

## Planning Memorandum:

To: Renton Airport Advisory Committee (RAAC)

From: Airport Staff and Consultant Team

Date: August 12<sup>th</sup>, 2015

Re: Runway Safety Area (RSA) Alternatives Analysis

### Introduction.

The purpose of this planning memorandum is to present preliminary runway safety area (RSA) concepts and alternatives for Renton Municipal Airport. As described in Chapter C, the RSA is a cleared and graded area surrounding the runway capable of supporting aircraft and/or emergency equipment. Also, the dimensions of the RSA increase with the Runway Design Code (RDC) upgrade and according to FAA guidance, the RSA must be met and cannot be modified. This memo focuses on the RSA and future memos and/or chapters will be prepared that identify other issues to be addressed in the Master Plan.

Included in this memo are the fundamental reasoning or assumptions that are driving the planning process. The information in this memorandum will serve as input to the Alternatives chapter of the Airport Master Plan which provides a description of the various factors and influences which form the basis for the recommended long-term development program for the Airport.

Factors considered are the role of the Airport, the role of the Renton Airport Advisory Committee (RAAC) and the 2012 Sustainability Management Plan (SMP), as well as input received to date during this planning process. Several basic assumptions have been established that are intended to direct the future development of the Renton Municipal Airport, including:

**Assumption One.** The Airport will continue to serve as a reliever airport that accommodates primarily general aviation activity, as well as a small amount of military activity, and Boeing 737 manufacturing related activity.

**Assumption Two.** The Airport will be developed and operated in a manner that is consistent with local ordinances and codes, federal and state statutes, federal grant assurances, and Federal Aviation Administration (FAA) regulations.

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**Assumption Three.** This assumption relates to the critical aircraft size and type that use the Airport and the resulting setback and safety criteria that is used as the basis for the layout of airport facilities. The critical aircraft for each runway and taxiway facility at Renton Municipal Airport are as follows:

*Runway 16/34.* The critical aircraft for Runway 16/34 is a combination of the Lear 45 for approach speed (Approach Category D), and the Boeing 737 for wingspan (Design Group III) resulting in a Runway Design Code (RDC) of D-III.

*Parallel Taxiway A and Connector Taxiways A1 through A6.* The critical aircraft types for taxiway design are based on wheelbase and wingspan. For planning purposes, the King Air 200, (TDG 2, ADG II), is the critical aircraft type for these taxiways.

*Parallel Taxiways A and B (Portions serving Boeing ramps).* For planning purposes, the Boeing 737 (TDG 3, ADG III) is the critical aircraft type for these taxiways.

*Parallel Taxiway B and Connector Taxiways B6 through B3.* For planning purposes, the Beechcraft Bonanza (TDG 1B, ADG I) is the critical aircraft type for these taxiways.

**Assumption Four.** The runway at Renton Municipal Airport has an existing available takeoff length (published accelerate stop distance or ASDA) of 5,042 feet for takeoff to the north, and 5,082 feet for takeoff to the south and an available landing length of 4,742 feet in both directions. These takeoff and landing lengths must be maintained to appropriately accommodate the critical aircraft types (e.g. corporate jets, large turboprops and 737's, etc.).

**Assumption Five.** Because the amount of landside development area at Renton Municipal Airport is at a premium, the fifth assumption is that the plan for future airport development should strive to make most efficient use of the available are for aviation-related activities, with a focus on accommodating required general aviation aircraft storage.

**Assumption Six.** The Airport is to be developed to complement and enhance on-airport and off-airport regional economic development activities in accordance with the economic growth goals of the Airport and the City of Renton.

**Assumption Seven.** The next assumption considers the relationship to off-airport land uses and the compatible and complementary development of each. This is inherent in the design considerations and placement of facilities so as to complement, to the maximum extent possible, off-airport development, and to ensure the continued compatibility of surrounding land uses with the daily operation of the Airport.

**Assumption Eight.** Where possible, the goals and objectives of the Sustainability Management Plan (SMP) will be used to connect possible screening criteria and metrics for the alternatives under consideration in this Airport Master Plan.

# Master Plan

## Goals for Development

In developing the master plan assumptions, it became clear that they are study goals which connect will with other goals and objectives established by the Airport. During the recently completed SMP, the Airport worked with the RAAC to establish a series of sustainability goals. Those goals connect will with the master plan study assumptions. The goals of the SMP are for the Airport to become more financially viable, operationally efficient, while conserving natural resources, and being socially responsible. Specific categories and goals outlined in the Airport's SMP include:

### 1- Airport Finance

- a. Providing an economically stable asset that contributes to the community; and,
- b. Balance expenditures with revenue to remain financially self-sufficient in the long- term.
- c. Improve revenue to provide for future development opportunities.
- d. Provide financial capacity that will enable the Airport to pursue sustainability initiatives in the future.

### 2- Airport and Local Economic Values

- a. Attract airport tenants and aircraft operations that add economic value to the local economy.
- b. Continuously improve as a tier one supplier for Boeing aircraft manufacturing.
- c. Diversify tenants and aviation services for land and sea based operations.
- d. Increase employment.

### 3- Community Outreach and Education

- a. Continuously improve the airport's relations with the surrounding neighborhoods and with airport tenants.
- b. Raise community awareness of airport services and value to regional employment.

### 4- Energy Consumption /Greenhouse Gases

- a. Reduce energy consumption without adversely affecting the Airport or its tenants.
- b. Reduce Airport owned greenhouse gas emissions.

### 5- Noise from Aircraft Operations

- a. Maintain 65 DNL noise contour on airport property.
- b. Minimize aircraft noise over neighborhoods.

### 6- Operations, Maintenance, Capital Improvements of Airport Facilities

- a. Maintain a safe airport on a daily basis.
- b. Maintain airport and seaplane infrastructure in good condition.

### 7- Water Quality

- a. Reduce stormwater runoff quantity.
- b. Improve stormwater quality.

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## Alternatives Screening Criteria

The sustainability goals listed above were reviewed for applicability to the alternatives development process and how they could be coupled with the assumptions to create a list of initial screening criteria that are consistent with these sustainability goals and assumptions. The list included in the following table, *POTENTIAL RSA ALTERNATIVES SCREENING CRITERIA* is only an initial list and the consultant team will be working with the RAAC and the City to refine and expand this list over the coming months. The criteria also fit into the Airport Council International-North America’s (ACI-NA’s) definition of sustainability which includes Economic, Operational, Natural resources, and Social (EONS).

Table D1 **POTENTIAL RSA ALTERNATIVES SCREENING CRITERIA**

EONS Category	Screening Criteria	SMP Goal/Objective from SMP (see page 3)
(E) Economic	Construction cost	1-b/c/d
(E) Economic	Land acquisition cost	1-b/c/d
(O) Operational	Effect on Airport operations	2-a/b/c/d
(O) Operational	Land acquisition requirements	3-a
(O) Operational	Safety/RSA standards	6-a
(O) Operational	Safety/RPZ standards	6-a
(O) Operational	Road closures/relocation	3-a
(O) Operational	Seaplane pull out/dock impacts	6-b
(N) Natural resources	Energy	4-a
(N) Natural resources	Impervious surface/Fill into Waters of US	7-a/b
(S) Social	Subsistence resource impacts	3-a
(S) Social	Displacement of businesses/residences	3
(S) Social	Noise change	3
(S) Social	Recreation/parks	3-a

SOURCE: Mead & Hunt and Synergy Consultants.

The sections below include a description of each alternative, as well as a discussion of the positive and negative effects of the alternatives.

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## Runway Safety Area (RSA) Alternatives

As described in the previous chapter, FAA guidance states that RSA standards must be met and cannot be modified. To best meet RSA standards at Renton Municipal Airport through the year 2035, several fundamental development considerations have been identified. These fundamental development considerations are identified below, along with an analysis of potential RSA alternative options associated with each consideration.

Because all airport functions relate to and revolve around the basic runway layout, runway development alternatives (in this case RSA alternatives) must first be carefully examined and evaluated to meet standards and operational necessity. Specific considerations include runway capacity, runway length, as well as runway orientation and approach protection criteria needed to support forecast use through the planning period. The dimensional criteria associated with the RSA off each end of Runway 16/34, as described in the previous chapter, are 1,000 feet long by 500 feet wide for aircraft overrun protection and 600 feet long by 500 feet wide for aircraft undershoot protection. In other words, more cleared and graded area is required off each end of the runway to support an aircraft overrun than what is required prior to the landing threshold for an aircraft that potentially lands short. This is important at Renton Municipal Airport given the existing displaced thresholds and published declared distances.

FAA Order 5200.8 Runway Safety Area Program states that following a determination that RSA is deficient at an airport, the first alternative to be considered in every case is constructing the traditional graded area surrounding the runway. Should it be determined that traditional graded RSA is not feasible, the following alternatives should be considered and addressed in the supporting documentation:

- a. Relocation, shifting, or realignment of the runway.
- b. Reduction in runway length where the existing runway length exceeds that which is required for the design aircraft,
- c. A combination of runway relocation, shifting, grading, realignment or reduction,
- d. Declared distances,
- e. Engineered Materials Arresting Systems (EMAS).

The runway length analysis conducted as part of this Airport Master Plan has determined that a reduction in runway length is not feasible. Consequently option b. from the above list is not applicable. Also, due to surrounding terrain and the proximity of the Cedar River, realignment of the runway is also not feasible.

Within the context of “a” through “e” above, the following RSA alternatives have been identified:

- Alternative 1: Traditionally Graded RSA
- Alternative 2: Declared Distances w/South Shift
- Alternative 3: Declared Distances w/North Shift
- Alternative 4: Engineered Materials Arresting System (EMAS) w/South Shift
- Alternative 5: EMAS w/North Shift

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## Alternative 1 – Traditional Graded RSA

As explained in the previous chapter, the Airport does not meet dimensional criteria standards for RSA with the upgrade to RDC D-III (laterally and off the ends of the runway) due to increased use of the airport by the critical aircraft types. FAA Order 5200.8 *Runway Safety Area Program* states that following a determination that RSA is deficient at an airport, the first alternative to be considered in every case is constructing the traditional graded area surrounding the runway. Then, where it is not practicable to obtain the entire safety area in this manner, as much as possible should be obtained.

Given the proximity of Lake Washington to the north, Airport Way and urban development to the south and the Cedar River to the east, it is likely not practicable to obtain traditional graded RSA. FAA Order 5200.9, *Financial Feasibility and Equivalency of Runway Safety Area Improvements and Engineered Material Arresting Systems* defines practicable. In this case, according to charts in the order, the practicability threshold would be approximately \$25.5 Million. This threshold will need to be confirmed by FAA.

However, for comparative purposes this alternative was developed and a cost estimate conducted that identifies both the amount of land acquisition that would be required as well as the amount of fill material that would need to be placed in Lake Washington in order to achieve traditional graded RSA at the Airport. The lateral RSA associated with the penetration by the Cedar River is addressed in all five alternatives by realigning the river channel and relocating/reconstruction the north bridge.

Alternative One also includes the relocation of Airport Way to approximately the location of Tobin Street and the associated relocation of Perimeter Road. This alternative would require that the Airport acquire approximately 51 parcels of land consisting of 27.3 total acres and a total assessed value of \$23.4 million. Also, this alternative would require the acquisition of 8.3 acres within Lake Washington.

### Alternative 1 – Traditional Graded RSA

- Runway 16/34 would be maintained in its existing configuration with the existing 300' displaced threshold at the north end and the existing 340' displaced threshold at the south end.
- The Airport's existing published declared distances would remain the same.
- Fill material to construct a land mass approximately 500 feet wide and 700 feet long would be placed in Lake Washington at the north end of the runway to achieve a standard RSA.
- The existing seaplane pullout and dock would be relocated outside of the RSA.
- The airport boundary line to the south would need to be expanded to allow for construction of traditional graded RSA as well as the relocation of both Perimeter Road and Airport Way.
- Approximately 22 residential properties would need to be acquired and relocated in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act) of 1970.
- Approximately 19 commercial properties would need to be acquired and relocated in accordance with the Uniform Act.
- The location of the existing approach and departure RPZs at both ends of the runway would remain the same.

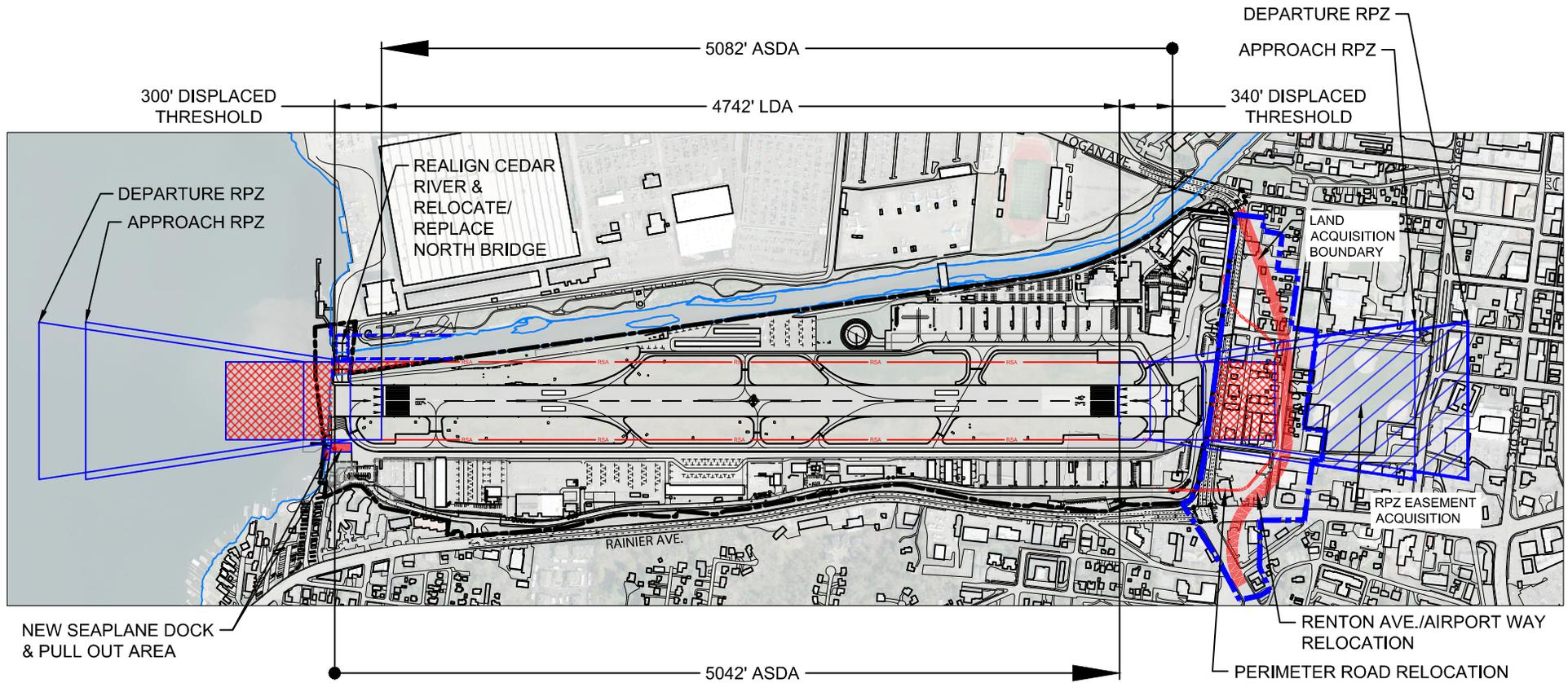
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## Positive Qualities of Alternative 1

- Would fully comply with FAA design standards for RDC D-III RSA both off the runway ends and laterally.
- Would enhance safety by providing appropriate undershoot protection for aircraft that land short and appropriate overrun protection for aircraft that run past the end of the runway during landing or takeoff operations.
- Would maintain existing runway length.
- Would provide approximately 4.2 acres of additional landside developable property that could assist with long-term airport financial self-sufficiency.
- Would not require the construction of additional runway or taxiway pavement.
- Would maintain Airport Way which serves as a principal arterial roadway for the City of Renton.
- Would maintain access from the Boeing north bridge across the runway to Taxiway A.

## Negative Qualities of Alternative 1

- Would require land acquisition of 27.3 acres of land as well as the acquisition and relocation of 19 commercial properties and 22 residential properties at a cost of approximately \$23.4 Million.
- Has the potential for community disruption through the relocation of Airport Way which serves as a principal arterial roadway for the City of Renton.
- May also require the acquisition of 11.6 acres (fee simple or RPZ easements) of land from Renton High School for RPZ land.
- May also require the acquisition of 9.5 acres (fee simple or RPZ easement) of commercial and residential land uses in the RPZ.
- Would require fill into Waters of the U.S.
- Would impact seaplane activity and seaplane access to the Airport from Lake Washington.
- Would require the relocation of the Cedar River channel and reconstruction of the flood protection berm.
- Would require the relocation/replacement of the north bridge which was just replaced in 2014.



**Disclaimer:**

This illustration is for study purposes only, based on national FAA standards, and is not necessarily intended for implementation. For further information please see Chapter D of the Airport Master Plan and the FAQ document on the Airport's website.

**LEGEND**

- FUTURE RUNWAY PAVEMENT
- FUTURE TAXIWAY PAVEMENT
- FUTURE ROADWAY ALIGNMENT
- FUTURE RUNWAY SAFETY AREA (RSA) EXPANSION
- FUTURE RUNWAY PROTECTION ZONE (RPZ) EASEMENT
- FUTURE ENGINEERED MATERIAL ARRESTING SYSTEM (EMAS)



FIGURE D1 **Alternative 1 - Traditional Graded RSA**

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## Alternative 2 – Declared Distances w/South Shift

Alternative Two would shift the runway to the south by 700 feet and utilize declared distances to maintain takeoff runway length (shown as Accelerate Stop Distance or ASDA on the following illustration) and landing runway length (shown as Landing Distance Available or LDA on the following illustration). Declared distances are the distances that the airport owner declares available for a turbine powered aircraft's takeoff run, takeoff distance, accelerate-stop distance and landing distance requirements.

Extensions of both parallel taxiways (Taxiways A and B) would also be required as well as connector taxiways to the future Runway 34 threshold. In accordance with the southern shift of both the landing and takeoff thresholds, the approach and departure RPZs at the south end of the Airport would also shift south and encompass additional incompatible land uses south of both 2<sup>nd</sup> and 3<sup>rd</sup> Streets.

Alternative Two would also include a proposed tunnel for approximately 900 feet of Airport Way as it is not feasible to realign Airport Way in this alternative. Finally, this alternative would require that the Airport acquire approximately 49 parcels of land consisting of 24.6 total acres and a total assessed value of \$20.4 million.

### Alternative 2 – Declared Distances w/South Shift

- Runway 16/34 would be shifted approximately 700 feet to the south with changes to the existing declared distances. The LDA is maintained at 4,750 in both directions while ASDA is 5,082 for takeoff to the north and 5,350 for takeoff to the south.
- The displaced threshold at the north end would increase from 300 feet to 600 feet.
- The displaced threshold at the south end would decrease slightly from 340 feet to 332 feet.
- Airport Way would be tunneled under the shifted runway as it is not considered feasible to relocate airport way around the RSA.
- A portion of both Tillicum Street and S. Tobin Street would be closed.
- The existing seaplane pull out and dock would be relocated outside of the RSA.
- The airport boundary line to the south would be expanded to allow for the runway shift.
- Approximately 21 residential properties would be acquired and relocated in accordance with the Uniform Act.
- Approximately 20 commercial properties would be acquired and relocated in accordance with the Uniform Act.
- The location of the approach and departure RPZs at the south end of the runway would shift to the south in accordance with the runway shift.

### Positive Qualities of Alternative 2

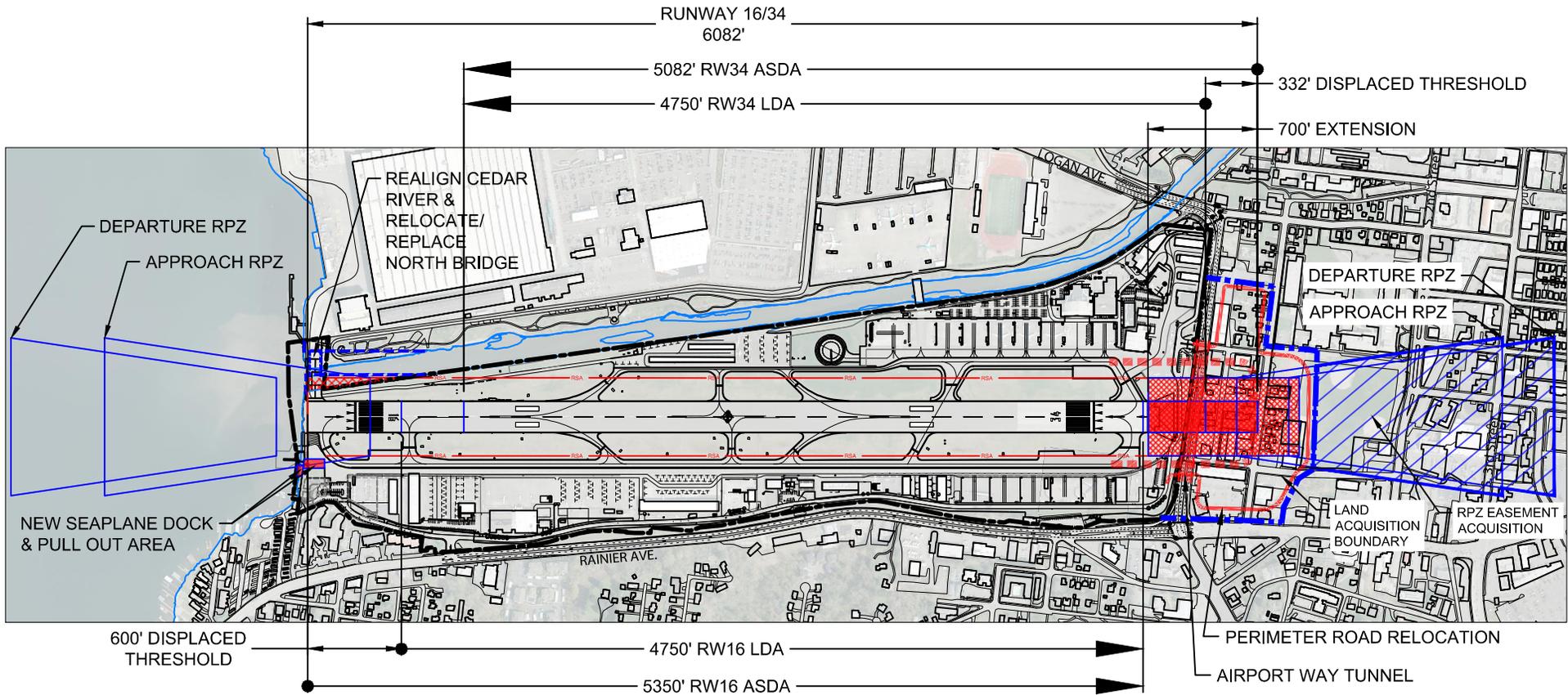
- Would fully comply with FAA design standards for RDC D-III RSA.
- Would enhance safety by providing appropriate undershoot protection for aircraft that land short and appropriate overrun protection for aircraft that run past the end of the runway during landing or takeoff operations.
- Would maintain existing runway length (LDA and ASDA)
- Would provide approximately 1.5 acres of additional landside developable property that could assist with long-term airport financial self-sufficiency.
- Would avoid impacting Lake Washington and associated environmental impact.

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- Would maintain Airport Way which serves as a principal arterial roadway for the City of Renton.
- Would maintain access from the Boeing north bridge across the runway to Taxiway A.

### Negative Qualities of Alternative 2

- Would require land acquisition of 24.6 acres as well as the acquisition and relocation of 20 commercial properties and 21 residential properties at a cost of approximately \$20.4 million.
- Would require the relocation of the Cedar River channel and reconstruction of the flood protection berm.
- Would have the potential for significant community disruption during construction and due to the closure of roads and expansion of the airport property boundary to the south.
- Would impact seaplane activity and seaplane access to the Airport from Lake Washington.
- Significant RPZ shifts to the south and would introduce of a number of additional incompatible land uses in both the approach and departure RPZs at the south end of the Airport.
- May also require the acquisition of 8.7 acres of land (fee simple or RPZ easements) from Renton High School for RPZ land.
- May also require the acquisition of 24.6 acres (fee simple or RPZ easements) of commercial and residential land uses in the RPZ.
- Would likely shift the noise contour to the south.



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FIGURE D2 **Alternative 2 - Declared Distances w/ South Shift**

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## Alternative 3 – Declared Distances w/North Shift

Alternative Three would shift the runway to the north by 660 feet and utilizes declared distances to maintain takeoff runway length shown as ASDA on the following illustration) and landing runway length (shown as LDA on the following illustration). An extension of Taxiway A would also be required as well as a connector taxiway to the future Runway 16 threshold. In accordance with the northern shift of both the landing and takeoff thresholds, the approach and departure RPZ would also shift north; however, this the RPZ would be entirely located over Lake Washington and would not encompass incompatible land uses.

Alternative Three would include the placement of fill into Lake Washington capable to supporting full strength runway and taxiway pavement and would require the relocation of the seaplane pull out ramp and dock. Alternative Three would avoid all associated environmental and community impacts of expanding the airport boundary to the south as proposed in Alternatives One and Two. Finally, this alternative would require that the Airport acquire 12.7 acres (fee simple or easement) of property for construction purposes in Lake Washington.

### Alternative 3 – Declared Distances w/North Shift

- Runway 16/34 would be shifted approximately 660 feet to the north with changes to the existing declared distances. The LDA would be maintained at 4,750 in both directions while ASDA would be 5,350 for takeoff to the north and 5,042 for takeoff to the south.
- The displaced threshold at the north end would decrease slightly from 300 feet to 292 feet.
- The displaced threshold at the south end would increase from 340 feet to 632 feet.
- The existing seaplane pull out and dock would be relocated outside of the RSA.
- No residences or businesses would be acquired or relocated.
- The location of the approach and departure RPZs at the north end of the runway would shift to the north in accordance with the runway shift.

### Positive Qualities of Alternative 3

- Would fully comply with FAA design standards for RDC D-III RSA.
- Would enhance safety by providing appropriate undershoot protection for aircraft that land short and appropriate overrun protection for aircraft that run past the end of the runway during landing or takeoff operations.
- Would maintain existing runway length (LDA and ASDA).
- Would avoid the potential community and environmental impacts of expanding the airport boundary to the south.
- Would avoid the need to relocate or close roads south of the Airport.
- Would maintain Airport Way which serves as a principal arterial roadway for the City of Renton.
- Would maintain access from the Boeing north bridge across the runway to Taxiway A.

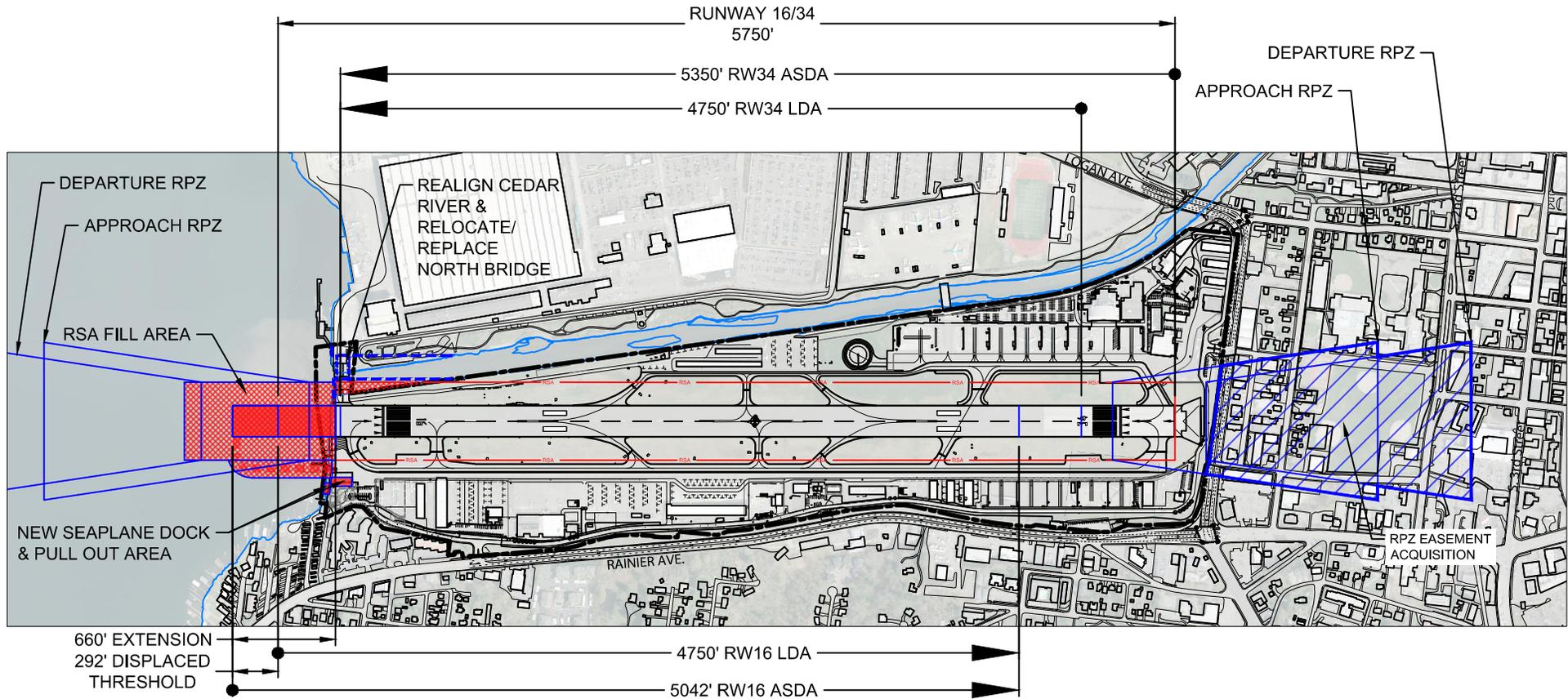
### Negative Qualities of Alternative 3

- Would require the placement of fill into Lake Washington.
- Of all the alternatives, would result in the largest impacts to Waters of the U.S.; has the potential for environmental impacts associated with Lake Washington.
- Would impact seaplane activity and seaplane access to the Airport from Lake Washington.
- May also require the acquisition of 12.5 acres of land from Renton High School for RPZ land.

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- May also require the acquisition of 20.7 acres of RPZ easements over commercial and residential land uses in the RPZ.
- Would require the relocation of the Cedar River channel and reconstruction of the flood protection berm.
- Would require the relocation/replacement of the north bridge which was just replaced in 2014.

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FIGURE D3 **Alternative 3 - Delcared Distances w/ North Shift**

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## Alternative 4 – EMAS w/South Shift

Alternative Four is essentially the same concept as Alternative Two with a south shift of the runway and declared distances. However, the difference in Alternative Four, relative to Alternative Two, is that EMAS beds are provided at each end to reduce the amount of land necessary to meet RSA standards. Alternative Four would shift the runway to the south by 242 feet and includes the placement of an EMAS bed (308 feet by 200 feet) at each runway end. At the north end of the runway, the EMAS bed must be placed such that access from the Boeing north bridge to Taxiway A is maintained. At the south end of the runway, the shift and EMAS bed placement would require the relocation of Perimeter Road and Airport Way. Extensions of both parallel Taxiways A and B would be required and the approach and departure RPZs at the south end would also shift south.

Alternative Four would also avoid impacts to Lake Washington to the north. Finally, this alternative would require that the Airport acquires approximately 46 parcels of land consisting of 24.9 total acres and a total assessed value of \$20 million.

### Alternative 4 – EMAS w/South Shift

- Runway 16/34 would be shifted approximately 242 feet to the south with changes to the existing declared distances. The LDA is increased to 4,909 in both directions while ASDA is 5,151 for takeoff in both directions.
- The displaced threshold at the north end would decrease from 300 feet to 242 feet.
- The displaced threshold at the south end would decrease from 340 feet to 245 feet.
- The existing seaplane pullout and dock would not be impacted.
- The airport boundary line to the south would be expanded to allow for the runway shift.
- Approximately 22 residential properties would be acquired and relocated in accordance with the Uniform Act.
- Approximately 18 commercial properties would be acquired and relocated in accordance with the Uniform Act.
- The location of the approach and departure RPZs at the south end of the runway would shift to the south in accordance with the runway shift.

### Positive Qualities of Alternative 4

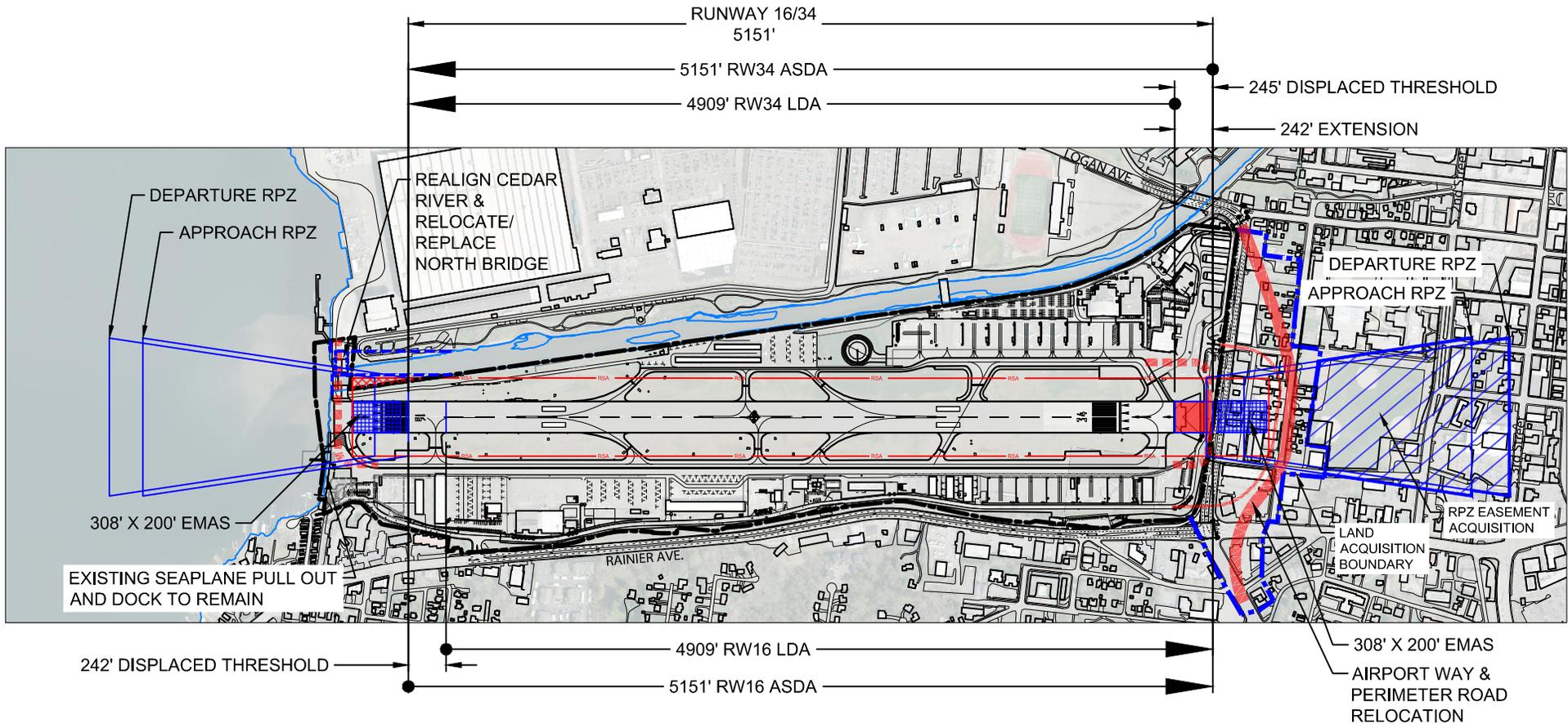
- Would fully comply with FAA design standards for RDC D-III RSA.
- Would enhance safety by providing appropriate undershoot protection for aircraft that land short and appropriate overrun protection for aircraft that run past the end of the runway during landing or takeoff operations.
- Would maintain existing runway length (LDA and ASDA).
- Would provide approximately 3.2 acres of additional landside developable property that could assist with long-term airport financial self-sufficiency.
- Would avoid impacting Lake Washington and associated environmental impacts.
- Would maintain Airport Way which serves as a principal arterial roadway for the City of Renton.
- Would maintain access from the Boeing north bridge across the runway to Taxiway A.
- Would not require the relocation of the existing seaplane pull out and dock.

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## Negative Qualities of Alternative 4

- Would require land acquisition of 24.9 acres as well as the acquisition and relocation of approximately 18 commercial properties and 22 residential properties at a cost of \$20 million.
- Would require the relocation of the Cedar River channel and reconstruction of the flood protection berm.
- Would have the potential for significant community disruption during construction and due to the closure of roads and expansion of the airport property boundary to the south.
- Significant RPZ shifts to the south and the associated introduction of a number of additional incompatible land uses in both the approach and departure RPZs.
- May also require the acquisition of 10.7 acres (fee simple or RPZ easements) of land from Renton High School for RPZ land.
- May also require the acquisition of 13.5 acres (fee simple or RPZ easements) of commercial and residential land uses in the RPZ.
- Annual maintenance requirements and costly replacement of EMAS blocks in the event that the blocks are damaged.
- Would likely shift the noise contour south by approximately 215 feet.
- Due to the geometric layout of the EMAS bed, there may be potential for EMAS bed damage from pilots unfamiliar with the airfield layout who inadvertently roll into the bed.

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FIGURE D4 **Alternative 4 - EMAS w/ South Shift**

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## Alternative 5 – EMAS w/North Shift

Alternative Five would also place EMAS beds at each end of the runway to meet RSA standards. However, in Alternative Five, the EMAS bed at the north end would be placed on a deck on pillars (approximately 500 foot wide by 325 foot long deck) while the EMAS bed at the south end would be placed on existing airport pavement.

Similar to Alternative Four, at the north end of the runway, the EMAS bed must be placed such that access from the Boeing north bridge to Taxiway A is maintained. At the south end of the runway, new connector taxiways to the Runway 34 threshold would be constructed providing access from Taxiways A and B.

Alternative Five would avoid community impacts to the south by not requiring land acquisition to the south or the acquisition of residences and businesses. Alternative Five would also avoid the need to relocate and/or close roads. This alternative would require the acquisition of 4.4 acres within Lake Washington.

### Alternative 5 – EMAS w/North Shift

- Runway 16/34 would be shifted slightly north with changes to the existing declared distances. The LDA is increased to 4,943 in both directions while ASDA is 5,170 for takeoff in both directions.
- The displaced threshold at the north end would decrease from 300 feet to 227 feet.
- The displaced threshold at the south end would decrease from 340 feet to 227 feet.
- The existing seaplane pull out and dock would be relocated.
- The airport boundary line to the north would be expanded by 4.4 acres.
- No residences or businesses would be acquired and relocated and no roads would be relocated, tunneled or closed.
- The location of the approach and departure RPZs at the south end of the runway would shift to the north in accordance with the Runway 34 threshold shift.

### Positive Qualities of Alternative 5

- Would fully comply with FAA design standards for RDC D-III RSA.
- Would enhance safety by providing appropriate undershoot protection for aircraft that land short and appropriate overrun protection for aircraft that run past the end of the runway during landing or takeoff operations.
- Would maintain existing runway length (LDA and ASDA).
- Would avoid the potential community and environmental impacts of expanding the airport boundary to the south.
- Would avoid the need to relocate or close roads south of the Airport.
- Would maintain Airport Way which serves as a principal arterial roadway for the City of Renton.
- Would maintain access from the Boeing north bridge across the runway to Taxiway A.
- Would shift RPZs at the south end of the Airport to the north and reduce amount of incompatible land uses located within the RPZs.
- Would require minimal construction of additional airfield pavement to construct new connector taxiways to the relocated Runway 34 threshold.

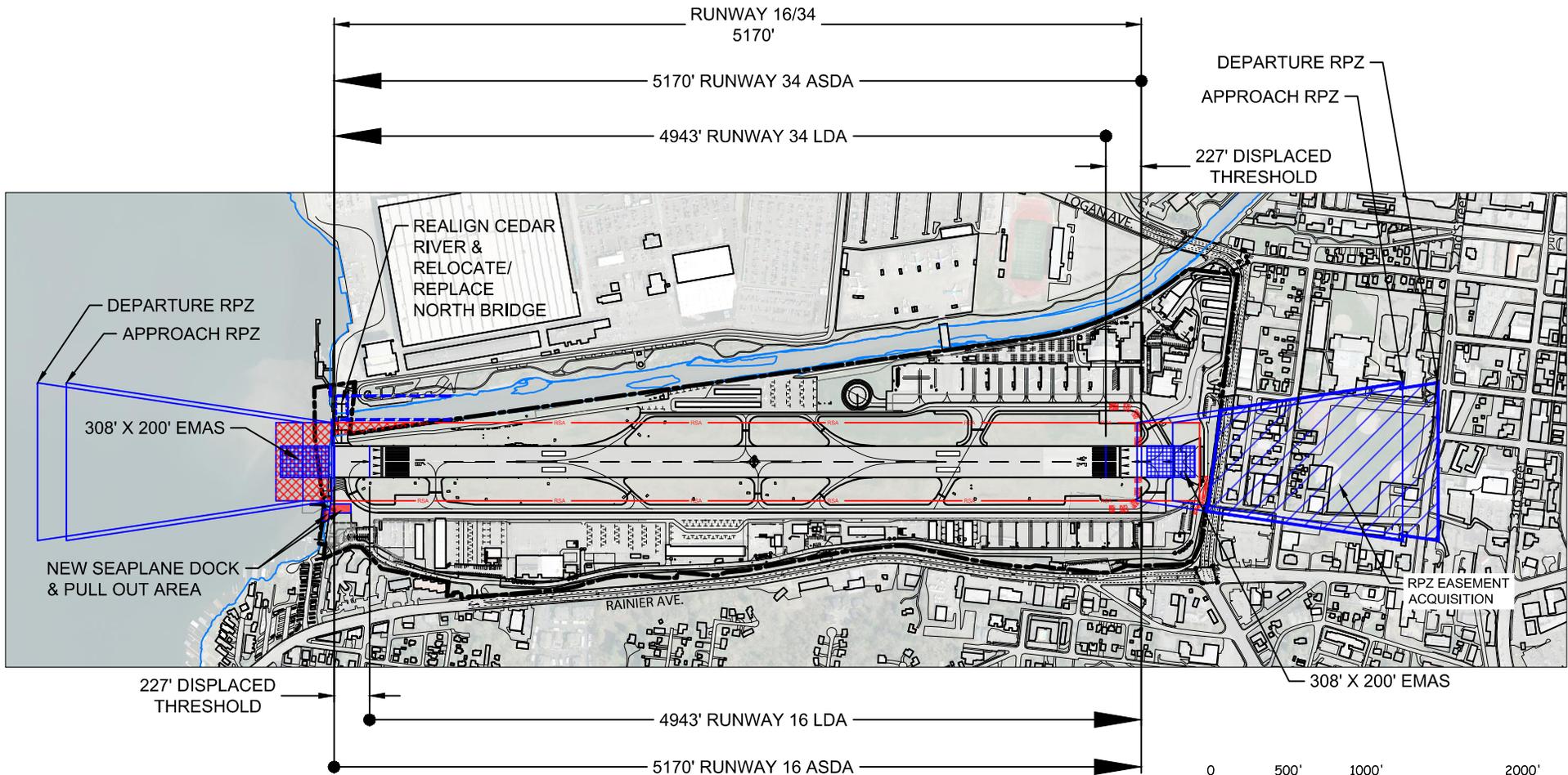
### Negative Qualities of Alternative 5

- Would require construction of a paved deck over Lake Washington.
- Would require the relocation of the Cedar River channel and reconstruction of the flood berm.

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- Would have the potential for environmental impacts associated with Lake Washington.
- Would impact seaplane activity and seaplane access to the Airport from Lake Washington.
- May also require the acquisition of 12.4 acres of land (fee simple or RPZ easements) of land from Renton High School for RPZ land.
- May also require the acquisition of 18.8 acres (fee simple or RPZ easements) of commercial and residential land uses in the RPZ.
- Annual maintenance requirements and costly replacement of EMAS blocks in the event that the blocks are damaged.

DRAFT



**Disclaimer:**  
 This illustration is for study purposes only, based on national FAA standards, and is not necessarily intended for implementation. For further information please see Chapter D of the Airport Master Plan and the FAQ document on the Airport's website.

- LEGEND**
- FUTURE RUNWAY PAVEMENT
  - FUTURE TAXIWAY PAVEMENT
  - FUTURE ROADWAY ALIGNMENT
  - FUTURE RUNWAY SAFETY AREA (RSA) EXPANSION
  - FUTURE RUNWAY PROTECTION ZONE (RPZ) EASEMENT
  - FUTURE ENGINEERED MATERIAL ARRESTING SYSTEM (EMAS)



FIGURE D5 **Alternative 5 - EMAS w/ North Shift**

# Master Plan

## RSA Alternatives Cost Comparison

Planning level cost estimates were completed for each of the RSA alternatives and the estimates are listed in the following table entitled *RSA ALTERNATIVES COST ESTIMATES* for comparison purposes. It is important to note that these cost estimates include only what is necessary to construct the alternative to meet FAA design standards for RSA. Additional costs that are not directly related to the purpose and need of meeting RSA standards, such as land acquisition costs or easement costs for RPZ purposes are not included.

Table D2, RSA ALTERNATIVES COST ESTIMATES

RSA Alternative	Land Acquisition Cost	Construction Cost	Total Cost
RSA Alternative 1 – Traditional Graded RSA	\$23,402,200	\$36,697,800	<b>\$60,100,000</b>
RSA Alternative 2 – Declared Distances w/South Shift	\$20,439,900	\$93,460,100	<b>\$113,900,000</b>
RSA Alternative 3 – Declared Distances w/North Shift	\$0 <sup>1</sup>	\$56,900,000	<b>\$56,900,000</b>
RSA Alternative 4 – EMAS w/South Shift	\$20,061,900	\$50,538,100	<b>\$70,600,000</b>
RSA Alternative 5 – EMAS w/North Shift	\$0 <sup>1</sup>	\$51,300,000	<b>\$51,300,000</b>

SOURCE: Mead & Hunt.

<sup>1</sup> Alternatives 3 and 5 may require property acquisition and/or a long term easement from the Washington Department of Natural Resources. Costs for such an acquisition are unknown at this time.

## RSA Alternatives Screening Analysis

The RSA Alternatives will be screened against a number of criteria as described previously in this planning memorandum. Some criteria include quantifiable metrics while other require professional judgment. The results of this analysis will be presented in a matrix type format following input and discussion from the RAAC.

## Summary

The information provide in this planning memorandum provides a description of preliminary alternatives for the purpose of meeting FAA design standards for RSA. The alternatives will be screened using standard master planning screening criteria as well as additional criteria developed using the goals established in the Airport’s SMP. Following RAAC and FAA review and comment, the alternatives as well as the screening criteria may be revised and republished in subsequent working papers or chapters of the Airport Master Plan.