PREPARED BY

Mead & Hunt

FINAL

Santa Barbara Airport Drainage Master Plan Update

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SANTA BARBARA, CA 93117

Santa Barbara City Agreement No. 28,227
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Santa Barbara Airport

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Executive Summary

The Santa Barbara Airport is owned and managed by the City of Santa Barbara. The Airport is located in the South Coast region of Santa Barbara County, on the coastal plain between the Santa Ynez mountains and the Pacific Ocean and is immediately surrounded by the City of Goleta, County of Santa Barbara, and University of California, Santa Barbara. The Airport occupies 952 acres. The Airport property includes 400 acres designated for aviation use and 100 acres designated for commercial/industrial use. Most of the remaining acreage includes the Goleta Slough, which is an ecological reserve that spans 430 acres inside the Airport property boundary. It is an area of tidal marsh and wetlands that drain into the Pacific Ocean.

The Airport was constructed in Goleta Slough on fill material during the 1940s. The elevation of the Airport is very low, with ground elevations between 8 and 18 feet NAVD 88. In addition to Goleta Slough, three creeks bound the Airport: Carneros Creek and Tecolotito Creek flow around the western end of the airfield, and San Pedro Creek flows on the east side of the Airport. Significant portions of Goleta Slough and the lower ends of the creeks are tidally influenced. Almost the entire Airport property is within the 100-year floodplain boundary.

The existing airport drainage system includes drainage inlets that connect to pipes, culverts, and swales. Stormwater is collected throughout the airport and ultimately discharges at pipe outfalls to Tecolotito Creek, Carneros Creek, San Pedro Creek, and Goleta Slough. The creeks carry a significant sediment load from the Santa Ynez mountains. Sediment is deposited in the vicinity of the Airport because this is where the creeks reach the coastal plain, and their slopes and flow velocities decrease. Extensive sediment deposition often occurs in Tecolotito, Carneros, and San Pedro Creeks south of Hollister Avenue, which reduces channel capacity and causes overbank flooding. The County Flood Control District maintains two sediment basins on Tecolotito and Carneros Creeks south of Hollister Avenue.

The Airport has flooded three times in the last 18 months (January 9, 2023, February 4, 2024, and February 18-19, 2024) during which floodwaters shut down Runway 7-25. The primary source of the flooding in 2024 was from Carneros Creek overtopping the bank on the north side of the airport and inundating the runway. The Airport also experiences temporary ponding at select inlets due to high water elevations in the creeks during storm events.

The Airport completed a Master Drainage Plan in 2001 to assess Airport overall drainage conditions. Mead & Hunt was retained to prepare a Drainage Master Plan Update (Plan) to guide drainage improvements associated with the Master Plan Update to be completed in 2024. The Master Plan Update addressed existing and future development to address current Airport needs and evaluated future development associated with aviation forecasts and facility requirements. The Master Plan Update defined a preferred development plan for a 20-year planning horizon.

The Basis of Design in the Plan summarizes applicable FAA, regional, county, and municipal drainage requirements and is included in **Section 2**. Data developed for the existing conditions assessments includes historical flood data, a pipe conditions assessment including video inspection of select pipes, an environmental conditions assessment as part of the Master Plan Update, site observations, terrain and structure elevations, soil type and land cover from past geotechnical investigations, rainfall data, drainage area delineations, and receiving waters conditions. This data is included in **Section 3.2**.

An assessment of the existing storm drain system evaluated areas of known drainage issues and areas demonstrating flooding as modeled in the existing conditions hydrologic and hydraulic model. Model analysis considered existing pipe capacities, temporary inundation of airfield pavements, and drawdown time of stormwater runoff from the airfield. The existing conditions assessment concluded that airfield drainage is poor during larger storms, particularly when modeled as coupled with high water surface elevations in the receiving waters of Goleta Slough, San Pedro Creek, Tecolotito Creek, and Carneros Creek. This is discussed in **Section 3.4**.

To develop mitigation strategies, areas of interest (AOI) were identified from the existing conditions assessment for inclusion in the alternatives analysis. The AOI included locations where modeled water surface elevations were higher than runway and taxiway pavement elevations, areas of known drainage concerns as reported by the Airport, and areas of concern identified in the pipe conditions assessment.

The preferred development plan from the Master Plan Update defined the proposed conditions for future development. The proposed conditions hydrology and hydraulic model was updated with the revised land use data. The AOI were expanded with additional AOI corresponding to the development projects. The AOI were divided into two categories for development of alternatives: (1) known drainage concerns and short-term projects; and (2) intermediate and long-term projects. This is discussed in **Section 4.3**.

All AOI were evaluated in an alternatives matrix to explore various mitigation strategies. The alternatives matrix used a weighted scoring criteria as ranked by the Airport. The alternatives matrix identified a recommended alternative for each AOI. The Airport selected the preferred alternatives for each AOI. The preferred alternatives associated with known drainage concerns and short-term projects were advanced to a 20% concept design level, while the preferred alternatives associated with intermediate and long-term projects were advanced to a 10% concept design level. Project data sheets, including planning level cost estimates, were created for each preferred alternative associated with known drainage concerns and short-term projects. This is discussed in **Section 5**.

Recommended storm drain system improvements include the following types:

1. Replacement or lining of pipe sections based on the pipe conditions assessment;
2. Conveyance improvements associated with proposed development projects;
3. Grading modifications to allow additional temporary surface water storage to store water away from airfield pavements until water surface elevations at the outfalls recede;
4. Maintenance and sediment removal in portions of Carneros Creek and Goleta Slough to allow for lower offsite water surface elevations and improved airfield drainage; and
5. Studies of Tecolotito and San Pedro Creeks to evaluate creek conveyance improvements.

The Airport will look to implement the recommended storm drain improvements contained within the Plan as feasible through the Airport's Capital Improvement Plan or other possible funding streams.

1. Introduction

1.1 Plan Purpose

The Santa Barbara Municipal Airport (Airport), owned and operated by the City of Santa Barbara (City), retained Mead & Hunt to prepare an Airport Drainage Master Plan Update (Plan). The Plan consists of a comprehensive plan to guide stormwater management associated with future development and buildout of the airport properties within the Airport Improvement Plan (AIP) boundary aligned with the Master Plan Preferred Development Concept. The Plan is an update to the 2001 SBA Master Drainage Plan. Background information on the 2001 SBA Master Drainage Plan is presented in **Section 1.2**. The Plan is intended to guide surface stormwater drainage improvements including collection, conveyance, quantity and quality design objectives, and environmental protections in support of regional stormwater management goals and strategies over a twenty-year planning horizon.

The Plan includes a Basis of Design presenting the drainage design criteria and includes existing conditions assessments comprised of a drainage system inventory and hydrologic and hydraulic analysis. The Plan also includes the proposed conditions assessments, drainage mitigation conceptual designs to guide the future construction and drainage improvements, and project conceptual level cost estimates. The Plan focuses on onsite stormwater management on Airport property and does not model or modify the existing conditions or proposed conditions floodplains, floodways, streams, slough, slough mouth, or other external natural waterways apart from the onsite grading and drainage improvements that address onsite issues. Data published by the Federal Emergency Management Agency (FEMA), specifically the Flood Insurance Rate Map No 06083C1361H, effective September 28, 2018, shows most of the Airport lies within the 100-year floodplain and parts of the Airport are within the 100-year floodway. The study limits of the Plan include the airport drainage system to the outfalls to adjacent receiving waters as shown in **Figure 1**.

Large-scale, systemic solutions for drainage and flooding issues at SBA could include raising of airfield pavements and installation of flood protection systems. These options are beyond of the scope of this study and will be considered in conjunction with the SBA climate adaptation planning and future planning efforts, which could include floodplain mapping updates.

FIGURE 1: PLAN STUDY LIMITS

1.2 Background and Previous Studies

The City completed an airport-wide drainage study in 2001 to assess the overall drainage conditions of Airport properties south of Hollister Avenue, identify deficiencies in the storm drain system and engineered channels, provide recommendations on drainage improvements, and provided drainage alternatives for the Runway Safety Area (RSA) Extension Project, Terminal and parking improvements, and general aviation facility improvements. The 2001 drainage study recommended relocating Tecolotito Creek and extending Runway 7-25 to the west to establish required RSAs and maintain adequate drainage and this work was completed in 2006. Since concluding the study, the City has completed other improvements to drainage infrastructure. Subsequently, development has taken place on airport property and surrounding areas.

1.3 Concurrent and Ongoing Studies

There are numerous concurrent and ongoing studies at the Airport which impact future development at the Airport. A discussion of a general scope of those studies and interactions with the Plan are as follows:

- **Airport Master Plan Update** – The Airport completed an Airport Master Plan Update (Master Plan) including stakeholder involvement; a revised Airport Geographic Information Survey; an existing condition inventory; an environmental inventory; an updated Airport Recycling, Reuse, and Waste Reduction Plan; aviation forecasts; facility requirements analysis; alternatives development and evaluation; a financial feasibility analysis and implementation plan; an aircraft noise analysis; and the development of an Airport Layout Plan. The Master Plan was led by Mead & Hunt and is to be completed in 2024.
    - The Master Plan provided information regarding future projects analyzed in the Plan.
    - The Master Plan provided field survey information and other mapping information used in the Plan.
    - The Master Plan provided an environmental inventory for consideration in future implementation of recommendations from the Plan.
    - The Master Plan included general drainage-related impacts and considerations for the preferred development concept. The Plan is intended to provide more detail on drainage recommendations associated with future development at the Airport.
- **Terminal Improvement Project** – The Airport is evaluating improvements to the terminal building. Drainage improvements for any building site improvements will be covered under that project and need not be addressed in the Plan.
    - This project area was excluded from study under the Plan.
- **Fixed Base Operator (FBO) Redevelopment Project** – The Airport is planning an FBO Redevelopment to establish two (2) new FBO leaseholds in the northeast quadrant of the Airport to accommodate the relocation of the two (2) existing FBOs. Drainage improvements for any building site improvements will be covered under that project and need not be addressed in the Plan.
    - This project area was excluded from study under the Plan.
- **Climate Adaptation Plan** – The Airport is developing a Climate Adaptation Plan including an asset inventory, vulnerability assessment and risk evaluation, adaptation strategies, and stakeholder outreach. The Climate Adaptation Plan is ongoing and led by ESA with support from Mead & Hunt.
    - The Climate Adaptation Plan provided supplemental information for establishing elevated receiving water surface elevations at the airport drainage system outfalls.
    - The Plan will be used to aid in determining drainage-related impacts and needs for future projects outlined in the Climate Adaptation Plan.

2. Basis of Design

Multiple references at various jurisdictional levels provide regulatory guidance for stormwater management and design at this location. The references considered are listed in this section.

2.1 References

2.1.1 Federal Aviation Administration (FAA)

Advisory Circulars (AC):

- FAA AC 150/5320-5D, Airport Drainage Design, August 2013
- FAA AC 150/5200-33C, Hazardous Wildlife Attractants on or Near Airports, February 2020

2.1.2 California Water Quality Board – Central Coast Region

- Post-Construction Stormwater Management Requirements for Development Projects in the Central Coast Region, July 2013

2.1.3 Santa Barbara County

- Santa Barbara County Flood Control and Water Conservation District Standard Conditions of Project Plan Approval, January 2011
- Low-Impact Development Hydrologic Analysis, Prince George's County, Maryland, 1999
- Santa Barbara County's Floodplain Management Ordinance (SBCC Development Standard) Chapter 15A, "Floodplain Management"
- Santa Barbara County's Setback Ordinance (SBCC Development Standard) Chapter 15B, "Development Along Watercourses")
- SBCC Development Standard Chapter 24, "Offenses, Miscellaneous," Section 24-7, "Watercourses – Erecting buildings, etc., which obstruct flow prohibited"

2.1.4 City of Santa Barbara

- City of Santa Barbara "Storm Water BMP Guidance Manual", December 2020

2.2 Design Criteria

2.2.1 Federal Aviation Administration (FAA)

The FAA AC 150/5320-5D, *Airport Drainage Design* specifies guidelines for the collection and conveyance of stormwater runoff to provide for the safe passage of vehicles and operation of the facility without causing adverse onsite or off-site impacts (FAA, 2013). In addition, local, state, and/or federal regulations often control the allowable quantity of stormwater discharges (FAA, 2013, Section 1-5.3). For airfields, the typical design storm is the 5-year storm event with no encroachment of runoff on taxiway and runway pavements (including paved shoulders) (FAA, 2013, Section 2-2.4). Consideration must be given to the probable consequences of storms more severe and less frequent than the design storm (FAA, 2013, Section 2-2.5). However, the damage or inconvenience that may be caused by larger infrequent storms may not warrant the increased cost of a drainage system large enough to accommodate that storm. For storm drain design, following the initial design of the storm drain network, it is advisable to evaluate the system using a higher check storm, such as the 100-year flood frequency (FAA, 2013, Section 6-2.4.1).

The FAA AC 150/5200-33C, *Hazardous Wildlife Attractants on or Near Airports* recommends that stormwater management systems be designed so as not to create above-ground standing water; if above-ground standing water is created it will drain down within 48-hours after the design storm event. In addition, when selecting vegetation, one needs to consider the potential to attract wildlife and eliminate vegetation that may provide food or cover for wildlife (FAA, 2020).

2.2.2 California Regional Water Quality Board – Central Coast Region

The Post-Construction Stormwater Management Requirements ensure that pollutant discharges are reduced to the maximum extent practicable and that key watershed practices are protected. Regulated projects include all new development and redevelopment projects that create and/or replace 2,500 square feet of impervious surface. Projects of this size or greater must comply with four performance requirements:

- Performance Requirement #1 – minimize stormwater runoff from the site for projects with a net impervious area of 2,500 square feet or greater.
- Performance Requirement #2 – provide stormwater quality treatment for runoff produced by the 95th percentile storm for projects with a net impervious area of 5,000 square feet or greater.
- Performance Requirement #3 – provide stormwater retention for projects with a net impervious area of 15,000 square feet or greater.
- Performance Requirement #4 – manage the peak runoff of stormwater so that the proposed conditions' total volume does not exceed the existing conditions' total volume for the 2-year to 10-year storm recurrence interval for projects with a net impervious area greater than 22,500 square feet.

2.2.3 Santa Barbara County

The Santa Barbara County *Flood Control and Water Conservation District Standard Conditions of Project Plan Approval* outlines the design criteria and policies for design and construction in Santa Barbara County. The Standard Conditions outline standard design principles for storm drains, drainage inlets, manholes, hydrologic calculations, grading and improvement plans, and detention basins. The Standard Conditions include optional input parameters to be used with the Santa Barbara Urban Hydrograph (SBUH) for the South Coast Area for modeling detention basins. The parameters include storage-indication pond routing method, SCS 24-hour, Type I rainfall distribution, Antecedent Moisture Condition II, 0.1-hour hydrograph ordinate time increment, and the 24-hour total rainfall amounts for the South Coast Area in **Table 1**.

TABLE 1: 24-HOUR TOTAL RAINFALL AMOUNTS (INCHES), SOUTH COAST AREA

2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
3.20	4.61	5.55	6.71	7.56	8.38

The Low-Impact Development Hydrologic Analysis prepared by Prince George's County, Maryland is approved by Santa Barbara County Flood Control and Water Conservation District for use in calculating composite curve numbers that consider low-impact development (LID) design components. The objective of LID is to maintain the pre-development runoff volumes and the pre-development peak runoff rate and frequency relationships. The analysis outlines procedures to calculate retention and detention storage volumes that control the increase in peak runoff rate after development.

All developments additionally must adhere to the Santa Barbara County Codes (SBCC) Development Standards.

2.2.4 City of Santa Barbara

The City of Santa Barbara *Storm Water BMP Guidance Manual* outlines practices to reduce the discharge of non-point source pollutants into local creeks and the ocean, and to protect water quality within the City. The Manual provides options in the selection, integration, design, and implementation of BMP options for a project to meet the City of Santa Barbara post-construction stormwater management requirements for development and redevelopment projects based on four project tiers:

- Tier 1 – Identify and demonstrate the use of at least one stormwater BMP for projects with less than 499 square feet of new and/or redeveloped impervious area.
- Tier 2 – Identify and demonstrate the use of appropriate site design and BMP to capture and treat an area and volume of runoff equivalent to the total area and runoff volume for projects 500 to 1,999 square feet.
- Tier 3 – In addition to the requirements of Tier 2, provide stormwater runoff BMP to meet the City's stormwater runoff requirements for pollutant treatment, runoff volume, and peak discharge rates for projects with 2,000 to 14,999 square feet of new and/or redeveloped impervious area.
- Tier 4 – In addition to the requirement of Tier 3, select and implement BMPs to capture and treat runoff generated from a 1'' storm from at least 95% of the project site's impervious area. Additionally, 1.2'' of the 24-hour rainfall event must be retained/prevented from flowing off-site for all replaced impervious area and 2.4'' of the 24-hour rainfall for all new impervious area for projects that add or replace more than 15,000 square feet of impervious area.

The City's performance requirements are more stringent than the Regional Water Quality Board's, and therefore control stormwater design.

2.3 Summary

A summary of the drainage design requirements for Airport Drainage System elements is included in **Table 2**. These are the standards at time of Plan development. Future projects would need to verify design standards at time of project development.

TABLE 2: SUMMARY OF DRAINAGE DESIGN CRITERIA

ELEMENT	CRITERIA	VALUE	REFERENCE
Drainage Systems	Design storm – SCS rainfall distribution	Type 1	FAA AC 150/5320-5D
	Design storm frequency	5-year	FAA AC 150/5320-5D
	Storm Drain Design – Runoff Calculations	Rational Method	Santa Barbara County Flood Control and Water Conservation District Standard Conditions of Project Plan Approval
Channel Design	Discharge Frequency – Roadside and median drainage channels	5- to 10-year	FAA AC 150/5320-5D
	Discharge Frequency – Temporary channel lining	2-year	FAA AC 150/5320-5D
	Triangular/trapezoidal side slopes	1V:3H or flatter; 1V:4H or flatter for traffic safety areas	FAA AC 150/5320-5D
	Freeboard – Temporary channel	None	FAA AC 150/5320-5D
	Freeboard – Steep gradient channel	Equal to flow depth	FAA AC 150/5320-5D
Culvert Design	Design guidance	Federal Highway Administration (FHWA) HDS-5	FAA AC 150/5320-5D
	Design storm frequency – Flood protection	No less than 10-year	FAA AC 150/5320-5D
	Headwater depth	Shall not exceed 1.25 feet	FAA AC 150/5320-5D
	Pipe diameter	18-inch minimum; 24-inch in areas with windblown materials	FAA AC 150/5320-5D
	Wingwalls	Flared at 8 units of length for every 1 unit of increased width	FAA AC 150/5320-5D
Stormwater Control Facilities	Rainfall depth for volume reduction	2.4'' of 24-hour rainfall for new impervious area, 1.2'' for replaced impervious (SBUH)	City of Santa Barbara Storm Water BMP Guidance Manual
	Flow control design storm	2-, 5-, 10-, and 25-year, 24-hour storm events (SBUH)	City of Santa Barbara Storm Water BMP Guidance Manual
	Flow control design storm	2-, 10-, and 100-year events	FAA AC 150/5320-5D
	Maximum detention time	48 hours	FAA AC 150/5200-33C

ELEMENT	CRITERIA	VALUE	REFERENCE
Storm Drain Design	Design storm frequency – Sag points	50-year	FAA AC 150/5320-5D
	Check storm	100-year	FAA AC 150/5320-5D
	Minimum velocity	3 ft/s for full-pipe flow 2 ft/s for 25% diameter flow depth	FAA AC 150/5320-5D
	Minimum time of concentration	5-minutes	FAA AC 150/5320-5D
	Inlet design – debris blockage	Assume 25%	Engineer discretion
	Design storm	25-year	Santa Barbara County Flood Control and Water Conservation District Standard Conditions of Project Plan Approval
	Inlet design – sumps	Sized for 100-year storm	Santa Barbara County Flood Control and Water Conservation District Standard Conditions of Project Plan Approval
	Structure design – floor elevation	At least 2 feet above the 100-year water surface elevation	Santa Barbara County Flood Control and Water Conservation District Standard Conditions of Project Plan Approval
Storm Drain Design (continued)	Storm drain design – width of easement	6 inches on both sides plus 1:1 trench slope	Santa Barbara County Flood Control and Water Conservation District Standard Conditions of Project Plan Approval
	Storm drain design – materials	Minimum class III RCP strength, 18-inch minimum diameter	Santa Barbara County Flood Control and Water Conservation District Standard Conditions of Project Plan Approval
Pavement Surface Drainage	Design storm	5-year	FAA AC 150/5320-5D
	Design storm – Depressed section/underpass	50-year	FAA AC 150/5320-5D
	Check storm – roadways	100-year	FAA AC 150/5320-5D
	Check storm spread – roadways	One lane free of water, open to traffic	FAA AC 150/5320-5D
Surface Drainage	Longitudinal slope – Sag vertical curves	Minimum slope of 0.3% should occur within 50 feet of the low point of the curve	FAA AC 150/5320-5D
	Overland escape path	Clearly defined	Santa Barbara County Flood Control and Water Conservation District Standard Conditions of Project Plan Approval

ELEMENT	CRITERIA	VALUE	REFERENCE
Water Quality	Volume-based stormwater runoff BMPs	Sized for 1-inch, 24-hour design storm from all impervious area (SBUH)	City of Santa Barbara Storm Water BMP Guidance Manual
	Flow-based stormwater runoff BMPs	Sized for 0.25 inch/hour for 4 hours rainfall over the project site (SBUH)	City of Santa Barbara Storm Water BMP Guidance Manual

3. Existing Conditions Assessments

The airport drainage existing conditions assessments included baseline data development, field investigations, geotechnical and environmental conditions assessments, and computer hydrologic and hydraulic model simulations to identify areas of interest for evaluation in the development of drainage mitigation recommendations.

3.1 Existing Airport Drainage System Description

The existing airport drainage system includes drainage inlets that connect to pipes, culverts, and swales. Stormwater is collected throughout the airport and ultimately discharges at outfalls to Tecolotito Creek, Carneros Creek, San Pedro Creek, and Goleta Slough. Goleta Slough is an area of estuaries, tidal creeks and marsh, and wetlands through which Tecolotito Creek flows. Some of the outfalls drain to the tidal creeks within the Goleta Slough before draining to Tecolotito Creek, and some outfall directly to Tecolotito Creek. The existing drainage system and outfalls are shown in **Exhibit 1**.

The Airport site is flat and close to sea level with much of the site ranging from 8 to 18 feet NAVD 88. Almost the entire Airport property is within the 100-year floodplain boundary (FEMA Flood Insurance Rate Map Number 06083C1361H, effective September 28, 2018). The Airport drainage system is subject to tidal influences as the outfalls discharge directly to the tidally influenced receiving waters of Goleta Slough, San Pedro Creek, Carneros Creek, and Tecolotito Creek. Outfalls are also subject to fluctuating water surface elevations in these creeks related to stream flow rates. Outfalls located at low inverts are typically submerged at high tide and during a storm event and take at least one (1) day to fully drain down after a storm, once the receiving waters water levels recede. Many outfalls have tide gate check valves to prevent backflow of water onto the airport.

3.2 Existing Conditions Data Development

Baseline data developed to support the existing conditions assessments are described below. This data includes historical flood data, pipe conditions, environmental conditions, site observations, terrain and structure elevations, soil types, land cover, rainfall, drainage areas, and receiving waters conditions.

3.2.1 Historical Flood Data

The Airport has been impacted by multiple storm events. The Airport supplied photos and observations from a storm on January 9, 2023 at locations where flooding occurred. During this storm event, Runway 7-25 was underwater, along with Taxiways D, C, B, and A5. Photos of Taxiways C and D shown below in **Figure 2** depict standing water from that storm event. The storm event resulted in ponded water on the airport primarily due to exceptionally high tidal influences and high-water elevations in the receiving waters at the outfalls.

FIGURE 2: TAXIWAYS C AND D FLOODED DURING THE JANUARY 9, 2023 STORM EVENT

Runway 7-25 operation was also impacted due to flooding from storm events on February 4, 2024 and February 18-19, 2024. In these three storm events, the primary source of the flooding was Carneros Creek, overtopping the bank on the north side of the airport and inundating the runway.

The Plan primarily focuses on airfield drainage infrastructure and does not evaluate the receiving waterway systems and flooding or deficiencies within that system. The Plan recognizes the limitations at the Airport outfalls and considers outfall improvements in the drainage mitigation alternatives.

3.2.2 Pipe Condition Assessments

Downstream Services, Inc. completed pipe condition assessments at select locations at the Airport (Downstream Services, Inc., 2023). These locations included storm drainpipes crossing Runway 7-25 and Taxiway A to determine the conditions of pipes under these critical airfield pavements. The assessments were performed using mobile closed-circuit television (CCTV) services. The pipes were cleaned prior to performing televising, including dewatering and removal of sediment. Two pipe segments (the outfall pipes of Outfall 10 and Outfall 12) were inundated with water and were not able to be cleaned or assessed in April 2023. Additional measures were deployed to seal the outfall tide gate check valves at these locations in order to clean and assess the pipes in April 2024. The general findings were that most pipes were in good condition, with a few issues rated as “most significant defect” grades using the Pipeline Assessment Certification Program (PACP) Code matrix. The summary of pipe conditions and the CCTV inspections is included in **Appendix A**.

Pipe segments with a PACP code of 3 or higher are summarized in **Section 3.4.6** as Pipe Areas of Interest for consideration of being addressed in future potential projects.

3.2.3 Environmental Conditions Assessments

The environmental conditions assessment was completed by Rincon Consultants, Inc. as part of the Environmental Inventory chapter prepared for the Master Plan to identify potential constraints that could affect the development of a drainage strategy for the Airport. The Environmental Inventory chapter includes an environmental inventory of biological resources including critical habitat areas and special-status plant and wildlife species. The Environmental Inventory chapter also includes an inventory of cultural resources. The assessment located twelve archaeological sites within the environmental study area, with one listed on the National Register of Historic Places. The environmental study area does not overlap with any of the City's six cultural resource sensitivity areas. Future projects in the airfield and airspaces areas should consider impacts to the sensitive resources, sites, and areas. The Environmental Inventory chapter is included in **Appendix B** labeled as draft as the Master Plan is to be completed later in 2024. This information is considered in the preferred alternatives in **Section 5**.

3.2.4 Site Observations

Mead & Hunt conducted a site visit on April 12, 2023, accompanied by Airport staff. The site investigations included observations of the outfalls, areas where flooding is known to occur, and various swales, culverts, and inlets across the Airport. Notable site conditions observed during the site visit and verified by topographic survey include the following:

- Based on pictures and survey data, the outfall pipe at Outfall 26 is adversely (reverse) sloped. Pictures from the surveyor and observations during the site visit confirmed standing water in the upstream inlet, DI-W07-507. Outfall 26 and inlet DI-W07-507 are shown below in **Figure 3**.
- The pipes leading to Outfalls 10 and 12 were full of water at the time of the pipe conditions assessment in April 2023. During the site visit, standing water was also observed on the downstream side of these outfalls, as shown below in **Figure 4**. Observations at Outfall 10 during a storm event reveal that the water level at the outfall in Goleta Slough take at least a day to drain down.
- Standing water was observed in many of the channels leading from the outfalls to Tecolotito Creek, Carneros Creek, and Goleta Slough.


FIGURE 3: OUTFALL 26 AND DI-W07-507 STANDING WATER, APRIL 2023

FIGURE 4: OUTFALL 10 AND OUTFALL 12, APRIL 2023

3.2.5 Terrain and Structure Elevations

Aerial survey data and topographic survey data were provided from effort on the Master Plan performed by NV5 (NV5 Geospacial, Inc., 2023) in 2022 and 2023. LiDAR (light detection and ranging) data obtained in 2022 as part of the Master Plan is used as the basis of the Airport topography. These topographic contours are shown on **Exhibit 1** and were used for mapping results. Structure information (including pipe inverts, structure rims, and bottom elevations) was primarily sourced from the Airport's Utility Map Book (Penfield & Smith, 2018) and was supplemented with data for select structures surveyed as part of the topographic survey effort by NV5. The vertical datum for elevations is NAVD 88 feet.

3.2.6 Soil and Land Cover

Soil data was obtained from the National Resources Conservation Service (NRCS) Web Soil Survey Tool. The soils within the study area are primarily fine sandy loams and are designated as Hydrologic Soil Group (HSG) C. HSG C soils have moderately high runoff potential when thoroughly wet and restricted water transmission through soil. Other soils are classified as Fill Areas.

A geotechnical assessment was completed by Earth Systems (Earth Systems, 2023) and includes a summary of prior field investigations and laboratory testing, an overview of the project site including regional geology, drainage infiltration potential and limitations, probable groundwater depths, soil erosion potential, and general considerations for construction. The geotechnical assessment confirmed the soil classifications expected onsite. Additional findings included groundwater depths ranging from 3.5 to 9.0 feet below current site grades across the Airport, and highly erodible soils. The Geotechnical Technical Memorandum is included in **Appendix C**.

The geotechnical assessment concluded that the onsite Fill Area is composed of silty sand, clayey sand, poorly graded sand, well-graded sand, and sandy lean clay, similar to the Airport's natural soil, and therefore was classified as HSG C.

Land cover boundaries were delineated using the linework provided by the NV5 survey, validated during site observations, and categorized into the following: pavement, buildings, vegetation (open space fair ground cover), and gravel roads. The pervious area curve number (SCS Curve Number) for each land type was derived from Tables 2-2a through 2-2d from the NRCS's TR-55 Manual (USDA, NRCS, 1986). **Figure 5: Existing Conditions Land Use** shows the land cover delineations for the study area.

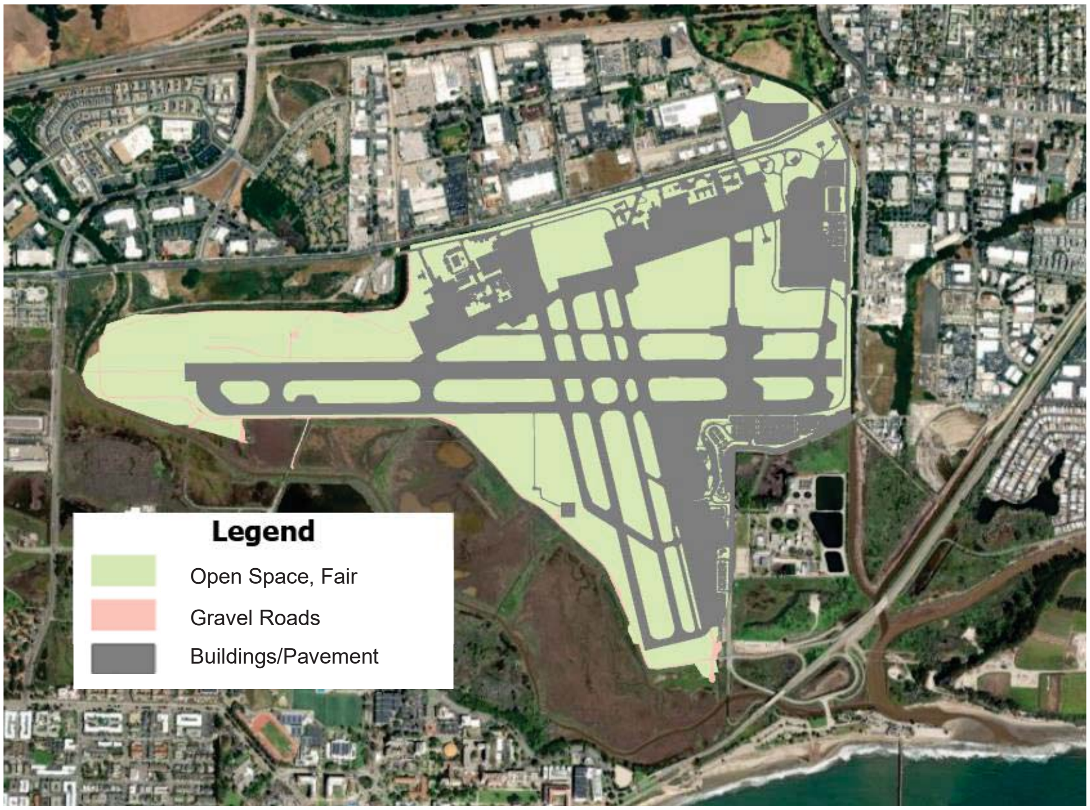


FIGURE 5: EXISTING CONDITIONS LAND USE

The curve numbers used in the hydrologic model are summarized in **Table 3**.

TABLE 3: PERVIOUS AREA CURVE NUMBERS

Land Cover	Hydrologic Soil Group	SCS Curve Number
Pavement	C	98
Buildings	C	98
Open Space, Fair	C	79
Gravel Roads	C	89

Manning's "n" roughness coefficient values quantifying surface roughness for the hydrologic and hydraulic calculations were assigned based on site observations. References that were consulted for Manning's "n" value selection included a reference table developed by NRCS-Kansas (NRCS, 2016). The values used are summarized in **Table 4** below.

TABLE 4: MANNING'S "N" VALUES

Roughness Category	Manning's "n" Value
Concrete Pipe	0.013
CMP Pipe	0.024
PVC Pipe	0.010
HDPE Pipe	0.012
Concrete Channels	0.011
Natural Channels, Brush on Side	0.05
Natural Channels, Clean, Straight	0.03
Smooth Surfaces (concrete, asphalt, gravel)	0.011

3.2.7 Rainfall Data

Rainfall data was modeled using the SCS 24-hour, Type 1 rainfall distribution. The SBUH rainfall depths are summarized in **Table 1** in **Section 2.2.3**.

3.2.8 Drainage Areas

The Airport site is relatively flat and close to sea level. Airport stormwater is conveyed through surface runoff, swales, and storm drains to twenty-two outfalls. The Airport primarily drains westerly and southerly to Goleta Slough. There are outfalls to the Goleta Slough tidal creeks and directly to Tecolotito Creek and Carneros Creek. On the east side of the Airport, there are outfalls to San Pedro Creek. The naming of the drainage areas and associated drainage systems in this study follows the naming convention for the drainage areas included in the Airport's Stormwater Pollution Prevention Plan (SWPPP) (Santa Barbara Municipal Airport, 2015) where applicable. Drainage areas not included in the SWPPP were named using the numbering system of the outfalls as labeled on stakes in the field; these outfall numbers are consistent with the numbering system used in the Utility Map Book (Penfield & Smith, 2018). Locations of drainage areas and associated outfalls are presented below in **Figure 6** and attached **Exhibit 2**.

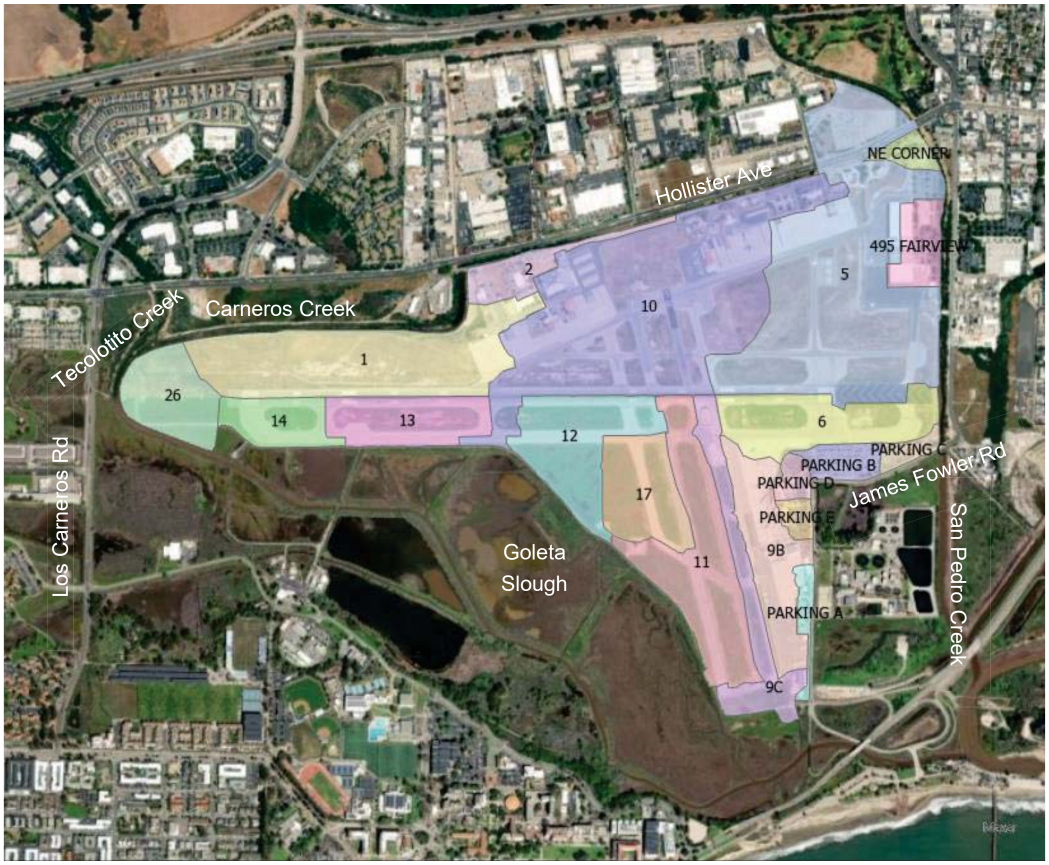


FIGURE 6: EXISTING DRAINAGE AREAS

Drainage Area 1 drains the western portion of the aircraft ramp and runway and taxiway pavements in the northwestern section of the Airport. It discharges to Carneros Creek through Outfall 1.

Drainage Area 2 captures runoff from the northern edge of Airport property adjacent to Firestone Road and discharges to Carneros Creek through a system of swales and culverts at Outfall 2.

Drainage Area 5 encompasses the system of swales and storm drain that collect water from the northeast section of the Airport and picks up surface runoff from runway and taxiway pavements before discharging to San Pedro Creek at Outfall 5. Surface runoff from a lot north of Airport property also enters Drainage Area 5 through a culvert under Hollister Avenue.

Drainage Area 6 collects stormwater from the terminal ramp and runway pavements, and discharges to San Pedro Creek at Outfall 6.

Drainage Areas 9B and 9C include the storm drain system that collects water from the western and southern portions of the terminal ramp, and the southeastern runway and taxiway pavements. It discharges to Goleta Slough at Outfall 9B and 9C.

Drainage Area 10 collects stormwater from a large area in the center of the Airport, from the northern Airport buildings and runway and taxiway pavements, and ultimately discharges to Goleta Slough at Outfall 10.

Drainage Area 11 includes the storm drain system that collects stormwater from the southwest infield areas along Runway 15R/33L and discharges to Goleta Slough at Outfall 11.

Drainage Area 12 collects stormwater from the infield areas of Runway 7/25 and discharges to Goleta Slough at Outfall 12.

Drainage Area 13 collects stormwater from the infield areas of Runway 7/25 and discharges to Goleta Slough at Outfall 13.

Drainage Area 14 collects stormwater from the infield areas of Runway 7/25 and discharges to Tecolotito Creek at Outfall 14.

Drainage Area 17 collects stormwater from the southwestern runway and taxiway pavements and discharges to Goleta Slough at Outfalls 17a and 17b.

Drainage Area 26 collects surface runoff from the southwestern edge of the Airport and discharges to Tecolotito Creek at Outfall 26.

495 Fairview Hangars storm drains collect stormwater from ramps adjacent to Hollister and Fairview avenues, and discharges to San Pedro Creek at Outfalls F-1 and F-2.

The **Northeast Corner** of the Airport collects surface water into a culvert that discharges to San Pedro Creek at Outfall Northeast Corner.

Parking Areas along the Terminal Area and James Fowler Road collect surface runoff in isolated storm drain systems and ultimately discharge to San Pedro Creek at Outfalls Parking B, Parking C, Parking D, and Parking E and Goleta Slough at Outfall Parking A.

3.2.9 Receiving Waters Conditions

The water levels of the receiving waters for the Plan were provided by ESA as part of the Climate Adaptation Plan development. ESA analyzed data taken from river stations located at breaks in slope on the FEMA flood profiles for the 1-, 10- and 100-year water levels and the 1-year water level at the Goleta Slough gage, which was determined by performing an extreme value analysis on the Goleta Slough gage data from 2013 to 2023. The Goleta Slough gage reads the water level at the mouth of the slough, and is influenced by San Pedro, Atascadero, and Tecolotito Creeks and tidal effects. Whichever value was higher between the FEMA flood profiles and the Goleta Slough Gage was used as the water level at that river station. The 5-year design storm WSE at each of these stations was determined by interpolating between the selected 1-year design storm WSE and 10-year design storm WSE using the annual chance of occurrence. The 25-year design WSE was determined through interpolation between the FEMA 10-year design storm WSE and 100-year design WSE using a Gumbel distribution.

The Plan then interpolated peak WSE for each design storm at each outfall in feet NAVD 88, discussed in **Section 3.3.4.** All outfalls are typically submerged during significant storm events, which limit discharge from the storm drain systems until the receiving water levels recede.

3.3 Existing Conditions Model

An existing conditions hydrologic and hydraulic model was developed using XPSWMM modeling software version 2020.1. XPSWMM is suited for this effort because of its ability to model water surfaces and flow rates simultaneously across a wide, integrated network, which is necessary for relatively flat drainage environs such as airports adjacent to variable receiving waters. The SBUH method was used to calculate runoff using drainage areas, curve numbers, times of concentration, and rainfall data. Routing was modeled as dynamic routing. The model parameters are discussed below.

3.3.1 Subbasins

Each drainage area was further subdivided into subbasins draining to each drainage inlet based on topographic contours, allowing for hydrologic computations at each node in the XPSWMM model. Existing Conditions Model Input is included in **Appendix D**.

3.3.2 Time of Concentration

The TR-55 flow segment method was utilized for computation of the time of concentration. Flow paths were delineated in AutoCAD Civil 3D software based on available elevation data, survey information, and aerial imagery. Segments of the flow path for each subbasin included sheet flow, shallow concentrated flow, and concentrated (open channel or pipe) flow as applicable. A Manning's "n" friction coefficient of 0.15 was used in the time of concentration calculations for sheet flow across short grass.

3.3.3 Routing

Runoff from each node was routed through pipes or channels as links following the known airport drainage system.

Inlets located in low points are susceptible to ponding and can store ponded water on the ground surface if the runoff from a storm event exceeds the capacity of the downstream pipes or if the receiving water elevation is high. At these locations, the approximate available surface storage volume was calculated based on the surface contours. Where a storage area may overflow as surface flow to a nearby inlet in the same infield area, the surface flow was modeled as flowing in a wide and very shallow trapezoidal channel.

Surface flow that could transfer between drainage areas when significant ponding had the potential to overtop the runway and taxiway pavement crown was modeled as weir flow. Weir flow would occur if the water surface elevation in the storage areas was higher than the crown of pavements. A broad-crested weir coefficient of 2.7 was used for the calculations (USACE, 2016). Note that some weir elements only experience flow during certain conditions and scenarios, and that the XPSWMM software may provide blank output or placeholder values of “-9e+99” for water surface elevations when not in use.

3.3.4 Boundary Conditions

There are twenty-two outfalls that discharge into Goleta Slough, Tecolotito Creek, Carneros Creek, and San Pedro Creek. Peak water surface elevations (WSE) at river stations during 5- and 10-year design storms as well as initial conditions for model boundary conditions were provided by ESA as part of the Climate Adaptation Plan (final plan in progress), as described in **Section 3.2.9**.

The WSE data provided by ESA as part of the Climate Adaptation Plan was spatially interpolated along the watercourses for this analysis to estimate the peak WSE for each design storm at each outfall in feet NAVD 88, as included below in **Table 5**.

TABLE 5: INTERPOLATED OUTFALL PEAK WSE VALUES

Outfall	5-Year WSE (feet)	10-Year WSE (feet)	25-Year WSE (feet)
1	9.98	10.19	11.65
2	10.82	11.00	12.50
5	12.63	13.20	13.8
6	10.84	11.35	12.6
9B	8.43	9.10	10.0
9C	8.43	9.10	10.0
10	9.06	9.40	11.04
11	8.43	9.10	10.0
12	9.04	9.38	11.02
13	9.13	9.46	11.09
14	9.46	9.77	11.33
17a	8.55	9.10	10.35
17b	8.55	9.10	10.35
26	9.64	9.94	11.47
495 Fairview-1	13.68	14.11	15.62
495 Fairview-2	13.68	14.11	15.62
Northeast Corner	17.31	17.80	18.40
Parking A	8.43	9.10	9.97
Parking B	10.30	10.75	12.09
Parking C	10.49	10.96	12.27
Parking D	10.21	10.65	12.01
Parking E	10.03	10.45	11.84

These peak WSEs were then used by ESA to develop a time series of the water levels for the 5-

year design storm at each outfall centered around the temporal peaks. This time series was developed using water level data from the SBSPWD Goleta Slough stream gauge during the January 2023 storm event and adjusted to each station based on the FEMA bed elevation and peak water level for each scenario. The 10-year design stormwater level time series was calculated by shifting the WSE time series up vertically by the difference between the maximum water level at each outfall for the 10-year and 5-year design storm. When input into the XPSWMM models, the water level time series were temporally aligned with their peaks at modeled storm event hour 10 to coincide with the timing of the peak runoff discharge rate from the Airport. The water level elevations and time series at each outfall are summarized in **Appendix E**.

3.3.5 Design Storm Selection

In the 25-year design storm event, the WSE in the surrounding waterways at the outfalls are near or above Airport ground surface elevations, which sits at 8 to 18 feet NAVD. Therefore, the 25-year design storm event was not modeled in the XPSWMM model as the downstream WSE would block any discharge from happening. Additionally, in the 100-year design storm event, the Airport is completely inundated; therefore, 100-year design storm event checks were not performed.

Three events were simulated in the existing conditions model: 5-year design storm event with free discharge conditions at the outfalls and boundaries, 5-year design storm event with 5-year WSE time series at the outfalls, and 10-year design storm event with 10-year WSE time series at the outfalls. The 5-year design storm event with free discharge conditions at the outfall is solely used to evaluate the existing pipe system capacity for the associated drainage areas.

3.4 Existing Conditions Results

The computed existing conditions model results include the peak stormwater runoff discharge rates. The hydrologic and hydraulic inputs and results of each node and link are included in **Appendix D,** and output hydrographs are included in **Appendix F**.

3.4.1 Drainage System Capacity

Analysis of the results for the three selected model scenarios and the storm drain system's ability to drain runoff from the Airport are discussed below. The Existing Conditions Result Maps are included in **Exhibit 3**.

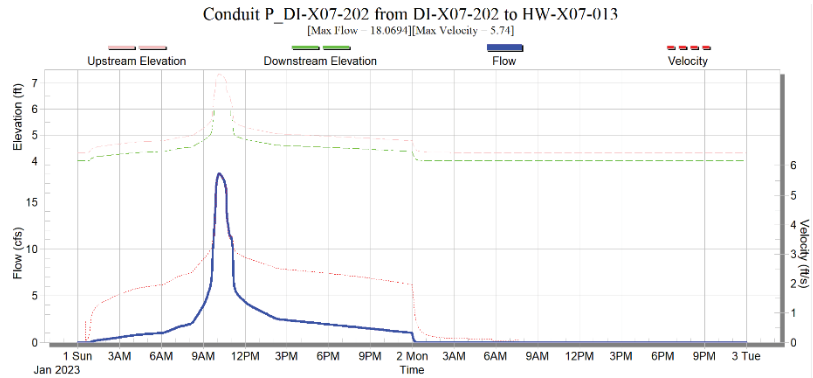
The 5-year design storm with free discharge conditions at the discharge point was simulated to perform a capacity check on the existing drainage system. The results showed that with no tidal or off-site flooding influences, the Airport drainage infrastructure satisfactory drains the 5-year design storm with the exception of two locations as follows:

1. Due to the adversely sloped pipe at Outfall 26, water overflows to Drainage Area 14 to exit the Airport.
2. The pipes directly south of the east general aviation apron experience backflow because they do not have enough head to combine with flow coming from the North at drainage structure DI-Y06-313.

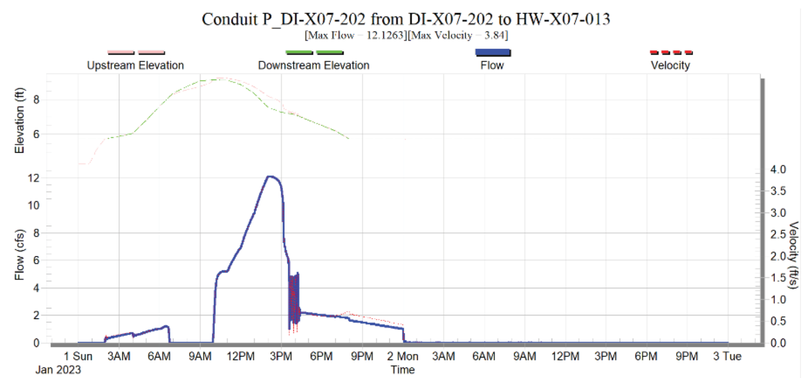
The 5-year design storm event with 5-year WSE at the discharge point and 10-year design storm event with 10-year WSE at the discharge point were simulated to evaluate the performance of the existing Airport drainage system considering the WSE of the receiving waters during design storm events. In general, the associated flood levels in Goleta Slough, Tecolotito Creek, Carneros Creek, and San Pedro Creek create high tailwater conditions that significantly limit outflow. These simulations assume that the receiving waters maximum WSE and the peak Airport runoff rates exactly aligned temporally. This assumption is conservative, as the maximum WSE and peak Airport runoff rate will often not occur at the same time in reality; however, this test was performed to assess the effects of the worst-case outfall conditions on the Airport drainage system.

The models indicate widespread drainage system sensitivity to outfall conditions and reveal that the system is restricted and is typically unable to drain stormwater until receiving water levels recede in even the 5-year design storm event. In some locations for both the 5-year and 10-year models, tailwater elevation effects extend upstream through the pipe network causing inlets to surcharge, resulting in an increase of overland flow and weir flow.

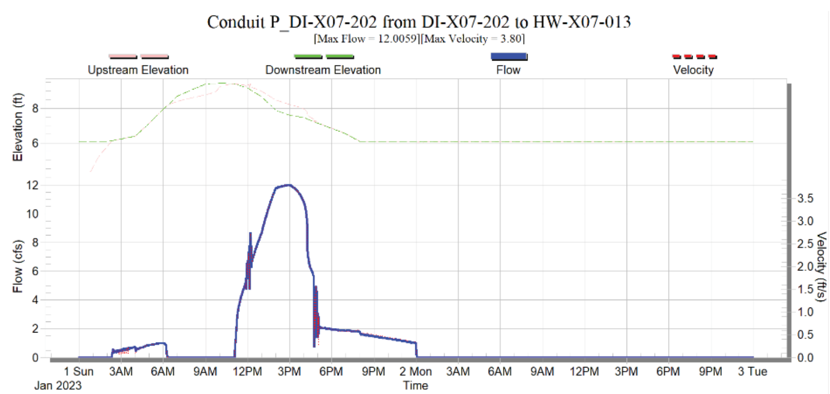
Graphical examples of outfall hydrographs included below in **Figure 7**, in this case specifically for Outfall 13, demonstrate the different model scenarios described above. The hydrographs show the reduction of flow through the outfall and the impacts to the duration and peak runoff discharge. when the outfall is submerged. The outfall is unable to drain until the downstream water level of the receiving waters recedes, increasing the amount of time stormwater is held on the Airport. Hydrographs for all outfalls in all three modeling simulations are included in **Appendix F**.



5-YEAR EVENT WITH FREE DISCHARGE



5-YEAR EVENT WITH 5-YEAR TAILWATER



10-YEAR EVENT WITH 10-YEAR TAILWATER

FIGURE 7: REPRESENTATIVE SIMULATION HYDROGRAPHS AT OUTFALL 13

Peak discharge results for all drainage area outfalls for the three modeling simulations are listed in **Table 7**. The peak pipe flow rate was compared to the outfall pipe maximum design full flow rate, which assumes no surcharge of the pipe occurs. Outfall pipes in which the peak flow rate exceeds the design full flow capacity are highlighted in **Table 7**.

TABLE 6: EXISTING CONDITIONS PEAK FLOW RESULTS

Drainage Area	Outfall	5-Year Peak Discharge – Free Discharge (cfs)	5-Year Peak Discharge – 5-Year WSE (cfs)	10-Year Peak Discharge – 10-Year WSE (cfs)	Pipe Design Maximum Flow (cfs)
1	HW-65	15.6	13.3	13.7	9.6
2	N-X06	5.0	4.4	5.7	15.8
5	HW-Z07-462	46.1	23.0	23.9	55.0
6	HW-Z07-460	24.0	25.6	31.2	49.4
9B	HW-Y09-009	24.2	13.5	13.9	24.0
9C	HW-Y09-009-2	30.0	17.7	27.7	40.6
10	N-X07-010	39.3	30.9	34.5	81.1
11	HW-Y08-011	7.2	5.9	6.2	3.1
12	HW-X07-012	15.8	11.8	12.5	5.7
13	HW-X07-202	18.1	12.1	12.7	10.6
14	HW-W07-511	19.1	8.5	13.9	14.6
17a	HW-Y08-204	8.0	5.1	5.5	5.4
17b	HW-Y08-017	7.6	7.6	10.1	25.6
26	HW-X06-?3 [sic]	0.0	0.0	0.0	24.0
495 Fairview-1	HW-Z06-343	6.0	3.3	3.7	1.4
495 Fairview-2	HW-Z06-134	5.2	2.2	2.8	0.8
Northeast Corner	DI-Z07-304	2.8	2.5	2.9	0.8
Parking A	HW-Y09-009	3.5	3.2	3.3	14.0
Parking B	DI-Y07-473	2.0	3.9	5.6	15.0
Parking C	N-Z07-016	4.3	4.6	6.4	0.4
Parking D	CB-Y07-?36 [sic]	7.3	5.3	5.8	6.7
Parking E	CB-Y08-?54 [sic]	5.8	3.5	3.2	4.0

3.4.2 Drawdown Rates

As listed in Table 2: Summary of Drainage Design Criteria, the maximum allowable detention time of stormwater on airport property is 48 hours to reduce the potential for attracting wildlife. In the 5-year design storm event with free discharge, direct drawdown is achievable within 48 hours. During the 5-year and 10-year design storm events with corresponding 5-year and 10-year WSE at the discharge points, pipe flows are restricted when the downstream WSE is higher than the outfall pipe invert and is reduced to zero during the time when the downstream WSE is as high as or is higher than the onsite water. Discharge resumes once the tailwater conditions subside and creek WSEs lower. In the model with peak runoff and peak WSEs aligned at hour 10, drawdown still occurs within 48 hours.

3.4.3 Pavement Encroachments

As listed in **Table 2: Summary of Drainage Design Criteria**, the required design storm frequency for drainage systems is the 5-year design storm. FAA guidance states that surface water should not encroach on runway or taxiway pavements for storm events at least as large as the 5-year event. The various XPSWMM models produced hydraulic grade lines (HGL) throughout the onsite storm drain systems. The HGL were used to establish resulting WSE throughout the storm drain system and across the airfield. Using topographic data and tools in AutoCAD and geographic information system (GIS) software, WSE were visualized spatially in GIS as inundation (ponding) areas. **Exhibit 3** shows the spatial results from the three scenarios, specifically highlighting pavement encroachments where the water surface mapping intersects pavements and/or buildings.

3.4.4 Flooding Areas of Interest

Areas where potential flooding issues have been identified from the existing conditions assessment are further summarized here each as an Area of Interest (AOI) for evaluation in the alternatives analysis. These AOI were identified from the modeling scenario of the 5-year design storm event with 5-year WSE model as locations where water has encroached on pavement in the design storm event. These areas are further evaluated with the proposed condition alternatives analysis. AOI are numbered as #-#, with the first number being the Drainage Area the AOI is in and the second number being its order in the alternatives evaluation discussed later in **Section 5**. These locations are visualized in **Exhibit 4**.

Drainage Area 1
1-4. Taxiway A3-C Connection

Drainage Area 5
5-1. Taxiway B1
5-3. Taxiway F

Drainage Area 6
6-1. Taxiway A1
6-3. Runway 7-25 Blast Pad

Drainage Area 9
9-1. Apron in front of Terminal Building

Drainage Area 10
10-4. Northern Portion of Taxiway E
10-5. NW GA Apron

Drainage Area 13
13-1. Run-up Pad

Drainage Area 14
14-1. Taxiway A5

495 Fairview

F-1. 495 Fairview Hangars

Parking Areas

P-1. Parking Long-term
P-2. Parking East Cell Phone Lot
P-3. Parking Terminal

3.4.5 Known Drainage Concerns

Areas of known drainage concerns reported by the Airport for consideration in the alternatives analysis are summarized below by Drainage Areas. These known drainage concerns are numbered as #-#, with the first number being the Drainage Area the issue is in and the second number being its order in the alternatives evaluation discussed later in **Section 5**. These locations are visualized in **Exhibit 4**.

Drainage Area 1

1-1. Ditch Behind Lift Station 3

The Airport reports that the inlet behind Lift Station 3 experiences back-up, and frequent maintenance is required to clear the ditch. Flow has been reported to overflow the existing ditch on a regular occurrence.

1-2. Outfall 1

Outfall 1 is typically submerged during a storm event, and Drainage Area 1 is unable to drain until the water level in Carneros Creek has receded. Additionally, three (3) times in the last thirteen months, Carneros Creek has overtopped its bank and flooded onto the Airport at Drainage Area 1.

Drainage Area 5

5-4. Airfield Conveyance Swale

Riprap protection upstream and downstream of culverts in a drainage conveyance swale between the fuel farm and Taxiway C is often dislodged from the channel banks during high flow events and needs to be reset.

Drainage Area 9

9-3. Concrete Conveyance Channel

Nuisance flooding at Fowler and Moffet occurs when the concrete channel gets clogged. Routine maintenance, street sweeping, and channel cleaning along Moffet are periodically required.

Drainage Area 10

10-3. Outfall Channel

The channel leading from Outfall 10 to Tecolotito Creek through the Goleta Slough had standing water observed in it in April 2023. In 2010, the Airport did a project to realign this channel. Maintenance has not occurred since.

Drainage Area 12

12-1. Outfall 12

The outfall tide gate check valve leaks.

Drainage Area 26

26-1. Outfall 26

The existing Outfall 26 pipe has a negative slope per the 2022 survey, and standing water was observed in the airside inlet.

3.4.6 Pipe Assessment Areas of Interest

Areas identified in the Pipe Conditions Assessment discussed in **Section 3.2.2** for consideration in the alternatives analysis are summarized below and are numbered as #-#, with the first number being the Drainage Area the issue is in and the second number being its order in the alternatives evaluation discussed later in **Section 5**. Pipe Conditions were rated on a scale of 1 to 5 for minor to most significant defect. The pipe condition assessment report is included in **Appendix A**. These locations are visualized in the **Exhibit 4**.

Drainage Area 6

6-4. Deposits and Cracks in Pipe

Existing 15-inch asbestos cement pipe (ACP) pipe has deposits and cracks.

6-5. Pipe with surface damage

Existing 18-inch ACP pipe has surface damage.

6-6. Deposits and cracks in pipe

Existing 18-inch ACP pipe has multiple cracks, deposits, and surface damage.

Drainage Area 9

9-4. Angular Pipe Joint

Existing 15-inch ACP pipe has an angular joint at the transition from ACP to polypropylene.

Drainage Area 10

10-1. Infiltration Runner

Existing 36-inch reinforced concrete pipe (RCP) has an infiltration runner under Runway 7-25. Infiltration through a pipe wall is categorized as seeper, dripper, runner, or gusher depending on the amount and speed of water, with seeper being the least amount of water infiltration and gusher being the most.

10-2. Pipe surface damage reinforcement, obstruction through pipe wall
Existing 36-inch RCP has surface damage and an obstruction through the pipe wall.

Drainage Area 11
11-2. Pipe with hole and joint offset
Existing 15-inch ACP pipe has a hole and joint offset.

Drainage Area 12
12-2. Pipe with surface damage
Existing 24-inch pipe transitions from RCP to corrugated metal pipe (CMP) after crossing Taxiway A. The 167 linear feet of CMP section has surface damage corrosion.

Drainage Area 13
13-2. Cracks/deposits/infiltration dripper/joint offset
Existing 24-inch ACP pipe has multiple cracks, an infiltration dripper, a joint offset, and deposits along 24 feet of pipe.

Drainage Area 14
14-2. Crack in RCP Pipe
Existing 24-inch RCP pipe has multiple level cracks.

4. Proposed Conditions Assessments

4.1 Proposed Development Projects

The proposed development projects analyzed as part of the Plan were selected from the preferred development concept in the Master Plan which is shown in **Exhibit 5**. The projects fall into three categories: short-term, intermediate-term, and long-term. Short-term projects are planned to be completed in the next five (5) years, intermediate-term projects are in the five- to ten- (5-10) year planning horizon, and long-term projects are in the ten- to twenty- (10-20) year planning horizon. A discussion of each of these projects and updates for inclusion in the Plan based on guidance from the Airport is included herein.

4.1.1 Short-Term Projects

The short-term projects and associated impacts considered with the Plan are described as follows:

Curbside Loading Improvements

This project includes improving the curbside loading and unloading area at the Terminal. For the purposes of the Plan, it is expected to have nominal impacts to site drainage and is not included in the Plan.

FBO Redevelopment Project

The ongoing FBO Redevelopment Project will establish two (2) new FBO leaseholds in the northeast quadrant of the Airport to accommodate the relocation of the two (2) existing FBOs. The ultimate layout and facilities provided within the FBO redevelopment areas will be determined by the FBOs in conjunction with Airport management. Stormwater management improvements for any site improvements will be covered under that project and need not be addressed in the Plan. The taxiway reconfiguration in this area is considered with the Plan along with findings from the existing conditions assessment.

Taxiway Improvements

The taxiways planned for improvements in the short-term timeframe include the following for fiscal year 2024: Taxiway A1, Taxiway B1, Taxiway F, and Taxiway D.

The following taxiway improvements are slated for fiscal year 2025: Taxiway E, Taxiway A5, existing Taxiway A3.

Runway 7-25 Rehabilitation

Although not shown on the preferred development plan in the Plan, the Airport has slated a rehabilitation of Runway 7-25 to occur in 2029.

4.1.2 Intermediate-Term Projects

The intermediate-term projects and associated impacts considered with the Plan are described as follows:

Fuel Storage

This project includes expanding the existing fuel storage facilities to accommodate future demand and fuel shortage issues. The project includes the addition of 1,000 square feet of new impervious surface.

Hangar Expansion

This project includes the addition of hangars outside the FBO Redevelopment Project area in three (3) locations:

1. East end of Runway 7/25
2. Approach end of Runway 15 L (requiring the closure of Runway 15L/33R before construction could occur)
3. Northwest quadrant west of the Runway 15R approach end

In total, the Hangar Expansion includes 1.9 acres of replaced impervious area and adds 5.7 acres of new impervious area. As this project is mostly composed of impervious surface and as this location has little to no current qualitative or quantitative stormwater management facilities, the relative cost of stormwater management improvements for this project is expected to be high. The Plan provides general recommendations but does not include an in-depth alternatives analysis as site improvements will be designed by the Developer.

Runway 15L/33R Closure

This project includes the closure of Runway 15L/33R and the taxiway improvements associated with the closure. Closure of Runway 15L/33R includes the removal of 15.1 acres of impervious surface and adds 4.6 areas of impervious surface This project will require new storm drainpipes, catch basins, manholes, and other structures to accommodate new site grading.

Taxiway Improvements

Taxiway improvements listed in the Master Plan but not in the short-term timeframe are assumed to occur in the intermediate-term. These include Taxiway B2, future Taxiway A3, and Taxiway G.

4.1.3 Long-Term Projects

The long-term projects and associated impacts considered with the Plan are described as follows:

Vertiport and eVTOL Operations

This project includes the reconstruction of an existing parking lot to construct a vertiport for electric vertical takeoff and landing (eVOTL) aircraft. A small passenger building would be constructed as well. This project replaces 0.4 acres of impervious surface and adds 0.12 acres of new impervious surface.

Parking Garage

This project includes the addition of a multi-story parking garage in place of the long-term economy parking lot north of Hollister Ave. This project replaces 7.3 acres of impervious surface.

4.1.4 Projects Not Included

There are other projects referenced in the Plan but not included in the Plan analysis. Those projects and rationale for exclusion are provided as follows:

FBO Redevelopment Project

As noted above, the ongoing FBO Redevelopment Project will include site improvements designed by others; therefore, the Plan does not include these site improvements in the analysis.

Taxiway B Extension

This project includes the extension of Taxiway B with the addition of 5.6 acres of impervious surface and removal of 2.47 acres of impervious surface with the removal of the Taxiway C-Runway connection. This project design is underway by others; therefore, the Plan provides consideration of other improvements that could be done in conjunction with this project but does not include these site improvements in the analysis.

Terminal Expansion

The Master Plan identified the Terminal Expansion project to be outside the twenty (20) year planning horizon. Although the Terminal Expansion project will include changes in impervious area, the Plan does not include these site improvements in the analysis as it is outside the twenty (20) year planning horizon.

Southfield Redevelopment

This project adds pervious pavement to the Long-Term Parking Lot. This project design is underway by others; therefore, the Plan does not include these site improvements in the analysis.

4.2 Proposed Conditions Modeling Updates

The proposed conditions hydrology and hydraulic modeling updates to XPSWMM include the short-term, intermediate-term, and long-term projects land use changes. One combined model was created to analyze changes in hydrology.

4.2.1 Subbasins

Proposed subbasins were updated to include the impervious nature of proposed development.

Proposed land use based on the Proposed Developments from the Master Plan is shown below in **Figure 8** and the Proposed Conditions Model parameters are included in **Appendix G**.

FIGURE 8: PROPOSED CONDITIONS LAND USE

Additionally, subbasins were updated to reflect new taxiway geometry. Where appropriate, the new taxiway centerlines are assumed to be the new high points and the subbasin boundaries are updated to match. The proposed taxiway elevations were estimated using the minimum transverse slopes from the runways required to comply with FAA requirements and the assumption that parallel taxiways would generally be lower than the corresponding parallel runways.

In areas of future private development, such as the FBO Redevelopment Project, proposed subbasins were revised to reflect anticipated changes to basin boundaries; however, the existing curve numbers were not changed in the proposed conditions XPSWMM model as these projects would need to provide independent stormwater management to match pre-development site runoff rates.

4.2.2 Time of Concentration

Proposed times of concentration calculations were updated for each proposed subbasin where the flow path changed due to changes in subbasin boundary locations or to changes in impervious area.

4.2.3 Routing

Proposed model routing was updated to correspond to the proposed development. New weir elements were added at the assumed crowns of proposed taxiways.

4.2.4 Boundary Conditions

The Climate Adaptation Plan draft concluded that the intermediate-high risk scenario of 0.8 feet of sea level rise is estimated to be reached by 2048, which is outside the twenty (20) year scope of the Plan. Therefore, the current range of water surface elevations in the Goleta Slough area were used in the proposed conditions model and the subsequent alternatives mitigation model.

4.2.5 Design Storm Selection

Three events were simulated in the proposed conditions model: 5-year design storm event with free discharge conditions at the outfalls, 5-year design storm event with 5-year WSE time series at the outfalls, and 10-year design storm event with 10-year WSE time series at the outfalls.

4.3 Proposed Conditions Results

The computed proposed conditions model results include the peak stormwater runoff discharge rates. The hydrologic and hydraulic inputs and results of each node and link are included in **Appendix G** and output hydrographs are included in **Appendix H**.

4.3.1 Drainage System Capacity

The same three events from the existing conditions model were simulated in the proposed conditions model: 5-year design storm event with free discharge conditions at the discharge point, 5-year design storm event with 5-year WSE time series at the discharge point, and 10-year design storm event with 10-year WSE time series at the discharge point. Peak discharge results for all drainage area outfalls for the three modeling simulations are listed in **Table 7**. The peak pipe flow rate was compared to the outfall pipe maximum design full flow rate, which assumes no surcharge of the pipe occurs. Outfall pipes in which the peak flow rate exceeds the design full flow capacity are highlighted in **Table 7**.

TABLE 7: PROPOSED CONDITIONS PEAK FLOW RESULTS

Drainage Area	Outfall	5-Year Peak Discharge – Free Discharge (cfs)	5-Year Peak Discharge – 5-Year WSE (cfs)	10-Year Peak Discharge – 10-Year WSE (cfs)	Pipe Design Maximum Flow (cfs)
1	HW-65	21.0	13.9	15.7	9.6
2	N-X06	6.2	6.2	7.4	15.8
5	HW-Z06-462	46.3	20.6	22.1	55.0
6	HW-Z07-460	22.5	25.2	27.3	49.4
9B	HW-Y09-009	20.4	11.2	10.4	24.0
9C	HW-Y09-009-2	34.0	20.9	29.8	40.6
10	N-X07-010	38.8	32.5	36.1	81.1
11	HW-Y08-011	7.0	5.7	5.9	3.1
12	HW-X07-012	15.5	11.7	12.6	5.7
13	HW-X07-202	17.5	12.0	12.6	10.6
14	HW-W07-511	19.4	10.1	13.5	14.6
17a	HW-Y08-204	8.0	5.1	5.4	5.4
17b	HW-Y08-017	7.7	7.7	10.1	25.6
26	HW-X06-?3 [sic]	0.0	0.0	0.0	24.0
Northeast Corner	DI-Z06-304	2.9	2.5	2.9	1.4
495 Fairview-1	HW-Z06-343	6.0	3.3	3.7	0.8
495 Fairview-2	HW-Z06-134	5.2	2.2	2.8	0.8
Parking A	HW-Y09-009	4.7	6.8	7.5	14.0
Parking B	DI-Y07-473	2.0	3.9	5.2	15.0
Parking C	N-Z07-016	4.3	4.6	6.3	0.4
Parking D	CB-Y07-?36 [sic]	7.5	3.0	3.3	6.7
Parking E	CB-Y08-?54 [sic]	5.8	3.5	3.2	4.0

4.3.1 Drawdown Rates

As listed in the **Table 2: Summary of Drainage Design Criteria**, the maximum allowable detention time of stormwater on airport property is 48 hours to reduce potential for attracting wildlife. In the 5-year design storm with free discharge, direct drawdown is achievable within 48 hours. During the 5-year and 10-year events with corresponding 5-year and 10-year WSE at the discharge points, pipe flows are restricted when the downstream WSE is higher than the outfall pipe invert and is reduced to zero during the time when the downstream WSE is as high as or is higher than the onsite water. Discharge resumes once the tailwater conditions subside and creek WSEs lower. In the model with peak runoff and peak WSEs aligned at hour 10, drawdown still occurs within 48 hours.

4.3.2 Pavement Encroachments

As listed in **Table 2: Summary of Drainage Design Criteria**, the required design storm frequency for drainage system is the 5-year design storm. This FAA criterion includes the recommendation that no ponding encroachment on runway or taxiway pavements occurs, recommended up to the 5-year design storm minimum. Proposed results were mapped using the existing topographic data and estimated elevations of future taxiways. No assumptions were made in the mapping on proposed elevations in the infields. **Exhibit 6** shows the spatial results from the three proposed scenarios, specifically highlighting pavement encroachments where the water surface mapping intersects pavements and/or buildings.

4.3.3 Flooding Areas of Interest

Areas where potential onsite flooding issues have been identified from the proposed conditions assessment are designated as AOI for evaluation in the alternatives analysis. These AOI were identified from the 5-year design storm event with 5-year WSE model as locations where water has encroached on existing or proposed pavement in the 5-year design storm event. AOI are numbered as #-#, with the first number being the Drainage Area the AOI is in and the second number being its order in the alternatives evaluation discussed later in **Section 5**. AOI identified in the Existing Conditions Assessment that also are relevant in the Proposed Conditions Assessment are not relisted here.

Drainage Area 1
1-2. Taxiway B Extension

Drainage Area 6
6-2. Taxiway A3

Drainage Area 5
5-2. Taxiway B2
5-6. Vertiport Site

Drainage Area 10
10-6. NE Hangar Development

4.3.4 Proposed Development Areas of Interest

Areas where the proposed conditions model did not show any potential flooding, but that still have drainage recommendations associated with proposed development areas are listed here.

Drainage Area 5
5-5. New fuel farm

Drainage Area 9
9-2. Future Parking Garage
9-5. Long-term Parking

Drainage Area 10

10-7. Redistribute flow as appropriate at Drainage Area 10
10-8. Taxiway A3 Removal

Drainage Area 11

11-1. Taxiway E Relocation

5. Drainage Mitigation Conceptual Designs

5.1 Alternatives Analysis

5.1.1 Alternatives Development Process

Drainage mitigation conceptual design alternatives were defined for each AOI and proposed development project. Drainage mitigation measures considered to minimize ponding and inundation areas and reduce maintenance considerations included the following:

- Stormwater collection and conveyance improvements such as structures, piping, channels, safe overflows, and pump stations.
- Flow and volume control such as detention basins, infiltration basins/trenches, and surface storage areas.
- Erosion control measures such as outfall protection and bank stabilization.

Proposed development projects will need to consider low-impact development and water quality enhancement strategies such as bioretention, biofiltration, infiltration, rainwater harvesting, oil/water separators, and engineered media filter systems. Linear airfield pavement improvement projects can utilize vegetated filter strips installed as part of site restoration for a low-cost and low-maintenance water quality treatment approach. Airside aprons, which typically have impervious areas directly connected to the underground drainage system, may require underground treatment systems. Landside developments have more flexibility to consider low impact development water quality treatment strategies, such as bioretention and biofiltration, as long as wildlife attractant concerns are considered in design. Detailed water quality treatment strategies are not defined in the alternatives unless it is expected to be a significant design component.

Scoring criteria for the alternatives analysis were established with Airport input based on the following factors:

- Maintains Airport Operability and Safety
- Alleviates Flooding and Known Drainage Concerns
- Incorporates Resiliency and Sustainability
- Considers Operations and Maintenance
- Minimizes Capital Cost
- Supports Regional Stewardship and Partnership
- Adheres with Master Plan Capital Plan
- Streamlines Permitting
- Aligns with the Climate Adaptation Plan Goals

For scoring purposes, the above criteria were weighted in order of importance to the Airport and were ranked on a scale from low priority to high priority. The Alternatives Prioritization Table is included in **Appendix I**.

The alternative evaluations were divided into two categories: (1) known drainage concerns and short-term projects; and (2) intermediate and long-term projects. The alternatives considered are described below. Alternatives noted separately could be completed in conjunction with other alternatives.

5.1.2 Known Flooding Areas and Short-Term Project Mitigation Measures

Mitigation alternatives were identified and evaluated for Existing Conditions Flooding Areas of Interest, Known Drainage Concerns, and Pipe Assessment Areas of Interest (**Sections 3.4.4**, **3.4.5**, and **3.4.6**, respectively) as well as Proposed Conditions Flooding Areas of Interest and Proposed Development Areas of Interest (**Sections 4.3.3** and **4.3.4**) in the vicinity of the Short-Term Projects. The alternatives considered for each project or AOI are listed below and included in more detail in **Appendix J**. AOI are numbered as #-#, with the first number being the Drainage Area in which the project or AOI is located and the second number being its order in the alternatives evaluation.

Drainage Area 1

1-1. Ditch Behind Lift Station 3

- Alternative No. 1. Do nothing and continue frequent maintenance.
- Alternative No. 2. Complete improvements with the future Taxiway B Extension to regrade the surface channel towards a new inlet.
- Alternative No. 3. Complete local storm drain system upgrades (increase the existing storm drain to 18'', regrade existing ditch area, and create a surface-to-pond to detain surface water) independent of Taxiway B Extension.

1-2. Outfall 1 Improvements

- Alternative No. 1. Do nothing and leave as is.
- Alternative No. 2. Raise the Outfall 1 invert elevation.
- Alternative No. 3. Upsize Outfall 1.
- Alternative No. 4. Pump ponded water during the storm to alleviate Drainage Area 1 storm infrastructure.
- Alternative No. 5. Perform maintenance on Carneros Creek to remove built-up sediment.
- Alternative No. 6. Conduct further study of the downstream Carneros and Tecolotito Creeks conveyance such improvements.
- Alternative No. 7. Distribute overflow water to Outfall 14 or 13 by adding additional conveyance connections to these drainage basins
- Alternative No. 8. Distribute overflow water to Outfall 14 or 26 by adding additional conveyance to these drainage basins.
- Alternative No. 9. Distribute overflow water to Outfall 26 by adding additional conveyance to this drainage basin.

1-4. Taxiway A3-C Connection

- Alternative No. 1. Rely on other Drainage Area 1 Improvements in Project 1-2 to solve the ponding.
- Alternative No. 2. Wait for the Taxiway B extension that would remove this pavement.
- Alternative No. 3. Regrade the infield prior to and independent of the Taxiway B extension to provide more surface storage within FAA guidelines.

  Add an infield underground detention system to store water until it can drain off the Airport.

Drainage Area 5

5-1. Taxiway B1

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Provide underground detention in conjunction with AOI 6-3.

Alternative No. 3. Increase surface storage to store ponded water away from the pavement within FAA guidelines and remove the east corner of Taxiway B1 not painted or used for aircraft, thus reducing inundated pavement and increased the infield surface water storage area.

Alternative No. 4. Conduct further detailed study of San Pedro Creek conveyance improvements.

Alternative No. 5. Reroute water to Outfall 10.

5-3. Taxiway F

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Improve infield grading to provide surface storage within FAA guidelines independent of FBO development but considering the future taxiway location.

Alternative No. 3. Wait for FBO development to provide appropriate stormwater management meeting the applicable regulations while maintaining flow to Outfall 5.

5-4. Airfield Conveyance Swale Maintenance

Alternative No. 1. Continue maintenance as currently performed.

Alternative No. 2. Replace the riprap with some other type of erosion control.

Alternative No. 3. Widen the channel.

Alternative No. 4. Upsize the culverts to allow high flows to pass without damaging the riprap.

Alternative No. 5. Grout the riprap into place.

Drainage Area 6

6-1. Taxiway A1

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Raise the Outfall 6 invert elevation.

Alternative No. 3. Route water to Outfall 11 and improve grading to store ponded water away from the pavement within FAA guidelines.

Alternative No. 4. Add underground detention to store water underground (this would also serve AOI 6-*2*).

6-3. Runway 7-25 Blast Pad

Alternative No. 1. Do not add any drainage improvements.

Alternative No. 2. Replace the portion of Runway 7-25 Blast Pad to remain with porous pavement.

Alternative No. 3. Add an underground detention system in the infield north of the Blast pad whether the pavement is removed or not.

Alternative No. 4. Provide surface storage to store ponded water away from the pavement within FAA guidelines.

Alternative No. 5. Pump ponded water to San Pedro Creek.

6-6. Deposits and cracks in pipe under Taxiway A1

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Replace 197 LF of 18'' ACP in conjunction with the Taxiway A1 rehab project.

Alternative No. 3. Line 197 LF of 18'' ACP in conjunction with the Taxiway A1 rehab project.

Drainage Area 9

9-1. Terminal Apron

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Upsize the storm drainpipe that connects to the Drainage Area 9 trunk line.

Alternative No. 3. Add underground detention in the infield west of the apron allowing additional capacity for water coming off the apron. This could be done in conjunction with the Runway 15L-33R decommissioning.

9-3. Concrete Conveyance Channel Maintenance

Alternative No. 1. Continue maintenance as currently performed.

Alternative No. 2. Widen channel and upsize culverts.

Alternative No. 3. Increase maintenance of landscaping.

Alternative No. 4. Improve inlets by adding capacity and adding clog resistant grates/screens to block debris from entering the channel.

9-4. Angular pipe joint

Alternative No. 1. Do nothing and leave the pipe as-is.

Alternative No. 2. Reroute flow west to Drainage Area 11.

Drainage Area 10

10-1. Infiltration runner

Alternative No. 1. Do nothing and leave pipe as-is.

Alternative No. 2. Continue to monitor the Runway pavement for signs that pipe needs to be maintained.

Alternative No. 3. Line 570 LF of 36’’ RCP pipe when Runway 7-25 rehab occurs.

Alternative No. 4. Replace a section of 36’’ RCP pipe when Runway 7-25 rehab occurs.

10-2. Pipe surface damage, obstruction through pipe wall

Alternative No. 1. Do nothing and leave the pipe as-is.

Alternative No. 2. Replace the 36’’ RCP pipe independent of Taxiway A3 removal.

Alternative No. 3. Replace the 36’’ RCP pipe in conjunction with the Taxiway A3 removal.

10-3. Outfall 10 Channel Maintenance

Alternative No. 1. Do nothing and leave the channel as-is.

Alternative No. 2. Conduct a project to restore the channel to its 2010 design.

10-4. Northern Portion of Taxiway E

Alternative No. 1. Do nothing and rely on downstream projects in Drainage Area 10 to alleviate the issue.

Alternative No. 2. Redefine infield grading to provide additional temporary water surface storage (within FAA guidelines) independent of Taxiway E removal.

Alternative No. 3. Redefine infield grading to provide additional temporary water surface storage (within FAA guidelines) in conjunction with Taxiway E removal.

Alternative No. 4. Add an underground detention system independent of Taxiway E removal.

Alternative No. 5. Add an underground detention system in conjunction with Taxiway E removal.

10-7. Distribute Flow Away from Drainage Area 10

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Reroute water with a new pipe connection under Runway 7-25 to Drainage Areas 17 or 11.

Alternative No. 3. Add a pipe connection under Runway 7-25 to Drainage Area 11 and leave existing connection to Drainage Area 10 to allow flow in either direction.

Alternative No. 4. Reconfigure parts of Drainage System 10 to connect to Drainage Area 1 or 5 if Drainage Area 1 or 5 receive capacity upgrades.

Alternative No. 5. Upsize Outfall 10 and Drainage Area 10 pipe system.

10-8. Existing Taxiway A3 Removal

Alternative No. 1. Keep the high point at the same location after Taxiway A3 is removed.

Alternative No. 2. Regrade the infield to shift the high point and eliminate the need for inlet DI-X07-035 to alleviate flow from Drainage Area 10.

Drainage Area 12

12-1. Outfall 12 Improvements

Alternative No. 1. Do nothing and leave the outfall as-is

Alternative No. 2. Replace the leaky check valve.

12-2. Pipe with surface damage

Alternative No. 1. Do nothing and leave the pipe as-is.

Alternative No. 2. Line 334 LF 24'' CMP section from Outfall 12 to the RCP transition at the edge of Taxiway A.

Alternative No. 3. Replace 167 LF of 24'' CMP pipe.

Drainage Area 13

13-1. Runway 7-25 Run-Up Pad

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Redefine infield grading within FAA guidelines to store water away from the pavement when shoulder removal occurs.

13-2. Cracks, deposits, infiltration dripper in ACP pipe

Alternative No. 1. Do nothing and leave the pipe as-is.

Alternative No. 2. Line the entire stretch of ACP pipe.

Alternative No. 3. Replace the entire stretch of ACP pipe.

Alternative No. 4. Monitor the condition of entire Drainage Area 13 ACP pipe system.

Drainage Area 14

14-1. Taxiway A5

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Rely on the short-term Taxiway A5 rehab project to eliminate the encroachment.

Alternative No. 3. Regrade the infield independent of the Taxiway A5 rehab project to provide additional surface storage within FAA guidelines.

14-2. Crack in RCP pipe

Alternative No. 1. Do nothing and leave the pipe as-is.

Alternative No. 2. Replace the section of pipe with the crack.

Alternative No. 3. Replace the entire stretch of pipe.

Drainage Area 26

26-1. Outfall 26 Improvements

Alternative No. 1. Do nothing and leave the pipe as-is.

Alternative No. 2. Reconstruct the outfall pipe.

Parking Areas

P-1. Long-Term Parking Lot

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Change pavement to pervious pavement when a project occurs in this parking lot.

Alternative No. 3. Add underground detention.

P-2. East Cell Phone Lot

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Change pavement to pervious pavement when a project occurs in this parking lot.

Alternative No. 3. Add underground detention.

P-3. Terminal Parking Lot

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Change pavement to pervious pavement when a project occurs in this parking lot.

Alternative No. 3. Add underground detention.

Alternative No. 4. Add an additional streetside inlet to reduce clogging and potential flooding.

495 Fairview Hangars

F-1. 495 Fairview Hangars

Alternative No. 1. Do nothing and leave as-is.
Alternative No. 2. Raise the outfall invert elevations.
Alternative No. 3. Reroute flows via pipe to Outfall 5.
Alternative No. 4. Add underground detention to store water until it can drain into San Pedro Creek.

5.1.3 Intermediate and Long-Term Project Mitigation Measures

Mitigation alternatives were identified and evaluated for each Existing Conditions Flooding Areas of Interest, Known Drainage Concerns, and Pipe Assessment Areas of Interest (**Sections 3.4.4**, **3.4.5**, and **3.4.6**, respectively) and Proposed Conditions Flooding Areas of Interest and Proposed Development Areas of Interest (**Sections 4.3.3** and **4.3.4**) in the vicinity of the Intermediate- and Long-Term Projects. The alternatives considered for each project or AOI are listed below and included in more detail in **Appendix J.** AOI are numbered as #-#, with the first number being the Drainage Area in which the project or AOI is located and the second number being its order in the alternatives evaluation.

Drainage Area 5

5-2. Future Taxiway B2

Alternative No. 1. Do not add any drainage improvements.

Alternative No. 2. Improve surface storage within FAA guidelines in both the infields east and west of future Taxiway B2 in conjunction with other storm system improvements, which include lining 670 LF of 24'' CMP pipe for longevity and improved flow capacity, and upsizing the existing 18'' ACP pipe under future Taxiway B2 to 24'' RCP

Alternative No. 3. Route water to outfall 10.

5-5. Future Fuel Farm

Alternative No. 1. Do not add any drainage infrastructure improvements.

Alternative No. 2. Add stormwater quality measures in conjunction with Fuel Farm improvements.

5-6. Vertiport Site

Alternative No. 1. Do nothing and leave as-is.

Alternative No. 2. Add a headwall to the outfall independent of development.

Alternative No. 3. Raise and reconstruct the outfall independent of development.

Alternative No. 4. Rely on the development of the Vertiport site to improve site grading and outfall improvements.

Drainage Area 6

6-2. Future Taxiway A3

- Alternative No. 1. Do nothing and leave as-is.
- Alternative No. 2. Route stormwater to Outfall 11 and improve surface storage within FAA guidelines.
- Alternative No. 3. Add underground detention (which would also serve AOI 6-1).
- Alternative No. 4. Replace existing 15'' ACP pipe with 18'' RCP aligning with the new taxiway geometry.

6-4. Deposits and cracks in pipe

- Alternative No. 1. Leave as-is.
- Alternative No. 2. Clean the previous abandonment action at the upstream end of this pipe. This could be done in conjunction with the construction of new Taxiway A3.
- Alternative No. 3. Line the ACP as an independent project.

Drainage Area 9

9-2. Parking Garage

No mitigation alternatives were considered for the future parking garage. When this area is developed it will require stormwater management including volume and flow control.

Drainage Area 10

10-5. NW GA Apron

Alternative No. 1. Do nothing until development occurs.

Alternative No. 2. Add additional inlets and increase inlet capacity to capture more runoff independent of development.

Alternative No. 3. Upsize the pipe connecting to storm drain system independent of development.

Alternative No. 4. Add an underground detention system in the infield south of the apron to allow additional capacity for water coming off the apron independent of development.

10-6. NE Hangar Development

No mitigation alternatives were considered for AOI 10-6. When this area is developed it will require stormwater management including volume and flow control and will need to be constructed above the 100-year flood elevation.

Drainage Area 11

11-1. Taxiway E Relocation

Alternative No. 1. Leave the storm drain trunk line in its existing location. Construct new inlets as needed.

Alternative No. 2. Relocate the storm drain trunk line and upsize the 12 and15’’ ACP to 18’’ RCP. Construct new inlets as needed. Modifications could also consider the minor flooding shown in the model on the Terminal Apron (*AOI 9-1*).

11-2. Pipe with hole and joint offset

Alternative No. 1. Do nothing and leave the pipe as-is.

Alternative No. 2. Replace 420 LF of 15’’ ACP with new RCP.

Alternative No. 3. Reconstruct the pipe during the Taxiway E Relocation.

5.1.4 Alternatives Scoring

Mitigation alternatives were scored using the project priority criteria described in **Section 5.1** and outlined in **Appendix I**. The alternatives for each AOI were ranked to determine a recommended preferred alternative for that AOI. The relative scores of each alternative for a select AOI were compared and the alternative with the highest score for that AOI was presented as a recommended alternative to the Airport. Results of the scoring are included in the mitigation project alternatives matrix in **Appendix J**.

5.2 Preferred Alternatives and Conceptual Designs

5.2.1 Alternatives Selection

Following the ranking of the alternatives to identify the recommended preferred alternatives, the Airport selected the preferred alternative for each AOI. The alternatives were further developed based on the two stated categories: (1) known drainage concerns and short-term projects; and (2) intermediate and long-term projects. The alternatives for the mitigation strategies for the known drainage concerns and short-term projects were advanced to a more refined level of conceptual design (20% design level) whereas the intermediate and long-term projects were advanced to a high-level conceptual design (10% design level) as presented in the alternatives matrix.

The preferred mitigation alternatives were incorporated into the proposed XPSWMM model as a new Preferred Alternatives Model. The Preferred Alternatives Model shows combined impacts of all preferred alternatives on the entire airfield. Modeled results of the mitigation impacts are only an estimation of potential results due to the alternatives being at planning level detail. Final impacts would require area-specific design that addresses proposed elevations and grading and incorporates refined modeling. The onsite stormwater ponding maps encompassing all short-term, intermediate-term, long-term, and known drainage concern alternatives are included in **Exhibit 7.** Preferred Alternatives Model parameters are included in **Appendix K**.

The preferred alternatives significantly reduce pavement encroachments. A hatch showing the reduction in pavement surface ponding resulting from the preferred alternatives is added to **Exhibit 7** to highlight beneficial impacts of the improvements. The area of reduced pavement encroachment from the preferred alternatives is 4.8 acres for the 5-year design storm event free discharge scenario, 24.3 acres for the 5-year design storm event with 5-year water levels scenario, and 17.0 acres for the 10-year design storm event with 10-year water levels scenario.

The results of the 5-year and 10-year scenarios with peak runoff and peak outfall water levels show a worst-case condition, and other watershed timing would reduce impacts to the airfield, resulting in increased drainage and reduced ponding. With the Airport being on flat land in a floodplain and having drainage limitations due to downstream receiving waters, the goal is to minimize impacted pavements as much as is feasible.

5.2.2 Known Flooding Areas and Short-Term Project Preferred Alternatives

The preferred alternatives for the known flooding areas and short-term projects are identified in bold in the mitigation project alternatives matrix in **Appendix J**. Locations of each project are shown in **Figure 9** below and are summarized as follows:

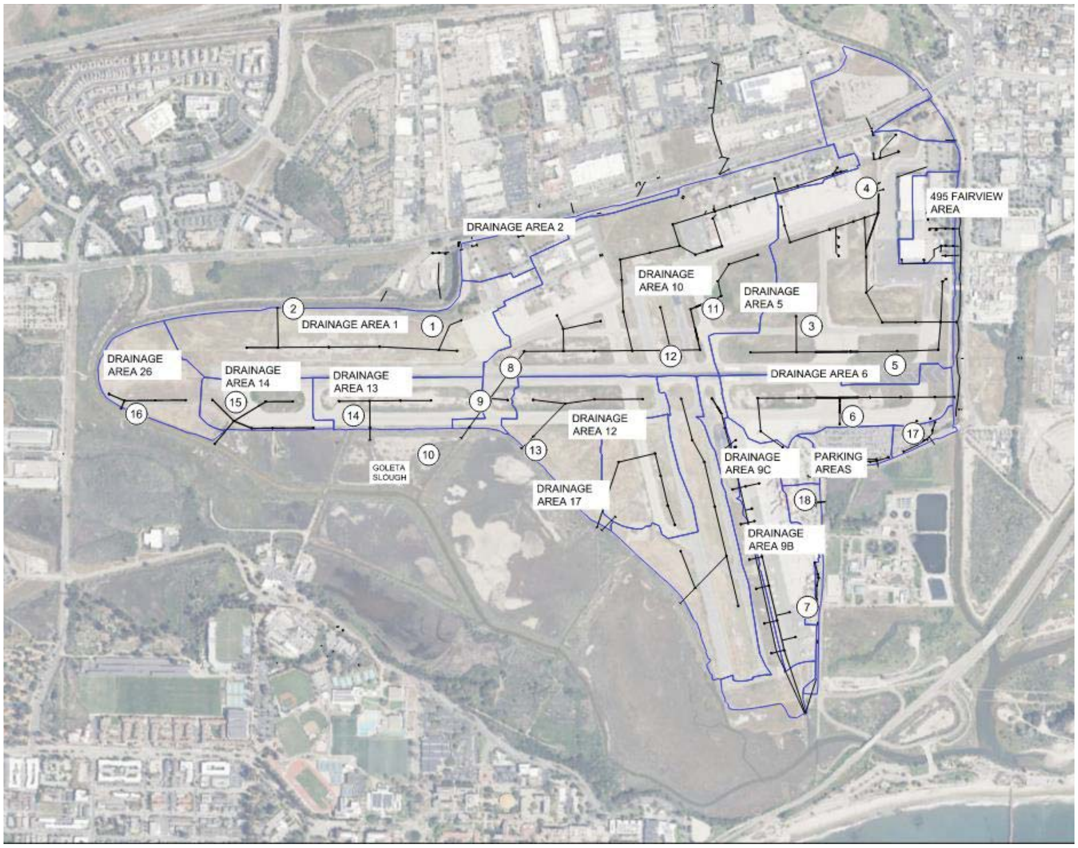


FIGURE 9: KNOWN FLOODING AREAS AND SHORT-TERM PROJECTS PREFERRED ALTERNATIVES LOCATIONS

1. *AOI 1-1.* Drainage Area 1 Local Storm Drain Upgrades

   Replace the existing 15-inch RCP storm drain with an 18-inch RCP, clean and increase the size of the ditch to inlet DI-X07-029 and grade a temporary surface storage area to temporarily store runoff until WSE at Outfall 1 recede.

2. *AOI 1-2.* Outfall 1 Improvements

   (a) Conduct routine maintenance in Carneros Creek to remove built-up sediment in the channel and decrease the likelihood of creek overtopping.

   (b) Perform a drainage study of Tecolotito Creek from its confluence with Carneros Creek to the interface with Goleta Slough, approximately 4,000 linear feet downstream. The study will investigate alternatives for providing additional capacity of Tecolotito Creek and improving the conveyance of the 10- and 25-year floods. The impact of alternatives on the 100-year flood will be documented. As Tecolotito Creek has been realigned since the most recent FEMA floodplain study, the effective FEMA hydraulic model cannot be used to investigate alternatives. A new hydraulic model will be required. The model will use publicly available LiDAR to define overbank elevations in the model. Field survey will be conducted along the creek to define channel elevations not included in the LiDAR dataset. Surface roughness in the model will be defined based on field observations. The study will include an alternatives analysis for recommended improvements. Results of the alternatives analysis will be documented in a project report.

3. *AOI 5-3.* Taxiway F Surface Storage

   Regrade infield to provide additional temporary surface water storage.

4. *AOI 5-4*. Airfield Conveyance Swale Maintenance

   Grout existing riprap into place.

5. *AOI 6-3, 5-1.* Drainage Area 5 and 6 Improvements

   (a) Associated with the Runway 7-25 Blast Pad removal, regrade the infield to provide additional temporary surface water storage including the removed east corner of unused Taxiway B1, lower the rim on inlet DI-Z07-098 to create more surface storage area, and line 670 linear feet of 24-inch CMP pipe to increase pipe longevity and capacity.

   (b) Perform a drainage study of San Pedro Creek from Hollister Ave to James Fowler Road. The study will investigate alternatives for providing additional capacity of San Pedro Creek and improving the conveyance of the 10- and 25-year floods. The impact of alternatives on the 100-year flood will be documented. The published FEMA hydraulic model will be used. The study will include an alternatives analysis for recommended improvements. Results of the alternatives analysis will be documented in a project report.

6. *AOI 6-6.* Taxiway A1 Pipe Maintenance

   Clean and line 260 linear feet of 18-inch ACP.

7. *AOI 9-3.* Concrete Conveyance Channel Maintenance

   Install screens and grates on all inlets to block debris from entering the channel.

8. *AOI 10-1.* Runway 7-25 Pipe Maintenance

   Associated with Runway 7-25 Rehab project, clean and line 570 linear feet of 36-inch RCP pipe from Junction N-X07-454 to Inlet DI-X07-041.

9. *AOI 10-2, 10-8.* Taxiway A3 Removal Improvements

   Associated with Taxiway A3 removal, replace 365 linear feet of 36-inch RCP. Retain the high point location between Drainage Areas 13 and 12 and connect existing inlet DI-X07-035 east to DI-X07-036 through new 18-inch RCP and remove the existing 15-inch ACP at the 36-inch RCP. A similar option is to upsize the existing 15-inch ACP, which is proposed to be removed, and connect downstream to the Drainage Area 12 system with 18-inch RCP.

10. *AOI 10-3.* Outfall 10 Channel Improvements

    Restore the channel through Goleta Slough from Outfall 10 to Tecolotito Creek to its 2010 Tidal Restoration Project design.

11. *AOI 10-4.* Drainage Area 10 Surface Storage

    Associated with Taxiway E relocation, grade the infield to provide additional temporary surface water storage while maintaining the rim elevations of the existing inlets for adequate pipe cover.

12. *AOI 10-7.* Drainage Area 10 Capacity

    Connect a new storm drainpipe to existing inlets and route under Runway 7-25 to connect to Drainage Area 11.

13. *AOI 12-1, 12-2.* Outfall 12 Improvements
    Associated with Taxiway A shoulder removal, replace the ineffective check valve on the 24-inch outlet pipe and clean and line 334 linear feet of 24-inch CMP pipe from Outfall 12 upstream to the transition to 24-inch RCP at the edge of Taxiway A.
14. *AOI 13-1, 13-2*. Drainage Area 13 Improvements
    Associated with Taxiway A shoulder removal, regrade the infield to provide additional temporary surface water storage away from the pavement and clean and line 260 linear feet of existing 24-inch ACP outfall pipe. A similar option is to upsize the existing 15-inch ACP in the infield to 18-inch RCP.
15. *AOI 14-1, 14-2.* Taxiway A5 Storm Drain Upgrades
    Associated with the taxiway upgrades, remove an existing inlet and install a new inlet and piping. Upsize pipe segments that are 15-inch in diameter to 18-inch. Remove and replace 20 linear feet of 24-inch RCP connected to Inlet DI-W07-?2 [sic] in the infield between Runway 7-25 and Taxiway A.
16. *AOI 26-1.* Outfall 26 Improvements
    Replace the 24-inch RCP outfall pipe to slope towards Tecolotito Creek, remove and replace 15-inch pipe with 18-inch RCP and new inlets.
17. *AOI P-1, P-2.* Long-Term Parking Lot and East Cell Phone Lot
    Associated with a project in the East Cell Phone Lot or Long-Term Parking Lot, upgrade the existing pavement to pervious concrete within the drive aisles and parking spaces.
18. *AOI P-3.* Terminal Parking Lot
    Associated with a project in the Terminal Parking Lot, upgrade the existing pavement to pervious concrete within the drive aisles and parking spaces.

5.2.3 Intermediate- and Long-Term Project Preferred Alternatives

The preferred alternatives for the intermediate- and long-term projects are identified in bold in the mitigation project alternatives matrix in **Appendix J** and are summarized as follows:

1. *AOI 1-3.* Taxiway B Extension
   Develop a comprehensive stormwater management plan to avoid any pavement inundation areas.
2. *AOI 5-6.* Vertiport Site
   To improve drainage in the northeast corner and the potential Vertiport site, the outfall should be raised and reconstructed with a headwall and design site grading to direct flow to the outfall.
3. *AOI F-1*. 495 Fairview Hangars Ponding
   Do nothing as no essential Airfield operations occur there and drainage improvements would be costly and have limited benefits due to the outfall water levels in San Pedro Creek.
4. *9-1.* Terminal Apron
   Do nothing as upsizing the storm drain system would not provide significant benefit because the existing pipe slope is the limiting factor for hydraulic capacity.

5. *9-4.* Angular Pipe Joint

   Do nothing as the angular pipe joint does not inhibit the pipe performance and the joint appears to be structurally sound.

6. *AOI 11-1* and *11-2.* Taxiway E Relocation/Runway 15L-33R Closure

   Associated with Runway 15L-33R closure and Taxiway E relocation, replace the existing trunk line, replace the existing ACP pipe with an 18-inch RCP to avoid upsizing the existing Outfall 11, and replace the pipe under Taxiway A.

5.2.4 Conceptual Designs

Preferred alternatives associated with known drainage concerns and short-term projects were advanced to a more refined level of conceptual design (20% design level) and detailed in project sheets included in **Appendix K**. The project sheets include the following information:

- Project Name
- Project Map
- Narrative
- Associated Master Plan Projects
- Project Type
- Type of Mitigation Project
- Project Footprint
- Funding Share
- Cost Estimate by Line Item

A planning level cost estimate is included for each concept design. Further design work would be required to develop higher confidence cost estimates. These estimates are based on previous Airport projects, CalTrans Contract Cost Data, and RSMeans. An inflation multiplier was applied to the costs obtained from previous Airport projects to escalate the values to present-day costs. All unit costs were then given a 10% markup for projecting them to an estimated 2025 construction year. The costs evaluated treat each mitigation as a standalone project that only addresses the drainage considerations identified in this study. It is understood that once these projects are implemented by the Airport, they may be combined with other project elements based on the Airport's overall program.

The cost estimates also include assumptions for soft project costs such as design, administration, and environmental review and permitting. These soft costs are assumed based on the percentages indicated in the Preferred Alternatives Data Sheets. Increased environmental costs were applied to select projects within the environmental inventory areas as identified in Figure 2-2 in **Appendix B** due to the likelihood of increased environmental considerations associated with projects in those areas. Detailed environmental evaluations were not performed. Special conditions for ACP pipe handling and disposal or other hazardous materials were not included in the estimates.

5.2.5 Implementation Considerations

The Airport will look to implement the concept designs as feasible through the Airport's Capital

Improvement Plan or by other possible funding streams. The cost estimates include percentages for soft project costs including design, administration, and environmental review and permitting, as indicated in the Preferred Alternatives Data Sheets. Actual soft costs will vary considerably depending on the specifics of each project once it is fully defined and programmed. The costs will also be impacted by the date at which each project is performed due to cost escalation and other potential factors unknown at the time of this study. Projects will require environmental clearances, field investigations including topographic survey and geotechnical investigations, and engineering design services to advance detailed design and preparation of construction contract documents.

6. References

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Exhibit 1: Existing Drainage System and Outfall Locations

SANTA BARBARA AIRPORT (SBA)
DRAINAGE MASTER PLAN

SANTA BARBARA CITY AGREEMENT NO. 28,228
1942500-221677.01
08/23/2024

EXISTING DRAINAGE SYSTEM AND OUTFALL LOCATIONS

Mead & Hunt

EXHIBIT 1

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Exhibit 2: Existing Drainage Areas

SANTA BARBARA AIRPORT (SBA)
DRAINAGE MASTER PLAN

SANTA BARBARA CITY AGREEMENT NO. 28,228
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08/23/2024

EXISTING DRAINAGE AREAS

Mead & Hunt

EXHIBIT 2

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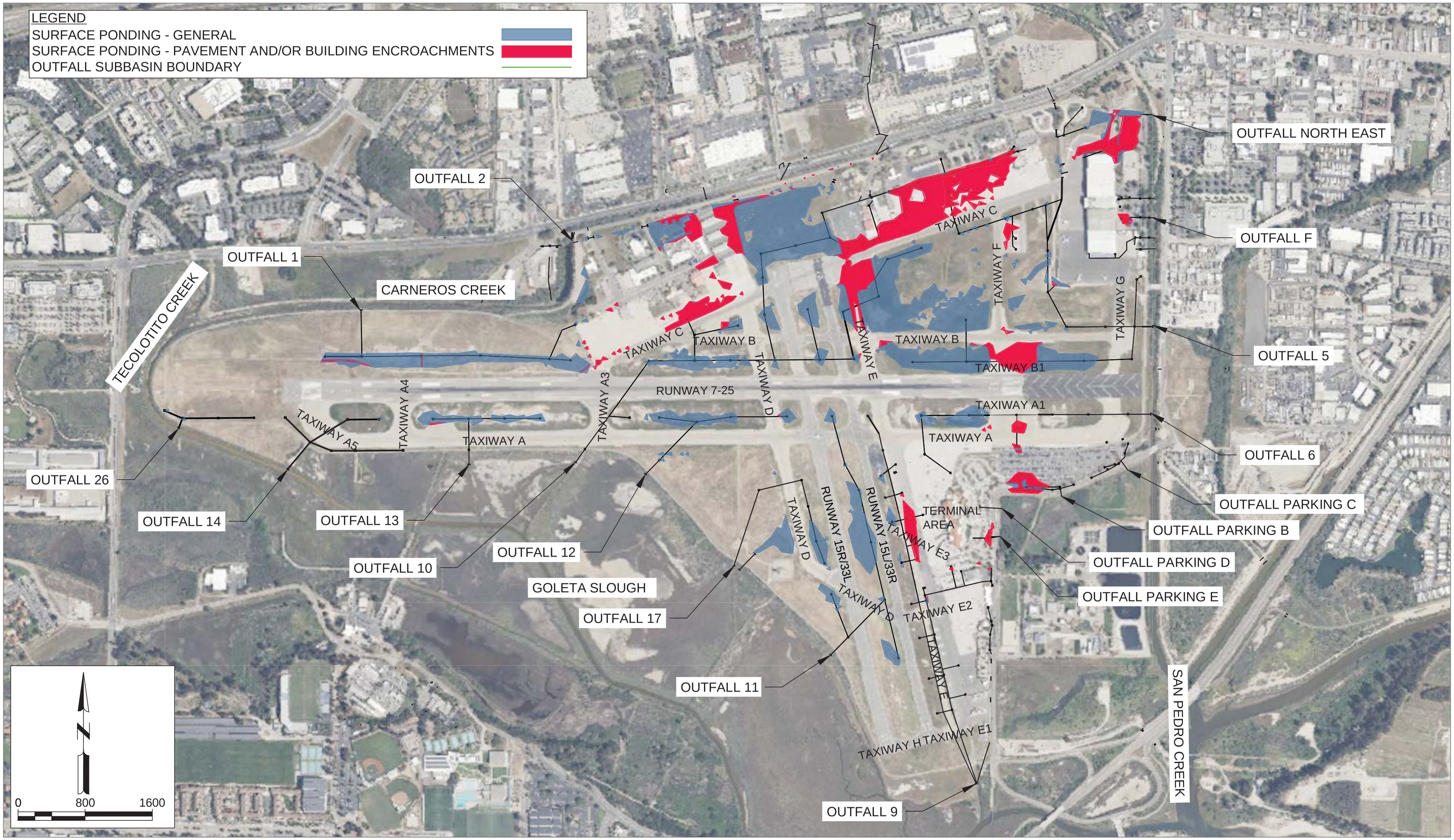
Exhibit 3: Onsite Stormwater Ponding – Existing Conditions



SANTA BARBARA AIRPORT (SBA)
SEA LEVEL RISE ADAPTATION PLAN

SANTA BARBARA CITY AGREEMENT NO. 28,228
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Onsite Stormwater Ponding Existing 5yr Results - Free Discharge Conditions

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EXHIBIT 3A

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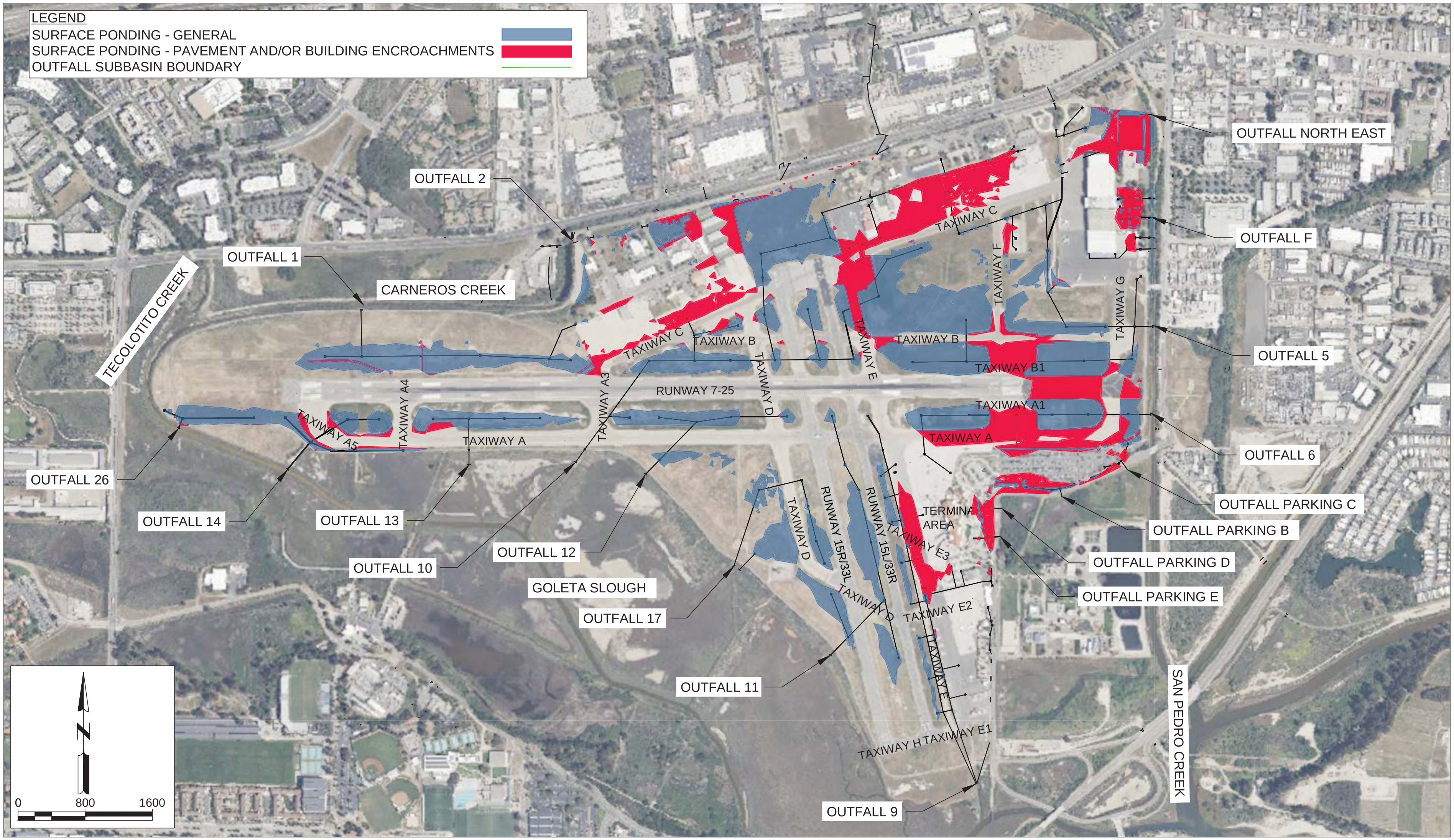

SANTA BARBARA AIRPORT (SBA)
SEA LEVEL RISE ADAPTATION PLAN

SANTA BARBARA CITY AGREEMENT NO. 28,228
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06/07/2024

Onsite Stormwater Ponding Existing 5yr Results - Peak Runoff and Peak Outfall Water Levels Coinciding

EXHIBIT 3B

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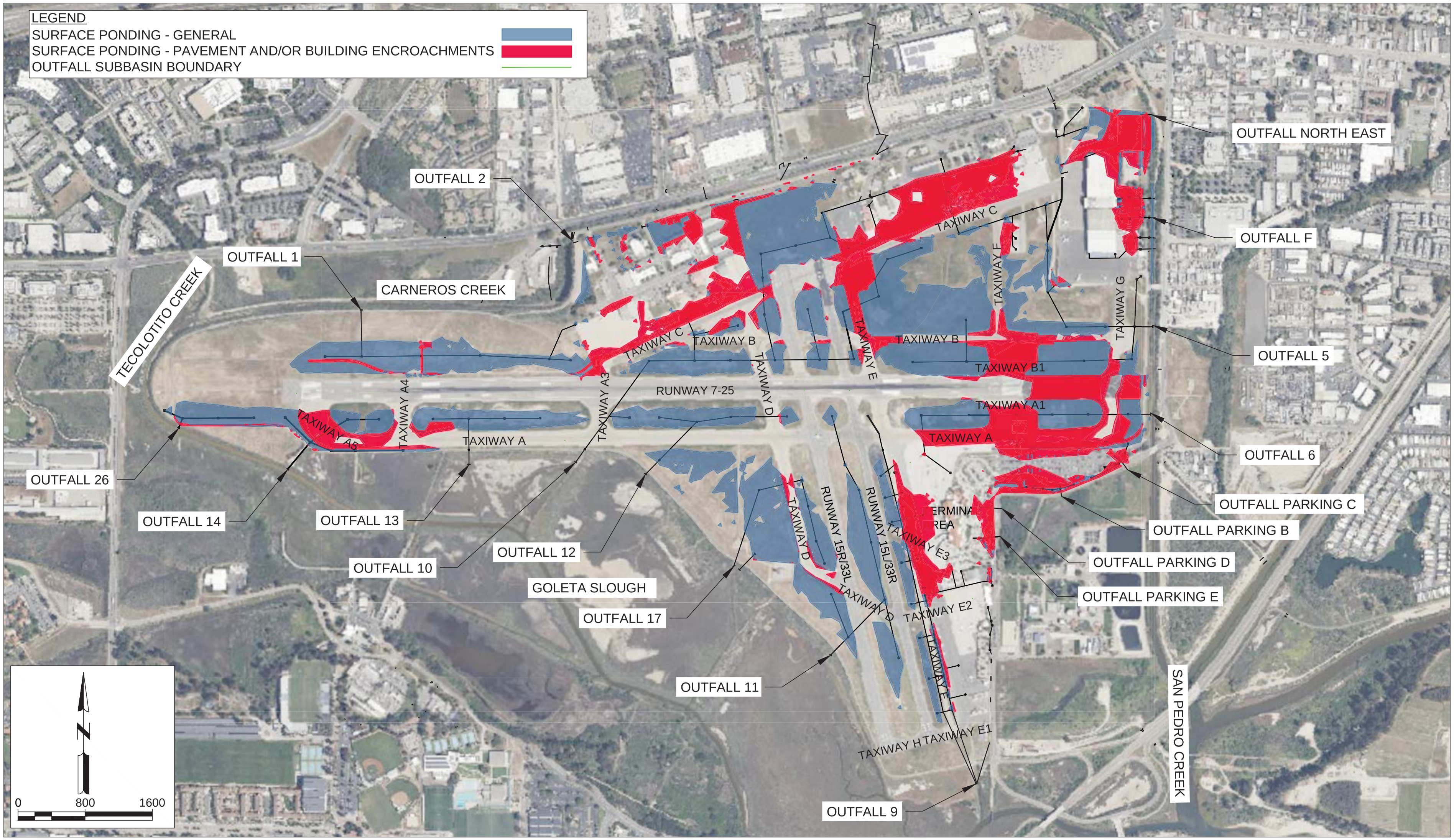

SANTA BARBARA AIRPORT (SBA)
SEA LEVEL RISE ADAPTATION PLAN

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08/14/2024

Onsite Stormwater Ponding Existing 10yr Results - Peak Runoff and Peak Outfall Water Levels Coinciding

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EXHIBIT 3C

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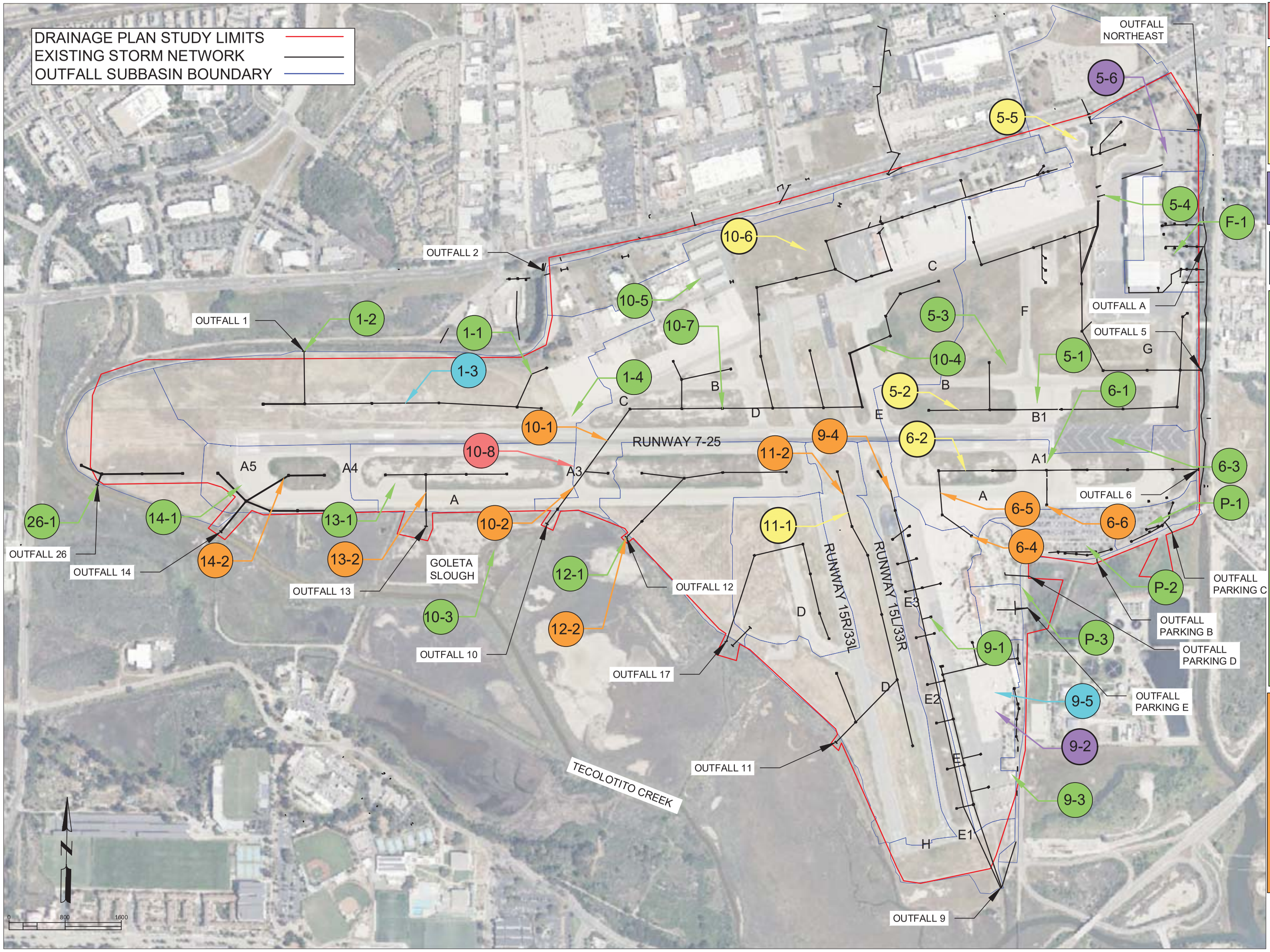
Exhibit 4: Project Priority Map



MASTER PLAN SHORT-TERM PROJECTS
10-8. EXISTING TAXIWAY A3 REMOVAL

MASTER PLAN INTERMEDIATE-TERM PROJECTS
10-6. NE HANGAR DEVELOPMENT
11-1. TAXIWAY E RELOCATION/RUNWAY 15-L-33R CLOSURE
6-2. FUTURE TAXIWAY A3
5-2. FUTURE TAXIWAY B2
5-5. FUTURE FUEL FARM

MASTER PLAN LONG-TERM PROJECTS
9-2. PARKING GARAGE
5-6. VERTIPORT SITE

NON-MASTER PLAN PROJECTS
1-3. TAXIWAY B EXTENSION
9-5. SOUTHFIELD REDEVELOPMENT

FLOODING AREAS OF INTEREST AND KNOWN DRAINAGE CONCERNS
1-1. DITCH BEHIND LIFT STATION 3
1-2. OUTFALL 1 IMPROVEMENTS
1-4. TAXIWAY A3-C CONNECTION
5-1. TAXIWAY B-1
5-3.TAXIWAY F REMOVAL/ADDITION
5-4. AIRFIELD CONVEYANCE SWALE MAINTENANCE
6-1. TAXIWAY A1
6-3. RUNWAY 7-25 BLAST PAD
9-1. TERMINAL APRON
9-3. CONCRETE CONVEYANCE CHANNEL MAINTENANCE
10-3. OUTFALL 10 CHANNEL MAINTENANCE
10-4. NORTHERN PORTION OF TAXIWAY E
10-5. NW GA APRON
10-7. DISTRIBUTE FLOW AWAY FROM DRAINAGE AREA 10
12-1. OUTFALL 12 IMPROVEMENTS
13-1. RUNWAY 7-25 RUN-UP PAD
14-1. TAXIWAY A5
26-1. OUTFALL 26 IMPROVEMENTS
F-1. 495 FAIRVIEW HANGARS
P-1. LONG TERM PARKING LOT
P-2. EAST CELL PHONE LOT
P-3. TERMINAL PARKING LOT

PIPE/OTHER MAINTENANCE AREAS OF INTEREST
6-4. DEPOSITS AND CRACKS IN PIPE
6-5. PIPE SURFACE DAMAGE REINFORCEMENT
6-6. DEPOSITS AND CRACKS IN PIPE
9-4. ANGULAR PIPE JOINT
10-1. INFILTRATION RUNNER IN PIPE
10-2. PIPE SURFACE DAMAGE REINFORCEMENT, OBSTRUCTION THROUGH PIPE WALL
11-2. PIPE WITH HOLE AND JOINT OFFSET
12-2. PIPE WITH SURFACE DAMAGE
13-2. CRACKS, DEPOSITS, INFILTRATION DRIPPER IN PIPE
14-2. CRACK IN PIPE

SANTA BARBARA AIRPORT (SBA)
DRAINAGE MASTER PLAN

SANTA BARBARA CITY AGREEMENT NO. 28,228
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PROJECT PRIORITIES EXHIBIT

EXHIBIT 4

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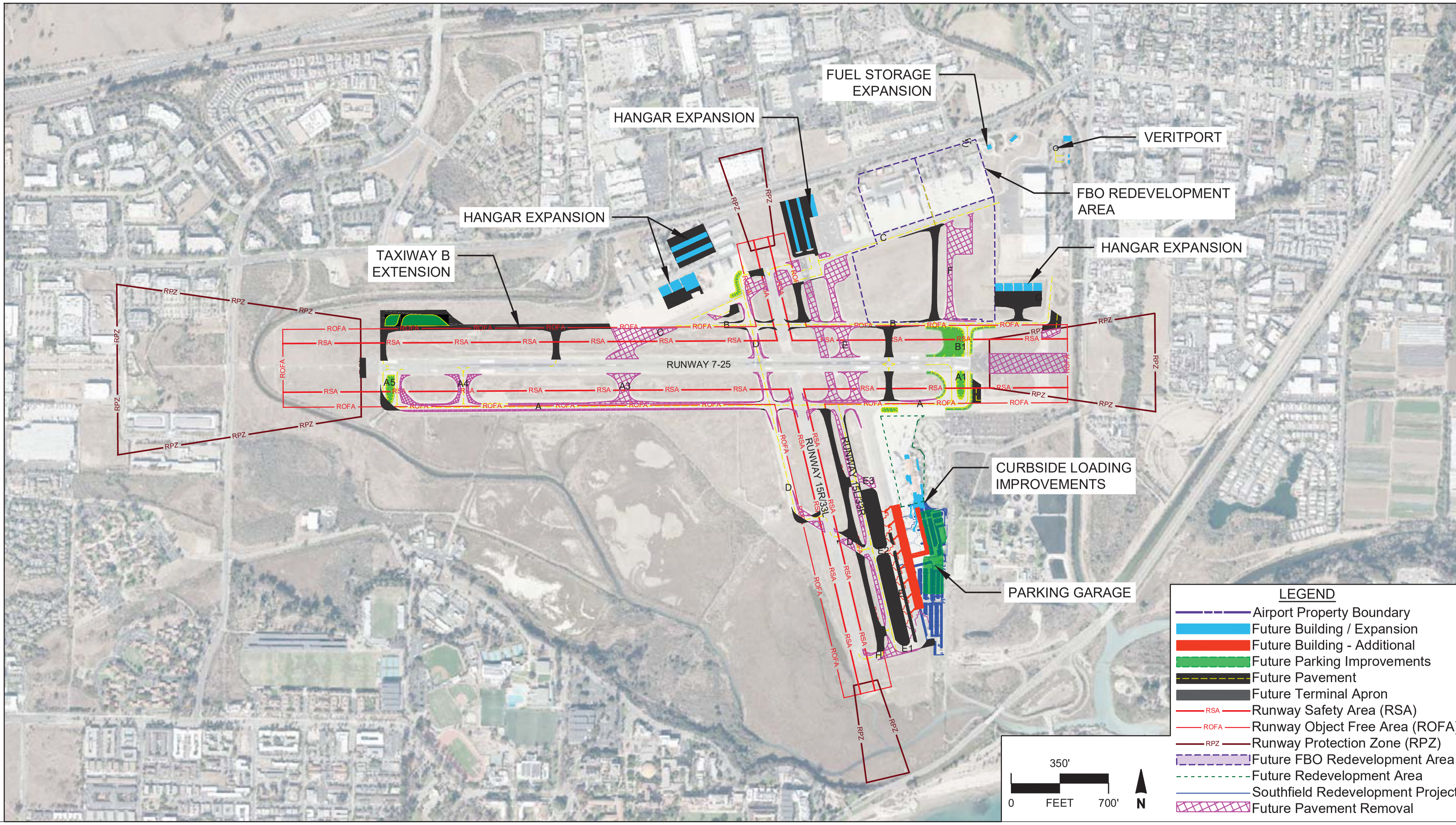
Exhibit 5: Proposed Development



SANTA BARBARA AIRPORT (SBA)
DRAINAGE MASTER PLAN

SANTA BARBARA CITY AGREEMENT NO. 28,228
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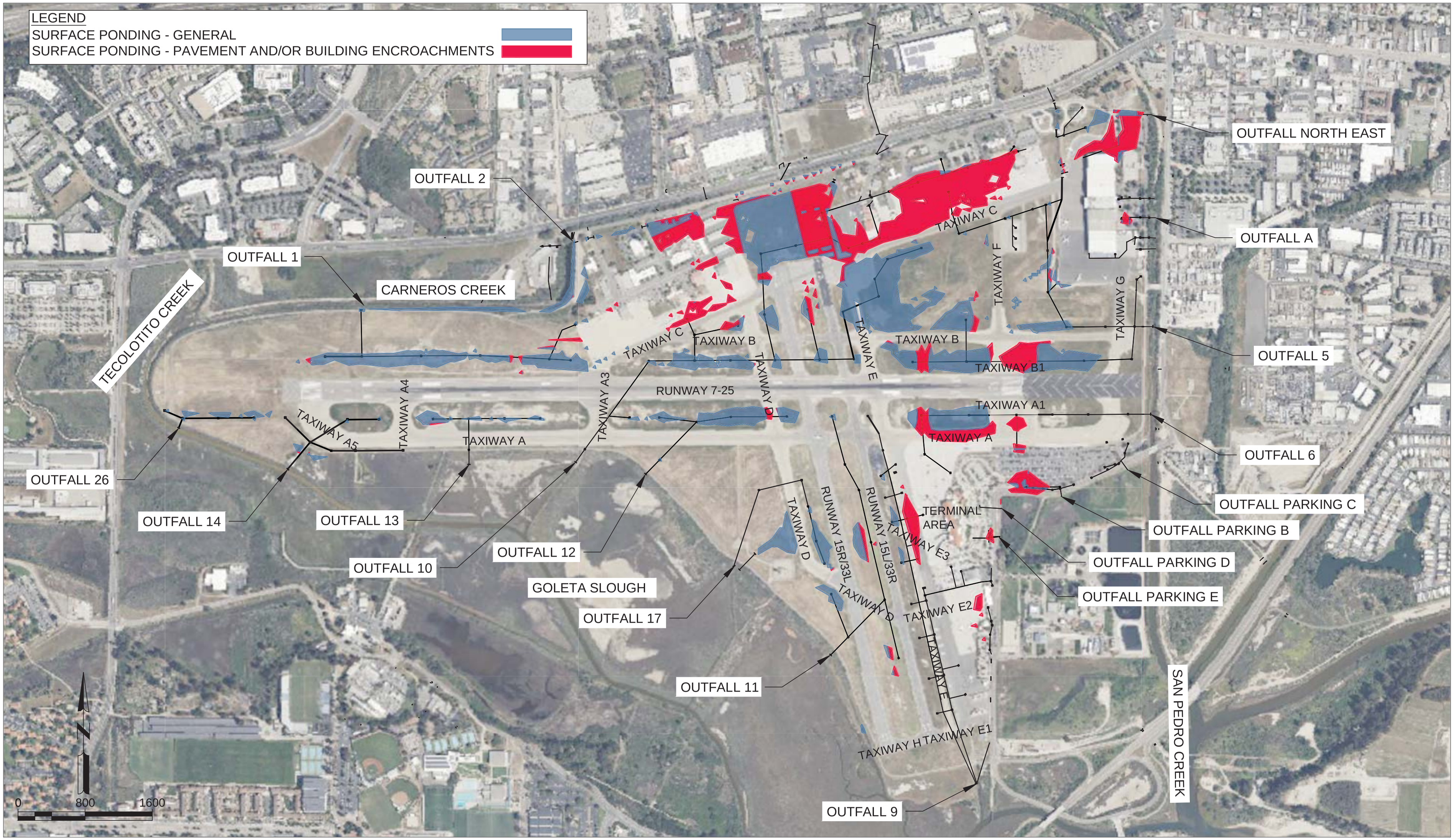
04/10/2023

PROPOSED DEVELOPMENT

EXHIBIT 5

Exhibit 6: Onsite Stormwater Ponding – Proposed Conditions



SANTA BARBARA AIRPORT (SBA)
SEA LEVEL RISE ADAPTATION PLAN

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Onsite Stormwater Ponding Proposed 5yr Results - Free Discharge Conditions

EXHIBIT 6A

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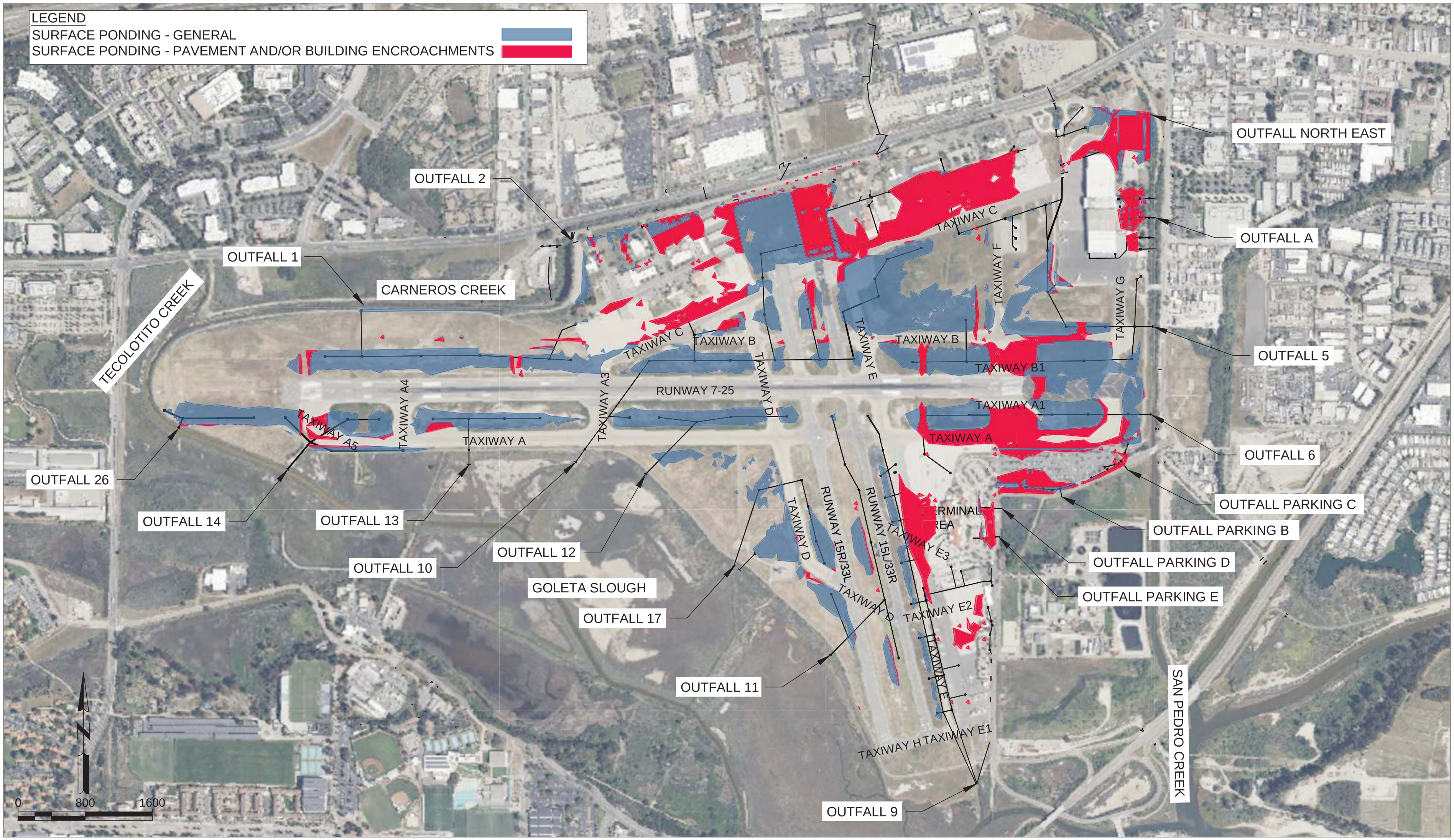

SANTA BARBARA AIRPORT (SBA)
SEA LEVEL RISE ADAPTATION PLAN

SANTA BARBARA CITY AGREEMENT NO. 28,228
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Onsite Stormwater Ponding Proposed 5yr Results - Peak Runoff and Peak Outfall Water Levels Coinciding

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EXHIBIT 6B

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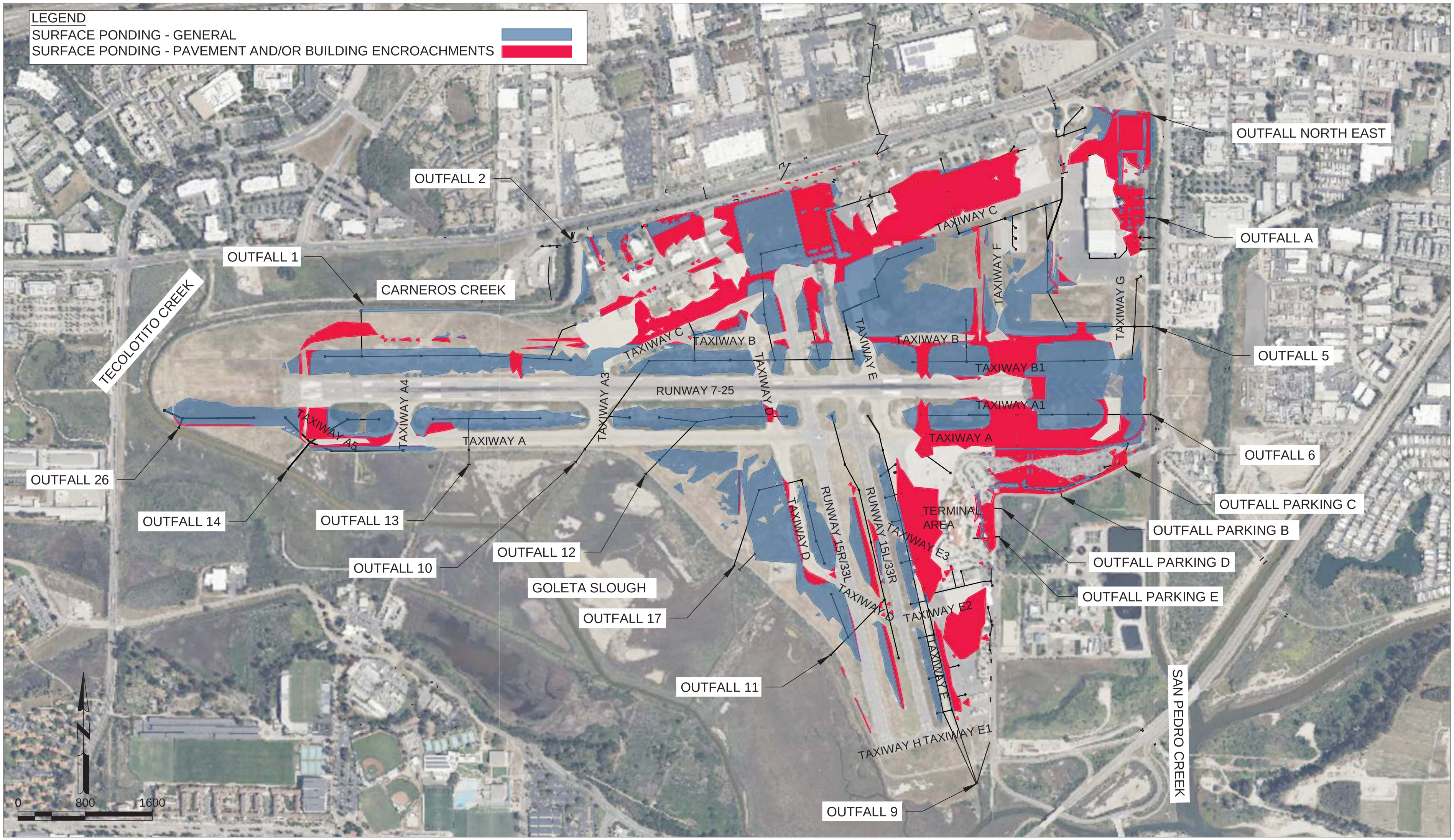

SANTA BARBARA AIRPORT (SBA)
SEA LEVEL RISE ADAPTATION PLAN

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Onsite Stormwater Ponding Proposed 10yr Results - Peak Runoff and Peak Outfall Water Levels Coinciding

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EXHIBIT 6C

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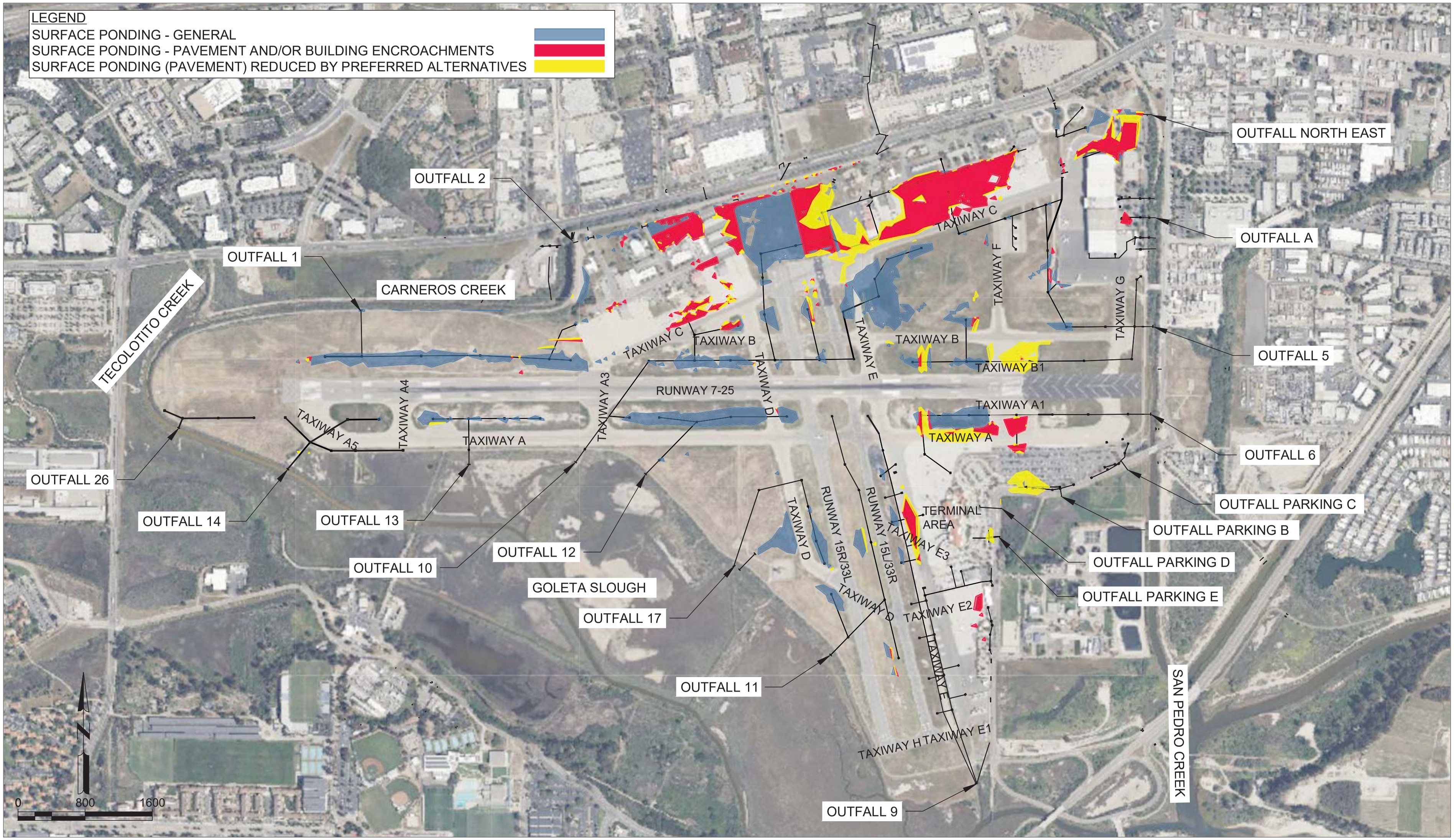
Exhibit 7: Onsite Stormwater Ponding – Preferred Alternatives



SANTA BARBARA AIRPORT (SBA)
SEA LEVEL RISE ADAPTATION PLAN

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Onsite Stormwater Ponding Preferred Alternatives 5yr Results - Free Discharge Conditions

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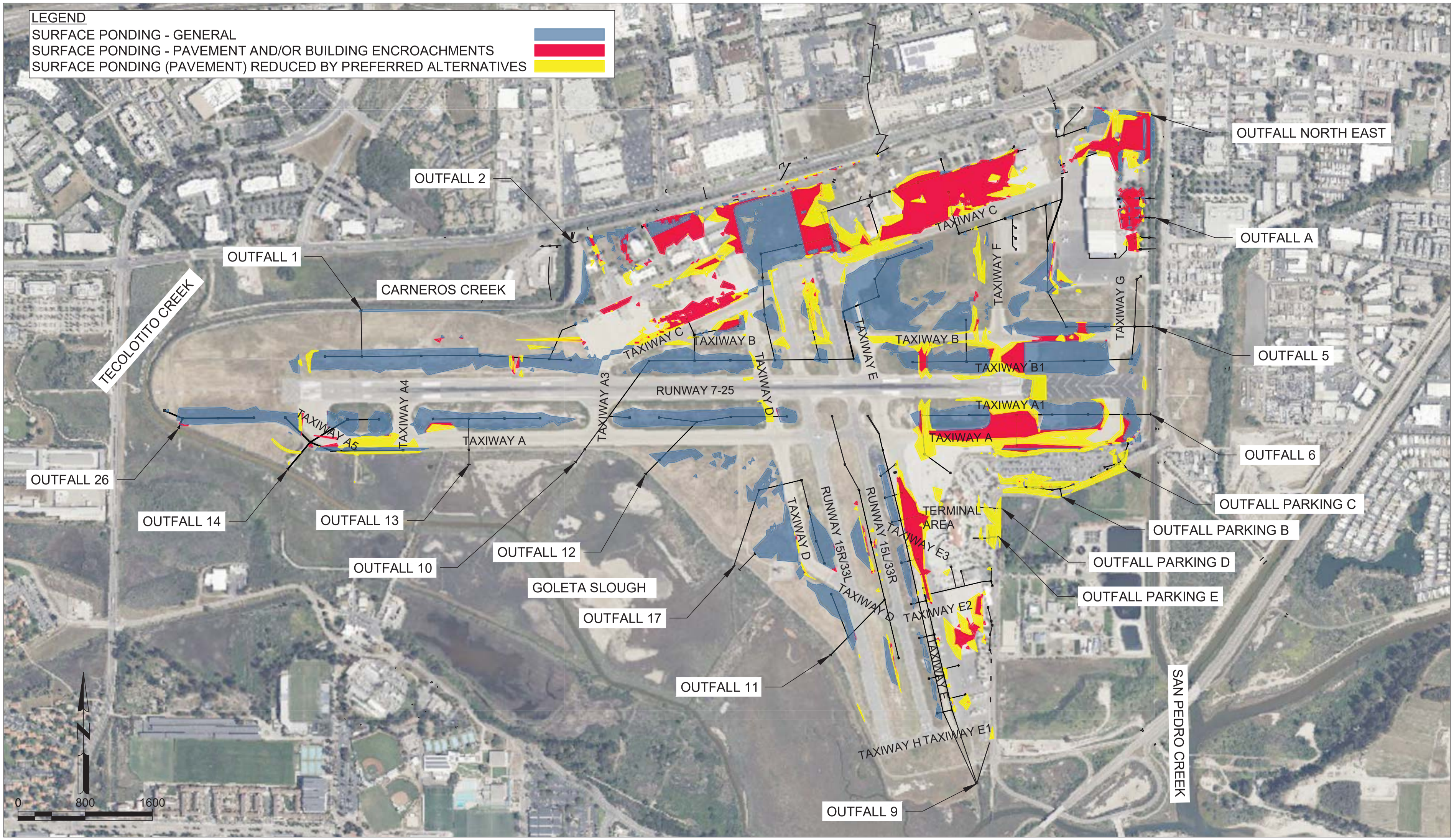

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SEA LEVEL RISE ADAPTATION PLAN

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Onsite Stormwater Ponding Preferred Alternatives 5yr Results - Peak Runoff and Peak Outfall Water Levels Coinciding

EXHIBIT 7B

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Santa Barbara Airport

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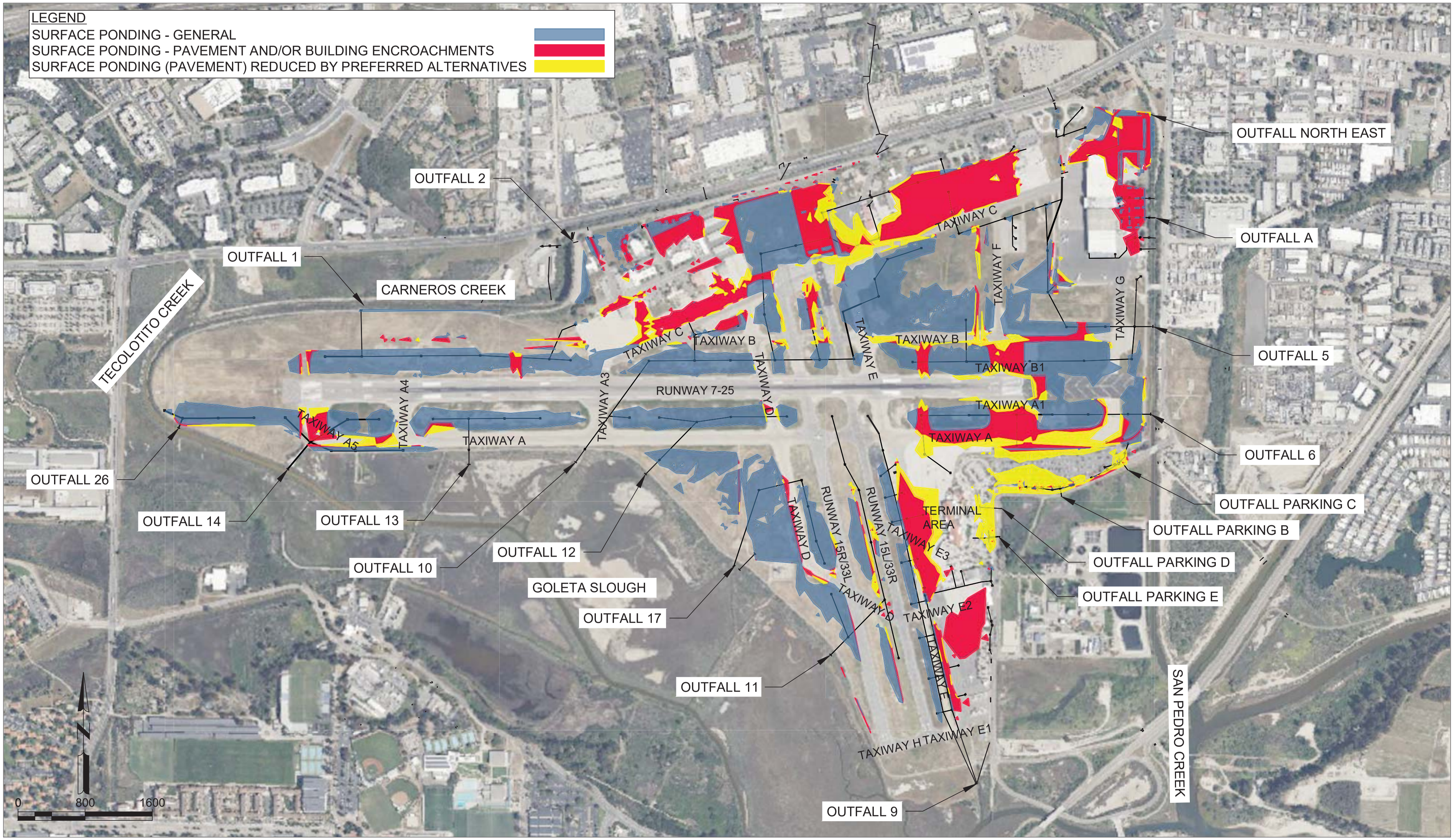

SANTA BARBARA AIRPORT (SBA)
SEA LEVEL RISE ADAPTATION PLAN

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Onsite Stormwater Ponding Preferred Alternatives 10yr Results - Peak Runoff and Peak Outfall Water Levels Coinciding

EXHIBIT 7C

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