Los Angeles County
Metropolitan Transportation Authority

Draft Environmental Impact Report

Appendix 3.10-A: Drainage Study/Hydraulics Report

C LINE (GREEN) EXTENSION TO TORRANCE

Metro

C Line (Green) Extension to Torrance

Draft Environmental Impact Report

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January 2023

Metro

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Abbreviations/Acronyms

AA..... Alternatives Analysis
ACE ..... Advanced Conceptual Engineering
Caltrans ..... California Department of Transportation
CEQA ..... California Environmental Quality Act
CMP..... Corrugated Metal Pipe
EIR ..... Environmental Impact Report
FEMA..... Federal Emergency Management Agency
FIRM ..... Flood Insurance Rate Map
LACDPW..... Los Angeles County Department of Public Works
LACFCD..... Los Angeles County Flood Control District
LAX ..... Los Angeles International Airport
LID ..... Low Impact Development
LRT..... Light Rail Transit
LRTP..... Long Range Transportation Plan
Metro ..... Los Angeles County Metropolitan Transportation Authority
MRDC ..... Metro Rail Design Criteria
PE ..... Preliminary Engineering
RCB..... Reinforced Concrete Box
ROW ..... Right-of-Way
RWQCB..... Regional Water Quality Control Board (Los Angeles Region)
SAA..... Supplemental Alternatives Analysis
SD ..... Storm Drain
TC ..... Transit Center

1. INTRODUCTION

1.1. STUDY BACKGROUND

The Los Angeles County Metropolitan Transportation Authority (Metro) has initiated a Draft Environmental Impact Report (EIR) for the C Line (Green) Extension to Torrance Project (Proposed Project) pursuant to the California Environmental Quality Act (CEQA). Metro is the lead agency for the Proposed Project. The Proposed Project is a light rail transit line that would extend approximately 4.5 miles from the end of the existing Metro C Line (Green) in Redondo Beach southeast to Torrance. The proposed light rail line would connect the Metro system further into the South Bay, serving the cities of Redondo Beach, Lawndale, and Torrance (Figure 1-1). The Project Area is primarily urbanized, with a wide range of existing and planned land uses.

Metro completed an Alternatives Analysis (AA) Study in 2009, which studied transit alternatives along the Metro-owned Harbor Subdivision right-of-way (ROW) between downtown Los Angeles, Los Angeles International Airport (LAX) and the Ports of Los Angeles and Long Beach. The AA identified the C Line (Green) Extension from Redondo Beach to Torrance, utilizing the Metro ROW in the Harbor Subdivision Corridor, as the preferred route alternative. Light rail was identified as the preferred mode. A Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) was initiated to study No Build, Transportation Systems Management, and light rail Alternatives along the ROW. However, after the failure of Measure J in 2012, the Draft EIS/EIR was stopped, and the project paused.

Following the passing of Measure M in 2016, Metro reinitiated the project with preparation of a Supplemental Alternatives Analysis (SAA). The 2018 SAA study focused on soliciting feedback from corridor cities and stakeholders to refine and update alternatives previously identified in the 2009 AA. The 2018 SAA evaluated four light rail alternatives, and on September 27, 2018, Metro's Board approved carrying forward Alternative 1 and 3 for environmental analysis.

In February 2021, Metro conducted scoping for this Draft EIR, without an EIS component. As a result of scoping comments, an additional design option was included in the analysis. This Draft EIR evaluates the following:

- **Proposed Project**: Follows the existing Metro-owned railroad right-of-way (ROW) for the length of the project, with an at-grade and aerial alignment between Redondo Beach (Marine) and 190th Street.
- **Trench Option**: Follows the existing Metro-owned ROW for the length of the project, with an at-grade and trench alignment between Redondo Beach (Marine) Station and 190th Street.
- **Hawthorne Option**: Starts within the existing Metro ROW, then leaves Metro's ROW to run along Interstate 405 (I-405) and Hawthorne Boulevard with an aerial alignment, before rejoining the Metro ROW at 190th Street.

A brief overview of the Proposed Project and design options is presented in Section 1.4.

1.2. REPORT PURPOSE AND STRUCTURE

The purpose of this Drainage Study/Hydraulics Report is to identify impacts, if any, of the light rail Advanced Conceptual Engineering (ACE) Proposed Project, Trench Option and Hawthorne Option on existing storm drain infrastructure. This report provides a general description of all alternatives, existing

storm drain infrastructure and identifies potential impacts between existing and proposed drainage patterns, existing storm drain facilities and proposed light rail infrastructure including, track alignments, bridge structures and station facilities. This report also includes drawings and other information that support the narrative of this report. Finally, the report will include recommendations and justifications for relocation of existing storm drainage facilities. These recommendations will be based on the study of light rail ACE alignments, existing storm drain infrastructure records, coordination with drainage authorities and results of pothole and structure dip information.

1.3. STUDY METHODOLOGY

This report has been prepared by:

1. Obtaining and reviewing previously prepared drainage studies for areas potentially affected by the Build Alternatives (see Appendix F – Past Drainage Reports);

2. Identifying potential drainage issues for the Proposed Project, Trench Option and Hawthorne Option;

3. Obtaining and reviewed the LACDWP, City of Torrance, Redondo and Lawndale as-built drawings to understand the existing storm drain infrastructure and potential points of connection for the corridor drainage. As-Builts for the existing drainage facilities are provided under Appendix B – As-Built Drawings/Record Drawings. In addition, existing drainage facilities are depicted on the composite utility drawings located in this report under Appendices C through E – Composite Utility Drawings & Matrices for all options. Existing drainage facilities, which are of various sizes and cross section types, are generally located outside of the Metro ROW or cross (encroach) the ROW laterally at various locations along the alignment. Appurtenant structures, such as catch basins and manholes are located adjacent to and outside of the Metro ROW. Existing facilities along the alignment are owned by LACDPW and the Cities of Lawndale and Torrance;

4. Meeting with agency stakeholders to discuss potential impacts between existing storm drain facilities and proposed improvements and render appropriate solutions to eliminate the impacts.

Detailed design of drainage features and associated structures will be provided in the Preliminary Engineering (PE) phase of this project.

1.4. PROJECT DESCRIPTION

1.4.1. Proposed Project

The Proposed Project alignment commences at the southern end of the existing Redondo Beach (Marine) Station, then runs southerly, within the Metro ROW, approximately 4.5 miles, to Crenshaw Boulevard. Please see the track alignment drawings for the Proposed Project under ACE Final Submission. The Proposed Project will shift the existing freight track from the original alignment, allowing a dual track light rail to also occupy the corridor. This option, in contrast to the Hawthorne Option, which leaves the Metro ROW, utilizes the existing railroad corridor for the entirety of the alignment. This has benefits such as being able to relocate utilities within the rail right-of-way with minimal impacts to vehicular traffic, and the ability to reduce the environmental impact because it uses an existing corridor. Two stations are proposed, an elevated Redondo Beach Transit Center (TC) Station

and at-grade Torrance TC Station. These two stations are proposed for the Proposed Project and Trench Options.

The Proposed Project includes approximately 4,050 feet of track on an aerial guideway. Most of the aerial viaduct segments are at four separate locations from approximately Stations 275+50 to 279+50, 303+50 to 326+50, 422+00 to 427+50 and 468+00 to 474+00. There are currently two grade-separated crossings at Artesia Boulevard and Grant Avenue. Track segments that are not on the aerial guideway will generally be "at-grade" or on low embankments.

1.4.2. Trench Option

The Trench Option has a similar horizontal alignment to the Proposed Project. It commences at the southern end of the existing Redondo Beach (Marine) Station, then descends into an open air trench north of Inglewood Avenue travel south under cross streets until it comes back to grade south of 170th Street. There is a second short trench segment to cross under 182nd Street. South of 182nd Street, the alignment is the same as the Proposed Project. Please see the track alignment drawings for the Trench Option in the ACE Drawings. The Trench Option will also shift the existing freight track from the original alignment, allowing a dual track light rail to also occupy the corridor. The benefits of using the existing rail corridor are similar for both the Proposed Project and Trench Option. In the Trench Option, the Redondo Beach TC Station is partially below existing grade because it is at the northernmost end of the second (south) trench.

The Trench Option includes approximately 10,700 feet of track within an open trench, below existing grade. For the Trench Option, there will be two separate trench runs. The first trench run will be located approximately from Station 288+50 to Station 361+50 while the second trench run will be located approximately from Station 377+00 to Station 411+00.

The Trench Option also includes approximately 1,150 feet of track on an aerial guideway north of where it rejoins the Proposed Project alignment, at Hawthorne Boulevard. The aerial guideway segments are primarily at two locations from approximately Stations 422+00 to 427+50 and 468+00 to 474+00.

Track segments that are not raised or trenched will generally be "at-grade" or on low embankments.

1.4.3. Hawthorne Option

The Hawthorne Option consists of elevated structures. The alignment will begin at the southern end of the existing Redondo Beach (Marine) Station, then exit the Metro ROW and run south, parallel to I-405 between Inglewood Avenue and Hawthorne Boulevard. The alignment would then travel along the center median of Hawthorne Boulevard in a southerly direction before rejoining the Metro ROW southeast of 190th Street. The Metro ROW is approximately 84 feet to 116 feet wide for this section, and typically can accommodate the construction of two new light rail tracks in addition to the existing freight tracks. Instead of a station at the Redondo Beach TC, there is one at the South Bay Galleria. Approximately 1,900 linear feet of the north segment and approximately 8,800 linear feet of the south segment of the Hawthorne Option alignment follows the same alignment as that of the Proposed Project and Trench Option.

Along the northern extent of the project from approximately Marine Avenue to south of Manhattan Beach Boulevard, the topography is relatively flat with an approximate maximum grade of 0.5%to the east. The ground surface elevation varies from approximately 60 feet to 125 feet above mean sea level.

1.5. DESIGN CRITERIA/REQUIREMENTS

Design criteria and requirements used as a basis to evaluate the existing drainage facilities with respect to suggested solutions include:

1. Metro Rail Design Criteria

    - The Project will be designed in accordance with the practices and requirements of respective local jurisdictions and the "Section 3.8 Drainage" section of the Section 3 - Civil MRDC.

2. Los Angeles County Department of Public Works (LACDPW).

    - The methodology of the hydrology calculations will be developed per guidelines and procedures outlined in the LACDPW Hydrology Manual, dated January 2006.
    - HydroCalc© software by the LACDPW and based on the Modified Rational Method is the tool for inputting all the required values for a Single and Multi-Subarea Watershed with the output calculations presented in summary reports, hydrographs, and chart areas.
    - At the PE phase, the designers will compile a detailed hydrology and hydraulics report for the project based on 50-year and 10-year storm frequencies.
    - For LACFCD facilities, all flows entering their system will be regulated and restricted to the maximum flow allowances for each conveyance system.

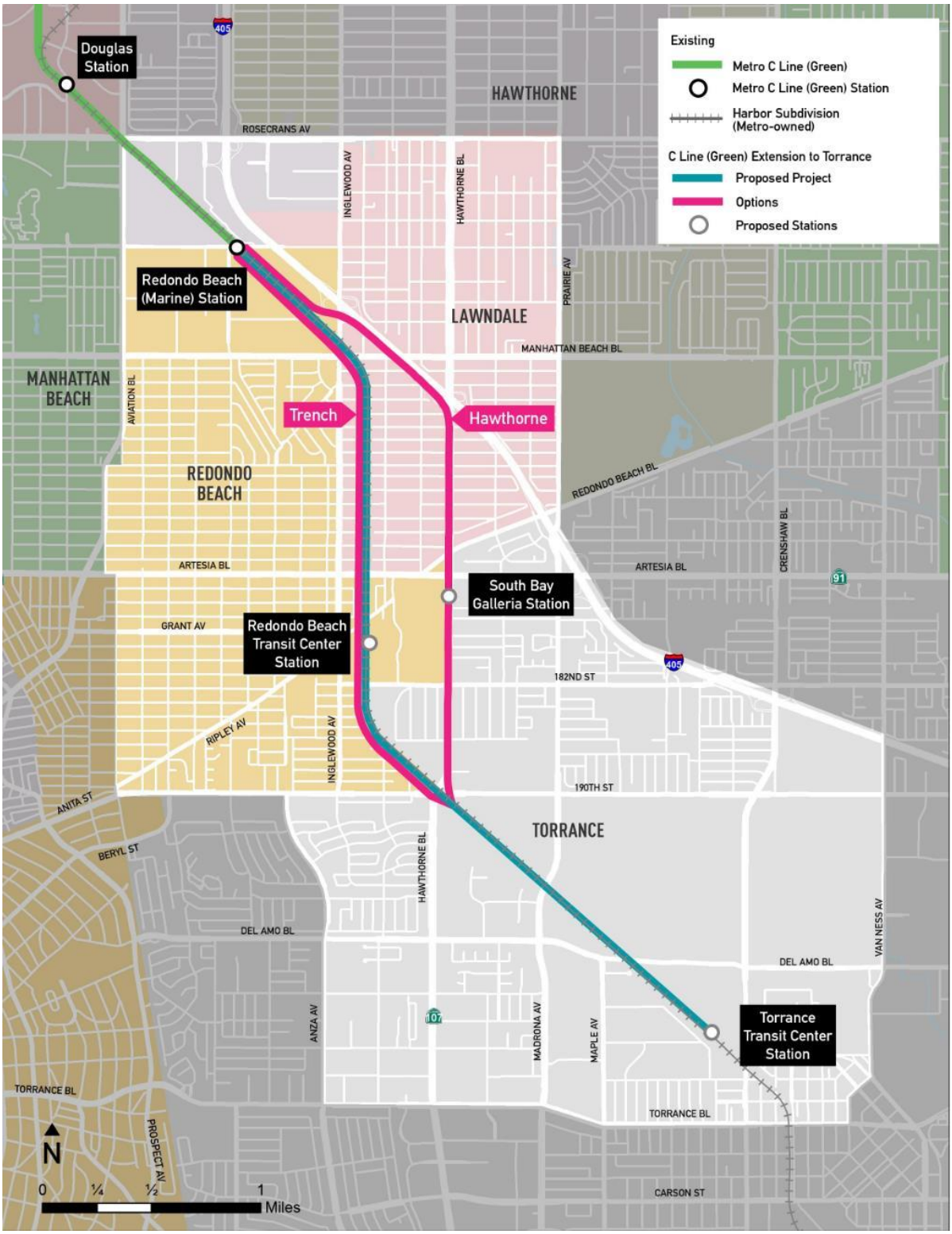
3. The Standard Plans for the City of Torrance, City of Redondo Beach and City of Lawndale.

    - In the event of any variation in design criteria between different stakeholder requirements, the applicable design criteria will be selected to ensure compliance with all relevant requirements.

4. Regional Water Quality Control Board

    - The stormwater collection and treatment system for the selected alternative must be designed to meet the requirements of the Los Angeles Region of the Regional Water Quality Control Board (RWQCB) Order No R4-2021-0105. This Order regulates the regional implementation of the National Pollutant Discharge Elimination System (NPDES) and Municipal Separate Storm Sewer System (MS4) program within the coastal watersheds of Los Angeles County. The County of Los Angeles, LACFCD, City of Lawndale, City of Redondo Beach and City of Torrance are all co-permittees on the RWQCB Order No R4-2021-0105.

Figure 1-1. C Line (Green) Extension to Torrance - Overview



Source: STV, 2022

2. PROJECT DRAINAGE EVALUATION

This section provides a discussion of the existing drainage facilities and conditions along the alignments of the proposed project and all options. A discussion of potential impacts to the existing drainage facilities and suggested solutions for the proposed project and options is also provided. The impacts consider proposed locations of bridge structures, such as foundations and columns as well as locations of proposed stations. Note that solutions discussed are conceptual in nature and will be refined during the PE stages of this project when a preferred alternate is chosen. The ultimate discharge of rainfall runoff generated along the alignment is the Pacific Ocean.

2.1. PROPOSED PROJECT

Existing drainage patterns along the Proposed Project alignment generally flow in either a northerly or southerly direction within the corridor, depending on the specific location. The topography in the northern extent of the project, from approximately Marine Avenue to south of Manhattan Beach Boulevard, is relatively flat with an approximate maximum grade of 0.5% to the east. The ground surface elevation between Marine Avenue and Crenshaw Boulevard varies from approximately 60 feet to 125 feet above mean sea level. South of Manhattan Beach Boulevard, rainfall runoff generated along the ROW exits to street crossings or other low points along the track alignment where it is collected and transported by existing municipal storm drain systems. No catch basins were anticipated within the railroad right of way to capture the generated runoff, based on the available record drawings. However, three catch basins located within the Metro ROW were observed during a site visit conducted on November 19, 2021. The first catch basin is double-grated and is located west of the existing tracks in the vicinity of 172nd Street. The second catch basin is single grated and is located at the northwest quadrant of the intersection of the track bridge structure and Grant Avenue. The third is a curb opening catch basin and is located on the west side of the existing tracks approximately 1,300 feet south of 182nd Street.

2.1.1. Proposed Drainage Modifications

Review of the ACE Plans for the Proposed Project determined that there is an absence of significant existing drainage features within the existing rail corridor. Drainage modifications within the right-of-way will generally consist of trackside ditches, underdrains, minor diversions and protection in place of existing storm drain facilities. The Proposed Project does not make significant changes to the elevations within the Metro ROW. There are, however, some areas of retained fill adjacent to the starts and ends of the aerial guideway portions of the alignments. Drainage will be modified as needed to reestablish and maintain the historic drainage patterns where these structures are proposed. Specific modifications to the existing drainage system will be studied further and designed in the PE phase of this project.

This report looks at key areas of interest to the Proposed Project's drainage. These areas are discussed in the subsections below.

2.1.1.1. Flood Evaluation At El Nido Park

The City of Torrance owns and operates the existing park (El Nido Park) located adjacent to and immediately east of the railroad right-of-way (see Figure H-1 under Appendix H – El Nido Park Flood Analysis Exhibits). There is an existing 48-inch and 72-inch storm drain pipeline that runs under the park and Metro ROW. This storm drain pipeline, which provides drainage for the El Nido Park area and the east side of the track structure, transport runoff to the west. It appears that the storm drain is 72 inches

in diameter where it crosses the track. Minimal amounts of runoff generated from the track area discharges into the storm drain. The as-built drawing is included in Appendix H.

The hydrology of the park area was evaluated to determine potential impacts due to the proposed light rail. As part of the evaluation, information provided on a Flood Insurance Rate Map (FIRM) that includes the track alignment and El Nido Park areas (see FIRM No. 06037C1930F located under Appendix H) was reviewed. As noted on the map, the park and adjacent track structure is not located within a "blue" shaded area. "Blue" shaded areas are considered Special Flood Hazard Areas and are considered a "High Risk" area for flooding during the 1% annual chance (100-year flood) event. The Park is located within a "Low Risk" area. As indicated on the FIRM, the track alignment and El Nido Park is in an unshaded portion of Zone X, which means that it is outside of the 0.2% annual chance flood (500-year floodplain). Based on this evaluation, the park and east side of the track structure is not subjected to flooding. Further discussions and conclusions are provided in Section 3.1.1 of this report.

2.1.1.2. Existing 7 Feet x 10 Feet Reinforced Concrete Box Storm Drain In Manhattan Beach Boulevard

There is an existing LACDPW Reinforced Concrete Box (RCB) storm drain. This existing storm drain structure, which is identified as Project No. 12, Line D, is located under Manhattan Beach Boulevard in the City of Lawndale (see as-built drawing in Appendix G – Existing 7 Feet x 10 Feet RCB Storm Drain As-Built Drawings). The RCB is 7 feet high x 10 feet wide and has a horizontal offset of approximately 12.5 feet north of the Manhattan Beach Boulevard centerline. The RCB, which has an approximate flow capacity of 552 cubic feet per second, has a maximum depth of cover of approximately 9 feet based on the available as-built drawings. As depicted in the ACE Plans, the light rail tracks of the Proposed Project will be on an elevated structure and the realigned BNSF freight tracks will be at grade where they cross the RCB. Currently, it is anticipated that the RCB storm drain will be protected in place for the Proposed Project and will not require relocation to accommodate construction of the light rail aerial guideway.

2.1.1.3. Torrance TC Station Surface Parking Lot

A surface parking lot is proposed to increase off-street, parking at the Torrance TC Station, at the southern terminus of the Metro C (Green) Line Project, to the west of the Torrance TC. The parking lot will add impervious area to the project, but this will be mitigated by incorporating low impact development (LID) measures within the parking lot design to collect, attenuate and treat stormwater runoff, in compliance with the requirements of the agencies having jurisdiction, prior to discharge offsite into the existing municipal system. The Torrance TC (which is a separate project from the Metro C Line extension) has been designed to discharge into a municipal storm system within the Crenshaw Boulevard right-of-way. The design of the surface parking lot will be advanced during the PE phase of the project where the stormwater treatment, storage and outfall design will be further developed. The surface parking lot is included in the advanced conceptual design for the Proposed Project, Trench Option and Hawthorne Option.

2.2. TRENCH OPTION

Existing drainage patterns along the Trench Option are similar to those of the Proposed Project alignment and generally flow in either a northerly or southerly direction within the corridor, depending on the specific location.

2.2.1. Proposed Drainage Modifications

From review of the ACE plans for the Trench Option, it has been determined that some existing storm drain pipes that cross the rail corridor in the vicinity of the trenched portions of the alignment, will be potentially affected by this option. The drainage features of an existing 7 Feet x 10 Feet RCB storm drain and a 48-inch and 72-inch storm drain are likely to be the most affected, as discussed below.

2.2.1.1. Flood Evaluation At El Nido Park

See the flood evaluation at El Nido Park, discussed in Section 2.2.1.1. The Trench Option will discharge the southernmost trench to the pipe that crosses El Nido Park. See Section 2.2.1.3 for further discussion of the trench sump drainage.

2.2.1.2. Existing 7 Feet x 10 Feet RCB Storm Drain In Manhattan Beach Boulevard

Portions of the Trench Option alignment will consist of the track structure to be routed under an existing LACDPW RCB storm drain. This existing storm drain structure, which is identified as Project No. 12, Line D, is located under Manhattan Beach Boulevard in the City of Lawndale (see as-built drawing under Appendix G – Existing 7 Feet x 10 Feet RCB Storm Drain As-Builts). The RCB is 7 feet high x 10 feet wide has a horizontal offset of approximately 12.5 feet north of the Manhattan Beach Boulevard centerline. The RCB, which has an approximate flow capacity of 552 cubic feet per second, has a maximum depth of cover of approximately 9 feet based on the existing as-built drawing. There are no plans to alter the existing hydraulic capacity of the RCB, however, the project design team is evaluating various options to construct the track structure under the RCB without changing the horizontal or vertical alignment. Currently, it is anticipated that the RCB storm drain will not require relocation to accommodate the planned track alignment, however, portions of the RCB may be supported/protected in place to allow for construction of the track below. There are several feasible options for constructing the trench around the existing RCB. These options are discussed in more detail in the "Traffic Handling and Staging" report as part of the ACE. Further discussions with conclusions are provided in Section 3.1.2 of this report. These options will be further explored and evaluated during the PE stage of the project if the Trench Option is selected as the preferred alternative.

The 7 Feet by 10 Feet RCB ties into a double 9.5 Feet by 10 Feet RCB (Line A) that crosses the parcel that is conceptually identified for a Traction Power Sub Station (TPSS) and Trench Drainage Sump Pump. The Trench Option improvements are not anticipated to impact Line A however portions of the 9.5-foot by 10-foot RCB may need to be protected in place to due to its proximity to the construction of the TPSS, sump pump and appurtenances within the parcels.

2.2.1.3. Trench Sump Drainage

The trench option proposals include conceptual requirements necessary for incorporation of two sump drainage systems. These systems will be used to collect rainfall runoff at two low points along the trenched portions of the track alignment. Where necessary a pump system will be provided to remove water from the sumps. Two low points are proposed, one at the vicinity of Manhattan Beach Boulevard and the other at the vicinity of 182nd Street. See Appendix I - Site Drainage Exhibits showing locations of the sump systems. The two sumps are designated as "Sump No 1" and "Sump No 2", respectively.

As shown in the ACE plans, the pumping system for Sump No 1 has been situated north of Manhattan Beach Boulevard, east of the Metro ROW. Rainfall runoff within the trench would be collected in the

sump, treated through an integrated clarifier, and then pumped and discharged into the existing LACDPW 7 feet x 10 feet RCB storm drain located below Manhattan Beach Boulevard.

It was determined that Sump No 2 will not require a pump system as the outfall into the existing storm drain (72-inch diameter RCP) is lower than the low point of the sump. The elevation difference between the proposed sump invert bottom and existing pipe is approximately 12 feet based on the available as-built information and ACE trench profile. The discharge pipeline providing drainage for Sump No 2 will be located west of the tracks. The line will generally follow an existing unsurfaced access road within Metro ROW and discharge to an existing 72-inch LACFCD storm drain located south of 182nd Street, approximately 1,300 feet south of the Sump No 2-low point.

It is anticipated that rainfall runoff collected in the two sumps may require treatment prior to discharge into existing storm drain facilities in conformance with State Water Resources Control Board requirements. Specific requirements for stormwater treatment can be confirmed during the PE stage of the project (if the Trench Option is chosen). However, at this time, conceptual surface areas indicated on the site plan exhibits include provisions for clarifier units. For the Sump No 1 area, the clarifier is situated adjacent to the pump station. The clarifier in the Sump No 2 area is situated north of 182nd street, west of the Metro ROW. A summary with conclusions is provided under Section 3.1.3 of this report.

Conceptual surface areas required for pump/clarifier systems are shown on the site plan exhibits. Areas required are based on inclusion of the following elements:

- Pump Station (Sump No. 1 only)
- Stormwater Clarifier
- Parking for facility maintenance (1 stall assumed)

Conceptual area requirements are as follows:

- SUMP NO. 1: 50 feet x 40 feet = 2,000 square feet
- SUMP NO. 2: 45 feet x 30 feet = 1,350 square feet

2.3. HAWTHORNE BOULEVARD OPTION

The drainage network along Hawthorne Boulevard and Inglewood Avenues generally flows in a northerly direction. A channel parallel to the San Diego Freeway, flows southeast. Runoff from existing catchments along the alignment corridor is being captured mainly by catch basins to existing storm drain systems as defined on the record documents. The main drain, into which northern and southern drains are connected to, is the Manhattan Beach Boulevard channel. This drain flows east and discharge into the Dominguez Channel. The area from Redondo Beach Transit Center to Hawthorne Boulevard / 190th Street drains by way of multiple storm drains to the South Santa Monica Bay. As noted on the Flood Insurance Rate Map (FIRM), see Appendix A – FEMA Maps, the Hawthorne alignment does not sit within a major flood zone.

2.3.1. Existing Drainage Infrastructure

The existing drainage facilities are shown on the composite utility drawings located in this report under Appendix E – Composite Utility Drawings & Utility Conflict Disposition Matrix – Hawthorne Option. Along the Hawthorne Alignment several storm drains have been identified. Pipelines are either crossing or run

parallel to the alignment, in variety of sizes ranging between 15 inches of a round concrete lateral drain to double 13 feet - 3 inches x 8 feet -9 inches reinforced concrete block channel underneath the 405 freeway. Runoff generated on Hawthorne Boulevard is collected through catch basins connected to major storm drains owned and maintained by LACFCD and City of Redondo Beach. Based on existing as-built drawings (see Appendix B – As-Built Drawings/Record Drawings) and current survey data, pipe slopes vary with the maximum at approximately 0.009 feet/feet, a 60-inch RCP section located under Hawthorne Boulevard. Existing facilities along the other alignment segments are owned by LACDPW and the Cities of Lawndale, Redondo Beach and Torrance. From 176th Street to 186th Street there are small storm drains (18-inch CMP, 4 feet x 1-foot RCB) crossing Hawthorne Boulevard and they are private drains as well as drains owned by City of Torrance with no available As Built records.

2.3.2. Proposed Drainage Modifications

Impacts to existing facilities will vary depending on the alignment section, which varies between and aerial guideway on bridge, elevated within retaining walls and at-grade. Some of drainage lines will require rerouting while others will need structural modifications or be protected-in-place.

For the aerial segment, where possible the column foundations can be located to avoid impacts to the existing storm drains, otherwise at elevated segments including retained fill, the major storm drains running parallel to the construction will be rerouted.

Along Hawthorne Boulevard, the existing LACFCD major storm drain will be relocated starting at approximate Station 460+00 and ending at approximate Station 489+70. The storm drain will be relocated parallel to the existing pipe location. All existing laterals will be reconstructed accordingly and connect to the proposed storm drain as well as the catch basins in street reconstruction. The existing City of Redondo Beach storm drain will be relocated starting at approximate Station 493+00 and ending at approximate Station 502+00. The existing laterals and catch basins in the construction area will be reconstructed to connect to this storm drain. On the remaining portion of the grade separation of the Hawthorne Alternative from Station 509+50 to Station 534+20, all small storm drain crossing the track will be relocated. Conceptual storm relocation plans are provided in Appendix E – Composite Utility Drawings & Utility Conflict Disposition Matrix – Hawthorne Option. Track plan and profiles are provided as reference under Appendix J – Track Drawings (Plan and Profile).

3. SUMMARY

3.1. PROPOSED PROJECT

3.1.1. Proposed Project Drainage

The project will not significantly change the existing drainage patterns within the watersheds. The Proposed Project leaves most of the Metro ROW at the existing elevation. Where aerial guideways are introduced, the existing drainage pattern can still be maintained using storm drain piping and inlets.

As discussed above, from the review of the ACE Plans for the Proposed Project, it has been determined that there is an absence of significant existing drainage features within the existing rail corridor. Drainage modifications within the Metro ROW will generally consist of trackside ditches, underdrains, minor diversions and protection in place of existing storm drain facilities. The Proposed Project does not make significant changes to the elevations within the Metro ROW. The Trench Option will depress the track elevations in parts of the Metro ROW. In the existing condition, the rail functions as a watershed. Runoff from the depressed portions of the alignment will be directed to discharge points and the discharge will be designed to be limited to the allowable flows. The portion of the Hawthorne Option that leaves the rail Metro ROW will travel within City rights-of-way and will not change the overall hydrology of the watershed. Specific modifications to the existing drainage system will be studied further and designed in the Preliminary Engineering (PE) phase of this project.

Due to the absence of significant existing drainage features within the existing rail corridor, drainage impacts will be limited to minor diversions and protection in place of existing storm drain facilities. It is anticipated that modifications of existing rainfall runoff discharge points will be minimal even with the inclusion of down drains for the aerial portions of the Proposed Project alignment. It should be noted that, at some locations, the impervious area(s) will increase in the proposed condition. In that case, the time of concentration will decrease, thus increasing flow rates and runoff volumes if existing hydrology is maintained. Stormwater management features may be introduced to offset the potential increase in runoff flow rates and volumes. These may include:

- Introduction of LID design elements to increase the time of concentration by increasing flow path of travel length
- Modifications to the hydraulics (i.e., changing connection points to existing facilities)
- Provision of detention features as needed to attenuate peak flows

The nature and quantity of the drainage improvements will be developed in more detail during the PE phase of the project.

It appears that there will be no significant changes to the hydrology with respect to flow runoff diversions leaving the Metro ROW for the at-grade portions of the alignment. Even with the inclusion of track underdrain facilities, discharge locations will most likely be the same as existing. Further analysis will be conducted during the PE stages of the project.

3.1.2. Flood Evaluation at El Nido Park

Based on the FIRM (Appendix H), there is no indication that flooding issues within the El Nido Park area and the existing track corridor have occurred in the past. In addition, it appears that the hydrology of El Nido Park and the existing track corridor will not change as a result of the light rail proposals. With

regards to the new trackwork, it appears that there will be no significant changes to the hydrology with respect to flow runoff diversions leaving the Metro ROW. Even with the inclusion of track underdrain facilities, discharge locations will most likely be the same as existing. It should be noted, as discussed above, flow characteristics may change when changing from pervious to impervious surfaces (i.e., increase in flow volumes). These flow characteristics may change in the track area, not the park. Recommendations to mitigate any minor increases, as indicated above, would also apply in this case. Based on this information, there is no indication of impact to existing hydrology because of the light rail proposals.

3.1.3. Existing RCB Storm Drain in Manhattan Beach Boulevard

Based on the options being considered as discussed in Section 2.1.1.2, it is anticipated that modifications to the hydraulics of the existing 7 Feet x 10 Feet RCB will be minimal. If a stormwater bypass system is considered (assuming portions of the RCB will be removed), it will be appropriately sized to effectively transport stormwater runoff. Further studies regarding the execution of this alternative will be performed during the PE stages of this project.

3.2. TRENCH OPTION

3.2.1. Flood Elevation at Nido Park

As with the Proposed Project, there is no indication that flooding issues within the El Nido Park area and the existing track corridor have occurred in the past. In addition, the hydrology of El Nido Park and the existing track corridor will not change significantly as a result of the LRT proposals. The ACE plans depict that the proposed top of rail elevation will be dropped by approximately 7 feet where it crossed the 72-inch storm drain that drains El Nido Park. The existing storm pipe appears to be buried 40 to 60 feet deep at this location and does not appear to need relocation. The new loading on the pipe because of the reduced cover, will need studied during the PE phase of the project.

3.2.2. Trench Sump Drainage

Like the Proposed Project, the absence of significant existing drainage features within the existing rail corridor, drainage impacts will be limited to minor diversions and protection in place of existing storm drain facilities. The most significant drainage feature impacted by the Trench Option alternative is a 7 Feet x 10 Feet RCB storm drain as previously discussed. Based on the options being considered as discussed in Section 2.2.1.2, it is anticipated that modifications to the hydraulics of the existing 7 Feet x 10 Feet RCB will be minimal. If a stormwater bypass system is considered (assuming portions of the RCB will be removed), it will be appropriately designed during the PE phase.

With regards to the remaining portion of the alignment, that is the portions not elevated or trenched, it appears that there will be minimal changes to the hydrology with respect to flow runoff diversions leaving the Metro ROW. Even with the inclusion of track underdrain facilities, discharge locations will likely be very similar to the existing. Further analysis will be conducted during the PE stages of the project.

3.2.3. Allowable Flow (Allowable Q)

The Trench Option may involve redirecting rainfall runoff within the trench box to discharge points that are different to the existing ones. This may be more noticeable with Sump No 1 as it covers a larger area than the Sump No 2 area. LACFCD has allowable flowrate limits (Allowable Q's) for land masses that drain to the stormwater conveyances within their regional stormwater management system. The

allowable flowrate limits vary based on the specific location and the size, slope and, available capacity of the specific culvert(s) serving that area. The allowable flowrate will factor into the sizing and design of project drainage. If it is determined that the existing outfalls cannot carry the flow rates generated from the sumps, additional storage and/or pump stations may be required. Additional infrastructure would need to be placed at outfall locations to minimize impacts to the existing hydrology. This can be further studied with existing hydrology studies during the PE stages of the project. Coordination with LACDWP will be necessary during PE stages of the project to compare flow rates between the sumps and outfalls and to ensure no significant impacts to downstream outfall systems. The Allowable Q's from LACDPW are in Appendix F.

3.2.4. Sump Pump

A sump pump station is proposed in the Trench Option, just north of Manhattan Beach Boulevard. As previously discussed, the pump will be required to remove rainfall runoff from the trench section if the Trench Option is the selected alternative. The sump pump design should be developed in coordination with LACDPW and LACFCD as the pump ownership and operation responsibilities are yet to be determined.

3.3. HAWTHORNE OPTION

The Hawthorne Option includes relocating the two major storm drains along Hawthorne Boulevard, however, although there are minor relocations within the existing drainage network there is no significant change to the hydrology of the network.

4. REFERENCES

Los Angeles County Metropolitan Transportation Authority (Metro). (2012). *Metro Rail Design Criteria (MRDC)*, Section 3 - Civil

Los Angeles County Department of Public Works (LACDPW). (2006). *Hydrology Manual.*

Federal Emergency Management Agency (FEMA). (2008). *Flood Insurance Rate Maps*.