

KANSAS CITY
Aviation

Airport Master Plan

KANSAS CITY DOWNTOWN AIRPORT – WHEELER FIELD

Appendix C

Runway 1 Instrument Approach Analysis

Appendix C
RUNWAY 1 INSTRUMENT APPROACH ANALYSIS

Instrument approach analysis is a highly specialized field of airport consulting. As a master plan project team member, LEAN Technology Corporation was tasked with analyzing if it would be feasible to establish an instrument approach to Runway 1. Operators at Kansas City Downtown Airport – Wheeler Field (MKC) have long desired instrument approach capability to Runway 1 as it is the longest runway serving approaches from the south.

The analysis undertaken here regarding the feasibility of implementing an instrument approach to Runway 1 is advisory in nature. Only the FAA can develop and publish an instrument approach in the national airspace system. With that said, the FAA will accept LEAN's analysis for consideration. To date, the FAA has concurred with previous LEAN instrument approach analyses for other airports, typically with some minor adjustments, and those airports have successfully established instrument approaches where none existed previously.

ANALYSIS OF INSTRUMENT APPROACH CAPABILITY

A detailed analysis was undertaken to determine if an instrument approach procedure (IAP) to Runway 1 is feasible. Currently, there is no instrument approach to Runway 1 and pilots land on the runway in visual conditions. Visual condition is when the cloud ceiling height is 1,000 feet or higher and the visibility minimum is greater than three miles. If the meteorological conditions are below either of these parameters, then pilots cannot land on Runway 1.

The analysis showed that it is feasible to establish an IAP to Runway 1 for all classes of aircraft, including the critical aircraft (D-III). With no changes to existing obstacles or the landing threshold of the runway, the cloud ceiling height would be 448 feet, and the visibility minimum would be 1⅜-mile.

Additional analysis was undertaken to determine if an IAP to Runway 1 could be established with lower minimums. **Table C1** shows the results of this analysis. There are two controlling obstacles on the final approach course to Runway 1 that impact the potential for lower minimums. The first is an existing

building (Weld Wheel building) and the second is the street light poles on the highway ramp from Interstate 70 to Interstate 35 (See **Figure C-1**). In 2024, the Weld Wheel building was demolished, and is planned to be replaced with condominiums that will rise to 78 feet above ground level. At this elevation, the new condominium building will not be a penetration to an instrument approach to Runway 1. With the Weld Wheel building having been removed, the IAP minimums would be 337 feet cloud ceiling height and 1-mile visibility. No additional obstruction removal would be required and no adjustment to the landing threshold to Runway 1 would be required.

Based on the LEAN analysis, an instrument approach with visibility minimums as low as ¾-mile and a cloud ceiling height of 250 feet does appear to be feasible, if additional obstacles are removed. However, other planning criteria associated with the runway protection zone size (i.e., RPZ land use compatibility) and the Part 77 approach and departure surface would both be impacted, requiring additional analysis beyond what LEAN has provided.

This analysis also assumes that the FAA Runway Airspace Maintenance Tool (RAM) will be utilized to deconflict several outdated buildings, stacks, and tree obstacles in the River Market.

TABLE C1 | Runway 1 Instrument Approach Options

Option	Obstacle Status	Retain Current Displaced Landing Threshold of 300' (1.0˚Offset FAC)	Displace Landing Threshold to 550' (1.5˚ Offset FAC)	Displace Landing Threshold 650' (1.5˚Offset FAC)
		Cloud Height/Visibility Minimum		
A	No changes to Obstacles	448' / 1⅜-mile	368' / 1-mile	250' / ¾-mile
B	Weld Building replaced by 78'AGL Condos	**337' / 1-mile**	250' / ¾-mile	250' / ¾-mile
C	Eliminate/Reduce Height for On-Ramp Light Poles	448' / 1⅜-mile	455' / 1⅜-mile	250' / ¾-mile
D	Replace Weld Building and Reduce Light Poles	250' / ¾-mile	250' / ¾-mile	250' / ¾-mile

FAC: Final Approach Course

Source: LEAN Technology analysis



Figure C-1: Instrument Approach Obstructions

RUNWAY 19 ILS MISSED APPROACH ANALYSIS

During their analysis of the instrument approach feasibility for Runway 1, LEAN was asked to include a proposed building development that would be located at the corner of 16th Street and Broadway. It was found that the proposed building would not impact the feasibility of an instrument approach to Runway 1, however, it would impact the missed approach procedure for the ILS approach to Runway 19. LEAN provided additional mitigation analysis which indicated that modest adjustments to the Runway 19 missed approach procedure could accommodate the proposed building. Two mitigating options have been presented:

1) For Category D aircraft on the ILS approach to Runway 19, the decision height would be raised from 250 feet to 280 feet.
2) For Category D aircraft on the ILS approach to Runway 19, a non-standard missed approach climb gradient of 315 feet per 1,600 nautical miles would be applied.

RECOMMENDATIONS

With MKC in proximity to downtown Kansas City, the approach airspace is challenging and complex. For these reasons, no instrument approach procedures have been established to Runway 1 in the past. However, many elements that contribute to instrument approach capability have improved, allowing for instrument approach capability where none existed previously. Those elements include the aerial survey resolution, the ability to offset approaches to runways, and obstruction removal.

Based on the analysis, the airport can and should move forward by making a formal request to the FAA for an instrument approach to Runway 1 at MKC. The airport layout plan reflects an instrument approach with 1-mile visibility minimums and 337-foot cloud ceiling heights. These minimums will not require any adjustment to the existing landing threshold or any additional object removal as the Weld Wheel building was demolished in 2024 (to be replaced with a shorter building that does not impact the potential instrument approach).

The following is a slide deck that summarizes the findings by LEAN in their feasibility analysis of establishing an instrument approach to Runway 1 at MKC. The last three slides show the results of the Runway 19 missed approach analysis and the mitigation measures that would be required to accommodate the proposed building on 16th Street and Broadway.

MKC Rwy 1 Procedure Feasibility Update

Paul Hannah – LEAN Corp

22AUG23



Topics Covered In Today's Briefing

1. Summary of Findings To Date
2. Rwy 1 VGSI Modifications to Support CAT D
3. Achieving Lowest Minimums on Rwy 1
4. Discussion, Summary and Next Steps

Summary of Findings

An offset RNAV (GPS) Rwy 1 procedure is feasible with minimums near 450ft – 1 3/8 mi

Lowest minimums 250ft – ¾ mi can be achieved with additional threshold displacement *and/or* obstruction mitigation

Changes to VGSI will be required to enable CAT D but can be accommodated within the current runway geometry

Historical weather analysis does not immediately justify the procedure and other factors may be required for FAA development

Proposed developments over West Bottoms and Downtown Loop will complicate and/or eliminate approaches to runway 1

Previous Procedures Explored

Procedure	Description	Minimums (CAT C)	Meets Criteria	Limiting Factors
RNAV (GPS) Rwy 1	Straight-In, Current Threshold, Match VGSI (3.70º GPA)	LPV 467 – 1 3/8 VNAV 1053 - 3 LNAV 1553 – 3	No	Current and future obstacle penetrations, limited to CAT C Only
RNAV (GPS) Rwy 1	Straight-In, Current Threshold, 3.50º GPA	LPV 454 – 1 3/8 VNAV 1419 - 5 LNAV 1553 - 3	No	Current and future obstacle penetrations
RNAV (GPS) O Rwy 1	Offset 1.0º, Current Threshold, Match VGSI (3.70º GPA)	LPV 462 – 1 3/8 LNAV 1553 - 3	Yes	Future obstacle penetrations CAT C Only
RNAV (GPS) O Rwy 1	**Offset 1.0º, Current Threshold, 3.50º GPA**	**LPV 448 – 1 3/8** **LNAV 1553 – 3**	**Yes**	**Future obstacle penetrations**
RNAV (RNP) Rwy 1	Curved Final, Current Threshold, 3.50º GPA	RNP 0.10 436 – 1 ¼ RNP 0.15 546 – 1 5/8 RNP 0.30 807 – 2 ½	Only as RNP-AR Special	Final rollout point is not compliant, few aircraft capable of 0.15/0.30

Additional Analysis for Today's Update

Determine if/how the Rwy 1 VGSI can be modified to accommodate CAT D approach operations

Identify how to achieve the lowest possible CAT C/D minimums (250ft – ¾ mi) on runway 1 through either a displaced threshold or obstacle mitigations

Explore the proposed Weld Building conversion to residential condos

Rwy 1 VGSI Modifications

To Support CAT D Operations

Rwy 1 4L VASI

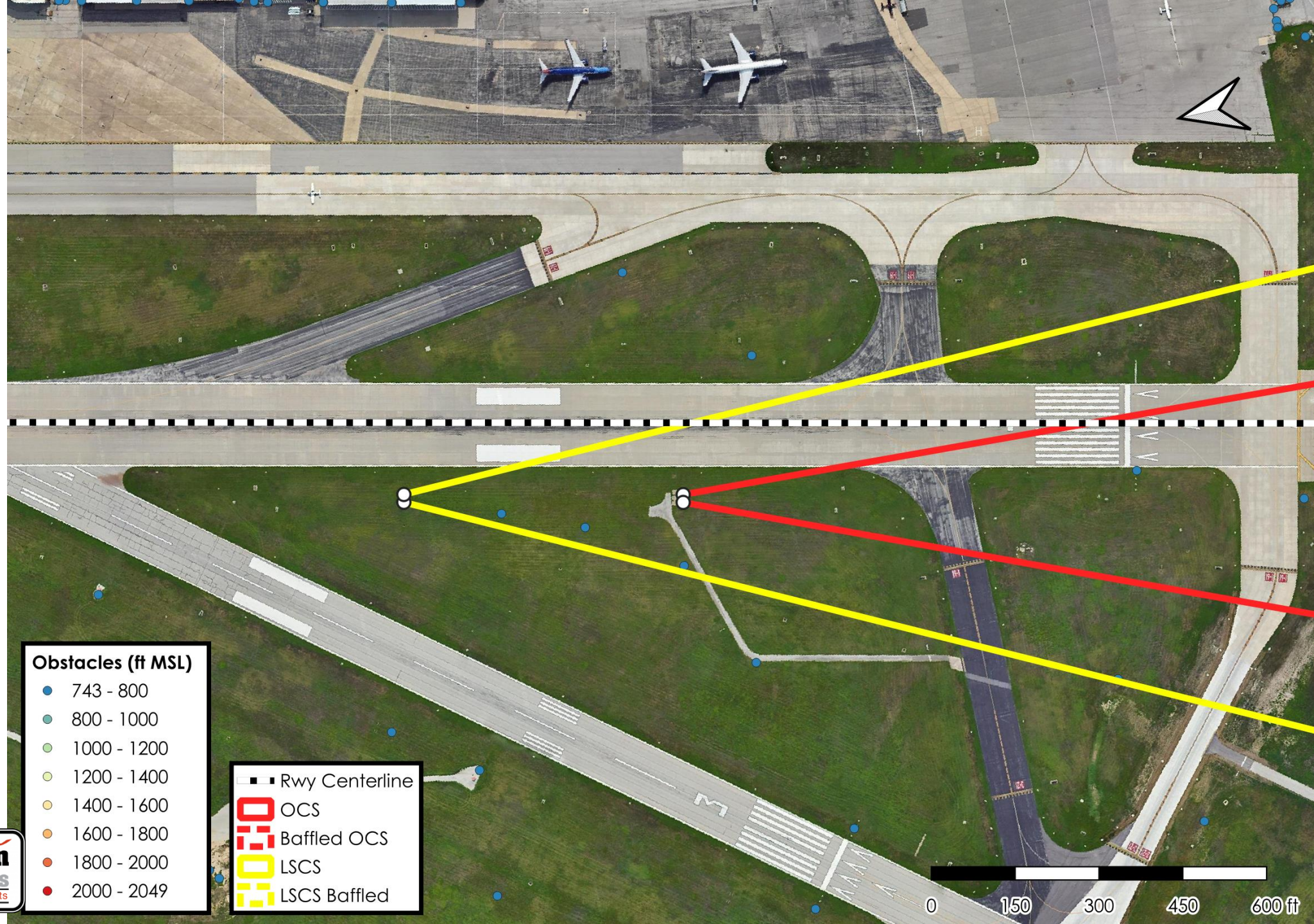
Nominal Aiming Angle of 3.70° and TCH of 66ft

14ft LHA Separation starting 50ft from edge of runway

Assumed to be FAA owned

OCS is clear and *was* limited by presence of trees

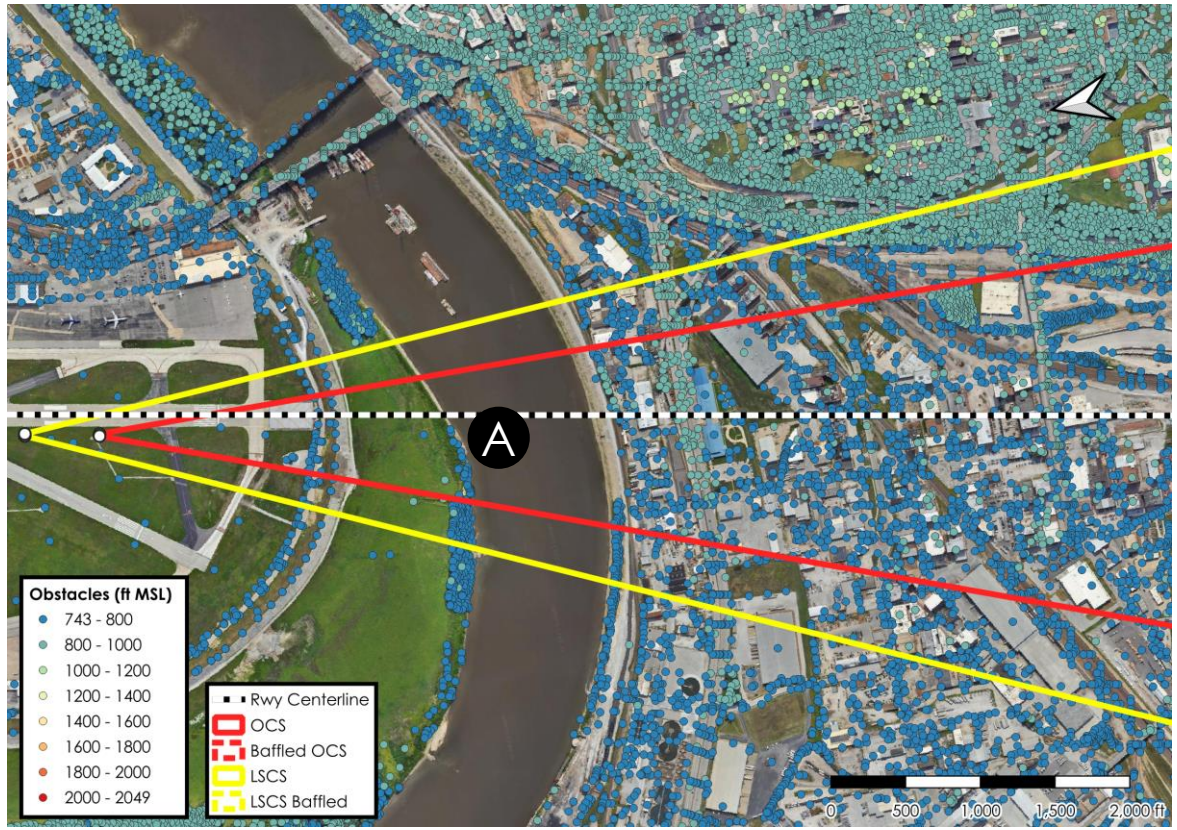
LSCS *is* penetrated and requires restriction on visible extent to 6.5° east of runway centerline to avoid FOX 4 Antenna



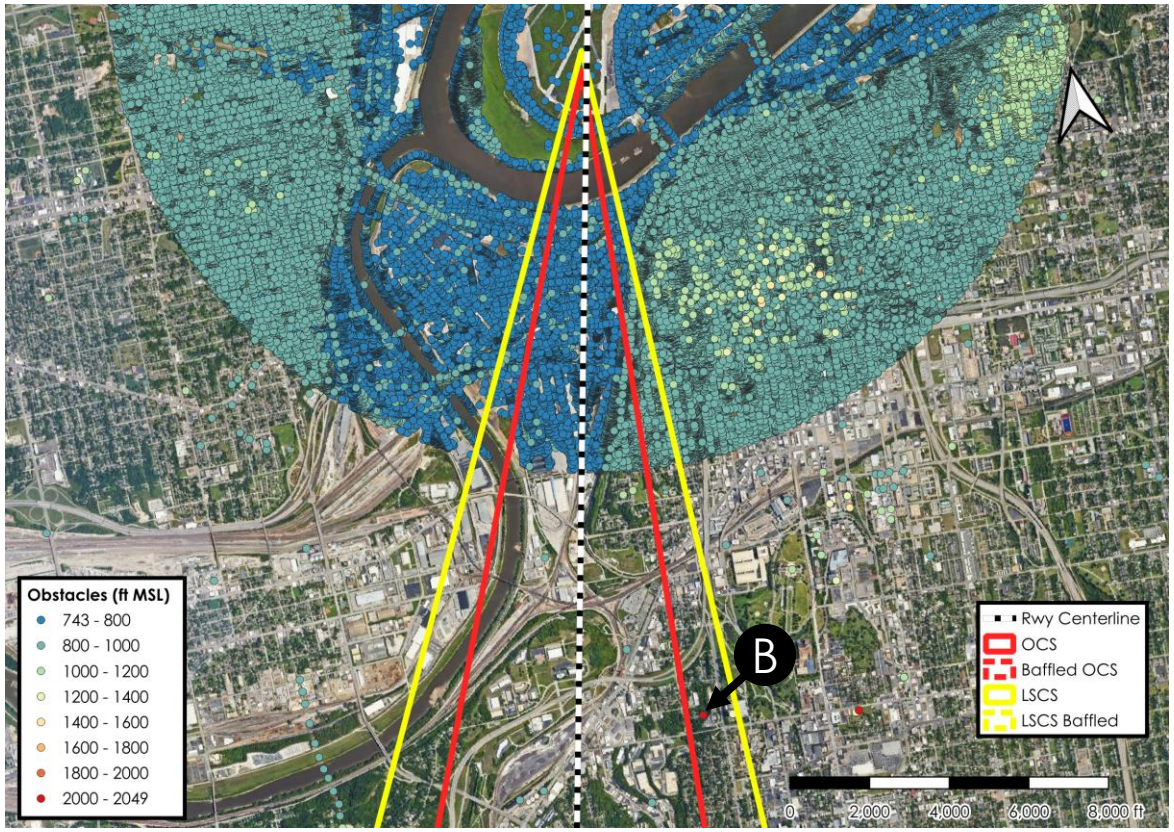
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Rwy 1 4L VASI
Medium and Distant Obstacle Clearance



VGSI *was* penetrated by trees (A) no current penetrations to justify 3.70°



FOX 4 Antenna (B) would require a nominal 5.52° aiming angle, or restrict the visible extent of the VASI to 6.5° east of the centerline

Rwy 1 4L PAPI

Nominal Aiming Angle of 3.30° - 3.50° and TCH of 60ft

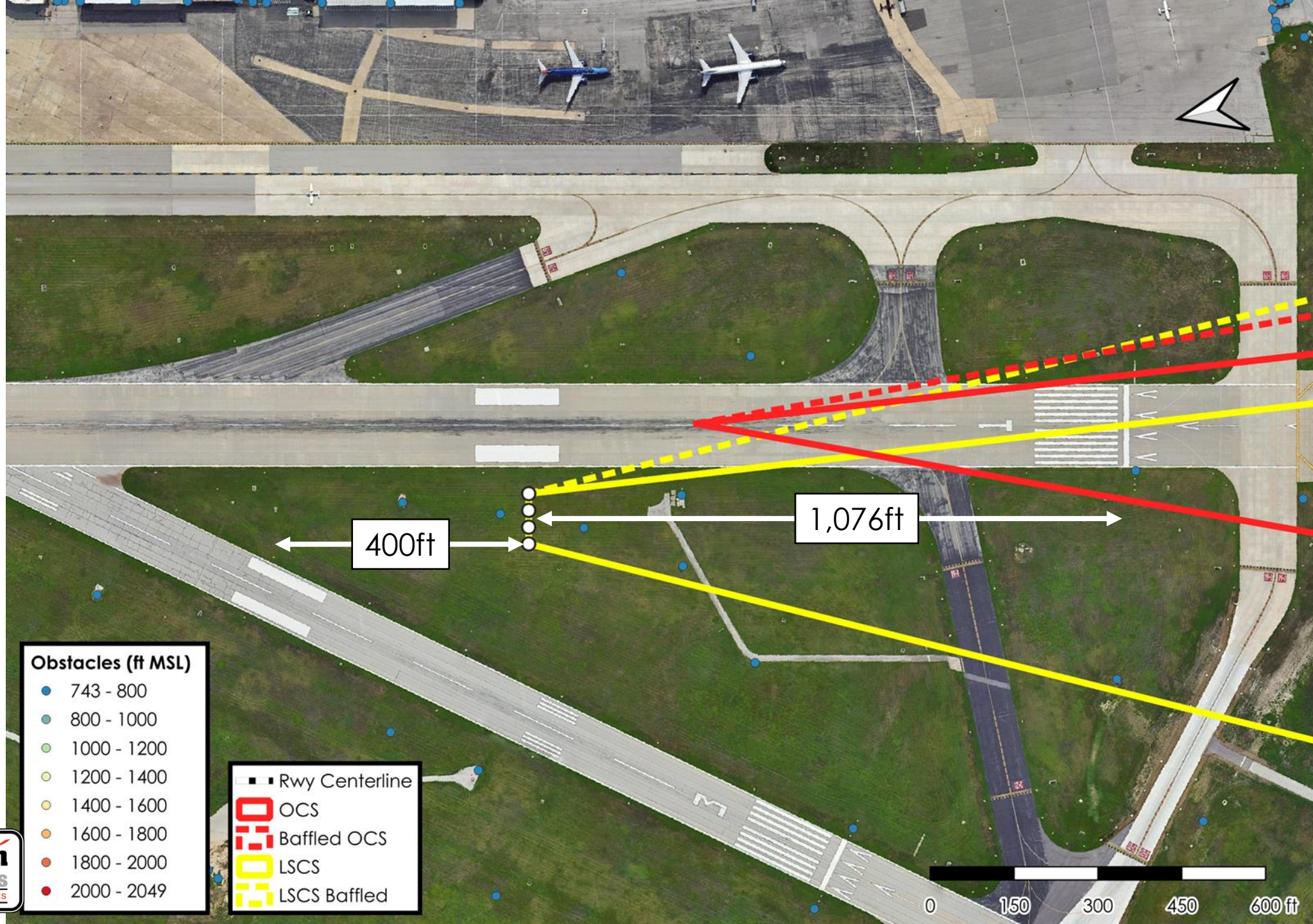
FAA or KCAD owned

30ft LHA separation starting 50 ft from edge of runway

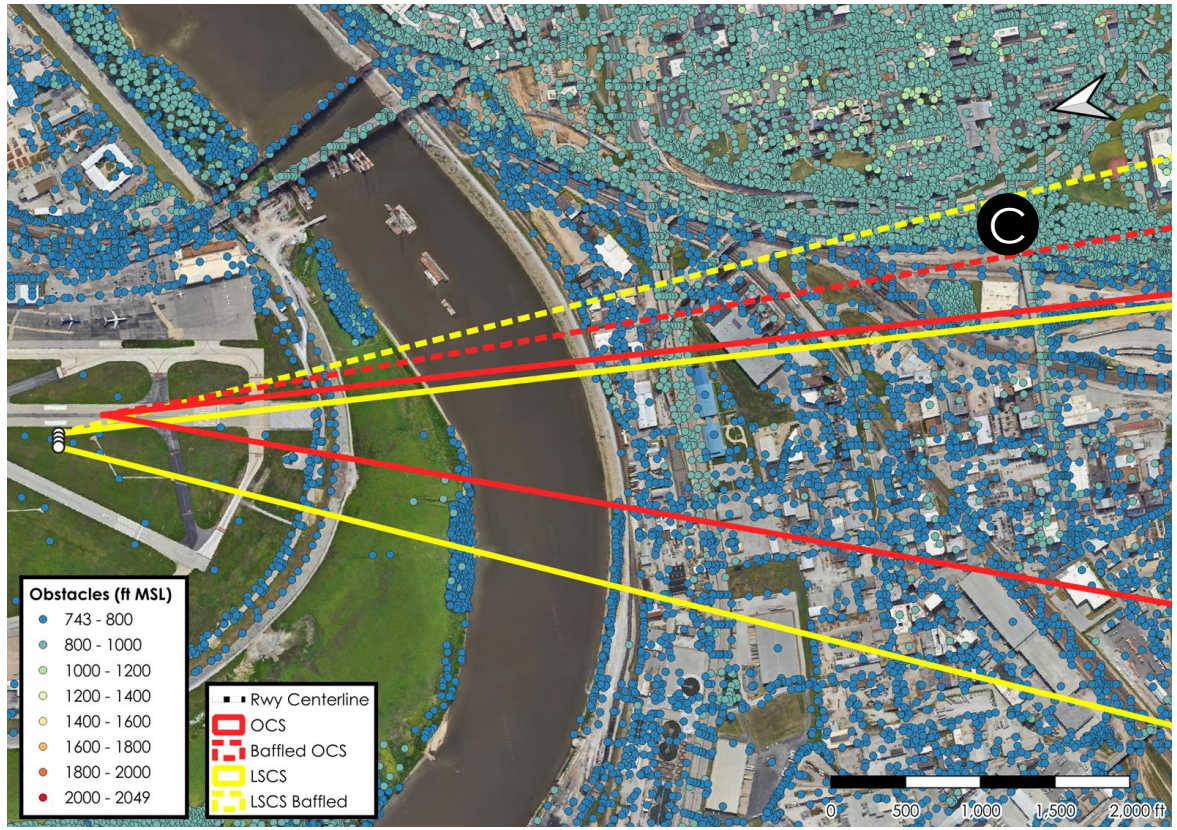
OCS *is* clear of penetrations

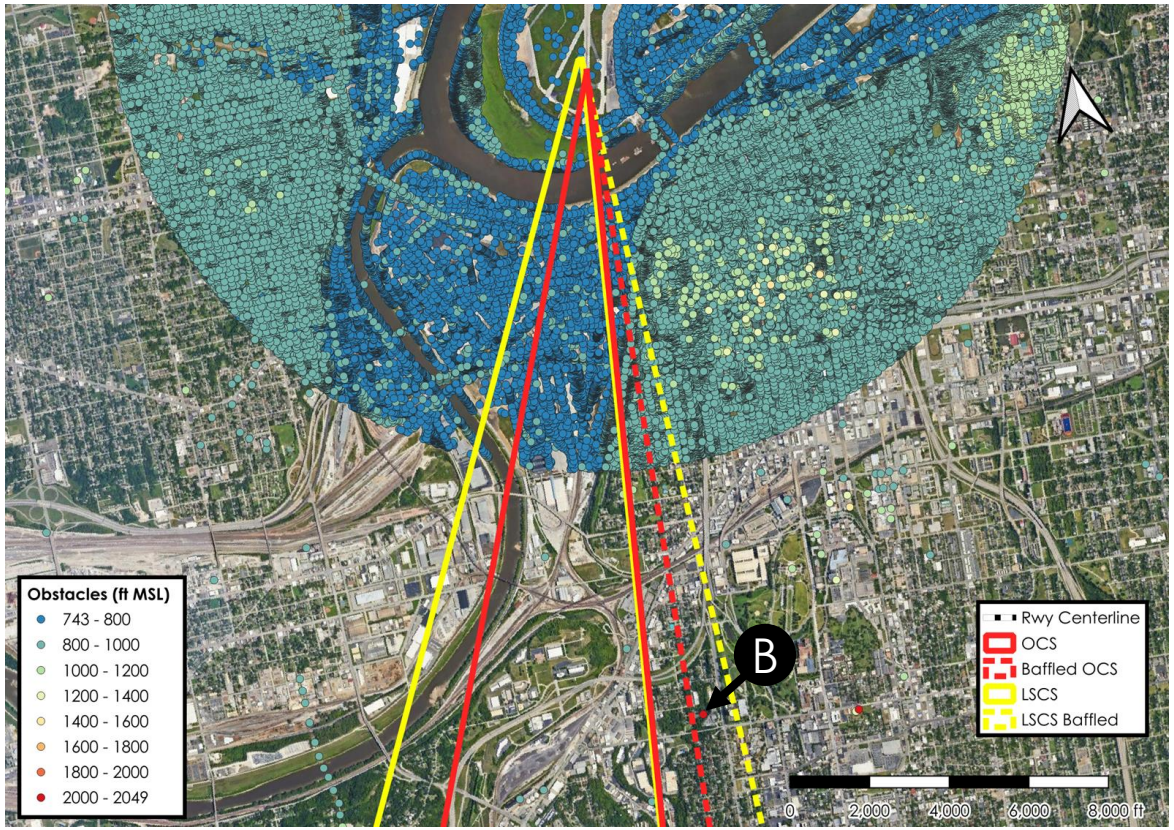
LSCS *is* penetrated and requires restriction on visible extent to 6.5° east of runway centerline to avoid FOX 4 Antenna

Variable locations can be supported between current location and 400ft north of the current location



Rwy 1 4L PAPI
Medium and Distant Obstacle Clearance





Baffled visible extent will lower the overall nominal angle and create additional lateral separation from both downtown C and FOX 4 Antenna B

VGSI Recommendations

Pursue replacement of 4L VASI with a 4L PAPI to correspond with RNAV (GPS) Rwy 1 approach development

- If FAA owned, pursue the upgrade during the next "convenient" opportunity or as a part of the IFP production (FOTS upgrade, lighting enhancement, runway rehab)
- If KCAD owned, via ACIP during the IFP production

Site PAPI to achieve a 60ft TCH with between 3.30° and 3.50° nominal aiming angle based on FAA AFS feedback to accommodate potential traffic pattern changes

- Higher TCH, which is required for the approach procedure, is not likely compliant with the design wheel height group and may force VGSI to become KCAD owned
- Plan for reducing visible extent to 6.5° east of the runway centerline through baffling

Achieving Lowest Minimums on Rwy 1

Achieving Lowest Minimums on Rwy 1

Current minimums for a future RNAV (GPS) Rwy 1 (LPV) are limited by two sets of existing obstacles

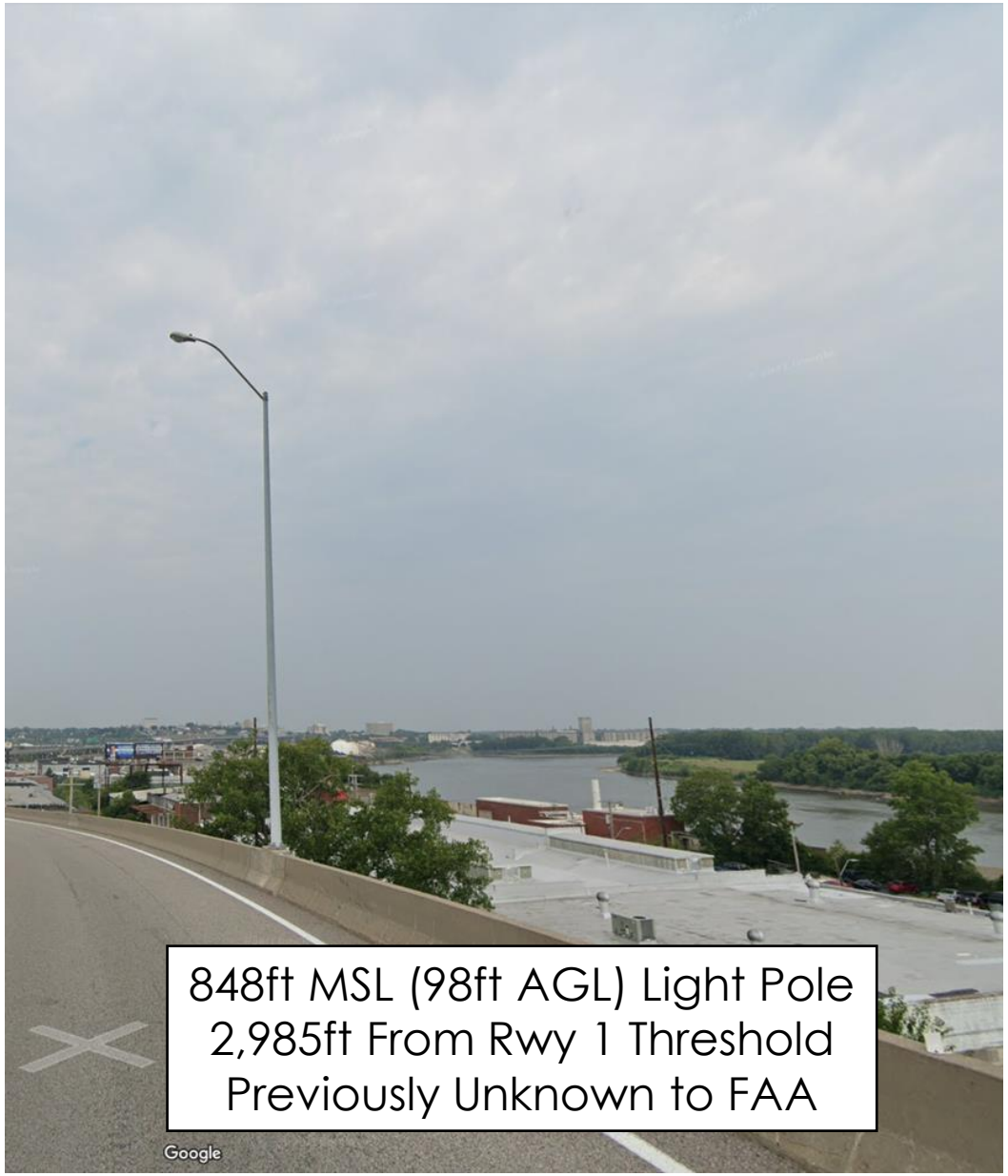
A. Weld Building
B. Street Lights on the On-Ramp from I-35N to I-70W

Combinations of additional threshold displacement and/or obstacle mitigation can overcome these challenges to achieve LPV minimums of 250ft – 3/4mi

FAA RAM Tool will be needed to deconflict several outdated building, stack and tree obstacles in River Bottoms

LPV minimums *below* 250ft – ¾ mi are not possible due to

1. Offset final approach course
2. Lack of ALS



Rwy 1 LPV Minimum Reduction Options

	Retain Current Displaced Landing Threshold of 300ft (1.0° Offset FAC)	Displace Landing Threshold to 550ft (+250) (1.5° Offset FAC)	Displace Landing Threshold to 650ft (+350) (1.5° Offset FAC)
A. No changes to Obstacle	448ft – 1 3/8mi	368ft – 1 mi	**250ft – 3/4mi**
B. Weld Building replaced by 78ft AGL Condos	337ft – 1 mi	**250ft – 3/4mi**	**250ft – 3/4mi**
C. Eliminate/Reduce Height for On-Ramp Light Poles	448ft – 1 3/8mi	455ft – 1 3/8mi	**250ft – 3/4mi**
D. Both Replace Weld Building and Reduce Light Poles	**250ft – 3/4mi**	**250ft – 3/4mi**	**250ft – 3/4mi**

Updated Geospatial Deconfliction

Weld Building

- 2023-ACE-1773 to 1780-OE – Residential Building to Replace Weld Building
- Footprint of residential condos will eliminate existing limitations imposed by Weld Building on instrument approach

FAA OAS Changes

- Faultless Brands Plant Replaced Previous Factory in 2002
  - OAS 29-001391 – Stack (removed)
  - OAS 29-024195 – Bldg (removed)
- Multiple Trees on Airport Removed
  - OAS 29-037998 – Tree (removed)
  - OAS 29-037522 – Tree (removed)
  - OAS 29-047694 – Tree (removed)





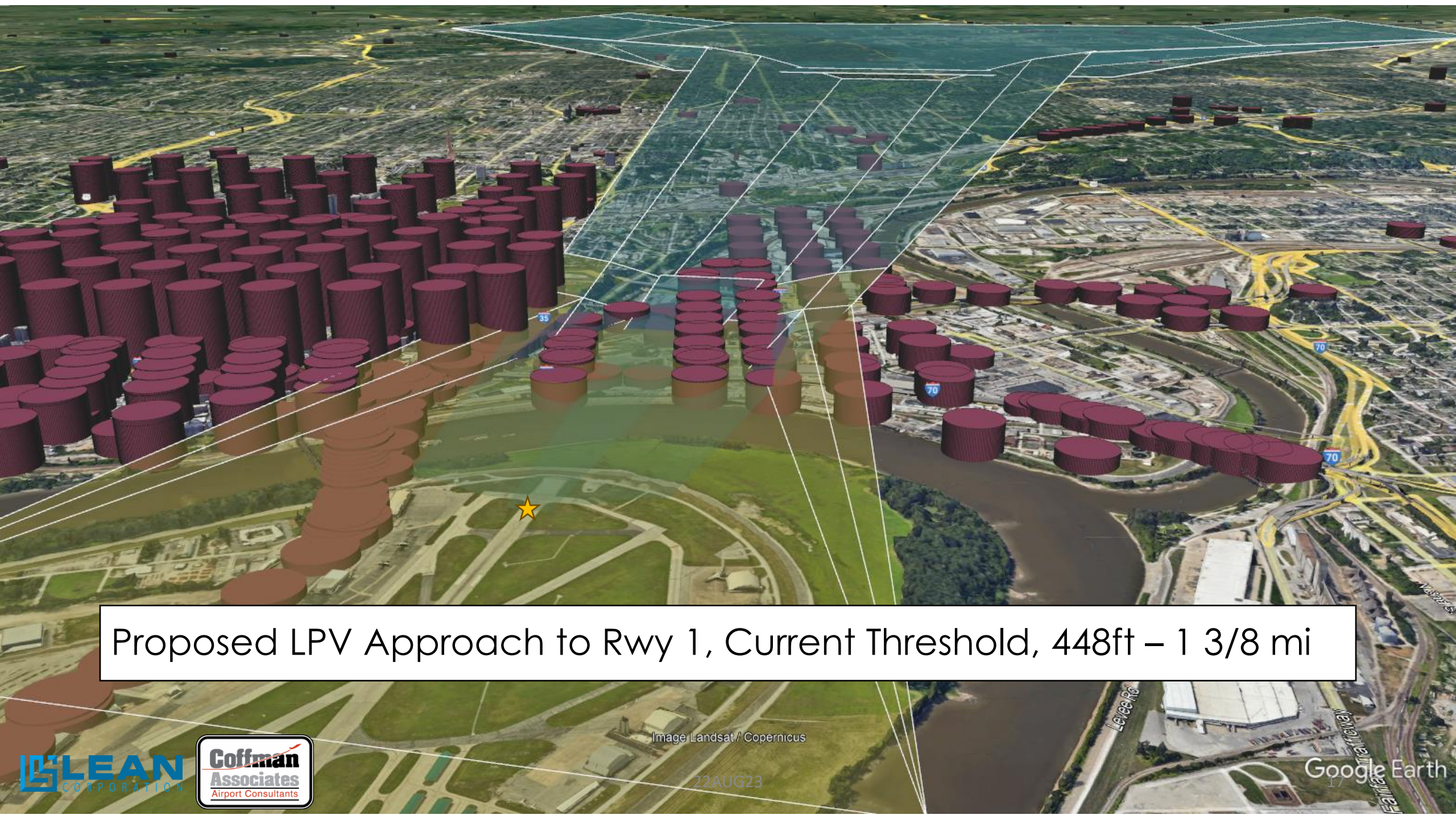
Proposed Developments

Proposed developments over West Bottoms and in the Downtown Loop can/will present additional impacts to a future RNAV (GPS) Rwy 1 approach

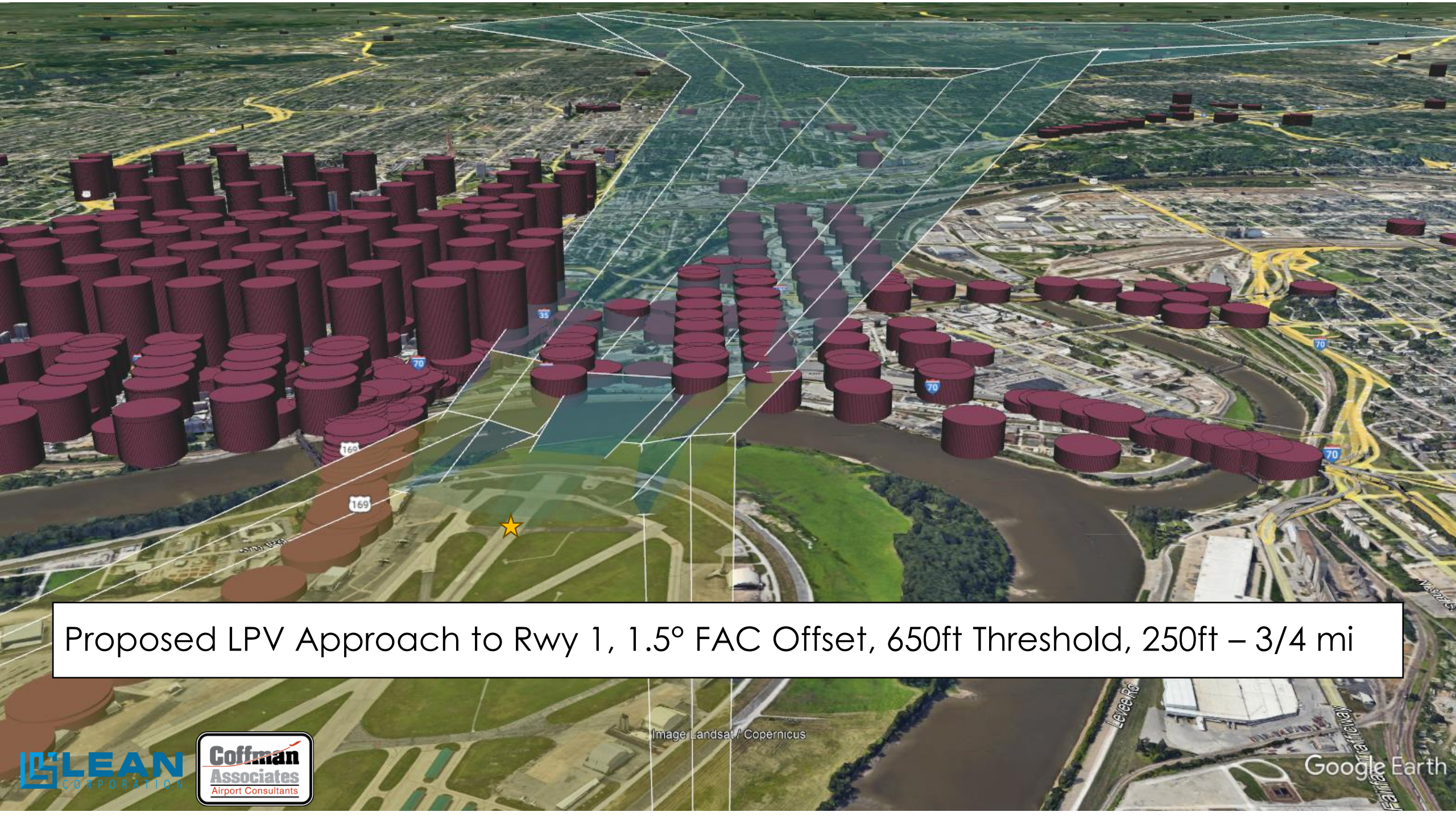
Downtown Loop impacts can be mitigated through a combination of

- Achieving the lowest LPV minimums (delays start of missed approach surface)
- Displacing threshold and offsetting final approach course

West Bottoms developments will require either increased minimums or, for developments closest to the river, eliminate LPV



Proposed LPV Approach to Rwy 1, Current Threshold, 448ft – 1 3/8 mi



Proposed LPV Approach to Rwy 1, 1.5° FAC Offset, 650ft Threshold, 250ft – 3/4 mi

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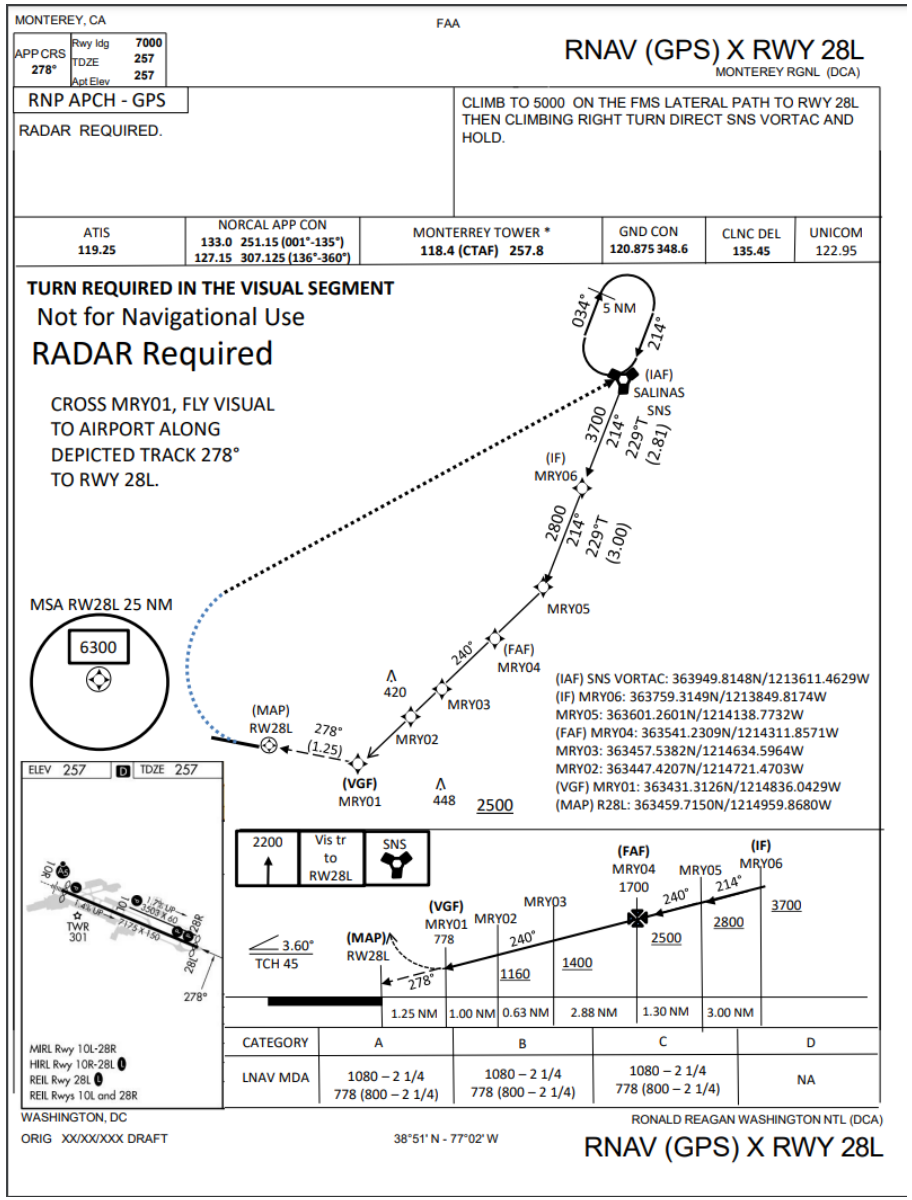
Other Findings

RNAV (GPS) Rwy 1 VNAV approach minimums are significantly impacted by the FOX 4 antenna

Non-LPV minimums reductions (LNAV) will require a "fly-visual segment" with a VGF point

FAA is finalizing criteria for this kind of approach which can be created to reduce minimums to 800ft – 2 mi

If this is pursued, it would be requested as a "second" approach to RNAV (GPS) Y Rwy 1 with the primary approach published as RNAV (GPS) Z Rwy 1



Instrument Procedure Feasibility Summary

Pursue both an RNAV (GPS) Z Rwy 1 and RNAV (GPS) Y Rwy 1 to achieve lowest minimums for varied users

- RNAV (GPS) Z Rwy 1: 250ft – ¾ mi LPV
- RNAV (GPS) Y Rwy 1: 800ft – 2 mi LNAV

Work with KCAD to implement RAM Tool project for FAA OAS mitigations following successful upload of new VGA survey

Provide details for supporting PAPI for current, or additional threshold displacement

Summary of Findings

An offset RNAV (GPS) Rwy 1 procedure is feasible with minimums near 450ft – 1 3/8 mi

Lowest minimums 250ft – ¾ mi can be achieved with additional threshold displacement *and/or* obstruction mitigation

Changes to VGSI will be required to enable CAT D but can be accommodated within the current runway geometry

Historical weather analysis does not immediately justify the procedure and other factors may be required for FAA development

Proposed developments over West Bottoms and Downtown Loop will complicate and/or eliminate approaches to runway 1

Recommended Procedures In the Feasibility Study

Procedure	Description	Minimums (CAT C)		Meets Criteria	Limiting Factors
RNAV (GPS) Z Rwy 1	Offset 1.0º, Current Threshold, 3.50º GPA	LPV LNAV	448 – 1 3/8 1553 – 3	Yes	Weld Building and Overpass Street Light
RNAV (GPS) Z Rwy 1 (Future Amdt)	Offset 1.0º, Current Threshold, 3.50º GPA	LPV LNAV	250 – 3/4 1553 – 3	Yes	Replacement of Weld Building and Removal/Reduction of Highway overpass street light
RNAV (GPS) Y Rwy 1	Offset TBD, Current Threshold, 3.50º GPA	LNAV	800 – 2	Pending	Fly Visual Segment used to help aircraft avoid FOX 4 Antenna and reduce LNAV mins

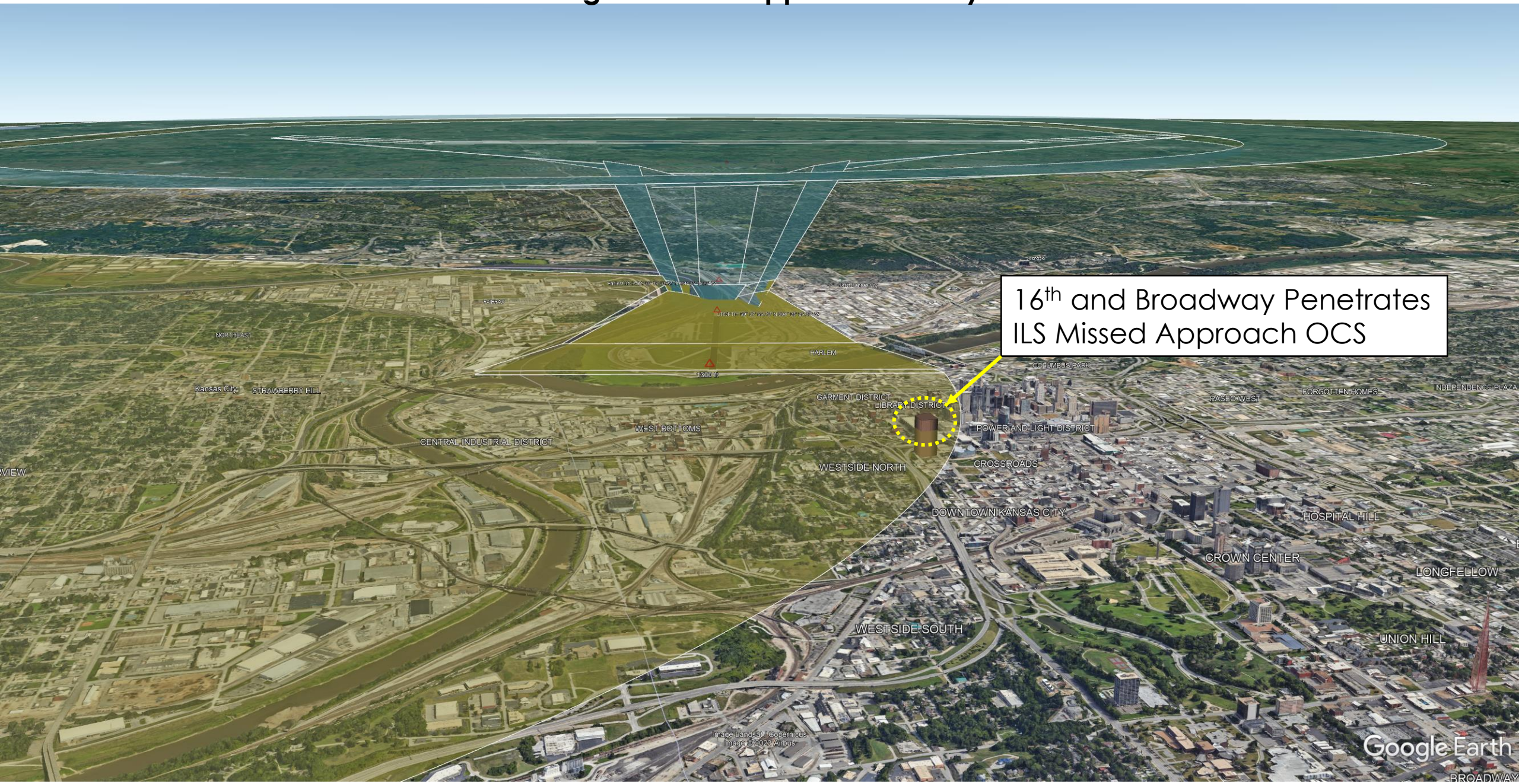
Runway 19 Missed Approach Analysis

The following three slides present analysis related to a proposed building located at 19th Street and Broadway in downtown Kansas City, MO.

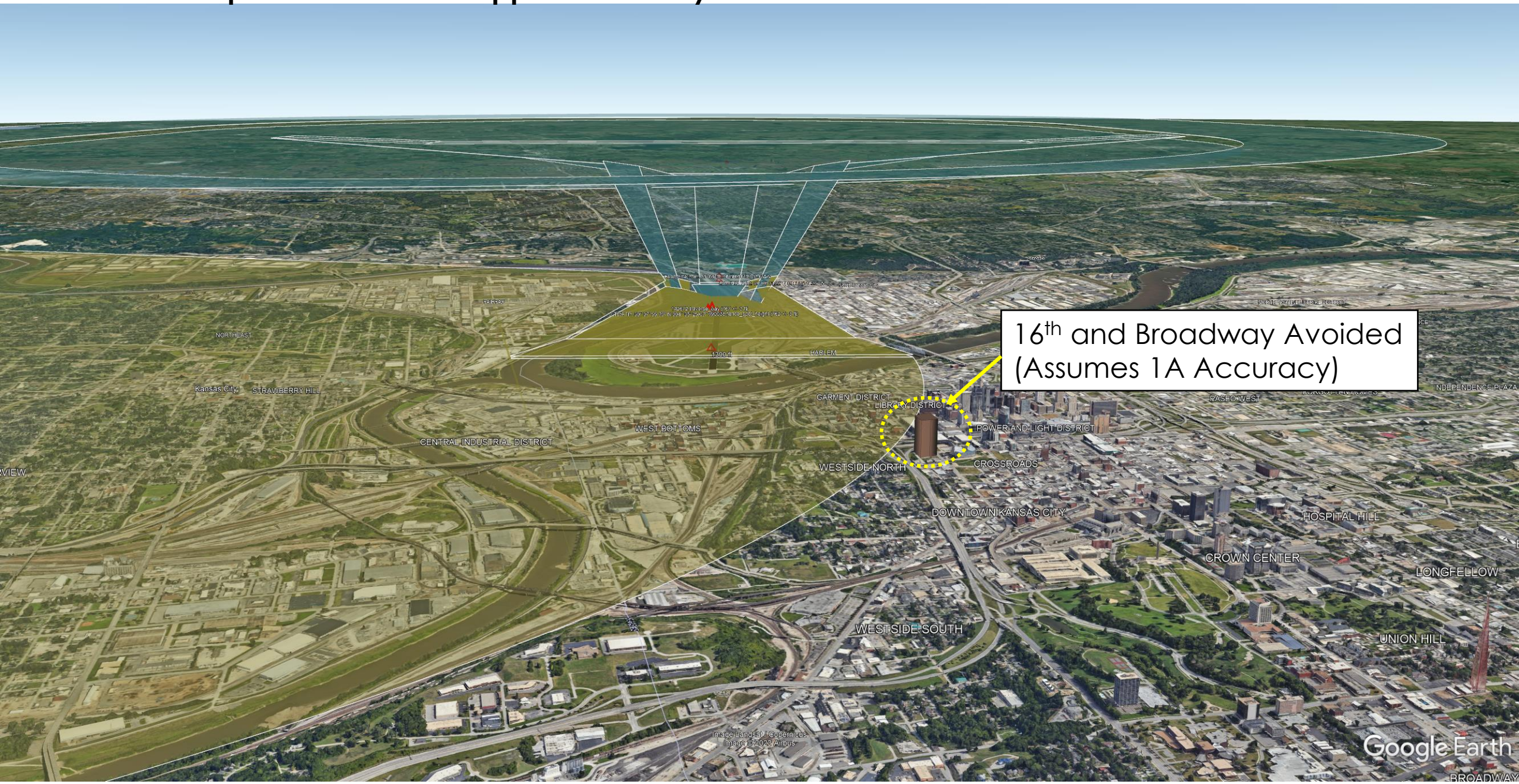
The analysis shows that the proposed building will not impact a potential instrument approach to Runway 1. It will impact the ILS missed approach to Runway 19. Two mitigating alternatives are presented.



Existing ILS CAT D Approach to Rwy 19



Option 1: ILS CAT D Approach to Rwy 19 With Increase in DH from 250 –> 280ft



Option 2: ILS CAT D Approach to Rwy 19 With DH 250ft and Non-Std Missed Approach Climb Gradient of 315ft/Nmi to 1,600ft

