Aeronautical Analysis of Levee Options Adjacent to the San Rafael Airport

Prepared for
Marin County Department of Public Works

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INTRODUCTION

Marin County (County) is evaluating potential means of creating new tidal wetlands adjacent to the San Rafael Airport (CA35). Mead & Hunt, Inc. has been tasked with evaluating project alternatives from an aeronautical perspective. More specifically, the alternatives will be evaluated for consistency with Federal Aviation Administration (FAA) Advisory Circulars:

- 150/5300-13A, Change 1, Airfield Design
- 150/5200-33B, Hazardous Wildlife Attractants on or Near Airports

Three alternatives have been evaluated. Two alternatives are based upon preliminary engineering designs prepared by the Marin County Department of Public Works. The two designs are similar, except that in one (Option A) the outer bank of the new levee has a relatively steep slope (see Figure 1), while in the second (Option B) the outer bank has a shallow slope (see Figure 2). Based upon discussions with Public Works staff, Mead & Hunt created a third alternative that is a variation on Option A. This third alternative (Option C) shifts the location of the drainage ditch and adjacent levee as close to the runway end as possible while meeting FAA airfield design standards (see Figure 3).

BACKGROUND

CA35 is a privately-owned airport that is not open to the public. Pilots wishing to use CA35 must obtain permission from the owner before landing. As is common with private airports, this airport does not have an Airport Layout Plan on file with Caltrans Division of Aeronautics. The Division of Aeronautics is the agency that issues the permit that allows the airport to operate. Division of Aeronautics’ records indicate that CA35 was originally classified as a Basic Utility I airport. FAA Advisory Circular 150/5300-4, Utility Airports – Air Access to National Transportation Classification, since superseded, stated that:

This type of airport serves about 75 percent of the single-engine and small twin-engine airplanes used for personal and business purposes. Precision instrument approach operations are not usually anticipated. This airport is designed for small airplanes in Airport Design Group I.

Division of Aeronautics staff indicated that the airport permit for CA35 lists the runway length as 2,140 feet; measurements taken from Google Earth Pro are consistent with Division of Aeronautics records. CA35 has only visual approaches; no instrument approach procedures have been published for this airport, and no future instrument procedures are planned.

Under current FAA classifications CA35 would be in Runway Design Code A-I(small)-VIS. FAA standards for Runway Design Code A-I(small)-VIS have been used in this analysis.

CONSISTENCY WITH AIRPORT DESIGN STANDARDS

RELEVANT AIRPORT DESIGN STANDARDS

The airport design standards applicable to airports in California are those published by the FAA. The State of California does not have standards of its own; therefore, the three design options in this analysis have been evaluated for consistency with the FAA design and clearance standards. The options will be evaluated for consistency with standards for: runway safety area, runway object free area, runway obstacle free zone, runway protection zone, and runway approach surface. These terms are defined below using...

- **Runway safety area (RSA):** A defined surface surrounding the runway prepared or suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway. RSA’s must be:
  - Cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations.
  - Drained by grading or storm sewers to prevent water accumulation.
  - Capable, under dry conditions, of supporting snow removal equipment, Aircraft Rescue and Fire Fighting (ARFF) equipment, and the occasional passage of aircraft without causing damage to the aircraft.
  - Free of objects, except for objects that need to be located in the RSA because of their function.

  At CA35, the RSA should be 120 feet wide, centered on the runway, and extend 240 feet beyond the runway end.

- **Runway object free area (ROFA):** The ROFA clearing standard requires clearing the ROFA of above-ground objects protruding above the nearest point of the RSA. Objects non-essential for air navigation or aircraft ground maneuvering purposes must not be placed in the ROFA. This includes parked aircraft and agricultural operations. At CA35 the ROFA should be 250 feet in width and extend 240 feet beyond the runway end.

- **Runway obstacle free zone (ROFZ):** The ROFZ clearing standard precludes aircraft and other object penetrations, except for frangible navigational aids (NAVAIDs) that need to be located in the OFZ because of their function. The ROFZ is a defined volume of airspace centered above the runway centerline, above a surface whose elevation at any point is the same as the elevation of the nearest point on the runway centerline. The ROFZ at CA35 should extend 200 feet beyond each end of the runway and should be 250 feet wide.

- **Runway Protection Zone (RPZ):** The RPZ is an area at ground level prior to the threshold or beyond the runway end to enhance the safety and protection of people and property on the ground by excluding incompatible uses. Incompatible uses include any use that involves the presence of people for more than a brief period. It is also desirable to clear the entire RPZ of all above ground objects. An RPZ begins 200 feet beyond the runway end. This trapezoidal surface is 250 feet wide at the end near the runway, 1,000 feet long, and 450 feet wide at its outer end.

- **Runway approach surface:** The approach surface is one of the airspace surfaces defined to identify areas that should be kept free from obstructions. It is considered the critical airspace surface to protect. The approach starts 200 feet beyond the runway end; the runway end is 250 feet wide. This trapezoidal surface is 5,000 long and 1,250 feet wide at its outer end. It has a 20:1 slope (i.e., 20-foot run with a 1-foot rise).

**CONSISTENCY WITH AIRPORT DESIGN STANDARDS**

**Option A**

Option A would meet standards for all five of the airfield standards: RSA ROFA, ROFZ, RPZ, and approach surface. While not required, it would be desirable to place the portion of the drainage ditch that lies beyond the RSA in a pipe and cover the ditch. This would increase safety in the event of a short landing or overrun during take-off. Although it meets standards, an earth berm (i.e., the levee) is not a desirable feature near the runway end.
Option B
The airfield side of the levee Option B is the same as Option A; therefore, it would also meet standards for all five of the airfield standards: RSA ROFA, ROFZ, RPZ, and approach surface. Similarly, while not required, it would be desirable to place the portion of the drainage ditch that lies beyond the RSA in a pipe and cover the ditch. This would increase safety in the event of a short landing or overrun during take-off. Although it meets standards, an earth berm (i.e., the levee) is not a desirable feature near the runway end.

Option C
Option C was created to show an option that only meets FAA airfield design standards. The levee and associated ditch were shifted as close to the runway as possible. The controlling point was where the top of the levee meets the approach surface. This shift results in the levee moving 172 feet closer to the runway end. With this configuration, Option C will meet all five of the key FAA design standards: RSA ROFA, ROFZ, RPZ, and approach surface. To a greater degree than the other two options, it would be valuable to place that portion of the drainage ditch that lies beyond the RSA in a pipe and cover the ditch.

POTENTIALLY HAZARDOUS WILDLIFE
OVERVIEW
Conflicts between aircraft and wildlife have occurred since the dawn of aviation. Orville Wright was the pilot associated with the first documented bird strike in 1905 during a flight over Dayton, Ohio. Data compiled by the FAA indicates that the number of conflicts between wildlife and aircraft has continued to increase since that time. Reasons for this increase include:

- The use of faster and quieter jet airliners.
- A general increase in air traffic.
- Increases in wildlife populations and their adaptation to urban areas.

Wildlife strike database records indicate that most wildlife strikes occurred in the immediate airport vicinity during aircraft approach or departure. More than 70% of all wildlife strikes occur at altitudes of less than 500 feet above ground level (AGL).

Data on Wildlife Hazards
Wildlife hazard data is not available for CA35; however, a Wildlife Hazard Assessment Report (WHA) was prepared for Marin County Airport/Gnoss Field in 2016 and accepted by the FAA. Gnoss Field is located approximately 9 miles from CA35 and is also adjacent to tidal marshes and tributaries of the San Pablo Bay. Based on their proximity to one another and adjacency to tidal waters, it is anticipated that similar species and conditions would be present at CA35.

To develop the WHA, the County undertook 28 field surveys during a 12-month period from 2015 to 2016.

- Nearly 20,000 individual birds were observed during field surveys conducted during the 12-month monitoring period.
- Approximately 44% of the avian wildlife were directly associated with the presence of adjacent open water (i.e., waterfowl, shorebirds, and gulls/terns), and all were identified as posing a critical hazard to aircraft operations.
- Of the 25 species/groups of species that FAA identifies as most hazardous to aircraft operations, 22 were observed at Gnoss Field.
Waterfowl and shorebirds pose one of the most serious threats to aircraft operations because of their abundance, size, and flocking behavior. Waterfowl, shorebirds, and gulls/terns are attracted to open water, marshes, wetlands, and ponds and basins to feed, nest, loaf, and escape predators.

Wildlife Hazard Guidance
The FAA provides guidance on wildlife and wildlife hazard management in Advisory Circular 150/5200-33B, *Hazardous Wildlife Attractants on or Near Airports*. Key elements pertinent to this analysis include:

- **Critical Area for Wildlife Hazards.** The FAA recommends a separation of 5,000 feet between airports serving piston-powered aircraft and potential wildlife attractants. A 5-mile separation is recommended for areas within aircraft approach/departure corridors.

- **Open water features/artificial marshes.** The FAA strongly discourages the creation of open water facilities or artificial marshes within the recommended separation distances.

- **Mitigation projects.** Wetland mitigation projects that may attract hazardous wildlife should be sited outside of the wildlife hazard critical zone as identified above. The FAA explicitly directs this policy at both airport-generated and non-airport mitigation projects.

Wildlife are attracted to areas that provide food, water, or shelter. To discourage wildlife from open water areas, the FAA recommends the use of steep-sided, narrow, rip-rap lined, linearly shaped water detention basins. Such features reduce the extent of open water visible to wildlife and discourage wildlife because they do not provide habitat or opportunities for foraging, nesting, and loafing.

Evaluation of Levee Options
All three levee designs are undesirable because they would create a hazardous wildlife attractant within the Runway 22 RPZ. FAA data indicate that most wildlife strikes occur at low altitudes during takeoff and landing cycles. If implemented, aircraft passing over the proposed project site would be traveling slowly and at low altitudes. If a strike were to occur, the pilot would have a limited ability to recover. The proposed restoration area within the RPZ are likely to attract waterfowl and shorebirds, which are known to pose hazards to aircraft operations. Moreover, any option that would create open water, wetland habitat, and potential wildlife closer to aircraft operations is inconsistent with FAA policy.

The levee options were considered using the criteria set forth in FAA Advisory Circulars 150/5300-13A and 150/5200-33B:

- **Option B** is the least desirable alternative because the shallower gradient increases habitat for foraging and loafing. The gradient provides a greater variety of habitat which will serve a wider variety of animals than the existing mixed scrub. This will expand the mix of birds attracted to the site.

- **Option C** has slightly less undesirable characteristics than Option B. It provides a steep-sided levee that could be less attractive than the shallow gradient in Option B; however, Option C would provide a comparatively greater amount of new tidal marsh area than in Option B. The proposed levee breach would create a two-sided interface between wetland and upland; both sides of the levee in the breached area would now provide this attractive transition area. The amount of the additional transition area would be larger than in Option A.

- **Option A** is similar to Option C in that it would provide a steep-sided levee. It would also create the least amount of tidal marsh. It would create less wetland-upland interface than Option C. Nevertheless, this option would create undesirable habitat within the RPZ.
FAA wildlife hazard criteria would find all three options undesirable. Wildlife attractants are not recommended FAA’s critical zone for wildlife hazards. The construction of a tidal restoration area will be attractive to waterfowl, shorebirds, gulls, and other wildlife that are known to pose hazards to aircraft operations. This would increase risks to the safety of air travelers and those on the ground.

CONCLUSIONS

Based upon the analyses in the report, we conclude that each of the options would meet FAA airfield design standards; however, all three of the options would pose a safety hazard to aircraft operations at the San Rafael Airport. If Marin County decides to pursue any of these options, we recommend that its staff discuss the project with the staff of the California Division of Aeronautics. That agency would be a likely commenter on any environmental documents prepared for this project. It would be useful to obtain their staff’s views in advance of a formal comment process.