

## Facility Requirements and Development Alternatives: Runway Development

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This appendix sets forth the runway design requirements used in evaluating the runway development alternatives described in Section III of the *Sonoma County Airport: Airport Layout Plan Narrative Report and Technical Study* (excerpt from Section IV):

### Airfield Requirements and Alternatives

Ten runway configuration alternatives were originally considered in this study, as follow:

- 1. Extend Runway 14-32**
  - a. 1,000-foot extension to southeast; or
  - b. 1,000-foot extension to northwest, or
  - c. A combination of extensions to the southeast and northwest totaling 1,000 feet.
- 2. Extend Runway 1-19**
  - a. 1,000-foot extension to south, or
  - b. 1,000-foot extension to north, or
  - c. A combination of extensions to the south and north totaling 1,000 feet.
- 3. Construction of a New 6,000-foot Runway**
  - a. Parallel to Runway 14-32, or
  - b. Not parallel to Runway 14-32.
- 4. Strengthen Existing Runway Surfaces to Accommodate Larger Aircraft**
  - a. Designed to permit operations by heavier passenger aircraft<sup>1</sup> such as the Boeing B-717 or B-737 models (includes FAA requirement for 1,000-foot safety zones off each runway end).
- 5. “No-Build” Alternative**
  - a. This alternative would not lengthen any existing runways, but could require 1,000-foot runway safety areas off each runway end.

Of the ten alternatives originally considered, the list was narrowed to five refined alternatives by the County’s (ALP Narrative Report) Technical Advisory Committee. The extensions of Runway 14-32 to the northwest and Runway 1-19 to the north were determined to be the most viable alternatives. The construction of a new 6,000-foot runway was eliminated due to its potential costs and impacts on the Burke’s Goldfields wildflower preserve. The alternative of strengthening the existing runway surfaces was rejected as not being feasible due to the high cost of strengthening the runways, taxiways and air carrier aircraft parking aprons to support the larger aircraft.

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<sup>1</sup> Of up to 150,000 pounds MTOW.

Because of the FAA's requirement for dealing with the runway safety areas, the "No Build" alternative was renamed the "Minimum Required Alternative." This alternative is based on the FAA's policy requirement that the Airport bring its Runway Safety Areas (RSAs) into compliance with current safety standards. As a result, it was determined that the RSAs at the approach ends of Runways 14 and 19 would have to be upgraded, irrespective of any proposed runway lengthening. This upgrade would require substantial land acquisition (84 acres) and the culverting of a portion of Redwood Creek. The FAA-required RSAs were also factored into the refined runway alternatives. The refined alternatives are as follows:

**"Minimum Required" Alternative**

- Essentially the "No Build" alternative plus the FAA-required runway safety areas.

**Alternative A-1**

- Extend Runway 14 900-feet to northwest.
- Extend Runway 19 500-feet to north (with 700-foot displaced landing threshold).

**Alternative A-2**

- Extend Runway 14 900-feet to northwest.
- Displace Runway 19 landing threshold 200-feet to south.

**Alternative B**

- Extend Runway 14 900-feet to northwest.
- Extend Runway 19 500-feet to north (with 700-foot displaced landing threshold).
- Extend Runway 1 500-feet to south.

**Alternative C**

- Extend Runway 1 1,200-feet to south (with 200-foot displaced landing threshold on north end).

Table IV-1 provides a comparative evaluation of the five refined alternatives. The pros and cons of each alternative are as follows:

**Minimum Required Alternative.** This alternative was the lowest construction cost alternative and would bring the Runway Safety Areas into compliance with FAA standards. However, it would not provide the 6,000 feet of runway length needed to accommodate regularly scheduled air carrier service by regional jets, and the costs of additional land requirements to comply with the FAA's RSA directive would make it the second or third most expensive alternative.

**Alternative A-1.**

Under Alternative A-1 the required runway modifications would be confined to one location of the airport (see Figures IV-1 and IV-2). Additionally, preliminary analyses indicated that there were no apparent significant environmental or biological impacts that could not be reasonably mitigated on site. Other factors of consideration included:

1. The alternative achieves the full use of 6,000 feet of runway required for regional jet operations.

2. Runway 14-32 is the Airport's principal runway and is equipped with precision instrument approach capability (instrumentation, lighting, and markings).
3. Air traffic control procedures and flight patterns would remain relatively unchanged.
4. Alternative A-1 is the second least expensive alternative. The incremental cost of Alternative A-1 over the least expensive alternative (Alternative A-2 at \$400,000), offers operational efficiencies and is a cost effective enhancement of Airport operational capability.
5. This alternative will allow air carriers more flexibility in takeoff procedures by increasing the takeoff length on Runway 1-19 to 5,500 feet.
6. The alternative will avoid the necessity of aircraft using the northernmost portion of Runway 14-32 to initiate their takeoff roll while on Runway 1-19, which improves safety, air traffic control, and aircraft separation.
7. Noise contours associated with Alternatives A-1 and A-2 result in the least cumulative impact and are generally consistent with those acceptable levels and locations identified in the Sonoma County General Plan, the Windsor General Plan and the Comprehensive Airport Land Use Plan for Sonoma County (see Appendix B of Sonoma County Airport Layout Plan Narrative Report and Technical Study).
8. Potential environmental impacts associated with Alternative A-1 are minimal when the FAA-required Runway Safety Area improvements are factored into the decision. The RSA improvements will result in impacts to Redwood Creek regardless of any decision as to whether or not to extend the runway.

**Alternative A-2.** This alternative would achieve the full 6,000 feet required for Runway 14-32, while emphasizing its continued use as the airport's principal runway without requiring any significant changes to existing operational patterns or procedures. This alternative would require extending Runway 14 900-feet to the northwest, which would have impacts on Redwood Creek. Construction costs would be higher as a result of earth works and environmental mitigation.

**Alternative B.** This alternative would also achieve the full 6,000 feet required for Runway 14-32, while emphasizing its continued use as the airport's principal runway without requiring any significant changes to existing operational patterns or procedures. This alternative would also require extending Runway 14 900-feet to the northwest, which would have impacts on Redwood Creek. Construction costs would be higher as a result of earth works and environmental mitigation. This alternative includes a 500-foot extension of Runway 19 to the south (see Figure IV-3), which would require an additional \$4.2 million in land acquisition costs, making it the first or second highest cost.

**Alternative C.** This alternative would achieve a useable length of 6,000 feet for Runway 1-19 by extending it 1,000-feet to the south (see Figure IV-4), and thereby avoid the need to extend Runway 14 to the north. However, it would change air traffic patterns and operational procedures, thereby increasing the emphasis on the use of Runway 1-19 by large aircraft. The runway is not currently lighted, and would have to be so for nighttime operations. There would also be high land acquisition costs associated with this alternative.

### **Preferred Alternative**

Of the five alternatives considered by the Board of Supervisors, Alternative A-1 was selected as the preferred Master Plan alternative. Alternative A-1 is characterized as follows:

1. Extend existing Runway 14-32 and associated parallel taxiway approximately 900 feet to the northwest to a total length of 6,000 feet.
2. Extend existing Runway 1-19 approximately 500 feet to the north to a total length of 5,500 feet for takeoff and displace Runway 19 landing threshold 700 feet leaving 4,800 feet for landing.
3. The estimated construction cost for Alternative A-1 is \$5.2 million, subject to environmental mitigation costs related to Redwood Creek impacts.

ALTERNATIVES:	MINIMUM REQUIRED ALTERNATIVE	ALTERNATIVE A-1	ALTERNATIVE A-2	ALTERNATIVE B	ALTERNATIVE C
	<ul style="list-style-type: none"> <li>Grade terrain and construct culvert to comply with RSA standards</li> </ul>	<ul style="list-style-type: none"> <li>Extend Runway 14 @ 900' to Northwest</li> <li>Extend Runway 19 @ 500' to North (with 700' Displaced Threshold)</li> </ul>	<ul style="list-style-type: none"> <li>Extend Runway 14 @ 900' to Northwest</li> <li>Displace Runway 19 Landing Threshold @ 200' to South</li> </ul>	<ul style="list-style-type: none"> <li>Extend Runway 14 @ 900' to Northwest</li> <li>Extend Runway 19 @ 500' to North (with 700' Displaced Threshold)</li> <li>Extend Runway 1 @ 500' to South</li> </ul>	<ul style="list-style-type: none"> <li>Extend Runway 1 @ 1,200' to South (with 200' Displaced Threshold on North)</li> </ul>

**PROJECT PURPOSE**

Runway Lengths					
<b>Runway 14-32</b>	5,115'	6,000'	6,000'	6,000'	5,115'
<b>Runway 1-19</b>	5,002' (with @ 200' Displaced Threshold on N)	5,500' (with @ 700' Displaced Threshold on N)	5,002' (with @ 200' Displaced Threshold on N)	6,000' (with @ 700' Displaced Threshold on N)	6,200' (with @ 200' Displaced Threshold on N)
<b>Runway Safety Area</b>	Complies with FAA standard	Complies with FAA standard	Complies with FAA standard	Complies with FAA standard	Complies with FAA standard
<b>NAVAID Relocations</b>	Runway 32 Localizer Antenna relocated @ 200' to NW	Runway 32 Localizer Antenna relocated @ 1,500' to NW	Runway 32 Localizer Antenna relocated @ 1,500' to NW	Runway 32 Localizer Antenna relocated @ 1,500' to NW	Runway 32 Localizer Antenna relocated @ 200' to NW
<b>Pros</b>	<ul style="list-style-type: none"> <li>Lowest construction cost alternative</li> <li>Brings Runway Safety Area into compliance with FAA standards</li> </ul>	<ul style="list-style-type: none"> <li>Achieves full 6,000' of useable Runway 14-32 length</li> <li>Emphasizes continuing use of Airport's principal Runway 14-32 <ul style="list-style-type: none"> <li>Already equipped with Precision Instrument Approach System (ILS 32)</li> <li>Already equipped with Instrument Approach Lighting System (MALSR 32)</li> <li>Well established and configured ATC flow</li> <li>No significant changes to existing operational patterns and procedures</li> </ul> </li> <li>Additional Runway 1-19 length of @ 500' (with 700' DT on N)</li> </ul>	<ul style="list-style-type: none"> <li>Achieves full 6,000' of useable Runway 14-32 length</li> <li>Emphasizes continuing use of Airport's principal Runway 14-32 <ul style="list-style-type: none"> <li>Already equipped with Precision Instrument Approach System (ILS 32)</li> <li>Already equipped with Instrument Approach Lighting System (MALSR 32)</li> <li>Well established and configured ATC flow</li> </ul> </li> <li>No significant changes to existing operational patterns and procedures</li> </ul>	<ul style="list-style-type: none"> <li>Achieves full 6,000' of useable Runway 14-32 length</li> <li>Emphasizes continuing use of Airport's principal Runway 14-32 <ul style="list-style-type: none"> <li>Already equipped with Precision Instrument Approach System (ILS 32)</li> <li>Already equipped with Instrument Approach Lighting System (MALSR 32)</li> <li>Well established and configured ATC flow</li> <li>No significant changes to existing operational patterns and procedures</li> </ul> </li> <li>Additional Runway 1-19 length of @ 1,000' (with 700' DT on N)</li> </ul>	<ul style="list-style-type: none"> <li>Achieves full 6,000' of useable Runway 1-19 length</li> <li>Avoids extension of Runway 14 to N</li> <li>Runway 19 is currently used on a regular basis for daytime visual and instrument departures ("Frees Five" IFR Departures)</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>Does not provide the 6,000' runway length needed to accommodate regional air carrier jet activity</li> <li>Existing Runway 1-19 length reduced to 4,802' for landings on Runways 1 and 19 and departures from Runway 1</li> </ul>	<ul style="list-style-type: none"> <li>Locates Runway 14 Threshold @ 900' further to NW</li> <li>Somewhat higher construction cost associated with Environmental Mitigation and Earthwork</li> <li>Existing Runway 1-19 length reduced to 4,800' for landings on Runways 1 and 19 and departures from Runway 1</li> <li>Higher biological impact on Redwood Creek and riparian habitat</li> </ul>	<ul style="list-style-type: none"> <li>Locates Runway 14 Threshold @ 900' further to NW</li> <li>Somewhat higher construction cost associated with Environmental Mitigation and Earthwork</li> <li>Existing Runway 1-19 length reduced to 4,802' for landings on Runways 1 and 19 and departures from Runway 1</li> <li>Higher biological impact on Redwood Creek and riparian habitat</li> </ul>	<ul style="list-style-type: none"> <li>Locates Runway 14 Threshold @ 900' further to NW</li> <li>Somewhat higher construction cost associated with Environmental Mitigation and Earthwork</li> <li>Locates Runway 1 Threshold @ 500' further to S</li> </ul>	<ul style="list-style-type: none"> <li>Increases emphasis on Runway 1-19 for "Large Aircraft" use, thus exposing areas to N &amp; S to increased overflight activity (including night operations)</li> <li>Locates Runway 1 Threshold @ 1,000' further to S</li> <li>Runway 1-19 is unlighted at present</li> <li>Runway 1-19 has no instrument approach capability at present</li> <li>Runway 1-19 is not the Airport's principal runway</li> <li>Somewhat high land acquisition and construction cost associated with need for tunnel or relocation of Laughlin Road</li> </ul>

Declared Distance Impacts												
	Runway 1		Runway 19		Runway 1		Runway 19		Runway 1		Runway 19	
TORA	5,002'	5,002'	5,000'	5,500'	5,002'	5,002'	6,000'	6,000'	6,200'	6,200'	6,200'	6,200'
TODA	5,002'	5,002'	5,000'	5,500'	5,002'	5,002'	6,000'	6,000'	6,200'	6,200'	6,200'	6,200'
ASDA	4,802'	5,002'	4,800'	5,000'	4,802'	5,002'	5,300'	6,000'	6,000'	6,000'	6,200'	6,200'
LDA	4,802'	4,802'	4,800'	4,800'	4,802'	4,802'	5,300'	5,300'	6,000'	6,000'	6,000'	6,000'

Off-Airport Impacts					
Minimum Fee-Simple Land Acquisition for Airport Use (Acres/Cost)	85 Acres / \$7,200,000	No additional land	No additional land	51 Acres / \$4,200,000	51 Acres / \$4,200,000
Single Family Residences	11	No additional land	No additional land	2	2
Development Costs					
Property Acquisition	\$7,200,000	No additional land	No additional land	\$4,200,000	\$4,200,000
Construction	\$2,300,000	\$5,200,000	\$4,800,000	\$8,300,000 (If Road)	\$4,000,000 (If Road) \$8,400,000 (If Tunnel)
Environmental Mitigation	?	+?+	+?+	?	?
<b>TOTALS</b>	<b>\$9,500,000 +</b>	<b>\$5,200,000 +</b>	<b>\$4,800,000 +</b>	<b>\$12,500,000 + (If Road)</b>	<b>\$8,200,000 + (If Road) \$12,600,000 + (If Tunnel)</b>

Note: All dimensions are approximate

**IFR (INSTRUMENT FLIGHT RULES)** Rules specified by the FAA for flight under weather conditions in which visual reference cannot be made to the ground and the pilot must rely on instruments to fly and navigate.  
**NAVAID (NAVIGATIONAL AID)** Any visual or electronic device (airborne or on the ground) that provides point-to-point guidance information or position data to pilots of aircraft in flight.  
**TORA (TAKEOFF RUN AVAILABLE)** The length of the runway declared available for satisfying takeoff run requirements. Takeoff run is the distance to accelerate from brake release to lift-off, plus safety factors.  
**TODA (TAKEOFF DISTANCE AVAILABLE)** The TORA plus the length of any remaining runway available for satisfying takeoff distance requirements. Obstacles in the departure area control the TODA length. The takeoff distance is the distance required to accelerate from brake release to the start of the takeoff climb, plus safety factors.  
**ASDA (ACCELERATE-STOP DISTANCE AVAILABLE)** The length of runway declared available and suitable for the acceleration and deceleration of an airplane aborting a takeoff.  
**LDA (LANDING DISTANCE AVAILABLE)** The length of runway declared available and suitable for satisfying landing distance requirements. The landing distance is measured from the runway threshold to the stop point, plus safety factors.

**TABLE IV-1**  
**Alternatives Comparison Summary**  
(Revised 4/11/07)