to provide both water for both domestic use and fire protection. Well installation and drilling are estimated to cost \$400,000 to \$500,000, plus costs for filtrations, storage tanks, and environmental review.
- ▶ Use of an onsite well for domestic water and connection to the SCWA aqueduct for fire protection. This is the least expensive option since storage for fire suppression tanks would not be required. However, a Finding of Necessity with SCWA and subsequent agreement would be required by the developer.

### ***Western Quadrant***

Two means for providing water service to the southern quadrant are potentially available for the western quadrant:

- ▶ Connection to the City of Windsor's water main on North Laughlin Road
- ▶ Development of an onsite well and water storage system.

**Connection to water main:** Like the southern quadrant alternative, connecting to an existing water main in North Laughlin Road appears feasible. However, the point of connection is further north near the intersection with Airport Boulevard (blue in **Figure 6-3** above). The length of the transmission line is shorter than the southern quadrant alternative at 5,900 feet. Directional bores will need to pass under Runway 14/32 and its parallel taxiway. The planning level estimate cost to design and construct this water line would be about \$1.5 to \$1.8 million. The cost estimate does not include environmental review, mitigation, and connection fees.

**Onsite water system:** As with the southern quadrant, providing water service with a well and storage system appears feasible. The cost is expected to be the same as discussed for the southern quadrant: \$400,000 to \$500,000. As with the southern quadrant, this does not include costs for storage tanks and distribution.



After analysis of each system, there are two feasible ways to provide water for domestic use and fire protection to the west quadrant:

- ▶ Extension of a water main from North Laughlin Road. This option is the most expensive, estimated to be \$1.5 to \$1.8 million. The cost estimate does not include environmental review, mitigation and connection fees. There is also greater uncertainty in this cost estimate.
- ▶ Use of an onsite well with storage tanks to provide both water for domestic use and fire protection. Well installation and drilling are estimated to cost \$400,000 to \$500,000. This does not include costs for filtrations, storage tanks, and environmental review.

## Realignment of Taxiway E

The FAA may require that the nonstandard taxiway configuration where Taxiway E connects to Runway 14/32 be realigned concurrently with the development of new hangars in Sites 12, 14, and 16. In the interest of safety, FAA standards direct that aircraft cross runways at their ends. Eliminating the current nonstandard condition before introducing additional based aircraft into the southern quadrant avoids increasing the potential for runway incursions.

The cost to design and construct the new alignment of Taxiway E is estimated (at the planning level) to be in the range of \$4 to \$5 million. This amount includes engineering design, construction, and construction administration. The cost does not include preparation of environmental documents and mitigation costs. This development impacts California tiger salamander habitat, jurisdictional wetlands, and known colonies of Burke's goldfield. The California tiger salamander and Burke's goldfield are both classified as endangered under both the Federal and California Endangered Species Acts. The environmental review process for this project is anticipated to be complicated and protracted.

## West Side Parallel Taxiway

Taxiway access to the western quadrant is currently available via Taxiways C and D. Neither taxiway meets current FAA standards as points to access Runway 2/20 or other parts of the airfield. Taxiway C intersects Runway 20 near the approach end, but not at its apex. Taxiway D crosses Runway 2/20 at a *high energy* point in the middle third of the runway. Pilots using the runway have limited opportunities to maneuver to avoid aircraft crossing. It is possible that the FAA will require development of a full-length parallel taxiway west of Runway 2/20 as a condition of hangar development in the western quadrant. For similar reasons, the FAA may also require construction of a partial parallel taxiway to connect Taxiway C to the approach end of Runway 20. This west side parallel taxiway and partial parallel taxiway connector to Runway 14 would be built to the same standards as Taxiway B, the partial parallel on the east side of Runway 2/20. The planning-level estimate to design and construct these taxiways is at least \$19 million. This does not include environmental documentation and mitigation costs.

## Site Evaluation

The possible GA development sites were evaluated based upon seven potential constraints:

- ▶ Impacts on existing facilities – Development on parcel will require relocation or elimination of existing uses
- ▶ Biological features – Known wetland, critical habitat, or protected species on parcel
- ▶ Adjacent taxiway access – Parcel proximity to existing taxiways or taxilanes
- ▶ Offsite taxiway required – Parcel development will require construction of major taxiway segment to access airfield
- ▶ Availability of utilities
- ▶ Street access
- ▶ Availability – Parcel part of airport and not part of existing leasehold

## Evaluation Methodology

The goal of this evaluation is to separate sites into one of four categories based upon their development potential. All characteristics may not apply to an individual site, and the most constraining characteristic will determine the site ranking:

### 1: Best Development Potential

- ▶ Little to no impact to existing facilities
- ▶ Little to no environmental impact
- ▶ Area available for immediate development
- ▶ Immediate access to utilities

### 2: Good Development Potential

- ▶ Little impact to existing facilities, with some relocation
- ▶ Minor environmental impact with possible mitigation
- ▶ Immediate development with some infrastructure improvements
- ▶ Utilities infrastructure improvements/extensions needed

### 3: Fair Development Potential

- ▶ Impact to existing facilities, with potential for relocation
- ▶ Major environmental impact with straightforward mitigation
- ▶ Near-term development dependent on infrastructure improvements
- ▶ Fair to poor access to utilities

### 4: Poor Development Potential

- ▶ Major impact to existing facilities
- ▶ Major environmental impact with complicated mitigation
- ▶ Major infrastructure requirements
- ▶ Poor access to utilities





The results of the evaluation of the eight sites selected for secondary review are presented in **Table 6-2**. The site ranking distinguishes between each site's suitability for near-term development and its long-term development potential. Sites with lower rankings should be preserved for eventual aviation use.



**Table 6-2: Secondary Site Review Summary**

Parcel #	2	4	14	16	18	19	20	23
Impact on Existing Facilities	0	0	L <sup>1</sup>	L <sup>2</sup>	L <sup>3</sup>	0	0	0
Sensitive Biological Features	M	M	L	H	M	L	0	0
Adjacent Taxiway Access	L	L	L	L	0	L	L	L
Offsite Taxiway Required	H	H	M	0	0	0	0	0
Availability of Utilities	H	H	H	H	0	0	0	0
Street Access	L	L	L	L	0	0	0	0
Availability	0	0	0	0	0	0	L	L
Near-Term Site Ranking	4	4	3	3	1	1	2	2
Long-Term Site Ranking	3	3	2	2	1	1	1	1

Key:

	1 – Best Development Potential	0 – No impact or constraint;
	2 – Good Development Potential	L – Limited impact or constraint;
	3 – Fair Development Potential	M – Moderate impact or constraint;
	4 – Poor Development Potential	H – High impact or constraint

Notes:

1. Two existing hangars would be relocated
2. Eliminates hardstands used for aircraft parking
3. Requires minor utility changes to fire hydrants and drop inlets

Source: Mead & Hunt

Of the eight sites, the four sites located on the east side are ranked as having best or good development potential. These sites will be easier and less expensive to develop because of the availability of utilities and simpler environmental approval process. Next easiest to develop are the two sites in the southern quadrant. The two sites in the southern quadrant have significantly higher development costs and site 16 has potentially environmental constraints to overcome. Sites 2 and 4 would rank the same as Site 14, except for the potential that a west-side parallel taxiway for Runway 2/20 might be required before significant development can occur. Therefore, Sites 2 and 4 should be considered as long-term development reserve for storage hangars or SASOs.

## GA DEVELOPMENT CONCEPTS

Hangar and apron layouts were conceptualized for the six sites identified as having fair to best near-term development potential. A matrix at the end of this section summarizes the number of hangars in each concept, the amount of total new pavement, and wetland area affected.

## Site 18 Concepts

Site 18 is limited to apron development due to the location. The building restriction limit and Part 77 airspace clearances do not allow for structures on this site. A concept for Site 18 is shown in **Figure 6-4**. This concept accommodates three helicopter parking positions plus transient parking relocated from the terminal apron and Apron A, to be relocated for future terminal expansion.

**Figure 6-4: Site 18 Concept**



The helicopter parking positions are designed to accommodate Robinson R22 and R44 helicopters, with 55-feet between centerline, which provides standard separation for turn-round and taxi-through operations. The 20-foot square pads are larger than the minimum 14.4 feet required. Pad size may be reduced, but this will not affect required offsets. The setbacks between the helicopter parking pads and Taxiway Q and the new fixed-wing apron are larger than FAA standards. FAA standards focus on wingtip and rotor clearances. The design incorporates larger separations to minimize the potential for impacts from rotor wash or flying debris.

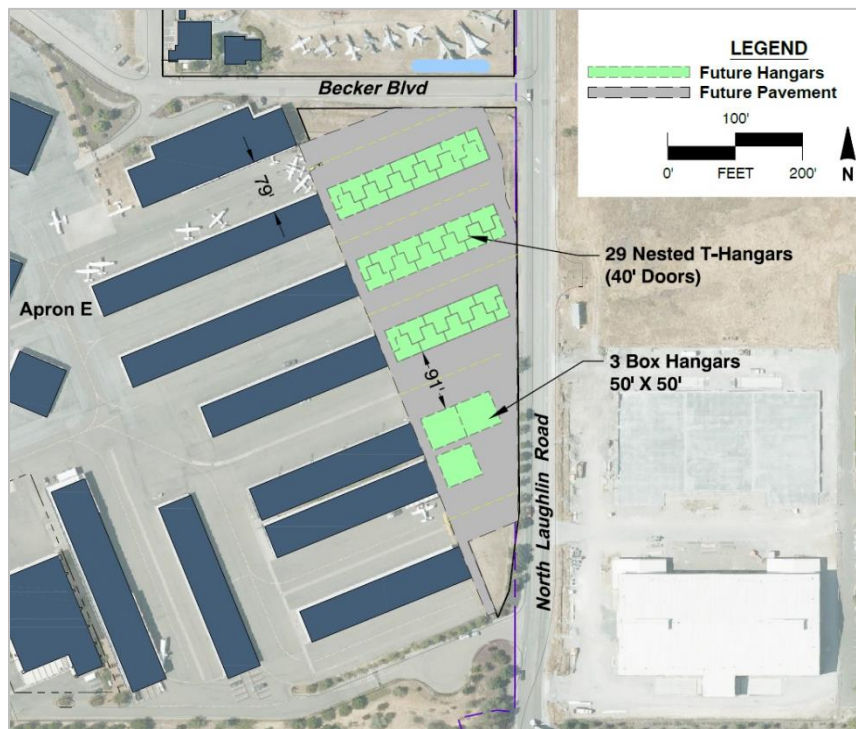
An additional fixed-wing parking apron of 23,500 square feet is shown with Taxilane Object Free Area for Airplane Design Group II. There are two fire hydrants, a drop inlet, and a drainage swale that pass through the site. Based upon an initial site inspection it appears that relocation of the utilities and modification of the drainage can be accomplished without major design challenges.

## Site 19 Concepts

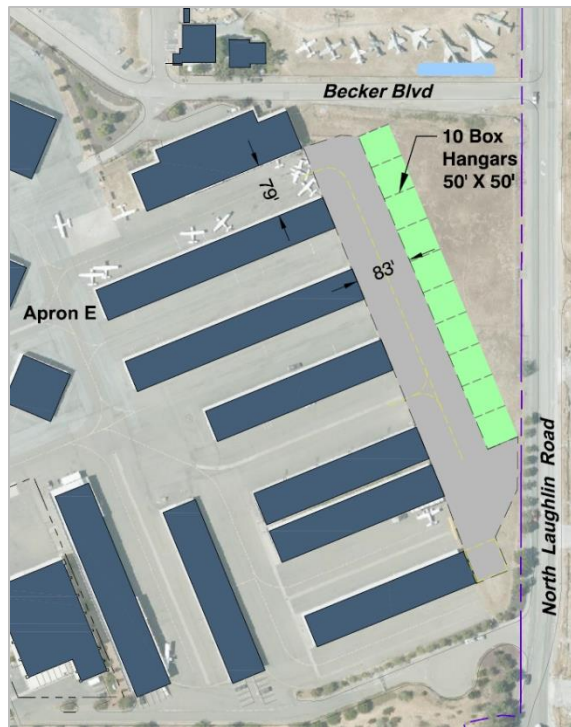
Site 19 is limited to Airplane Design Group (ADG) I aircraft with wingspans of 49 feet or less because of the narrow taxilane access from Apron E. Two possible development concepts are identified here.

Alternative 1 shows 29 nested T-hangars in rows and 3 box hangars extending to the east (**Figure 6-5**). The nested T-hangars have 40-foot doors, and the box hangars are 50 feet wide. Alternative 2 shows a row of 10 box hangars perpendicular to the existing rows west of Site 19 (**Figure 6-6**). The box hangars are 50 feet wide and fit on the parcel with taxilane access.

**Figure 6-5: Site 19 Alternative 1**



**Figure 6-6: Site 19 Alternative 2**



## Site 20 Concepts

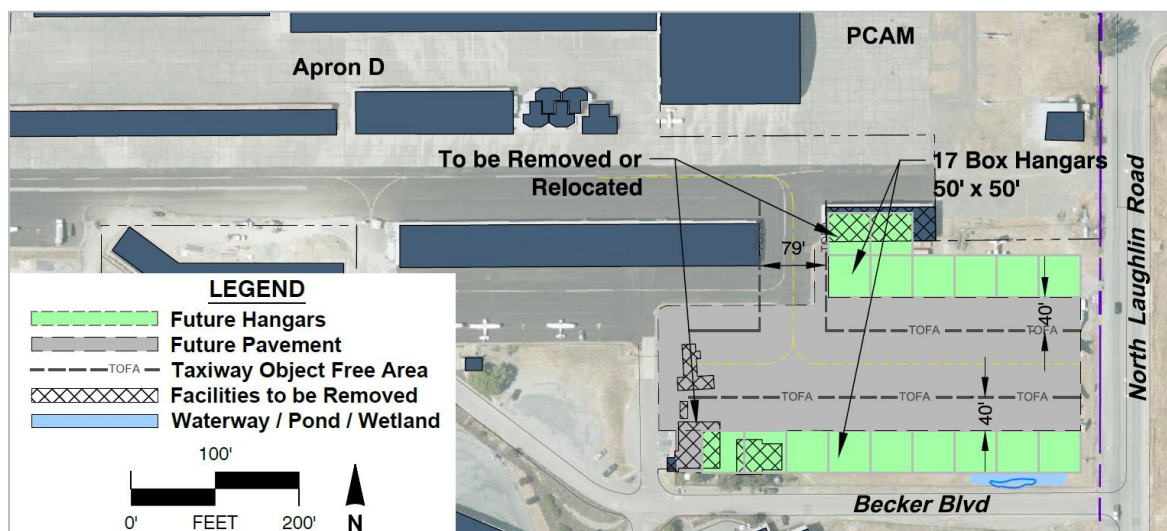
Site 20 is limited to ADG II aircraft with wingspans of 75 feet or less because of the taxilane access from Apron D. The two alternative concepts show varying hangar sizes to accommodate different tenants.

Alternative 1 is a concept developed as part of a 2015 preliminary hangar analysis that shows five corporate hangars with doors facing north (**Figure 6-7**). This allows for a taxilane plus some area in front of the hangar reserved for staging. The corporate hangars back up to Becker Boulevard with public parking at the street front. Site 20 Alternative 2 shows 17 box hangars that are 50-feet wide with a central taxilane and apron area between the hangar and taxilane for staging (**Figure 6-8**).

Figure 6-7: Site 20 Alternative 1



Figure 6-8: Site 20 Alternative 2



## Site 23 Concepts

Site 23 is constrained by existing FBO facilities on Apron B, Ordinance Road to the east, and a utility easement 20 feet wide running in a north-south direction along the west side of the parcel. Any development will require relocating the Sheriff's vehicle parking lot. Site 23 is limited to ADG II aircraft with wingspans of 79 feet or less.

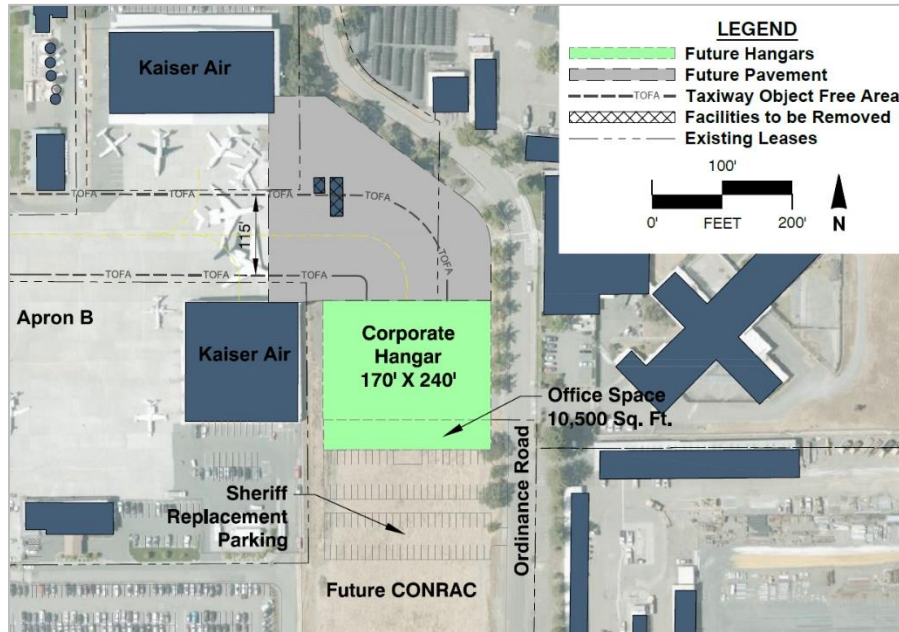
Two development concepts for Site 23 are presented here. Both alternatives are refinements of concepts developed as part of a 2015 preliminary hangars analysis. Alternative 1 presents a corporate hangar with a north facing door and new apron area north of the conceptual hangar and east of Apron B (Figure 6-9).



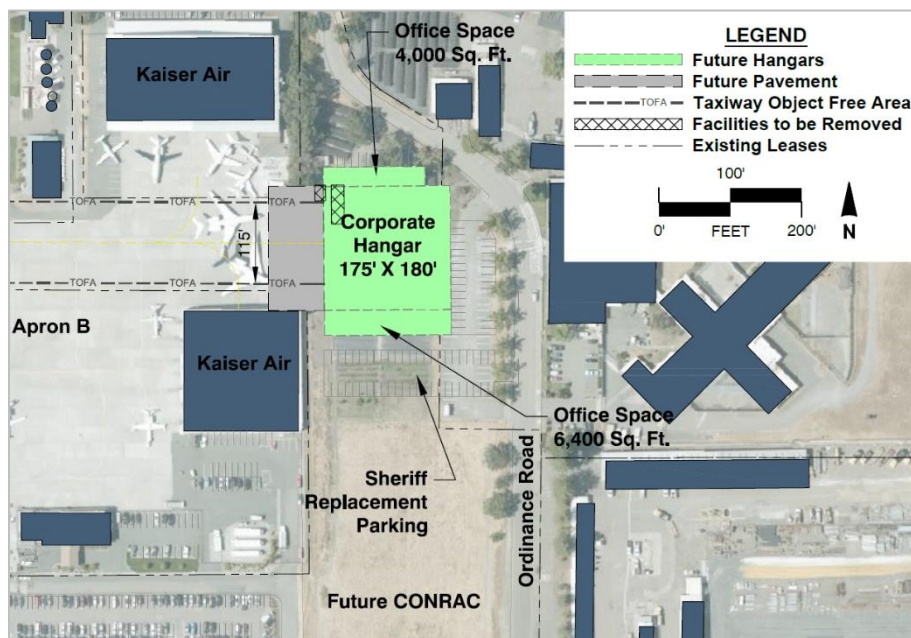
Additionally, a 10,500-square-foot office facility is attached to the new hangar, which provides space for FBO services. The shape and size of parcel limits the size of the new hangar and facility layout.

Alternative 2 shows a corporate hangar with a west facing door to provide direct access from Apron B (Figure 6-10). The hangar is flanked with office space on the north and south sides of the facility.

**Figure 6-9: Site 23 Alternative 1**



**Figure 6-10: Site 23 Alternative 2**

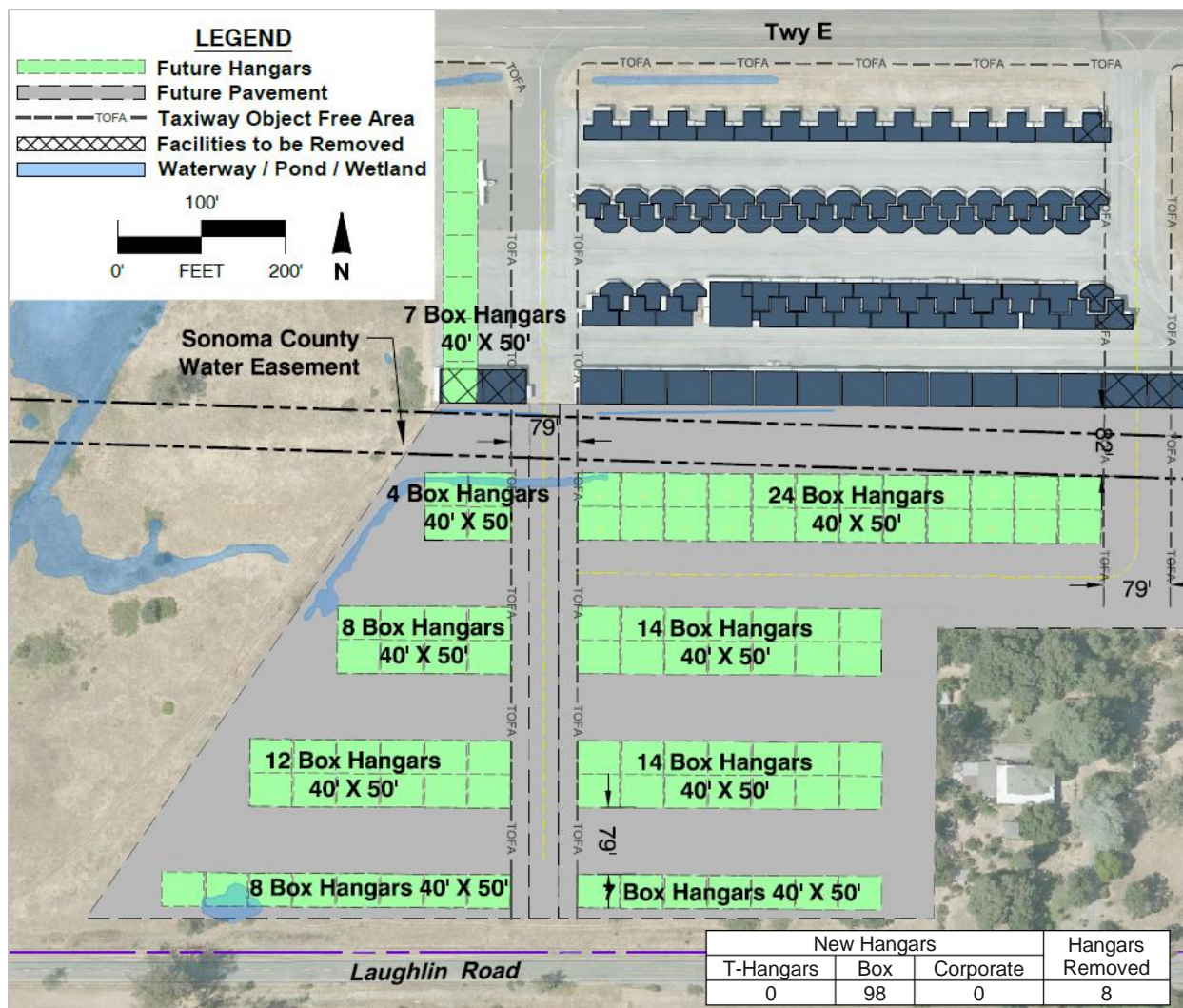


## Site 14 Concepts

Site 14 is the largest site identified with development potential. Two development concepts are presented here. The Sonoma County water easement runs east-west through the site, so buildings are not proposed over this. In each alternative, hangars are removed to provide standard wingtip clearance through Apron F and replaced in the developed area. Landside access is from Laughlin Road.

Alternative 1 consists of rows of box hangars laid out parallel to the existing hangars on Apron F with seven more box hangars on the west side of the existing apron (**Figure 6-11**). Taxiways on the east and west sides of Apron F extend south for airside access. These taxiways provide clearance for ADG I aircraft. The taxiway extensions displace eight hangars.

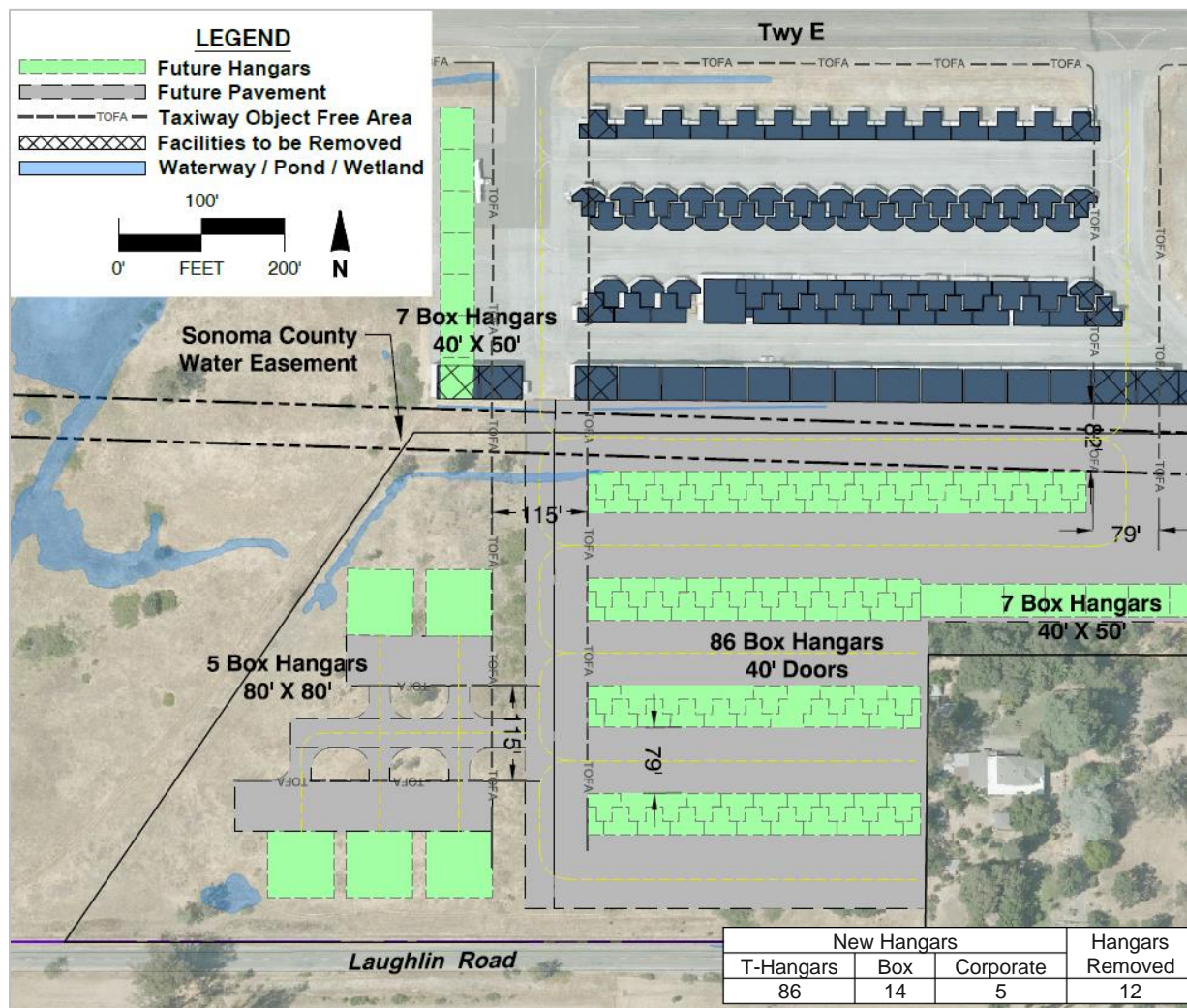
**Figure 6-11: Site 14 Alternative 1**





The Alternative 2 concept shows four rows of nested T-hangars (with 40-foot doors) south of Apron F and five corporate hangars with the potential to be used as FBOs or SASOs west of the extended taxilane (Figure 6-12). This west taxilane is designed to provide clearance for ADG II aircraft to correspond with the corporate hangar size and facility use. The lack of utilities limits the type of facility in this area. The design for Alternative 2 intends to limit wetland impacts compared to Site 14 Alternative 1.

**Figure 6-12: Site 14 Alternative 2**

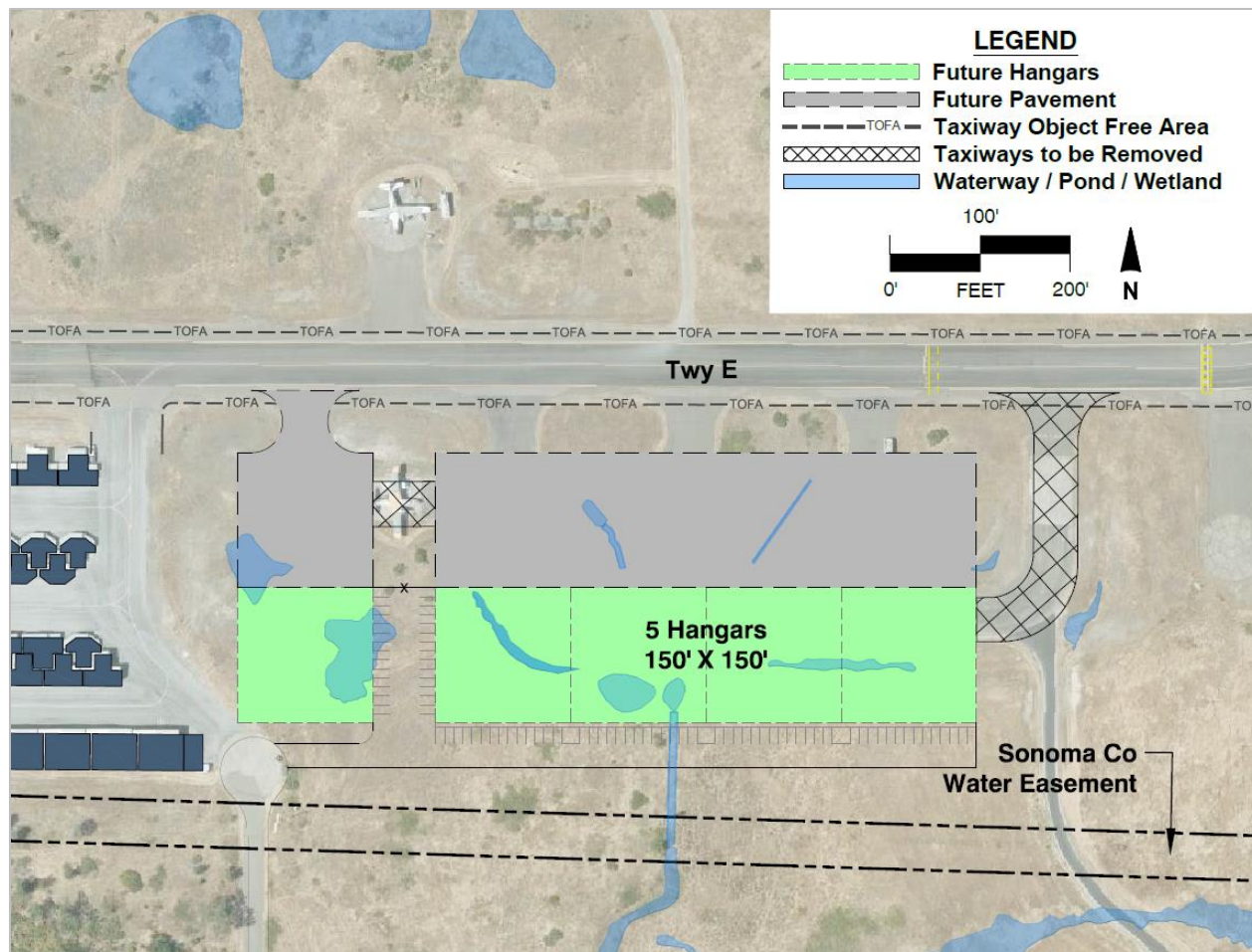


## Site 16 Concept

One development concept for Site 16 is illustrated in Figure 6-13. This concept replicates a similar layout that was developed as part of a 2015 preliminary hangar analysis. The concept shows five 150-foot-by-150-foot corporate hangars that may be utilized by an SASO or FBO. These sites take advantage of the existing hardstand positions and do not interfere with the water line easement or significant wetlands south of this area.



**Figure 6-13: Site 16 Concept**



## Development Concept Recommendations

The goal of this analysis is to narrow the areas that are realistically available for development and present concepts for what type of development is possible in each site. The concepts are intended to illustrate that varying aircraft, layouts, uses, and hangar facilities may be accommodated in each site. Because of limitations (utilities, access, funding), specific demand for development on a specific parcel is the trigger for exploring further refinement and options. Additional items to be considered are grading and drainage, detention basins, and funding for capital expenditures.

The construction of hangars and their associated taxilanes, apron and access roads will create impervious surfaces. The stormwater runoff from these surfaces will need to be managed to meet water quality and runoff standards. The Natural Resources Conservation Service's Web Soil Survey indicates that Airport soils are characterized by hydrologic soil group D soils, which have minimal ability to infiltrate. Therefore, it is anticipated that the stormwater from the new impervious surfaces will need to be treated, detained, and then metered out at the same rate as the existing conditions peak flows.

The treatment would be with bioretention swales. Detention basins would be used to slow the runoff. The runoff would then be channeled to existing streams. For planning purposes, each acre of impervious surfaces will require 1,750 square feet of bioretention swale and 910 square feet of detention basin.

**Table 6-3** shows a summary of the concepts with new hangars provided, total new pavement, and wetland area affected. The forecast summary of ultimate based aircraft is also included for reference. This table helps show how each concept may satisfy ultimate based aircraft or FBO and SASO demand. For example:

- ▶ Developing Site 18 would accommodate displaced helipads and transient parking from terminal building expansion and apron reconfiguration.
- ▶ Developing Site 19 Alternative 1 would satisfy the ultimate demand for piston aircraft, with surplus hangars.
- ▶ Developing Site 20 Alternative 2 would satisfy 55 percent of demand for piston aircraft.
- ▶ Developing Site 14 would satisfy the ultimate demand for piston aircraft, with surplus hangars.

**Table 6-3: Site Concept Development Summary**

Parcel #	Concept Alt #	New Hangars			Hangars Removed	Total New Hangar Area (sq ft)	Total New Pavement Area (sq ft)	Total Affected Wetland Area (sq ft)
		T-Hangars (~40' Doors)	Box (50'-80' Doors)	Corporate (>80' Doors)				
18		0	0	0	0	N/A	75,000	N/A
19	1	29	3	0	0	41,500	89,300	N/A
	2	0	10	0	0	25,000	58,000	N/A
20	1	0	0	5	0	45,125	73,500	2,000
	2	0	17	0	0	42,500	80,200	2,000
23	1	0	0	1	0	51,300	72,000	N/A
	2	0	0	1	0	41,900	13,600	N/A
14	1	0	98	0	8	196,000	390,000	6,000
	2	86	14	5	12	140,500	336,000	3,800
16		0	0	5	0	112,500	125,800	28,000
Aircraft Type		Total Forecast		Number on FBO Leaseholds		Net Demand		
Single-Engine Piston		21		0		21		
Multi-Engine Piston		12		2		10		
Jet / Turboprop		11		5		6		
Helicopter		2		2		0		

Source: Mead & Hunt

This exercise shows that these parcels accommodate ultimate demand. Also, if multiple sites are developed, there is potential for surplus hangar space, which may be utilized to capture shade hangar tenants on Apron D and open this area up for FBO or SASO development. The next section looks at relocating these tenants and redevelopment of Apron D.

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## APRON D REDEVELOPMENT

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The western half of Apron D has two shade hangars with a total of 21 units, four banks of T-hangars with 54 units and 5 portable hangars. Three interrelated issues affect the requirements for new storage hangars:

- ▶ Four banks of hangars on Apron D are requiring high levels of maintenance and warrant replacement.
- ▶ Additional space is needed for FBO/SASO leaseholds. Apron D, with available utilities and prominent airside access, is a prime location for these facilities.
- ▶ Both shade hangars extend past the building restriction line.

An engineering evaluation of Apron D hangars identified an extensive list of repairs that were needed to allow their continued use. It is appropriate to consider whether these hangars have reached the end of their useful life and need to be replaced. Maintenance activities are an increasing burden on STS's budget and operations staff. One alternative is to replace the hangars with similar units in the same location, but this alternative temporarily displaces the aircraft based in them. Another alternative constructs replacement hangars on the sites identified. This option prevents the temporary displacement of the based aircraft.

Additional FBOs/SASOs need space, but STS has limited sites for them. Only three parcels in the east quadrant are available to accommodate them. As described in the Development Potential Section above, two of these sites (19 and 20) have limited airside access or are constrained by existing development. Site 23 is a viable option for one FBO/SASO facility, but this location is constrained by existing development and displaces Sheriff's facilities. Any FBO or SASO facility in the south quadrant (Sites 12, 14, or 16) requires utility extensions and likely improvements to Taxiway E.

If redevelopment is selected, the new hangars must meet requirements related to the building restriction line. For Runway 14/32, that line is set 750 feet from the runway's centerline. Both existing shade hangars on Apron D extend past the building restriction line for Runway 14/32. If not being replaced, these are permitted to remain. If they are relocated, no new structures can extend past that line. This slightly reduces the area available for structures.

### Apron D Alternatives

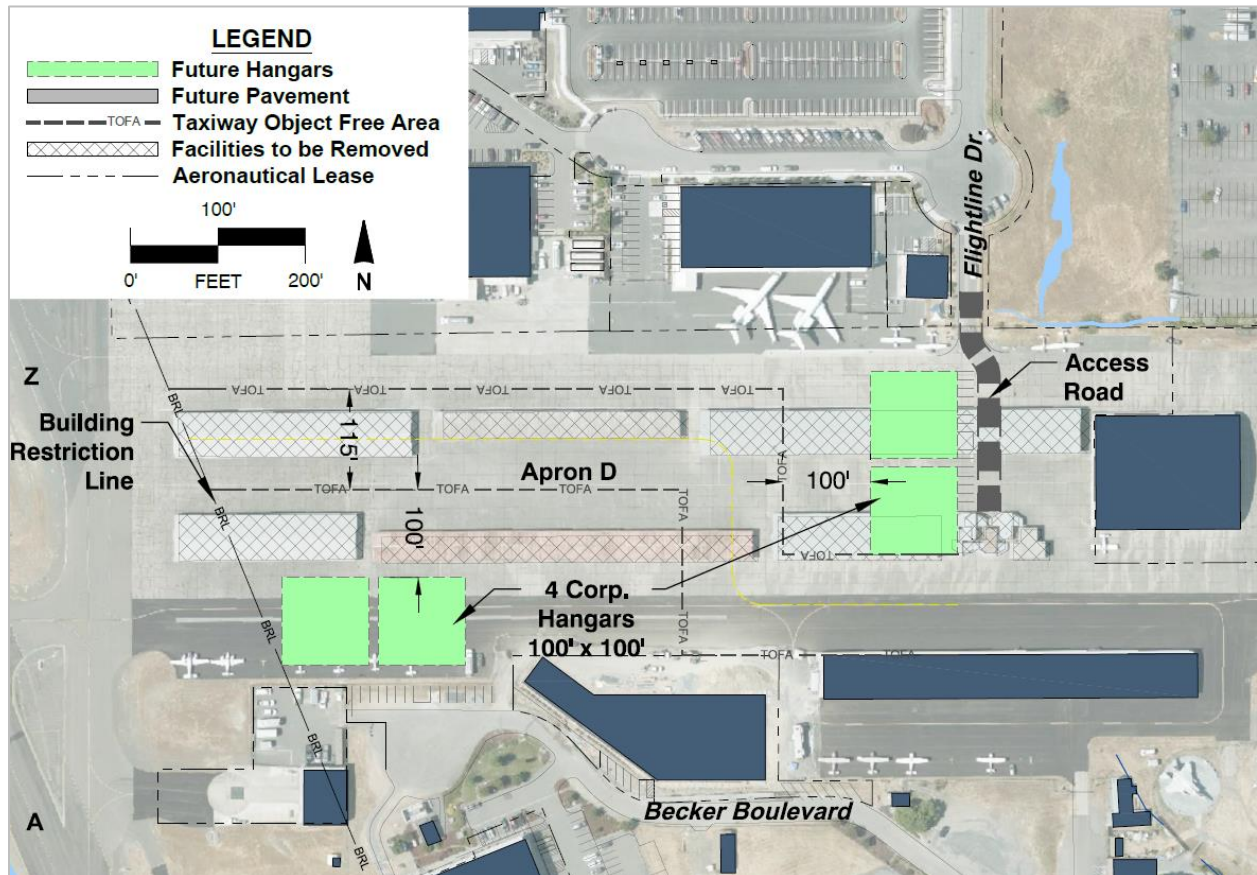
Assuming the south quadrant, specifically Site 14, is developed to accommodate the shade and T-hangar tenants, then the western half of Apron D is a viable option for development to accommodate corporate hangars, FBOs, or SASOs. Apron D is prime real estate with airside access, available utilities, and integration with other Airport facilities such as maintenance and fuel farms.

### Redevelopment Concepts Alternatives

Two concepts for Apron D redevelopment show corporate hangar development on Apron D with landside access. Apron D Alternative 1 (**Figure 6-14**) shows a concept similar to one developed as part of a 2015 preliminary hangar analysis. Two corporate hangars are on the southwest corner of Apron D north of the Sheriff's facility and directly west of a new FBO hangar. The new concept depicts hangars measuring 100 feet by 100 feet, shifted slightly west, and adds two corporate size hangars on Apron D.

A new taxilane accesses all facilities on Apron D including the FBOs on the north edge. The taxilane is designed for ADG II aircraft with wingspans up to 79 feet. The design of each new facility places apron area in front of the hangar for aircraft staging. Becker Boulevard provides landside access for the southwest facilities, and Flightline Drive provides access for the other hangars.

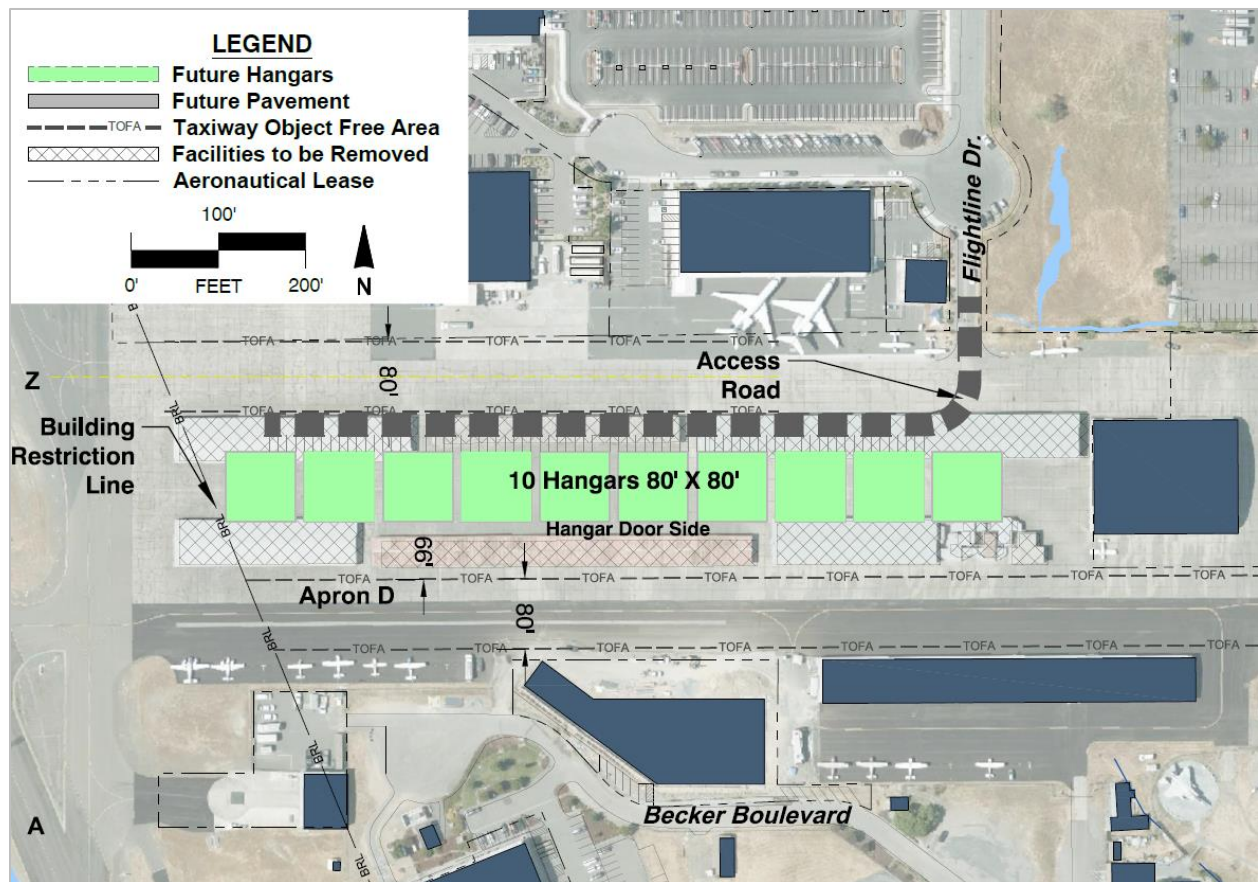
**Figure 6-14: Apron D Alternative 1**



Apron D Alternative 2 (**Figure 6-15**) is a concept that shows corporate hangars in the center of Apron D with south facing doors. Landside access runs east and west from Flightline Drive. One taxilane north of the access road allows aircraft to access the FBOs north of Apron D. This design for this taxilane accommodates ADG I aircraft. A second taxilane designed for ADG I aircraft on the south side of Apron D accesses the proposed and remaining facilities. Alternative 2 proposes more hangars, but smaller ones (80 feet by 80 feet) with less staging area between the hangar door and taxilane.

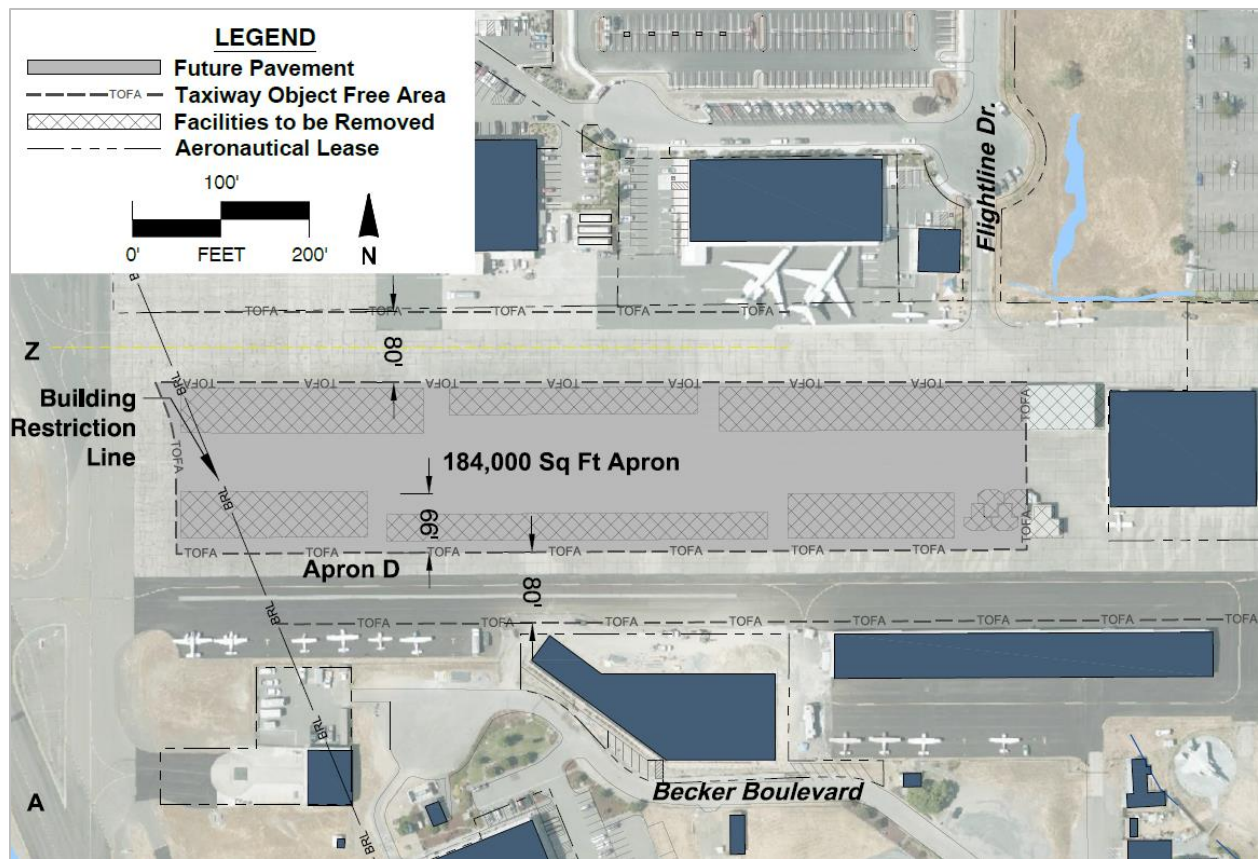


Figure 6-15: Apron D Alternative 2



Apron D Alternative 3 (**Figure 6-16**) is a concept that proposes a tie-down and transient apron for Apron D. This alternative may supplement apron and tie-down areas lost with terminal expansion to the north onto Apron A. This concept shows Apron D as a 184,000 square foot apron without any hangar development. The apron area is flanked on the north and south by taxilanes that allow access to existing hangars and Apron D.

Figure 6-16: Apron D Alternative 3



### Reconstruction in Current location

Reconstruction of the 53 small hangar units in their present location preserves the status quo. Two of the three taxilanes serving these hangars do not provide the standard clearance of 39.5 feet between the taxilane centerline and fixed or movable objects. However, it appears possible to reconstruct hangars to meet the alternative clearance requirements contained in FAA Engineering Brief No. 78.