

3 CHAPTER 3 ALTERNATIVES

This Chapter presents an objective examination of alternatives that meet the purpose and need for the Proposed Action, including the alternative to take no action. The intent of this evaluation is to ensure that all reasonable alternatives are evaluated as to the expected environmental effects and identify mitigation measures and unresolved conflicts, if any.

For airport actions taken under Federal Aviation Administration's (FAA) authority, Federal requirements specify that FAA will be the lead Federal agency responsible for evaluating reasonable alternatives in the environmental assessment, per the National Environmental Policy Act (NEPA).¹ Federal Aviation Administration (FAA) Order 1050.1E² and FAA Order 5050.4B³ establish the process for complying with these requirements.

3.1 IDENTIFICATION AND CONSOLIDATION OF ENVIRONMENTAL ASSESSMENT ALTERNATIVES

In order to comply with FAA requirements for evaluating reasonable alternatives, this Environmental Assessment (EA) uses alternatives analysis done as part of the Rocky Mountain Metropolitan Airport Master Plan Update (Master Plan),⁴ and gives consideration to a number of qualitative factors identified in the Master Plan formation. The Master Plan identified the nonstandard Runway Safety Area (RSA) condition for Runway 11L/29R and an extensive alternative analysis was conducted to determine a Preferred Alternative to remedy the problem. The resulting analysis will be used in this EA and has been evaluated in light of the purpose and need of the Proposed Action. The resulting analysis is described below.

3.2 PRELIMINARY EA ALTERNATIVES

The Airport undertook a Master Plan, beginning in 2009, to provide a comprehensive long-term assessment of the Airport's facilities. The Master Plan described infrastructure plans to meet projected future aviation demands and provided the framework needed to guide development at the Airport. The Master Plan also considered the potential environmental, financial, and socioeconomic impacts, while meeting all FAA requirements.

The Master Plan presented and analyzed an overall development and improvement plan for the Airport. This planning effort identified and evaluated long-range and near-term Airport development options that satisfied facility requirements, satisfied strategic objectives and goals of the Airport, and adhered to safe operational standards set by the FAA and the Airport. The Master Plan considered alternatives for multiple areas of the Airport, including those improvements necessary to meet FAA design standards, runway length requirements,

¹ U.S. Code. 1970. *National Environmental Policy Act of 1969*, 42 U.S.C. Subsection 4321.

² Federal Aviation Administration, Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, March 20, 2006.

³ Federal Aviation Administration, Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, April 26, 2006.

⁴ Rocky Mountain Metropolitan Airport, *Master Plan Update*, March 2011.

pavement condition, aircraft hold pad necessity, and upgrades to existing instrument approach procedures This EA considers specific Runway 11L/29R RSA alternatives identified in the Master Plan.

3.2.1 Master Plan Alternative Evaluation Process

The Master Plan alternatives evaluation process began with a broad group of alternatives that were progressively screened to produce reasonable alternatives that were responsive to Airport needs, while remaining fiscally and environmentally feasible. The evaluation was guided by a combination of general planning criteria and objectives. The following list of objectives was established for evaluation of the Master Plan alternatives:

- conforms to best practices for safety and security;
- conforms to the intent of applicable FAA design standards and other appropriate planning guidelines;⁵
- provides for the highest and best on- and off-airport land use;
- allows for forecast growth throughout and beyond the planning period;
- conforms to appropriate local, regional, and state transportation plans and other applicable plans;
- meets operational needs;
- provides for environmentally responsible development; and
- is financially feasible.

These guiding objectives were refined and applied to each Master Plan alternative. Specific criteria relate individually to each element and were tabulated to allow for quantitative analysis and ranking. The identification and analysis of Master Plan alternatives was divided into four main functional areas of the Airport:

- Airfield Development;
- Aircraft Facilities;
- Aviation Support Facilities; and
- Airport Access.

This EA is only concerned with Airfield Development alternatives and more specifically, the Master Plan Runway 11L/29R RSA alternatives.

3.2.2 Master Plan Runway 11L/29R RSA Alternatives

The first step to identify and refine the Master Plan Runway 11L/29R RSA alternatives, in addition to other airfield alternatives, was to conduct a charrette. A charrette is an intensive planning session where collaboration on a unified vision is conducted by the Airport, FAA, and RS&H staff. During the charrette, factors relating to airfield infrastructure limitations and the ability to meet the forecast aviation demand were considered and evaluated. Following this planning effort, the Airport used a public process to further gain insight from stakeholders in the development of alternatives. A Public Advisory Committee (PAC) and a Technical Advisory Committee (TAC) were established to ensure adequate input from subject area experts, airport users, local communities, and the public. One public workshop and six PAC and TAC meetings took place to enable input on the overall Master Plan alternatives, including specific Master Plan

⁵ Federal Aviation Administration, Advisory Circular 150/5300-13, *Airport Design*, current edition.

Runway 11L/29R RSA alternatives. Specific Master Plan Runway 11L/29R RSA Alternatives, labeled RSA Alternatives A1 – A6, are as follows:

- A1 - No Action;
- A2 - Maintain Existing Threshold;
- A3 - Reduce Runway Length;
- A4 - Displace Runway Threshold;
- A5 - Shift Runway to the East; and
- A6 - Install Engineered Materials Arresting System (EMAS).

Table 3-1 compares the Master Plan Runway 11L/29R RSA Alternatives as to their ability to meet the Master Plan criteria, the purpose and need analysis for the Proposed Action, and whether or not the alternative will be considered for further environmental analysis.

Table 3-1
MASTER PLAN RUNWAY 11L/29R RSA ALTERNATIVES CONSIDERED

Alternative	Meets Master Plan Criteria	Meets Purpose and Need	Advances for Further Analysis
A1 - No Action Alternative	No	No	Yes ^{/a/}
A2 - Maintain Existing Threshold	Yes	Yes	Yes
A3 - Reduce Runway Length	No	Yes	No
A4 - Displace Threshold	No	Yes	No
A5 - Shift Runway to the East	Yes	Yes	No
A6 - Install EMAS	Yes	Yes	No

/a/ NEPA requires the inclusion of the No Action Alternative

SOURCE: Rocky Mountain Metropolitan Airport, 2011.
PREPARED BY: RS&H, 2011

3.2.3 Summary of Master Plan Runway 11L/29R RSA Alternatives

3.2.3.1 No Action Alternative (A1)

This Master Plan Runway 11L/29R RSA Alternative would retain the current airfield configuration and the current operating procedures would be continued. The RSA dimensions for the departure end of Runway 29R would remain 600 feet beyond the end of pavement.

3.2.3.2 Maintain Existing Threshold (A2)

This Master Plan Runway 11L/29R RSA Alternative would require relocating the intersection of State Highway 128 and Interlocken Loop to accommodate a standard 1,000 foot RSA dimension beyond the departure end of Runway 29R.

Project elements for this Master Plan Runway 11L/29R RSA Alternative would be divided into both airside (within the Airport perimeter fence) and landside (outside the Airport perimeter fence). The airside project elements would include the relocation of the localizer antenna array, localizer equipment building, the Vehicle Service Road (VSR), and perimeter fencing at the departure end of Runway 29R. The landside project elements would include the relocation of the State Highway 128 and Interlocken Loop intersection, realignment of State Highway 128

and Interlocken Loop approaches to a relocated intersection, a bike/pedestrian trail, and all associated utilities.

3.2.3.3 Reduce Runway Length (A3)

This Master Plan Runway 11L/29R RSA Alternative would include reducing the Runway 11L/29R length by 400 feet resulting in an 8,600-foot Runway. This Master Plan Runway 11L/29R RSA alternative would require the removal of existing pavement at the departure end of Runway 29R and portions of Taxiways A and H. Connector Taxiway A-17, Taxiway H, Taxiway J, and the Runway Protection Zone (RPZ) for Runway 11L/29R would need to be relocated. Runway 11L/29R instrument approaches would also need to be modified.

All project elements with this Master Plan Runway 11L/29R RSA Alternative would occur within the existing airside boundaries of the Airport. This Master Plan Runway 11L/29R RSA Alternative would require the threshold of Runway 11L to be relocated 400 feet to the east of its current location. This action would be necessary in order to increase the RSA from 600 feet to 1,000 feet, and would require removal of approximately 113,000 square feet of Runway 11L/29R pavement. New taxiways would be required to reconnect Runway 11L/29R back to the taxiway system resulting in approximately 60,000 square feet of new pavement. The localizer antenna array and localizer equipment building would need to be relocated once the RSA extension would be completed.

3.2.3.4 Displace Threshold (A4)

This Master Plan Runway 11L/29R RSA Alternative would require reducing the landing distance by 400 feet on the Runway 29R departure end to accommodate a standard 1,000 foot RSA dimension off the departure end of Runway 29R. This Master Plan Runway 11L/29R RSA alternative would result in 8,600 feet available for takeoff and landing and would require the relocation of the existing RPZ and modification to the Runway 11L/29R instrument approaches.

All project elements with this Master Plan Runway 11L/29R RSA Alternative would occur within the existing property boundary of the Airport on the airside. The threshold of Runway 11L would be displaced 400 feet to the east of its current location in order to increase the RSA from 600 feet to 1,000 feet. The VSR would need to be constructed outside of the RSA in order to provide access to the Airport perimeter and the localizer equipment building. The localizer antenna array and localizer equipment building would need to be relocated once the RSA extension would be completed.

3.2.3.5 Shift Runway to the East (A5)

This Master Plan Runway 11L/29R RSA Alternative would require reducing the approach end of Runway 11L by 400 feet and adding 400 feet to the departure end of Runway 11L which would maintain the existing 9,000 foot runway length. This Master Plan Runway 11L/29R RSA Alternative would require modification to Runway 11L/29R instrument approaches, and would relocate airfield lighting, signage, and approach lighting.

All project elements with this Master Plan Runway 11L/29R RSA Alternative would occur within the existing property boundary of the Airport on the airside. The threshold of Runway 11L would be relocated 400 feet to the east of its current location to increase the RSA from 600 feet to 1,000 feet. Also, the VSR beyond both Runway 11L/29R thresholds would need to be constructed outside the RSA in order to provide roadway access to the perimeter and localizer equipment buildings. The localizer antenna array, localizer equipment building, and Taxiway A would need to be relocated once the RSA extension would be completed.

3.2.3.6 Install Engineered Materials Arresting System (EMAS) (A6)

This Master Plan Runway 11L/29R RSA Alternative would require installing an EMAS at the departure end of Runway 29R. EMAS, an FAA approved aircraft arresting system that uses porous cellular materials, is intended to stop aircraft that have overshot a runway. It is primarily feasible when there is insufficient distance for the standard 1,000 foot RSA dimension.

The EMAS consists of an arrestor material bed, anchor beam, and grooved pavement lead-in ramp. The arrestor bed features four foot by four foot cellular cement blocks adjusted in thickness to crush from the weight of aircraft. All project elements with this Master Plan Runway 11L/29R RSA Alternative would occur within the existing airside property boundary of the Airport. The airside components of this Master Plan Runway 11L/29R RSA Alternative would consist of the site preparation and installation of EMAS. The localizer antenna array, equipment building, and VSR to the localizer facilities would also have to be relocated.

3.2.4 Master Plan Runway 11L/29R RSA Alternatives Evaluation Criteria

Alternatives identified in the Master Plan had to:

- meet the facility demand requirements identified in the Facility Requirement analysis;
- satisfy the strategic objectives and goals of the Airports; and
- adhere to safety and operational standards set by FAA and the Airport.

In keeping with this criterion, the Master Plan used the following principals to evaluate Runway 11L/29R RSA alternatives. **Table 3-2** shows the Master Plan qualitative analysis for each of the Runway 11L/29R RSA based on the criteria discussed below.

3.2.4.1 Facility Requirements

In analyzing existing and future facility needs of the Airport, the Master Plan studied the ability of the Airport's current facilities to accommodate existing and forecast enplanements, operations, based aircraft and associated activity throughout the 20-year planning range. This analysis also considered the ability of airport facilities to meet FAA airport certification requirements and safety standards, as well as Jefferson County's strategic vision for the future of the Airport and the community it serves.

Each Master Plan Runway 11L/29R RSA Alternative was considered against current and future facility requirements. Each Alternative was evaluated against the Airport's ability to accommodate existing and future capacity levels, the impact of existing and future activity levels, and the impact of altering the physical characteristics of the Airport.

In particular, consideration was given to FAA RSA standards contained in FAA Advisory Circular (AC) 150/5300 and to the ability of Runway 11L/29R to meet the Airport Reference Code⁶ (ARC) C/D-III runway and RSA design criteria. Based on the aviation forecast, both the existing

⁶ The Airport Reference Code (ARC) is a coding system used by FAA to relate airport design criteria to the operational and physical characteristics of the aircraft intended to operate at the airport or on a specific runway. The ARC is defined by a letter designating the aircraft approach category, which relates to the approach speed of an aircraft, and a Roman numeral designating the design group, which refers to the wingspan and tail height.

and future critical aircraft anticipated to use Runway 11L/29R must comply with ARC C-III/D-III design standards contained in FAA AC 150/5300.

The Master Plan presents the forecast for total operations for the combined elements of commercial service operations, military operations, and general aviation operations. The forecast shows the following three scenarios for the 2030 forecast period:

- 2000 Master Plan Study;
- FAA Terminal Area Forecast; and
- 2011 Master Plan Update – high and low projections.

Based on the projections shown in **Appendix J, Aviation Forecast**, operations are expected to grow between one and two percent annually, corrected to use historical data for the base year. These scenarios are also dependent upon the expectation of relatively robust socioeconomic conditions to return to the region after the recession. As a result of future growth, the Airport must meet applicable FAA standards to accommodate ARC C-III/D-III design standards for existing and future critical aircraft. Critical aircraft for ARC C-III to D-III are also expected to increase at approximately the same growth rate as depicted in **Appendix J, Aviation Forecast**.

3.2.4.2 Environmental Considerations

Environmental factors were considered in the Master Plan to help the Airport thoroughly evaluate airport development alternatives and to provide information, and identify any needs or controversial issues that might affect future environmental reviews. A preliminary environmental analysis was based on the existing conditions at the Airport, as well as the immediate vicinity in which a Master Plan Runway 11L/29R RSA Alternative would potentially be impacted because impacts considered to be significant in environmental terms.

3.2.4.3 Feasibility

The Master Plan evaluated the feasibility of each Master Plan Runway 11L/29R RSA Alternative as it pertained to construction (including site preparation, utilities, phasing, and land acquisition) and the availability of funds was evaluated. Prior engineering and planning factors for each Master Plan Runway 11L/29R RSA Alternative was analyzed in order to determine potential impact. The financial costs associated with each of these alternatives was examined with a planning-level conceptual cost estimate.

3.2.4.4 User Friendliness

The Master Plan considered the ability of each Master Plan Runway 11L/29R RSA Alternative to meet the needs of Airport users, including commercial service providers and the General Aviation community.

3.3 ALTERNATIVES REFINEMENT FOR EA ANALYSIS

For the purpose of this EA, the Master Plan Runway 11L/29R RSA Alternatives were compared to the objectives of the Master Plan, FAA standards and the purpose and need of this EA. An

evaluation of each Master Plan Runway 11L/29R RSA alternative in respect to these criteria is discussed in this section.

3.3.1 No Action Alternative (A1)

This Master Plan Runway 11L/29R RSA Alternative would not satisfy the Master Plan Criteria because it does not correct the non-standard Runway 11L/29R RSA. Public Law 109-115 requires operators of airports certificated under 14 CFR Part 139 to comply with FAA RSA requirements by 2015.⁷ Without changing the current RSA dimensions of Runway 11L/29R, the Airport's RSA would only be able to serve ARC A/B aircraft to remain compliant with 14 CFR Part 139 RSA requirements. This limitation would require the Airport to stop serving air carrier passenger operations conducted in ARC C/D aircraft (this includes most air carrier aircraft with over 30 passenger seats). Also, the long term financial consequences of this alternative is that the Airport's ability to generate revenue will be severely limited if larger and heavy aircraft cannot operate at the Airport.

Accordingly, this alternative would not satisfy the criteria outlined in **Chapter 2, Purpose and Need** of the EA. However; FAA environmental policy and procedures requires further environmental analysis of the No Action alternative and this RSA alternative is analyzed further in **Chapter 5, Environmental Consequences**. This Alternative has no expected environmental impacts.

3.3.2 Maintain Existing Runway Threshold (A2)

This Master Plan Runway 11L/29R RSA Alternative would satisfy the Master Plan criteria because it corrects the non-standard Runway 11L/29R RSA dimensions, in accordance with Public Law 109-115 and 14 CFR Part 139. This Alternative would allow the Airport to continue to serve ARC C/D aircraft as it currently does. Further, this Alternative would allow the Airport to meet the demands of future aviation operations, as forecasted in the Master Plan. As such, this Alternative would satisfy the criteria outlined in **Chapter 2, Purpose and Need** of this EA.

While this Alternative is one of the mostly costly alternatives to implement, as discussed above, the long term financial consequences of this Alternative is that the Airport's ability to generate revenue would be severely limited if larger and heavy ARC C/D aircraft could not operate at the Airport.

For these reasons, this Alternative is considered to be a viable Master Plan Runway 11L/29R RSA Alternative to carry forward and will be analyzed further in **Chapter 5, Environmental Consequences**.

⁷ 14 CFR Part 139, *Certification of Airports*.

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**Table 3-2
QUALITATIVE ANALYSIS FOR RUNWAY 11L/29R ALTERNATIVES**

SITE OPTIONS	Maintain Existing Threshold (A-2)	Reduce Runway Length (A-3)	Displace Threshold (A-4)	Shift runway to the east (A-5)	Install EMAS (A-6)
	This concept features a 1,000' runway safety area, while maintaining the existing threshold location by a relocating the intersection of State Highway 128 and Interlocking Blvd.	This concept features a 1,000' runway safety area, by reducing the runway length by 400' resulting in a 8,600' runway. This option would require the removal of any movement area within the approach to Runway 11L.	This concept features a 1,000' runway safety area, by reducing the landing distance by 400' on the 11L end. This would result in 8,600' available for landing on Runway 11L and 9,000' available for take off.	This concept features a 1,000' runway safety area, by shifting the threshold of runway 11L end by 400' and adding an additional 400' to the runway and taxiway on the 29R end maintaining a 9,000' runway.	This concept features an 600' runway safety area, by installing Engineered Material Arresting System (EMAS) to reduce the required safety area.
PROGRAM ELEMENTS					
Facility Requirements					
Accommodates ARC C/D-III	Yes	Yes	Yes	Yes	Yes
Corrects Non-Compliant RSA Conditions	Yes	Yes	Yes	Yes	Yes
Maintains existing runway length of 9,000 feet	Yes	No, reduces the useful load for large airplanes over 60,000 lbs	Results in 8,600' effective length for takeoffs on 29R and landing on Runway 29R	Yes	Yes
Operational Performance					
Capacity - Does this alternative accommodate future activity levels and reduce the ASV ratio?	No net change is expected	This option may decrease capacity.	This option may decrease capacity.	No net change is expected	No net change is expected
Capability - Does this alternative provide for existing and future design aircraft?	No net change is expected	This option would reduce the runways capabilities	This option would make it more difficult for the existing and future design aircraft to operate at optimum useful loads.	No net change is expected	No net change is expected
Facility Relocation - Does this alternative required the relocation of existing facilities?	Yes, existing service road, localizer and equipment building must be relocated.	Yes, portions of Twy A, H, J, and the first 400' of Runway 11L, Twy A-17 would be relocated. In addition, localizer, RPZ, and equipment building must be relocated.	Yes, Localizer, RPZ, and Equipment Building would be relocated.	Yes, facility relocation is expected on both ends of the runway including , both service road, ILS approach equipment, approach lighting and equipment building	None
ENVIRONMENTAL CONSIDERATIONS					
General Comments	Airport development would require EA. Environmental documentation would be necessary for roadway development.	No Extraordinary Circumstances	No Extraordinary Circumstances	Airport development will require EA. Environmental documentation will be necessary for 400' extension on the 29R end.	No Extraordinary Circumstances
Air Quality, Water Quality, Wetlands, Floodplains	No Significant Impacts	No Significant Impacts	No Significant Impacts	No Significant Impacts	No Significant Impacts
Biological Resources; and Geology and Soils	Impacts will need to be analyzed, quantified, and mitigated to comply with Federal, State and Local requirements.	No Impact	No Impact	Impacts will need to be analyzed, quantified, and mitigated to comply with Federal, State and Local requirements.	No Impact
Socioeconomic and Secondary Induced Impacts	No Significant Impacts Expected	No Significant Impacts Expected	No Significant Impacts Expected	Impacts will need to be analyzed, quantified, and mitigated to comply with Federal, State and Local requirements.	No Significant Impacts Expected

Table 3-2 (Continued)
QUALITATIVE ANALYSIS FOR RUNWAY 11L/29R ALTERNATIVES

SITE OPTIONS	Maintain Existing Threshold (A-2)	Reduce Runway Length (A-3)	Displace Threshold (A-4)	Shift runway to the east (A-5)	Install EMAS (A-6)
	This concept features a 1,000' runway safety area, while maintaining the existing threshold location by a relocating the intersection of State Highway 128 and Interlocking Blvd.	This concept features a 1,000' runway safety area, by reducing the runway length by 400' resulting in a 8,600' runway. This option would require the removal of any movement area within the approach to Runway 11L.	This concept features a 1,000' runway safety area, by reducing the landing distance by 400' on the 11L end. This would result in 8,600' available for landing on Runway 11L and 9,000' available for take off.	This concept features a 1,000' runway safety area, by shifting the threshold of runway 11L end by 400' and adding an additional 400' to the runway and taxiway on the 29R end maintaining a 9,000' runway.	This concept features an 600' runway safety area, by installing Engineered Material Arresting System (EMAS) to reduce the required safety area.
ENVIRONMENTAL CONSIDERATIONS					
Noise and Air Traffic Issues	No new noise impacts would result as aircraft operations would not change.	Noise Impacts May Decrease	Noise Impacts May Decrease	Noise impacts will change as a result of aircraft operations shifting 400' to the east. Impacts to the will need to be analyzed.	No new noise impacts would result as aircraft operations would not change.
Land-use compatibility	Minimal short-term noise impacts as a result of construction activities	No Significant Impacts Expected	No Significant Impacts Expected	Minimal short-term noise impacts as a result of construction activities	Minimal short-term noise impacts as a result of construction activities
Resources, Energy, Light, Visual Impacts	No Impact	No Significant Impacts Expected	No Significant Impacts Expected	Impacts to the 29R end will need to be analyzed, quantified, and mitigated to comply with Federal, State and Local requirements.	No Impact
CONSTRUCTABILITY					
Site Preparation	Extensive grading required bringing safety area into standard	Extensive grading required to relocate taxiways and safety areas	Minor grading and construction phasing required	Extensive grading required to extend the taxiway runway and safety area on the 29R end	Minor grading and construction phasing required
Utilities	Will require major relocation on part of the Intersection relocation	Moderate extensions/relocations expected	Minor extensions/relocations only	Moderate extensions/relocations expected	Minor extensions/relocations only
Phasing	Will require a two phased approach; Relocate the intersection; then build retaining wall and safety area.	Will require significant phasing to accomplish desired result	Minor phasing expected	Will require significant phasing to accomplish desired result	Minor phasing expected
Land Acquisition	All development is within existing property limits; however, a right-a-way will be required for intersection relocation	None, All development is within existing property limits;	None, All development is within existing property limits;	None, All development is within existing property limits;	None, All development is within existing property limits;
USER FRIENDLY					
Impacts – Transients	Minor, mostly related to the roadway relocation	Minor	Moderate	Moderate	Minor
Impacts – Tenant	Minor	Minor	Minor	Moderate	Minor
FISCAL FACTORS*					
Estimated Construction Cost	\$7,804,000	\$3,570,600	\$820,600	\$10,107,000	\$6,417,000
General Fiscal Comments	Retaining wall will mostly be largest airside expense, while the intersection relocation will be the overall largest expense to the entire project	Moderate construction required	Minimal construction required	Extensive construction will occur with the additional 400 feet of runway and taxiway pavement required on the 29R	Annual maintenance cost of the EMAS option was estimated to be in the range of \$8 -12 million over 20 years
Financial Considerations	Localizer and equipment building can be reused once relocated	Localizer and equipment building can be reused once relocated	Localizer and equipment building can be reused once relocated	Extensive relocation of airfield lighting, signage, approach lighting and equipment, Localize and equipment building must be made; however, can be reused once relocated	There is an annual cost to maintain the EMAS once installed to consider
Overall Estimated Total Cost	\$17,610,000	\$5,357,000	\$1,233,000	\$15,162,000	\$9,627,000
* These initial planning level estimates were developed for each alternative to compare the probable cost of each alternative. These estimates provide an order of magnitude cost and were generated from terminal and landside concepts and are not based on detailed designs. Thus, a contingency factor was included to account for factors such as materials, design and financing. These estimates only cover the costs for capital development on airport property in accordance with Airport Improvement Program eligibility guidance.					

SOURCE: RS&H, 2011
 PREPARED BY: RS&H, 2011

3.3.3 Reduce Runway Length (A3)

This Master Plan Runway 11L/29R RSA Alternative would satisfy the criteria outlined in **Chapter 2, Purpose and Need** of this EA, and ensure the Airport is in compliance with Public Law 109-115 and 14 CFR Part 139. However; it would not satisfy the Master Plan criteria because it would restrict the ability for the Airport to accommodate ARC C/D aircraft requiring longer runway length.

This Alternative is the least costly of all the alternatives, but cost savings are short lived as it limits the Airport's ability to generate revenue because aircraft operations would be restricted. Shortening the runway would eliminate additional revenue generated by the higher landing fees associated with larger and heavier aircraft and the additional passengers they carry.

Accordingly, this Master Plan Runway 11L/29R RSA Alternative is not considered to be a reasonable RSA Alternative to carry forward for further environmental analysis.

3.3.4 Displace Threshold (A4)

Similar to shortening the runway alternative, this Master Plan Runway 11L/29R RSA Alternative would satisfy the criteria outlined in **Chapter 2, Purpose and Need** of this EA and ensure the Airport is in compliance with Public Law 109-115 and 14 CFR Part 139.

This Master Plan Runway 11L/29R RSA Alternative would not satisfy the Master Plan criteria because it would restrict the ability for the Airport to accommodate ARC C/D aircraft. Thus, this Alternative would restrict the Airport's ability to generate revenue because aircraft operations would be restricted. For these reasons, this Master Plan Runway 11L/29R RSA Alternative is not considered to be a viable RSA Alternative to carry forward for further environmental analysis.

3.3.5 Shift Runway to the East (A5)

This Master Plan Runway 11L/29R RSA Alternative would satisfy the criteria outlined in **Chapter 2, Purpose and Need** of this EA, and ensure the Airport is in compliance with Public Law 109-115 and 14 CFR Part 139. However, its anticipated environmental impact would make it difficult to implement.

Sifting the runway to the east would shift aircraft operations and associated aircraft noise over the residential development east of the airport, along the extended centerline of Runway 11L/29R. Environmental impacts for this Alternative would be much greater due to the possible mitigation measures associated with the future noise impact. The cost impact of this Alternative would be negligible to the environment impacts. As such, this Master Plan Runway 11L/29R RSA Alternative is not considered to be a reasonable RSA Alternative to carry forward for further environmental analysis.

3.3.6 Install EMAS (A6)

This Master Plan Runway 11L/29R RSA Alternative would satisfy the criteria outlined in **Chapter 2, Purpose and Need** of this EA, and ensure the Airport is in compliance with Public Law 109-115 and 14 CFR Part 139. It would not satisfy the Master Plan criteria because it would restrict the Airport's option to expand to the north in the future.

Per FAA Order 5200.8, EMAS is a viable alternative to correct the Airport's nonstandard RSA since the terrain limits the use of traditional grading to extend the RSA and associated construction costs are high.⁸ In this instance, these concerns are offset by the high cost to inspect, repair, and maintain the EMS and the unknown safety impact of an aircraft landing on EMS.

Daily inspections by trained Airport personnel would be necessary to check the EMAS bed and all of its associated components for damage, resulting in more time for Airport personnel to conduct FAA required safety inspections at multiple times of the day and night over annual periods. EMAS also would require special lightweight, non-penetrating snow removal equipment that the Airport does not possess and would have to purchase. The equipment that would most reasonably keep snow from hampering the effectiveness of the EMAS or from interfering with the Instrument Landing System (ILS) would need to clean at least two inches of accumulation per hour, which are the maximum anticipated snowfall rates for the Airport climate. In order to attend to 60,000 square feet of EMAS, a minimum of five lightweight, non-penetrating snow removal machines (one per 12,000 square feet) and dedicated personnel would be required, exceeding the current Airport staffing in snow events and necessitating additional manpower. During these snow removal efforts, the ILS would be unusable for aircraft approaches to the runway, which would potentially result in lost business for the Airport's tenants and for the Airport. Airport approach reliability in inclement weather would be critical to Airport and aircraft operations from both economic and safety standpoints.

The final EMAS factor is a notable lack of "undershoot" data from any manufacturers, the FAA, and other EMAS installations around the US. An "undershoot" is the approach of an aircraft to the runway where the EMAS would be located at the approach end of a Runway 11L. It is the opposite condition of an overrun, wherein an aircraft departs the paved surface located at the far end from the takeoff or departure point. An aircraft that undershoots essentially would land on the EMAS, having landed short of the paved surface. EMAS is not clearly proven as a viable technology in the conditions of aircraft load bearing in a landing configuration other than to assume a penetration of the EMAS material and a potentially less safe result for the aircraft than a traditional full length graded RSA would offer. The EMAS cost estimates derived in the Master Plan assumed an "at grade" installation of EMAS. The important note is that the grade of the Runway slopes upward at one percent from east to west. The current grade after the end of the Runway west is approximately three to four percent. This means that an approaching aircraft would undershoot into EMAS at an angle four to five percent more severe than the extended horizontal plane of the runway and the impact on a landing aircraft striking EMAS at this angle is unknown.

EMAS is not considered to be a reasonable RSA alternative to carry forward for additional environmental analysis.

3.4 PREFERRED ALTERNATIVE

Based on the analysis discussed above, the Master Plan Runway 11L/29R RSA Alternative A-2 has been identified as the Preferred Alternative. In future discussion, the Preferred Alternative will be referred to as the Proposed Action.

⁸ Federal Aviation Administration Order 5200.8, *Runway Safety Area Program*, October 1, 1999.

The primary features of this Master Plan Runway 11L/29R RSA Alternative to correct the non-standard RSA would include the following:

- maintaining the existing Runway 11L/29R length and location;
- extending the RSA from the existing FAA non-standard 600 feet to the FAA standard 1,000 feet; and
- relocating the intersection of State Highway 128 and Interlocken Loop to accommodate the extended RSA.

The Master Plan Runway 11L/29R RSA Alternative A2 was refined to a conceptual schematic design for the purposes of this EA (see **Figure 3-1** and **Appendix A, Roadway Design Submittal**). The conceptual schematic design was provided for review to local, state and Federal government agencies. The local and state reviews were necessary since roadway elements fell beyond the Airport to responsible roadway approval agencies. State Highway 128 was reviewed by the road transportation portion of the State of Colorado Department of Transportation (CDOT), while the Interlocken Loop was reviewed by the City and County of Broomfield. The FAA reviewed all aspects of the conceptual schematic design as the lead agency for this EA.

The outcome of the review was the designation of the conceptual schematic design as Alternative A2 for the EA. **Table 3-3** provides an overview of the various components of the No Action Alternative and Alternative A2. For the purposes of describing Alternative A2, the terms Airside and Landside are used. The Airside of the Airport is a term to describe those functions within the perimeter fence defined by the Airport Operations Area (AOA). The landside of the Airport is a term used to describe those portions of the Airport outside of the perimeter fence defining the AOA.

3.4.1 Project Components of Alternative A2

Alternative A2 would involve maintaining the existing Runway 11L/29R threshold and create a standard 1,000-foot RSA dimension beyond the departure end of Runway 29R. Major airside project components of Alternative A2 include:

- relocating the Localizer array (Localizer), a component of the Runway's ILS;
- constructing the Localizer equipment building;
- relocating underground electrical utilities;
- relocating a VSR inside the Runway Object Free Area (ROFA);
- conducting earthmoving operations; and
- relocating perimeter fencing.

Table 3-3
SUMMARY OF PROJECT COMPONENTS OF THE NO ACTION AND THE PROPOSED ACTION ALTERNATIVE

Project Component	No Action Alternative	Alternative A2
Airside		
Relocate Localizer Array	No	Yes
Relocate Localizer Equipment Building	No	Yes
Relocate Localizer Building Access Road	No	Yes
Relocate Utilities – Localizer Electrical	No	Yes
Relocate Vehicle Service Road	No	Yes
Perform Earthmoving Operations	No	Yes
Relocate Fencing	No	Yes
Landside		
Acquire Land	No	Yes
Relocate Utilities – Gas	No	Yes
Relocate Utilities – Cable	No	Yes
Relocate Utilities – Electric	No	Yes
Relocate Utilities – Fiber/Optic	No	Yes
Relocate Utilities – Telephone	No	Yes
Relocate Utilities – Water	No	Yes
Relocate Utilities – Stormwater Drainage	No	Yes
Relocate State Highway 128	No	Yes
Relocate Interlocken Loop	No	Yes
Relocate Traffic Signals & Lighting	No	Yes
Relocate Roadway Intersection	No	Yes
Relocate Bicycle/Pedestrian Trail	No	Yes
Perform Earthmoving Operations	No	Yes
Cost of Alternative		
Cost (in millions)	0	\$17.6

SOURCE: RS&H, 2011
 PREPARED BY: RS&H, 2011

Major Landside project components of Alternative A2 would include:

- acquiring land;
- relocating wet and dry underground utilities;
- relocating a portion of State Highway 128 and Interlocken Loop roadways;
- relocating State Highway 128 and Interlocken Loop intersection;
- relocating a bicycle/pedestrian trail; and,
- conducting earthmoving operations.

All project components for Alternative A2 are graphically depicted in **Figure 3-1**. The estimated engineers order of magnitude cost for the Landside and Airside components with appropriate contingencies and fees for Alternative A2 is \$17.6 million.

3.4.1.1 Airside Project Components of Alternative A2

The Localizer provides centerline guidance for approaching aircraft. The antenna array component of the Localizer consists of eight antennas equipped with obstruction lights. The relocated Localizer array would be 620 feet along the extended Runway 11L/29R centerline from the existing array, which would total 1,000 feet beyond the Runway 29R departure end. The Localizer would be at a height of approximately 35 feet from the base elevation. The height is approximate due to the need for final design adjustments that would be provided by the FAA that may increase or decrease the total height.

The Localizer equipment building, which holds the equipment and electronics serving the Localizer operation, would be relocated to a point adjacent and north of the relocated Localizer array antenna.

The Localizer equipment building access road would need to be relocated to the new location of the Localizer equipment building. The access road would extend from the relocated Localizer equipment building to the relocated VSR.

In order to bring power to the Localizer and the Localizer equipment building, approximately 1,000 linear feet of underground electrical cable and conduit would be relocated.

The VSR, located at the west end of Runway 11L/29R, provides critical access for vehicle operations and emergency access within the Airport. A new VSR would be located north of the existing roadway inside the ROFA but remaining outside the RSA. The future VSR would be composed of asphalt-rotomillings.

Approximately 1,000 feet off the departure end of Runway 29L, 250,000 cubic yards of soil would be excavated from an on-Airport borrow source for the necessary fill material needed to achieve the RSA and roadway grading. Additional material from the soil cut would also be used internal to the Airport. This Alternative assumes no import or export of fill or cut material beyond the Airport boundary. At the conclusion of earthmoving, soil mulching and seeding would occur to restore disturbed areas.

The Airport's perimeter fencing provides security control for AOA. Alternative A2 would require approximately 3,900 feet of diamond mesh fence to be relocated.

3.4.1.2 Landside Project Components of Alternative A2

In order to facilitate the anticipated design of the relocated State Highway 128 and Interlocken Loop roadways and the relocated intersection of the roadway, approximately 25 acres of land would need to be acquired.

The utilities that would be relocated include gas lines, cable lines, electrical lines, fiber/optic lines, telephone lines, street light, existing storm drainage and water lines. The quantity of utilities that would need to be relocated are:

- *Gas lines* – Approximately 4,800 linear feet of gas line would need to be relocated and reconnected around the new perimeter road.
- *Cable lines* – Approximately 2,800 linear feet of cable line would need to be added to existing cable.
- *Electric* – Approximately 8,000 linear feet of electrical lines would need to be added with the relocation.

- *Fiber/Optic* – Approximately 12,000 linear feet of new fiber optic lines owned by Level 3, AT&T, and Qwest would need to be lowered and rerouted.
- *Telephone* – Approximately 3,300 linear feet of new telephone lines owned by Quest would need to be added.
- *Street Lights* – Approximately 20 existing street lights on both roadways would need to be relocated and an additional 10 street lights would be added.
- *Water lines* - Approximately 1,100 linear feet of piping would need to be aligned with the new State Highway 128 relocation.
- *Stormwater Drainage* - Approximately 1,300 linear feet of piping and existing culverts would need to be built to a storm water detention area immediately south of the new State Highway 128 and Interlocken Blvd. Intersection.

State Highway 128 would remain a two-lane asphalt road with an acceleration lane in the westbound direction west of the Interlocken Loop intersection; a left-turn lane in the eastbound direction west of the Interlocken Loop intersection; and a right turn lane east of the Interlocken Loop intersection. State Highway 128 is oriented in an east-west direction, is northwest of the AOA perimeter, and would become realigned to accommodate the RSA and ROFA for Runway 11L/29R. As a result of the realignment, an additional 410 feet of pavement with an assumed width of 72 feet would be added to the current length, resulting in 0.68 acres of additional impervious surface. New traffic roadway striping also would be needed for the relocated roadway. Temporary erosion and sedimentation control would be needed upon completion of the relocated roadway. Seeding and mulching would be needed for the disturbed land.

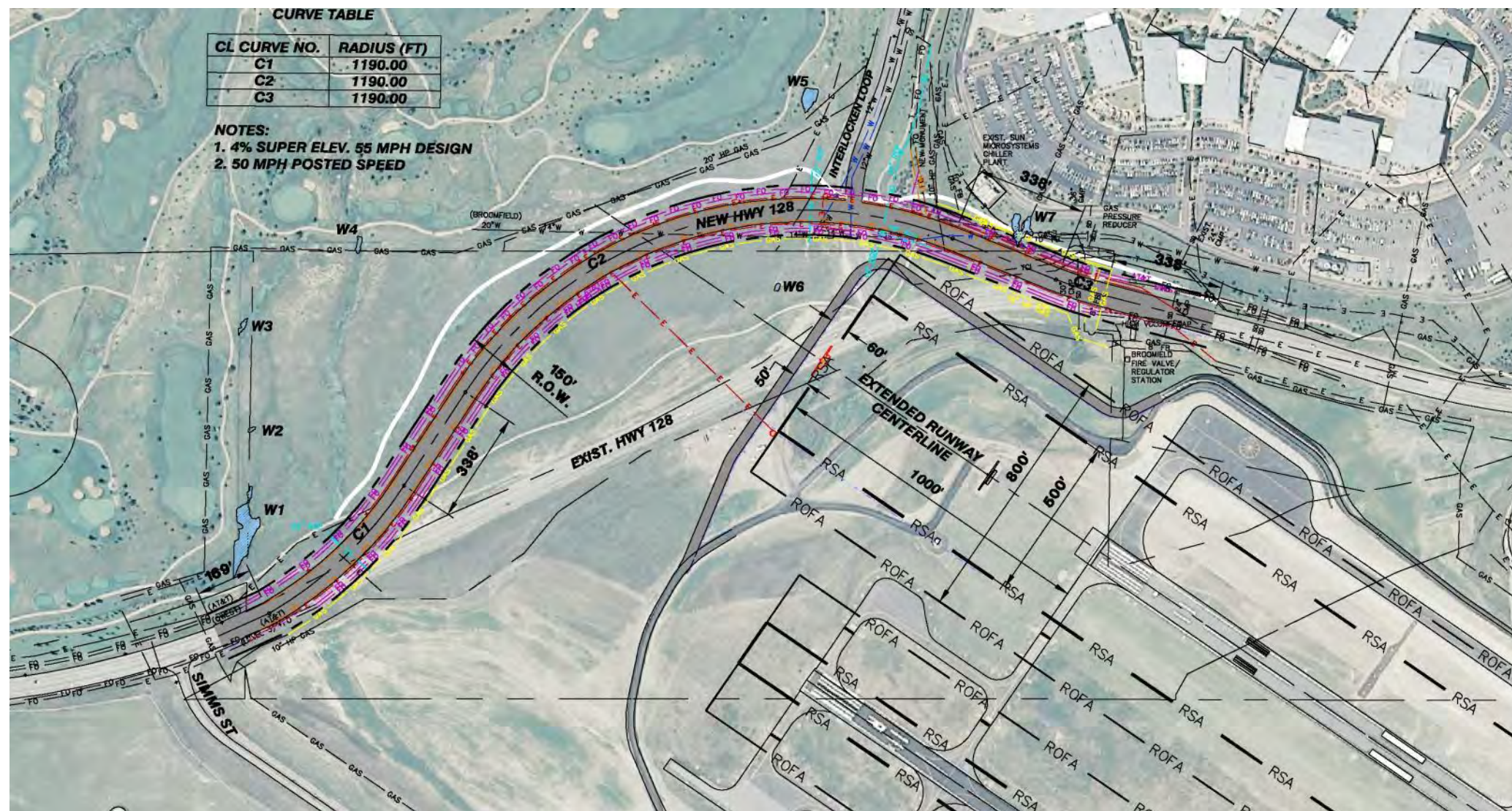
Interlocken Loop would remain a two-lane asphalt road with a right-turn lane in the southbound direction at the intersection with State Highway 128. Approximately 200 feet of Interlocken Loop would be shortened northward to accommodate the relocated State Highway 128/Interlocken Loop intersection. New traffic roadway striping also would be needed for the relocated roadway. Temporary erosion and sedimentation control would be needed upon completion of the relocated roadway. Seeding and mulching would be needed for the disturbed land.

The State Highway 128 and Interlocken Loop intersection traffic signals and associated intersection lighting would need to be relocated to the new intersection location.

The relocated State Highway 128/Interlocken Loop intersection would remain a “T” intersection. New traffic roadway striping also would be needed for the intersection. The intersection would conform to the approach and departure slope of State Highway 128 and the approach slope of Interlocken Loop.

An existing bicycle and pedestrian trail just north and west of State Highway 128 would need to be relocated because of the location of the future roadway. As a result, approximately 3,300 square yards of the 10-foot-wide concrete trail would be removed and replaced to align with the future roadway intersection.

Excavation and fill would occur to meet the conceptual Alternative A roadway grades. Approximately 80,000 cubic yards of dirt, including four inches of topsoil would need to be excavated northwest of the departure end of Runway 29R. Upon completion of the excavation, 31,000 square yards of subgrade preparation and 25,000 square yards of topsoil would occur to restore the surface to a prairie grass appearance similar to the surrounding area.



MAP NOT TO SCALE

LEGEND:

— RSA	— RUNWAY SAFETY AREA	— SD	— EXISTING STORM DRAIN	— T	— EXISTING TELEPHONE LINE	— SD	— NEW STORM DRAIN	— T	— NEW TELEPHONE LINE
— ROFA	— RUNWAY OBJECT FREE AREA	— W	— EXISTING WATER LINE	— USW	— EXISTING USW LINE	— W	— NEW WATER LINE	— USW	— NEW USW LINE
— — —	— EXISTING R.O.W. / PARCEL	— GAS	— EXISTING GAS LINE	— TCI	— EXISTING CABLE TV LINE	— GAS	— NEW GAS LINE	— TCI	— NEW CABLE TV LINE
— - - -	— FUTURE R.O.W.	— FO	— EXISTING FIBER OPTIC LINE	— X	— EXISTING FENCE LINE	— FO	— NEW FIBER OPTIC LINE	— E	— NEW ELECTRICAL LINE
		— E	— EXISTING ELECTRICAL LINE	—	— EXISTING ASPHALT				

SOURCE: RS&H, 2010
 PREPARED BY: RS&H, 2010

Figure 3-1
 PREFERRED ALTERNATIVE
 ELEMENTS

