

Appendix E: Stormwater Technical Memo

ADVANCED PLANNING TECHNICAL MEMO #25

STORMWATER IMPACTS OF THE WEST AIRFIELD PROGRAM

1 INTRODUCTION

The purpose of this technical memorandum is to analyze the stormwater impacts of the proposed West Airfield Program (WAP) and provide conceptual alternatives to mitigate these impacts. Analyses include evaluation of the WAP impacts on runoff flow rates, pipe and culvert capacities, water quality, regulatory impacts, and the utility conflicts associated with the proposed alternatives.

As shown in **Figure 1**, the proposed WAP area includes construction of the new Airfield Maintenance Facilities, new West Deicing Pad, new taxiway pavements (Taxiway S2 and reconfiguration of Taxiway A1 and T at Runway 29), and demolition of the existing Airfield Maintenance Facilities along with portions of Taxiway B and Taxiway T.

2 STORMWATER IMPACTS

2.1 IMPERVIOUS AREA

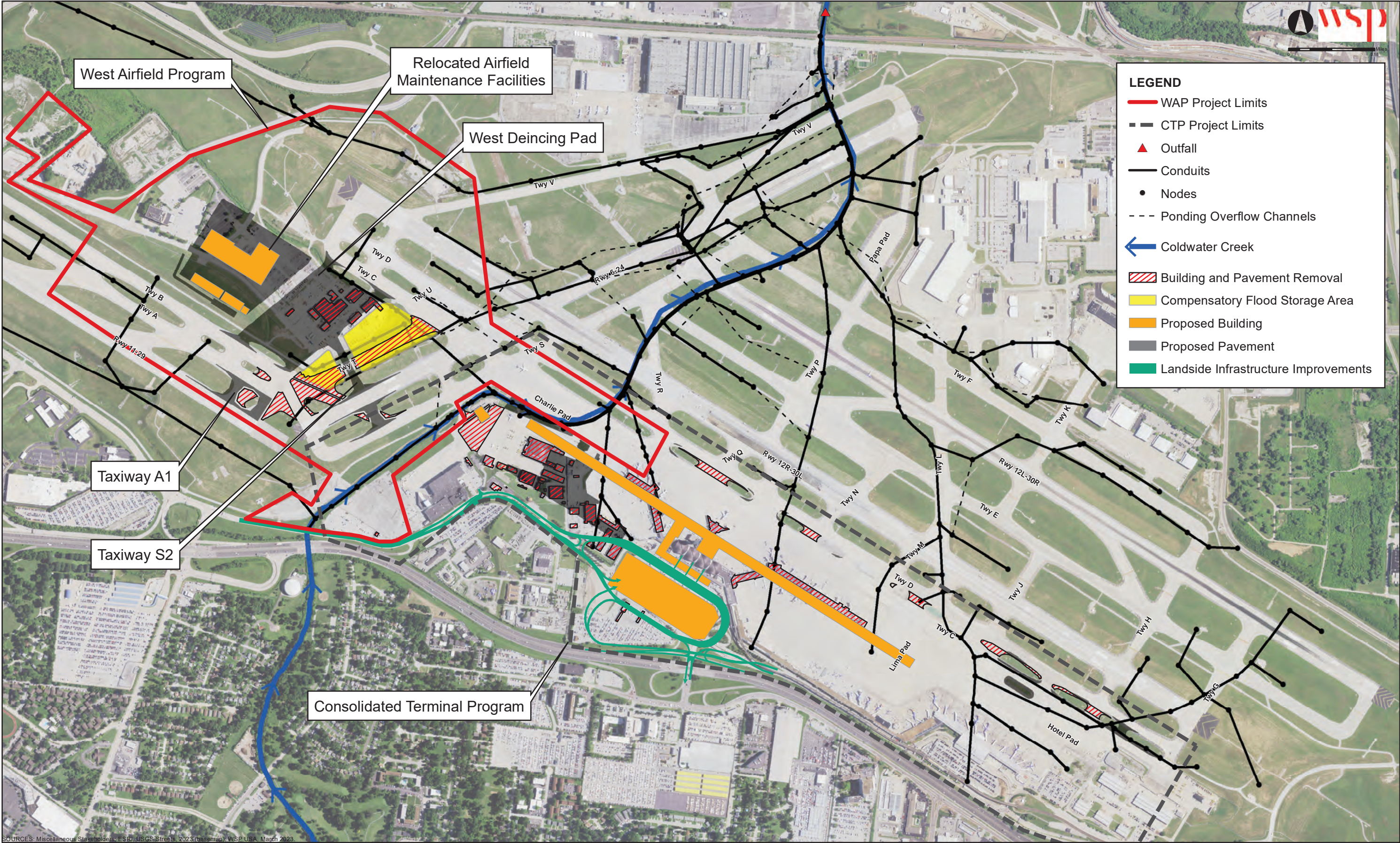
The total difference in impervious area was calculated to account for the new surfaces added for the Airfield Maintenance Facilities and West Deicing Pad, and the areas removed as part of the demolition of the existing Airfield Maintenance Facilities, Taxiway B, and Taxiway T.

- The total existing impervious area in the WAP area is 89.3 acres.
 - The proposed impervious area in the WAP area is 88.4 acres.
 - The result of these changes is a net decrease of 0.9 acres in impervious area.
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2.2 STORMWATER RUNOFF

The changes in impervious area resulted in the following runoff totals from the area impacted by the WAP during a 15-year, 3-hour cloudburst storm event.

- The total existing runoff from the WAP area is 530.7 cfs.
- The total proposed runoff from the WAP area is 529.2 cfs.
 - The result of these changes is a net decrease of 1.45 cfs in peak flow stormwater runoff rate.



3 REGULATORY REQUIREMENTS

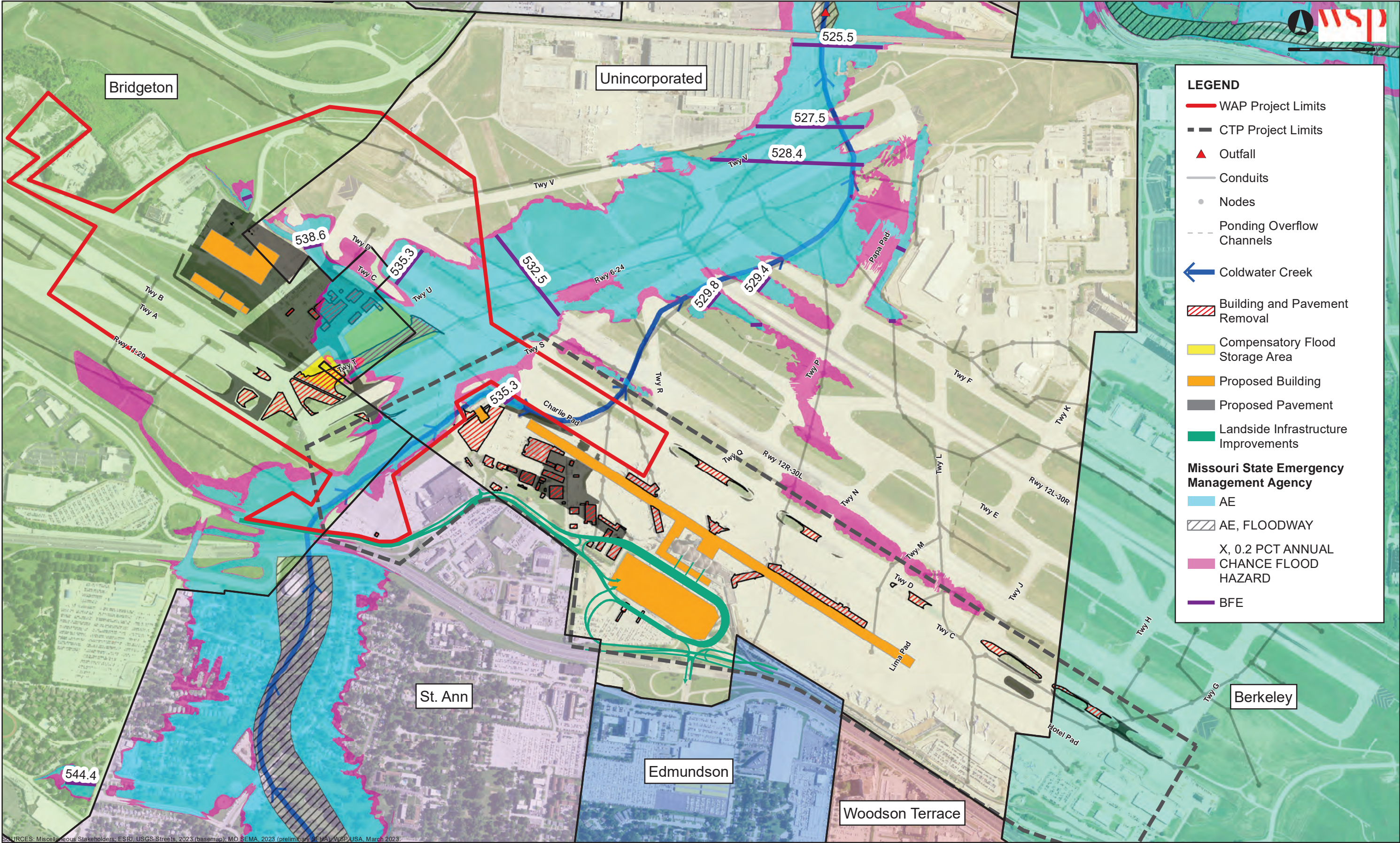
3.1 METROPOLITAN ST. LOUIS SEWER DISTRICT

Metropolitan St. Louis Sewer District (MSD) Stormwater quality compliance is required for all new development and redevelopment projects that disturb an area greater than or equal to one acre, including smaller projects that are part of a larger common parcel or project that is greater than one acre. In order to comply, projects must include water quality best management practices (BMPs). For this project, the recommended BMP is to provide water quality retention within the existing North Detention Basin. The details of this BMP are provided in Section 4, Proposed Alternatives.

MSD stormwater quantity compliance requires detention storage when the proposed development causes an increase in peak runoff of 2 cfs or greater. Due to the decrease in impervious area and peak runoff resulting from the proposed WAP, stormwater quantity measures are not required for the WAP improvements. However, rerouting additional flow to the North Detention Basin improvements is discussed in Section 4, Proposed Alternatives, to account for development of the Consolidated Terminal Program (CTP).

3.2 FEDERAL EMERGENCY MANAGEMENT AGENCY

A flood study will be required to determine the impacts of the WAP on the base flood elevations for Coldwater Creek. **Figure 2** shows the preliminary effective FIRM boundaries in the WAP area. The preliminary FIRM is anticipated to be adopted as the current effective FIRM in early 2024. As shown in **Figure 2**, the WAP area falls within the preliminary FIRM floodplain but is not in a regulatory floodway. The expectation is that any proposed fill in the floodplain proposed as part of the WAP will require some compensatory excavation within the floodplain to avoid a rise in the base flood elevation. This flood study will be completed as a separate task of this project.

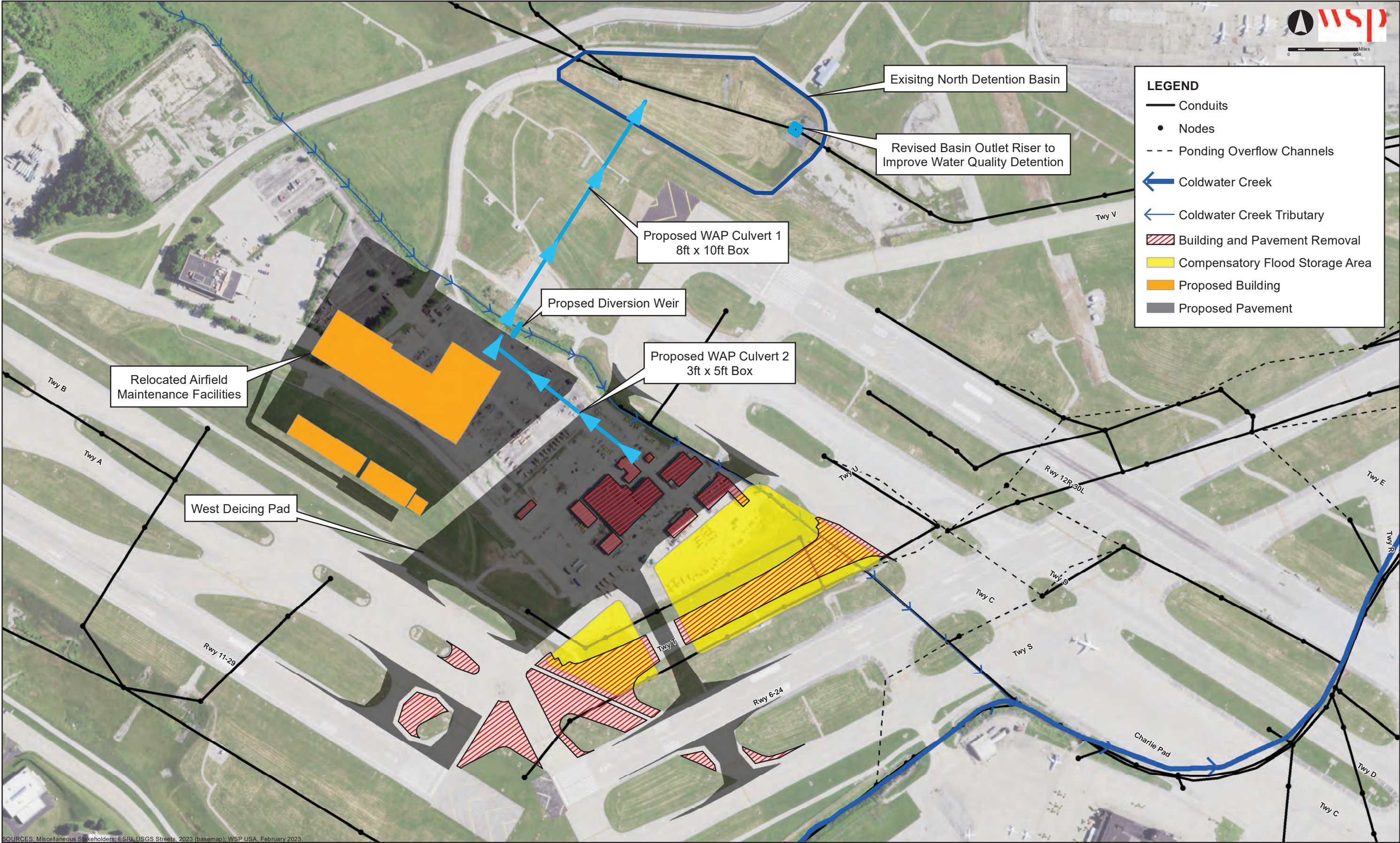


4 PROPOSED ALTERNATIVES

4.1 ALTERNATIVE 1 – REROUTE OF FLOW TO THE NORTH DETENTION BASIN

The purpose of Alternative 1 is to address water quality requirements associated with the WAP and stormwater quantity requirements for the collective impacts of the WAP and the CTP, which overall have a net increase in impervious area and stormwater runoff.

The existing North Detention Basin was originally designed to receive runoff from a midfield terminal that was never constructed. Utilizing PCSWMM software, the basin was modeled and determined to have the capacity to receive and detain additional flow. The basin has a total capacity of about 118 acre-feet of volume, and about 40% of this is currently utilized during the 100-year 24-hour storm event. As shown in **Figure 3**, Alternative 1 consists of installing 1,210 feet of 8ft x 10ft box culvert (WAP Culvert 1) to reroute flow to the North Detention Basin from the existing Coldwater Creek Tributary upstream of the segment between Taxiway C and the existing maintenance building. The flow in this tributary would normally flow southeastward under Taxiway T. Alternative 1 proposes the installation of a weir across this tributary with a 12-inch low flow orifice to divert the majority of flow through this new culvert to the North Detention Basin. The purpose of allowing base flow to continue through the low flow orifice is to preserve and maintain the existing route and morphology of the downstream tributary. Redirecting all of the flow away from the tributary would be considered rerouting and channelization of the stream, which may trigger the need for a US Army Corps of Engineers individual 404 permit. A 3ft x 5ft box culvert (WAP Culvert 2) is also proposed to divert runoff from the West Deicing Pad towards the Coldwater Creek Tributary and up to the North Detention Basin. The diversion of this additional flow to the basin will utilize about 80% of its volume capacity during the 100-year 24-hour storm event (an additional 40% from the current 40% utilized).



4.1.1 WATER QUALITY

MSD's *Rules and Regulations and Engineering Design Requirements for Sanitary Sewer and Stormwater Drainage Facilities*, states that water quality compliance will be required for all new development and redevelopment projects that disturb an area greater than or equal to one acre. Water Quality BMPs were evaluated for the WAP redevelopment since it exceeds the 1-acre threshold.

MSD has established a water quality volume (WQv) as the storage needed to capture and treat the runoff from 90% of recorded daily rainfall events. MSD's formula for calculating WQv is:

$$\text{WQv (in acre-feet)} = [(P)(R_v)(A)]/12$$

Where P = rainfall depth of 1.14 inches.

R_v = 0.05 + 0.009 (I) where I is the percent impervious cover for the tributary area.

A = tributary drainage area to the water quality BMP in acres.

The WQv was calculated as 17.8 acre-feet of retention volume for the proposed tributary area to the North Detention Basin. The existing outlet riser structure at the North Detention Basin will need to be modified to store this water quality volume and drain through a 3-inch orifice at the flow line of the detention basin outlet structure. The stored flow will drain within a 48-hour period to meet FAA guidelines while also meeting the MSD 24-hour extended detention requirements. A means of debris protection should be incorporated into the detailed design for the 3-inch orifice used to retain the WQv within the basin, but regular maintenance will be required following rain events to ensure the basin functions as intended. A maintenance schedule to inspect the basin after any rain event of 0.5 inches or greater is recommended. Level monitoring may also be warranted as part of the detailed design of the basin to monitor the basin function and alert maintenance staff of ponding levels and durations to ensure detention times remain within FAA guidelines.

4.1.2 WATER QUANTITY

As previously stated in Section 3.1, stormwater quantity measures are not required for the WAP improvements. However, rerouting additional flow to the North Detention Basin is proposed for Alternative 1 to account for development of the Consolidated Terminal Program (CTP) as MSD has stated the Airport property can be treated as a whole from a water quantity perspective. This means development on the Airport would be compliant with MSD water quantity requirements as long as development doesn't cause an increase in runoff leaving the property.

MSD water quantity requirements include detaining a Channel Protection Volume (CPv) and a Flood Protection Volume (FPv). The CPv is the 24-hour extended detention of the post-developed one-year, 24-hour storm event. The FPv is the required storage volume to achieve a post-developed peak flow that does not exceed the existing routed peak flow. A 5' wide x 2' high orifice was modeled to pass the CPv and FPv. The hydraulic results for Alternative 1 are summarized in **Table 1** and show a net decrease in flow leaving the Airport property through Coldwater Creek for both the 2-year and 100-year storm.

Table 1: Stormwater Quantity Summary

Model Scenario	HYDRAULIC MODEL RESULTS		
	Stormwater Storage in Basin (acre-feet)	Combined Peak Release Rate at WAP Outlets (cfs)	Peak Coldwater Creek Flow Rate at Airfield Outlet (Banshee Rd) (cfs)
Existing Conditions: 2-year 24-hour Storm (FPv)	5.08	76.5	4768.0
Proposed Conditions: 2-year 24-hour Storm (FPv)	13.27	99.6	4611.1
Existing Conditions: 100-year 24-hour Storm (FPv)	37.3	156.1	6174.6
Proposed Conditions: 100-year 24-hour Storm (FPv)	76.9	218.4	6093.2

Source: M3 Engineering Group, 2023.

4.1.3 UTILITY CONFLICTS

The proposed 8' x 10' box culvert crosses five existing FAA cables, one abandoned fuel pipe, two existing water lines, and an existing storm underdrain. A key map is provided as **Figure 4** to illustrate where each plan and profile figure is located within the WAP area. **Figure 5** provides the plan profile of proposed WAP Culvert 1 (8'x10' box culvert) relative to the existing utility crossings. **Figure 6** provides the plan profile of proposed WAP Culvert 2 (3'x5' box culvert) relative to the existing utility crossings, which includes revisions to two 8-inch sanitary sewers.

The following estimates were made on typical bury depths for each utility type:

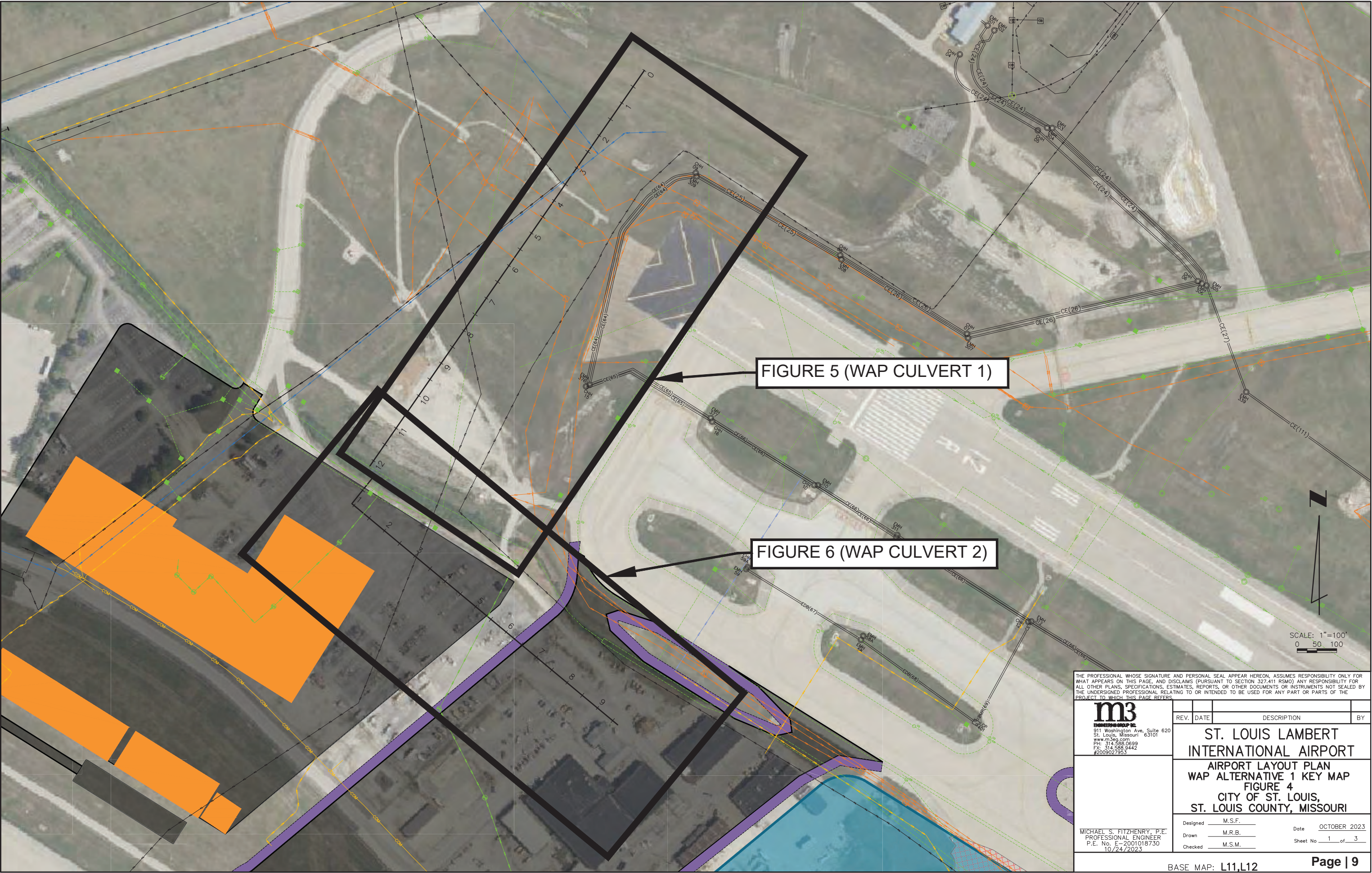
- Existing FAA cables have a depth of cover of 3 feet.
- The abandoned fuel pipe has a depth of cover of 4 feet.
- Existing water lines have a depth of cover of 4 feet.
- The existing storm underdrain has a depth of cover of 3 feet.

Existing utilities will need to be supported during open-cut excavation and construction of the new box culvert. Based on the estimated utility depths, the proposed culvert is not in conflict with existing utilities.

4.1.4 CONSTRUCTION COSTS

The construction costs for Alternative 1 include the cost to construct the 8' x 10' WAP Culvert 1, 3' x 5' WAP Culvert 2, modifications to the North Detention Basin outlet structure to address MSD water quality and water quantity storage, 8-inch sanitary sewer relocations, and the installation of a concrete diversion weir to divert additional flow to the North Detention Basin that would otherwise flow under Taxiway T.

The total cost is estimated at \$5.7 million, including a 30% contingency and accounts for uncertainties in potential utility conflicts that may be encountered during design and construction. A cost summary is provided in **Table 2**. A more detailed breakdown of the cost is provided in **Appendix A**.



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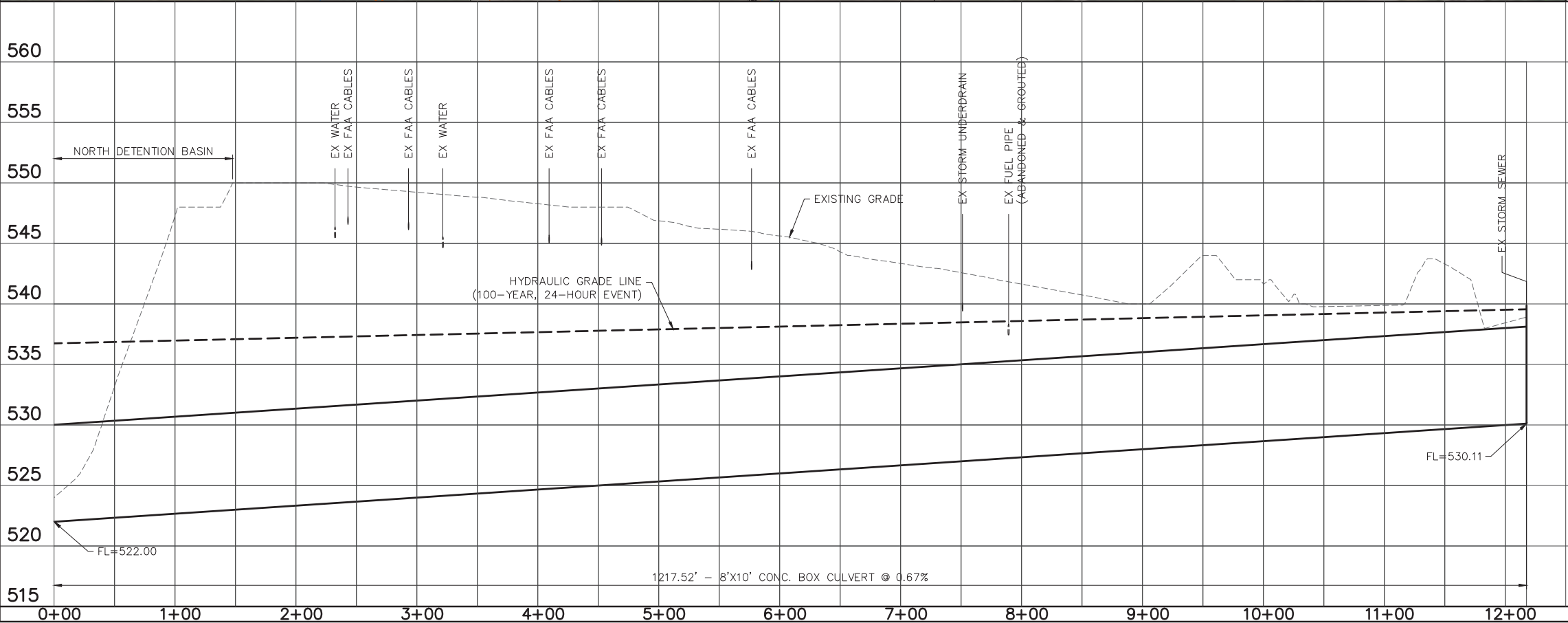
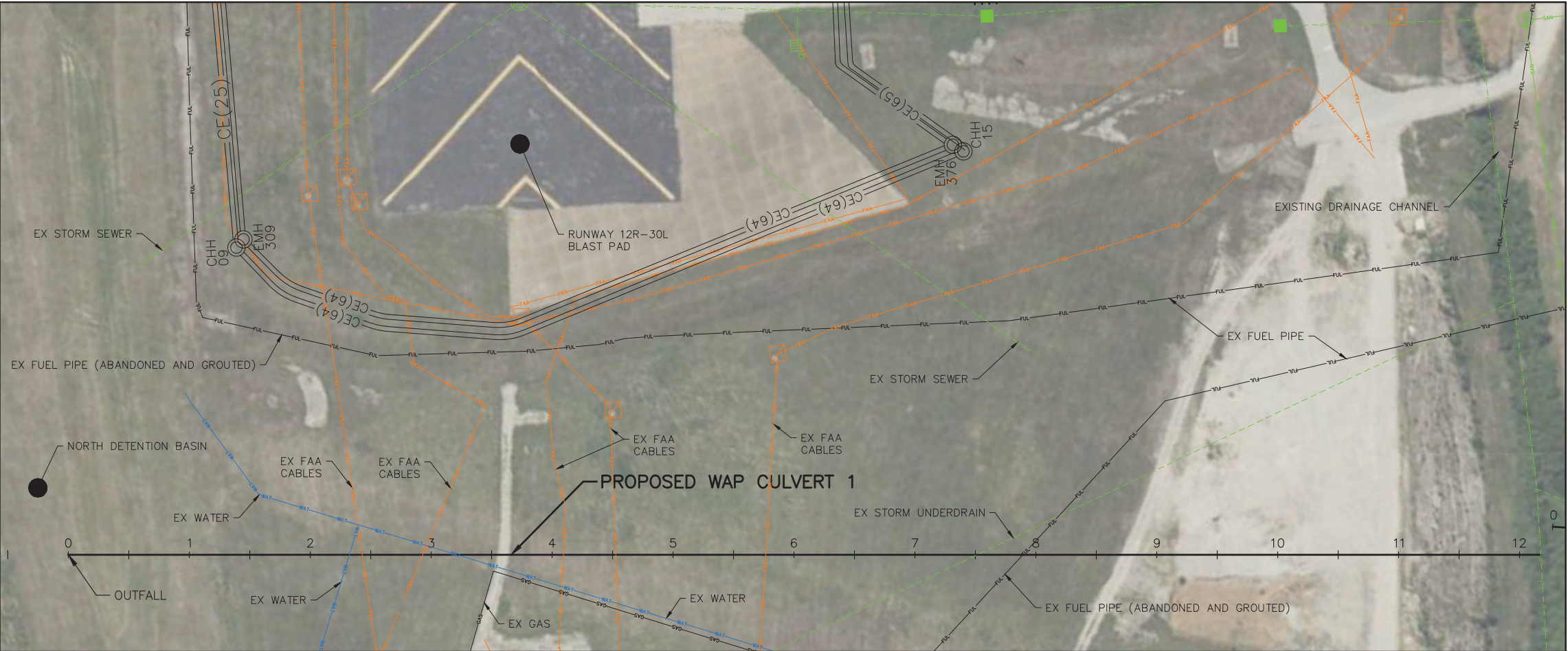
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BASE MAP: L11,L12

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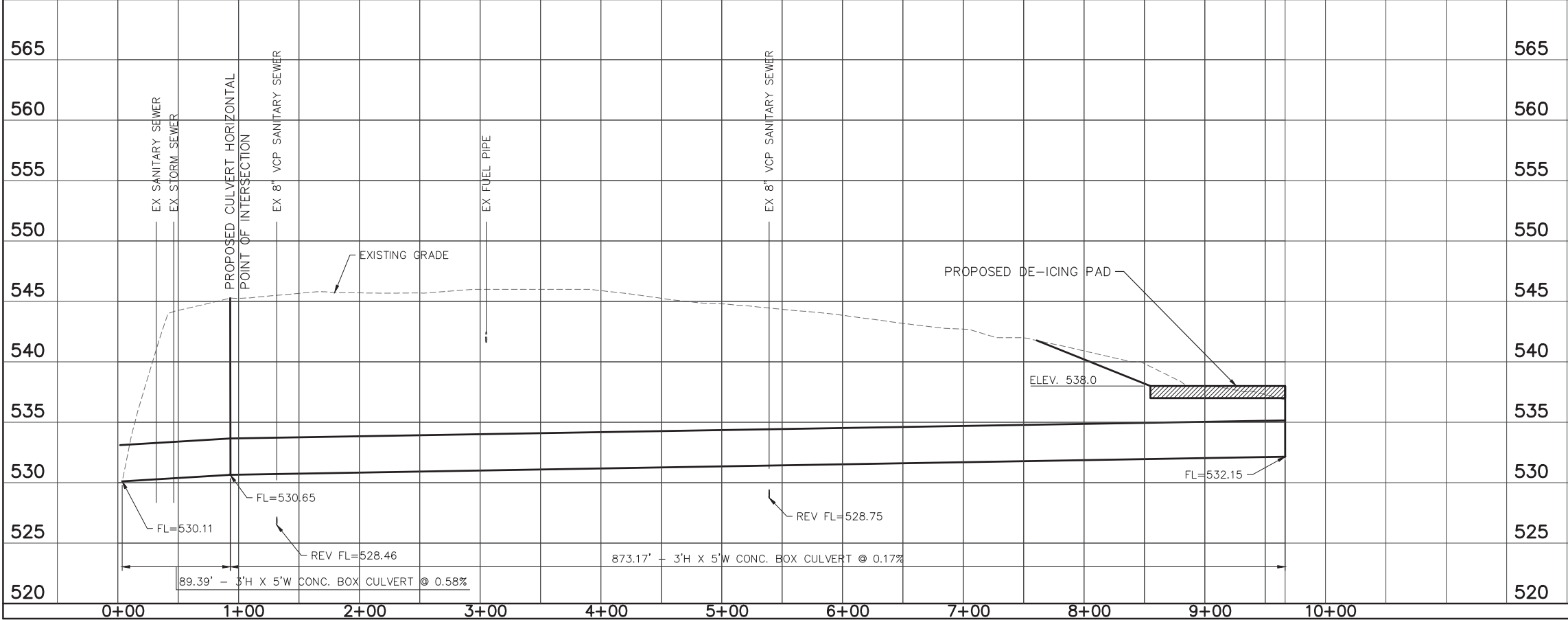
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AIRPORT LAYOUT PLAN WAP ALTERNATIVE 1 FIGURE 5				
CITY OF ST. LOUIS, ST. LOUIS COUNTY, MISSOURI				
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SCALE: 1"=50' HORZ.
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Table 2: WAP Alternative 1 Construction Cost Summary

	COST ESTIMATE (CURRENT DOLLARS)
Construction Costs	\$ 3,300,000
Contingency	\$ 990,000
General Contractor Markups	\$ 310,000
Owner's Soft Costs	\$ 800,000
Total Including Soft Costs	\$ 5,400,000
Environmental Assessment	\$ 300,000
ROM TOTAL COST ESTIMATE	\$ 5,700,000

Source: M3 Engineering Group, 2023.

4.1.5 CONSTRUCTION SEQUENCING

Table 3 below displays the necessary order and expected duration of events for the construction of the WAP stormwater improvements.

Table 3: Sequencing and Approximate Duration of Construction Events

CONSTRUCTION EVENT	APPROXIMATE DURATION
1. Demolition of Existing Maintenance Building and Parking Area	—
2. WAP Culvert 2 Construction (prior to construction of West Deicing Pad and Airfield Maintenance Facilities parking lot)	3 months
3. Modifications to North Detention Basin	4 months
4. WAP Culvert 1 Construction and Diversion Weir	6 months

Source: M3 Engineering Group, 2023.