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Preliminary Geological Hazards Study

City of San Diego Task 15GT15 - Water and Storm Drain Group 968
San Diego, California

Prepared for:

City of San Diego
525 B Street, Suite 750 (MS 908A)
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February 12, 2020

Project No.: 200055.2

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February 12, 2020
Project No. 200055.2

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Subject: Preliminary Geologic Hazards Study (9 sites)

Project: Task 15GT15 – Water and Storm Drain Group 968
San Diego, California

References: i) Cost Proposal to Provide Geological Hazard Reconnaissance Study, Task 15GT15 Water and Storm Drain Group 968, Proposal No. 19-2393 (Dated Jan 20, 2020).

ii) Plans for the Construction of Water and Storm Drain Group 968 (100% Design), Drawing Number 38719, 21 Sheets (print dated October 1, 2019).

ii) Twining Project No. 180325.2 Preliminary Geotechnical Investigation for City of San Diego Task 15GT15 – Manzanita Canyon Water and Storm Drain Group 968 (Dated September 28, 2018).

iii) City of San Diego Cycle Issues draft, Environmental Review prepared by LDR-Geology, Cycle 2, Project No. 630996 (Dated October 30, 2019).

Dear Ms. Nicole,

In accordance with your request and authorization, we are presenting the results of our geological hazard study for the above-referenced project located in several locations of San Diego, California. The purpose of this study was to evaluate the hazard associated at those proposed locations and to present the findings of the evaluation for the project.

The study was conducted to address the environmental review issues by the City LDR-Geology section, Project No. 630996, dated October 30, 2019 referenced above.

We appreciate the opportunity to be of service on this project. Should you have any questions regarding this report, or if we can be of further service, please do not hesitate to contact the undersigned.

Respectfully submitted,
TWINING, INC.

REGISTERED PROFESSIONAL ENGINEER PAUL C. SOLTIS G-2606 exp. 12/31/20 GEOTECHNICAL STATE OF CALIFORNIA

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1. PROJECT UNDERSTANDING

The objective of this Preliminary Geologic Hazards Study was to obtain information regarding the presence of potential geologic hazards at nine additional sites for the City of San Diego Water and Storm Drain Group 968 project. Twining previously performed a Geotechnical Investigation for Site 3 and prepared a report dated September 28, 2018 (see References). This study addresses the remaining nine sites that were not a part of our original scope for the Site 3 report which include the following sites: Sites 1, 2, 4, 5, 6, 7, 8, 9 and 10. The locations of the nine sites are shown in Figures 1A and 1B. The scope for this preliminary geologic hazards study does not include drilling or geotechnical engineering recommendations for installation of the planned pipes at these nine additional sites. This study is necessary to address the environmental review issues by the City of San Diego LDR-Geology section, Project No. 630996, dated October 30, 2019. This Preliminary Geologic Hazards Study has been prepared in accordance with the City of San Diego Guidelines for Geotechnical Reports (2018), California Environmental Quality Act (CEQA) Significance Determination Thresholds for Geologic Conditions (2011), and the Environmentally Sensitive Lands Regulations (ESL, 2020). As part of this study, we have identified if each project may have significant impacts due to the presence of geologic hazards and if mitigation is necessary; additionally, we provide recommendations for further work and field investigation, where warranted, to ultimately determine the presence of geologic hazards at each site.

2. EXECUTIVE SUMMARY

Based upon the City CEQA Significance Determination Thresholds for Geologic Conditions (2011), potential significance and mitigation for geologic conditions was found and provided for Sites 1, 2, 5, 7 and 9. Geologic input has been provided to address Environmentally Sensitive Lands Regulations (ESL, 2020), finding that the existing steep slopes in the canyon for Site 9 exceed 50 feet in height and appear to require an analysis by the City for ESL Steep Hillsides. Therefore, a geotechnical subsurface investigation is recommended for Sites 1, 2, 5, 7 and 9 to confirm geologic conditions prior to final design for these water main and/or storm drain replacement improvements. Please note that based on geotechnical standards of practice, we recommend geotechnical subsurface investigations at each of the nine sites.

3. SCOPE OF SERVICES

The scope of services included a review of published and unpublished geologic and geotechnical literature, review of historic aerial photographs and historic topographical maps, and a review of the City's geologic hazard zones as shown on the Seismic Safety Study Geologic Hazards and Faults Maps (2008). As part of this study a Twining Certified Engineering Geologist (CEG) performed a geologic site reconnaissance at each site. For this study, we reviewed the Cities 100-percent design plans for Water and Storm Drain Group 968 and we provide conclusions regarding the potential geologic hazards at each site and recommendations for further exploration and testing, as warranted, to address the City environmental regulations.

4. REGIONAL GEOLOGIC SETTING

The site is located in the Peninsular Ranges Geomorphic Province (PRGP) of California. The Peninsular Range Province is characterized by northwest-trending mountain ranges separated by a series of sub-parallel fault zones associated with the San Andreas Fault System. Within the PRGP, the mountain ranges generally consist of Cretaceous igneous rocks of the Peninsular Ranges Batholith and Jurassic metasediments and metavolcanics.

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The topographically lower areas in the coastal region typically consist of marine and terrestrial sedimentary rocks (Kennedy and Peterson, 1975). In the coastal region of San Diego County, Quaternary- and late-Tertiary-age folding and tilting has occurred in areas adjacent to the Rose Canyon fault zone, and small-scale faults exist throughout the region (Kennedy and Peterson, 1975, and Treiman, 1993). The nine sites evaluated as part of this study are within the coastal region.

5. TYPES OF GEOLOGIC HAZARDS

5.1 Fault Ground Rupture

Surface fault rupture is the result of fault movement that breaks to the surface of the earth either suddenly during earthquakes or slowly due to a process known as fault creep and is the result of tectonic movement that originates deep in the Earth. Surface fault rupture can pose a hazard to infrastructure if displacement occurs, as one side of the fault can move relative to the other. The City of San Diego utilizes a three-tier classification for faults as follows:

1. *Active Faults* had demonstrable surface displacement during the Holocene time, where Holocene time is the geological epoch that began 11,700 years before present.

2. *Potentially Active Faults* had demonstratable surface displacement during Quaternary time.

3. *Inactive Faults* are pre-Quaternary faults where the Quaternary period timeline is approximately 1.6 million years ago.

None of the nine sites are mapped within the State Alquist-Priolo Earthquake Fault Hazard Special Studies Zone based on a review of published geologic and fault maps. Site 1 is located on a known active or potentially active fault, although Site 1 has not yet been mapped within a designated State Earthquake Fault Hazard Special Studies Zone.

5.2 Earthquake Shaking and Soil Liquefaction

Ground shaking from moderate to large size earthquakes could occur during the life of the proposed infrastructure for all nine sites because the Southern California region is an area of moderate to high seismic risk. Seismically-induced soil liquefaction is a phenomenon in which loose to medium dense, saturated granular materials undergo matrix rearrangement, develop high pore water pressure, and lose shear strength due to cyclic ground vibrations induced by earthquakes or other means. Ground lurching, differential and lateral spread displacement can occur during a seismic event. Site 1 is located on a known active or potentially active fault. Sites 1, 2 and 5 are located within mapped liquefaction hazard zones.

5.3 Landslides

The movement of a mass of rock, soil, or earth down a slope is considered a landslide. The City of San Diego Seismic Safety Study and the State of California prepared and classify landslides and landslide susceptibility maps. The State utilizes a scale of 1 (Least Susceptible) to 4-2 (Most Susceptible). None of the nine sites are located within a mapped landslide or high susceptible landslide zone. However, surficial slope failures could exist at Site 9.

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5.4 Flooding

A review of the FEMA National Flood Hazard maps indicate that the nine sites are not located within a Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. The 1-percent annual chance flood is also referred to as the base flood or 100-year flood.

5.5 Tsunami/Seiche

The State of California prepared Tsunami Inundation Maps for Emergency Planning (2009). Based on a review of these maps, none of the nine sites are located within a tsunami inundation area. In addition, none of the nine sites are located near a body of water; therefore, these projects are not within a seiche (standing wave) hazard zone.

6. SITE 1 - OLD TOWN

6.1 Site History

Based on our review of historic aerial photographs and historic topographical maps in the area of the proposed Site 1 water main replacements, we note that Whitman Street was an existing road in the 1903 topo and 1953 aerial photos. The project area sits on flat terrain on the low river terrace below Presidio Hill. This site is located on an alluvial flood plain of the adjacent San Diego River at about an elevation of 10 to 15 feet. Due to flooding in the 1800's in San Diego's original historic settlement of Old Town, the San Diego river was ultimately channelized to flow due west to the Pacific Ocean. Based on the 1903 topographic map, this channel was located north of Site 1. Therefore, river flooding in this area of Old Town has not occurred since the 1900's. To the east of Site 1 is Presidio Hill, a small hill rising to about an elevation of 280 feet. On the south side of Site 1, grading created a level ball field and the topography for the Presidio golf course which was graded in 1931. On the north side of Site 1 is the existing City Presidio Community Park, which is adjacent to the larger State Park for Old Town. To the north of Site 1 is Interstate 8, and its interchange with Interstate 5 is to the northwest.

6.2 Local Geology, Soil Conditions and Groundwater

Based upon our review of published geologic maps and our field surface reconnaissance, the site is predominantly underlain by alluvial sediments, although the State geologic map (Kennedy and Tan, 2008) maps the site as Qaf, man-made artificial fill, as shown on Figure 2A. Based on an adjacent subsurface investigation (SONGS, 2012), the natural stratigraphy for Site 1 should consist of stratified sand, sandy silt and clayey silt deposits that are interpreted as the result of overbank sedimentation from river flooding. The alluvial soils in the project area could be capped with 1 to 5 feet of man-made, gravel-cobble fill utilized to level and raise the elevation at the site.

Based on our field reconnaissance, we note that Site 1 for the proposed water main replacement will be located in the existing roadway along Whitman Street and within an open space park area. Existing topography is flat at about an elevation of 15 feet. Excavations for the water main are anticipated to be within existing pipeline backfill, surficial fill and alluvium. Seepage or shallow groundwater was not observed during our site visit, although shallow groundwater should be anticipated in excavations based on the adjacent San Diego River, alluvial materials and low elevation.

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6.3 Geologic Hazards

The site is located in the City of San Diego's Geologic Hazards Categories 12 and 31 based upon sheet 20 of the City's Seismic Safety Study Geologic Hazards and Faults (2008). Geologic Category 12 is characterized as "Ground Rupture, Faults - Potentially Active, Inactive, Presumed Inactive, or Activity Unknown" and Category 31 as "Potential Ground Failure, Liquefaction - High Potential, shallow groundwater major drainages, hydraulic fills" (see Figure 3A). The Rose Canyon Fault Zone is the closest active fault, with one fault strand projected through Site 1 (SONGS, 2012). The project site is located on a known active or potentially active fault based on a review of published geologic and fault maps. Though, the site has not yet been mapped within a currently designated California Geological Survey (CGS) Earthquake Fault Special Study Zone. The site is not located within a mapped landslide or a high susceptible landslide zone. No landslides were observed on or near the site and the State map, OFR 95-03 Plate 33A, placed a classification symbol of 1, Least Susceptible (CGS, 1995), for potential landslide hazards. Where adverse geological conditions exist, we have identified those potential significant impacts and any recommended mitigation in the following section.

6.4 CEQA Significance & Mitigation

The City CEQA Significance Determination Thresholds for Geologic Conditions (2011) provide the following three City Initial Study Checklist questions for guidance to determine potential significance for geologic conditions:

1. Expose people or structures to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
   Our response: Yes, the water main replacement for Site 1 is mapped in the alignment of an active strand of the Rose Canyon Fault Zone and within a Liquefaction zone. The site could be subject to direct surface fault rupture, ground shaking and liquefaction from an earthquake.

2. Result in a substantial increase in wind or water erosion of soils, either on or off the site?
   Our response: An increase in wind or water erosion is not anticipated for Site 1.

3. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
   Our response: Yes, potential shallow groundwater and alluvial soils may subject the improvements to earthquakes and liquefaction that could cause geologic instability for Site 1.

Mitigation Recommendation for Site 1: A geotechnical investigation is recommended to confirm groundwater and characterize the subsurface soils prior to final design for the Site 1 water main replacement improvements. In addition, based upon the projection of the active Rose Canyon Fault strand through Site 1, during construction we recommend that a Certified Engineering Geologist monitor the excavations of the future water main replacement to confirm the existence or non-existence of faults and/or active faults that may cross the project. If faulting is encountered, the risks associated with fault displacement and any design mitigation measures should be discussed at that time.

The City Guidelines for Geotechnical Reports (2018) for discretionary projects request geologic input for the environmental document to address any geologic issues in accordance with the following Environmentally Sensitive Lands Regulations (ESL, 2020):

1. Could the project impact or require mitigation for the following types of ESL: Steep Hillsides, Coastal Beaches, Sensitive Coastal Bluffs and Special Flood Hazard Areas (except V Zones)? Our response: No impacts or mitigation for these types of ESL are anticipated for Site 1.

7. SITE 2 - AIRPORT

7.1 Site History

Based on our review of historic aerial photographs and historic topographical maps in the area of the proposed Site 2 water main replacements, we note that this area formerly consisted of mudflats where the San Diego River previously flowed to San Diego Bay. Between 1925 and 1949 this area was filled with soils from harbor dredging and brought to its current flat elevation of approximately 10 to 12 feet. Based on the 1953 aerial photos, the road adjacent to the south side of Site 2 (Harbor Drive) existed, although no structures had been built in the filled area of Site 2. In 1953 structures associated with the Naval Training Center existed to the west, and the San Diego Airport existed to the north of Site 2. The project area sits on flat terrain, filled above the river terrace and San Diego Bay muds. The San Diego River no longer flows through the site. No development was found on Site 2 until a review of the 1990 photo showed the current structure and parking lot.

7.2 Local Geology, Soil Conditions and Groundwater

Based upon our review of published geologic maps and our field surface reconnaissance, the site is predominantly underlain by man-made (hydraulic) fill, alluvial and/or estuarian sediments. The State geologic map (Kennedy and Tan, 2008) maps the site as Qaf, man-made artificial fill (Figure 2B). Based on unpublished drilling data adjacent to Site 2, the underlying soils should consist of approximately 5 to 20 feet of man-made fill, underlain by deeper estuarine deposits from the San Diego River and Bay.

Based on our field reconnaissance for Site 2, we note the proposed water main replacement will be located within the existing landscaped grounds and paved parking area in a secured gated military command center adjacent to the north side of North Harbor Drive. Existing topography is flat at about an elevation of 10 to 12 feet. Excavations for the water main are anticipated to be within existing pipeline backfill, and hydraulic man-made fill. Seepage or shallow groundwater was not observed during our site visit, although should be anticipated in trench excavations based on the adjacent San Diego Bay and moist to saturated soils encountered in other borings near the site.

7.3 Geologic Hazards

The site is located in the City of San Diego's Geologic Hazards Category 31 based upon sheet 16 of the City's Seismic Safety Study Geologic Hazards and Faults (2008). Geologic Category 31 is "Potential Ground Failure, Liquefaction - High Potential, shallow groundwater major drainages, hydraulic fills" (see Figure 3B). The Rose Canyon Fault Zone is the closest active fault to the site with the Spanish Bight Fault strand mapped to the east of Site 2. The project site is not located on a known active or potentially active fault based on a review of published

geologic and fault maps. The site has not mapped within a currently designated California Geological Survey (CGS) Earthquake Fault Special Study Zone. The site is not located within a mapped landslide or a high susceptible landslide zone. No landslides were observed on or near the site and the State map, OFR 95-03 Plate 33D, placed a classification symbol of 1, Least Susceptible (CGS, 1995), for the potential for landslide hazards. Where adverse geological conditions exist, we have identified those potential significant impacts and any recommended mitigation in the following section.

7.4 CEQA Significance & Mitigation

The City CEQA Significance Determination Thresholds for Geologic Conditions (2011) provide the following three City Initial Study Checklist questions for guidance to determine potential significance for geologic conditions:

1. Expose people or structures to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
   Our response: Yes, the water main replacement for Site 2 is mapped within a Liquefaction zone. Site 2 could be subject to ground shaking and liquefaction from an earthquake.

2. Result in a substantial increase in wind or water erosion of soils, either on or off the site?
   Our response: An increase in wind or water erosion is not anticipated for Site 2.

3. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
   Our response: Yes, potential groundwater, man-made hydraulic fills, and underlying alluvial/estuarine soils may subject the improvements to earthquakes and liquefaction that could cause geologic instability for Site 2.

Mitigation Recommendation for Site 2: A geotechnical investigation is recommended to confirm groundwater and characterize the subsurface soils prior to final design for the Site 2 water main replacement improvements.

The City Guidelines for Geotechnical Reports (2018) for discretionary projects request geologic input for the environmental document to address any geologic issues in accordance with the following Environmentally Sensitive Lands Regulations (ESL, 2020):

1. Could the project impact or require mitigation for the following types of ESL: Steep Hillsides, Coastal Beaches, Sensitive Coastal Bluffs and Special Flood Hazard Areas (except V Zones)?
   Our response: No impacts or mitigation for these types of ESL are anticipated for Site 2.

8. SITE 4 – ENCANTO

8.1 Site History

Based on our review of historic aerial photographs and historic topographical maps in the area of the proposed Site 4 water main replacements, we note that Scimitar Drive and Eider Streets were existing roads in the 1940's topographic maps and 1953 aerial photos. Site 4 is located near the top of a small hill that is about 450 feet high.

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In 1940, a few homes existed along these road alignments near the top of this ridge line. By the 1990's, more homes were constructed and the landscaping was matured in this area.

8.2 Local Geology, Soil Conditions and Groundwater

Based upon our review of published geologic maps and our field surface reconnaissance, the site is predominantly underlain by sediments associated with the early-Pleistocene- and late-Pliocene-aged San Diego Formation Sandstone Unit (Tsdss). This unit is predominantly yellowish-brown and gray, fine to medium grained, poorly indurated fossiliferous marine sandstone (Kennedy and Tan, 2008). See Figure 2C for an estimated distribution of the geologic units. The San Diego Formation can be locally cemented.

Based on our site reconnaissance, we note that the proposed water main replacement will be located in existing roadways along Scimitar Drive and Eider Streets. Existing topography ranged between 390 and 440 feet. Existing cut slopes along these roadways exposed the San Diego Formation. Excavations for the water main are anticipated to be within existing pipeline backfill and/or San Diego Formation. Seepage or shallow groundwater was not observed during our site visit.

8.3 Geologic Hazards

Site 4 is located in the City of San Diego's Geologic Hazards Category 52 based upon sheet 18 of the City's Seismic Safety Study Geologic Hazards and Faults (2008). Geologic Category 52 is characterized as "Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk" (see Figure 3C). The La Nacion Fault is the closest potentially active fault located west of the site. The project site is not located on a known active or potentially active fault based on a review of published geologic and fault maps. The site is not located within a currently designated California Geological Survey (CGS) Earthquake Fault Special Study Zone. The site is not located within a mapped landslide or a high susceptible landslide zone. No landslides were observed on or near the site and the State map, OFR 95-03 Plate 33E, placed a classification symbol of 3-1, Generally Susceptible (CGS, 1995), for the potential for landslide hazards. Where adverse geological conditions exist, we have identified those potential significant impacts and any recommended mitigation in the following section.

8.4 CEQA Significance & Mitigation

The City CEQA Significance Determination Thresholds for Geologic Conditions (2011) provide the following three City Initial Study Checklist questions for guidance to determine potential significance for geologic conditions:

1. Expose people or structures to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
   Our response: No known geologic hazards were encountered at Site 4.

2. Result in a substantial increase in wind or water erosion of soils, either on or off the site?
   Our response: An increase in wind or water erosion is not anticipated for Site 4.

3. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
   Our response: No known geologic instability is anticipated for Site 4.

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The City Guidelines for Geotechnical Reports (2018) for discretionary projects request geologic input for the environmental document to address any geologic issues in accordance with the following Environmentally Sensitive Lands Regulations (ESL, 2020):

1. Could the project impact or require mitigation for the following types of ESL: Steep Hillsides, Coastal Beaches, Sensitive Coastal Bluffs and Special Flood Hazard Areas (except V Zones)?
   Our response: No impacts or mitigation for these types of ESL are anticipated for Site 4.

9. SITE 5 – MISSION VALLEY

9.1 Site History

A review of historic aerial photographs from 1953 and historic topographical maps from 1903 in the area of the proposed Site 5 water main replacements shows that San Diego River naturally meandered from the north end of Site 5 to a bend in the river much further north of the site. Reportedly aggregate mining began in Mission Valley in 1913. The historic topographic maps between 1903 and 1970 show changes in the river alignment and numerous ponds that were most likely the result of mining to the west, north and east of Site 5. In the 1953 photos, Site 5 consisted of farming fields, the San Diego River alignment appeared to naturally flow further to the north, and Interstate 8 existed to the south of Site 5. Around 1966, the San Diego River was channelized to flow closer to the northern end of Site 5. The 1972 photos appear to show that the Site 5 area was filled with man-made soils to create a flat pad for future building development. The buildings that exist today on the west and east sides of the proposed alignment for Site 5 water main replacement were existing in the 1981 photos.

9.2 Local Geology, Soil Conditions and Groundwater

Based upon our review of published geologic maps and our field surface reconnaissance, Site 5 is predominantly underlain by man-made fill and alluvial river sediments. The State geologic map shows the site as Qya, young alluvial flood-plain deposits (Kennedy and Tan, 2008). These deposits are described as Holocene- and late-Pleistocene, poorly consolidated, poorly sorted, permeable flood-plain deposits of sandy, silty or clay bearing alluvium (Figure 2D).

Based on our field reconnaissance at Site 5, we note that the proposed water main replacement will be located within the existing landscaped grounds and paved parking area between two existing business buildings. The existing topography slopes north from Camino Del Rio North road toward the San Diego River, which is located adjacent to the northern end of the site. The site slopes from about an elevation of 80 feet at the southern end to about 60 feet at the northern end. Excavations for the water main are anticipated to be within existing pipeline backfill, and man-made fill for the building pads, and alluvial sediments. Seepage or shallow groundwater was not observed during our site visit, though should be anticipated if trench excavations extend into alluvial soils.

9.3 Geologic Hazards

The site is located in the City of San Diego's Geologic Hazards Category 31 based upon sheet 21 of the City's Seismic Safety Study Geologic Hazards and Faults (2008). Geologic Category 31 is "Potential Ground Failure, Liquefaction - High Potential, shallow groundwater major drainages, hydraulic fills" (Figure 3D). The Mission

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Gorge fault is the closest potentially active fault mapped near the alignment of the San Diego River just north of the site. The Rose Canyon Fault Zone is the closest active fault mapped a couple mile west of Site 5. The project site is not located on a known active or potentially active fault based on a review of published geologic and fault maps. The site has not mapped within a currently designated California Geological Survey (CGS) Earthquake Fault Special Study Zone. The site is not located within a mapped landslide or a high susceptible landslide zone. No landslides were observed on or near the site. The State map, OFR 95-03 Plate 33B, placed a classification symbol of 2, Marginally Susceptible (CGS, 1995), for the potential for landslide hazards. Where adverse geological conditions exist, we have identified those potential significant impacts and any recommended mitigation in the following section.

9.4 CEQA Significance & Mitigation

The City CEQA Significance Determination Thresholds for Geologic Conditions (2011) provide the following three City Initial Study Checklist questions for guidance to determine potential significance for geologic conditions:

4. Expose people or structures to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
   Our response: Yes, the water main replacement for Site 5 is mapped within a Liquefaction zone. Site 5 could be subject to ground shaking and liquefaction from an earthquake.

5. Result in a substantial increase in wind or water erosion of soils, either on or off the site?
   Our response: An increase in wind or water erosion is not anticipated for Site 5.

6. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
   Our response: Yes, potential groundwater, man-made fills and underlying alluvial soils may subject the improvements to earthquakes and liquefaction that could cause geologic instability for Site 5.

Mitigation Recommendation for Site 5: A geotechnical investigation is recommended to confirm groundwater and characterize the subsurface soils prior to final design for the Site 5 water main replacement improvements.

The City Guidelines for Geotechnical Reports (2018) for discretionary projects request geologic input for the environmental document to address any geologic issues in accordance with the following Environmentally Sensitive Lands Regulations (ESL, 2020):

1. Could the project impact or require mitigation for the following types of ESL: Steep Hillsides, Coastal Beaches, Sensitive Coastal Bluffs and Special Flood Hazard Areas (except V Zones)?
   Our response: No impacts or mitigation for these types of ESL are anticipated for Site 5.

10. SITE 6 – NORTH PARK

10.1 Site History

A review of historic aerial photographs and historic topographical maps in the area of the proposed Site 6 water main replacements, noted this section of Laurel Street, between Commonwealth Avenue and Boundary Street,

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was an existing road in the 1953 aerial photos. The area is surrounded with residential development that began in the 1940's. The homes adjacent to this section of Laurel Street existed in the 1953 photos.

10.2 Local Geology, Soil Conditions and Groundwater

Based upon our review of published geologic maps and our field surface reconnaissance, Site 6 is predominantly underlain by the 930,000-year-old Tierra Santa Terrace (Qvop8). This terrace material is described as Very Old Paralic Deposits, Unit 8, middle to early Pleistocene. The material is considered poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate. Underlying these surficial deposits are sediments associated with the early-Pleistocene- and late-Pliocene-aged San Diego Formation (Tsd). This unit is predominantly yellowish-brown and gray, fine to medium grained, poorly indurated fossiliferous marine sandstone and reddish-brown, transitional marine and nonmarine pebble and cobble conglomerate (Kennedy and Tan, 2008). The excavations for Site 6 may not be deep enough to encounter the San Diego Formation. See Figures 2E for an estimated distribution of the geologic units.

The Site 6 reconnaissance noted the proposed water main replacement would be located within an existing flat roadway along a short section of Laurel Street. Existing topography ranged between 294 and 298 feet. Excavations for the water main are anticipated to be within existing pipeline backfill and/or Very Old Paralic Deposits. Seepage or shallow groundwater was not observed during our site visit.

10.3 Geologic Hazards

The site is located in the City of San Diego's Geologic Hazards Category 52 based upon sheet 17 of the City's Seismic Safety Study Geologic Hazards and Faults (2008). Geologic Category 52 is characterized as "Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk" (see Figure 3E). The Texas Street Fault is the closest potentially active fault located west of the site. The project site is not located on a known active or potentially active fault based on a review of published geologic and fault maps. The site is not located within a currently designated California Geological Survey (CGS) Earthquake Fault Special Study Zone. The site is not located within a mapped landslide or a high susceptible landslide zone. No landslides were observed on or near the site. The State map, OFR 95-03 Plate 33E, placed a classification symbol of 2, Marginally Susceptible, in terms of Landslide Susceptibility for the subject area (CGS, 1995). Where adverse geological conditions exist we have identified those potential significant impacts and any recommended mitigation in the following section.

10.4 CEQA Significance & Mitigation

The City CEQA Significance Determination Thresholds for Geologic Conditions (2011) provide the following three City Initial Study Checklist questions for guidance to determine potential significance for geologic conditions:

1. Expose people or structures to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
   Our response: No known geologic hazards were encountered at Site 6.

2. Result in a substantial increase in wind or water erosion of soils, either on or off the site?
   Our response: An increase in wind or water erosion is not anticipated for Site 6.

3. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
   Our response: No known geologic instability is anticipated for Site 6.

The City Guidelines for Geotechnical Reports (2018) for discretionary projects request geologic input for the environmental document to address any geologic issues in accordance with the following Environmentally Sensitive Lands Regulations (ESL, 2020):

1. Could the project impact or require mitigation for the following types of ESL: Steep Hillsides, Coastal Beaches, Sensitive Coastal Bluffs and Special Flood Hazard Areas (except V Zones)?
   Our response: No impacts or mitigation for these types of ESL are anticipated for Site 6.

11. SITE 7 – MID CITY HEIGHTS (QUINCE ST & ALLEY)

11.1 Site History

Our review of historic aerial photographs and historic topographical maps in the area of the proposed Site 7 water main replacements show that these improvements are to be located in an unimproved alley that extends north from the unimproved right of way of Quince Street and is located between Central Avenue and 41st Street. Based upon the 1944 topo map only a few residential structures existed in the area. Based on the 1953 aerial photos, the residential development was mainly in the northern area and not as far south as Quince Street. One residential home was located in the central portion of the subject alley area in the 1953 photo; however, the home was removed prior to the 1964 photo. By 1980, the southern area was developed with residential homes along Central Avenue and the terminus of the unimproved alley. Two to three residential homes are located on the unimproved alley abutting the unimproved portion of Quince Street and take access through a lot to Central Avenue. The northern portion of the alley only has hiking access and does not have driving access to Central Avenue.

11.2 Local Geology, Soil Conditions and Groundwater

Based upon our review of published geologic maps and our field surface reconnaissance, Site 7 is predominantly underlain by the 930,000-year-old Tierra Santa Terrace (Qvop8). This terrace material is described as Very Old Paralic Deposits, Unit 8, middle to early Pleistocene. The material is considered poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate. Undocumented, end-dumped fill soils may also be present. Underlying these surficial deposits are sediments associated with the early-Pleistocene- and late-Pliocene-aged San Diego Formation (Tsd). This unit is predominantly yellowish-brown and gray, fine to medium grained, poorly indurated fossiliferous marine sandstone and reddish-brown, transitional marine and nonmarine pebble and cobble conglomerate (Kennedy and Tan, 2008). The excavations for Site 7 may not be deep enough to encounter the San Diego Formation. See Figure 2F for an estimated distribution of the geologic units.

Based on our field reconnaissance at Site 7, we note that the proposed water main replacement will be located within an unimproved alley. The northern portion of the alley is only accessible down a small canyon by foot from the intersection of Central Avenue and Redwood Street. The alley is a rough dirt road over a ridge line. Two to three residential homes are constructed in the eastern half of the southern portion of the alley and take access

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thru an empty lot to Central Avenue near the intersection with the unimproved portion of Quince Street. At this time, it is unknown if the driving access thru this lot to the subject alley is private or public. Existing topography ranged between 240 and 310 feet. Excavations for the water main replacement are anticipated to be within existing pipeline backfill and/or Very Old Paralic Deposits. Seepage or shallow groundwater was not observed during our site visit. Trash and debris were noted at the southern end of the planned alley improvements where it slopes steeply down into natural space at the unimproved portion of Quince Street.

11.3 Geologic Hazards

The site is located in the City of San Diego's Geologic Hazards Category 52 based upon sheet 17 of the City's Seismic Safety Study Geologic Hazards and Faults (2008). Geologic Category 52 is characterized as "Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk" (Figure 3F). The closest potentially active faults located near the site are the Texas Street Fault to the west, and the La Nacion Fault to the east. The project site is not located on a known active or potentially active fault based on a review of published geologic and fault maps. The site is not located within a currently designated California Geological Survey (CGS) Earthquake Fault Special Study Zone. The site is not located within a mapped landslide or a high susceptible landslide zone. No landslides were observed on or near the site and the State map, OFR 95-03 Plate 33E, placed a classification symbol of 2 and 3-1, Marginally and Generally Susceptible (CGS, 1995), for the potential for landslide hazards. Where adverse geological conditions exist, we have identified those potential significant impacts and any recommended mitigation in the following section.

11.4 CEQA Significance & Mitigation

The City CEQA Significance Determination Thresholds for Geologic Conditions (2011) provide the following three City Initial Study Checklist questions for guidance to determine potential significance for geologic conditions:

1. Expose people or structures to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
   Our response: No known geologic hazards were encountered at Site 7.

2. Result in a substantial increase in wind or water erosion of soils, either on or off the site?
   Our response: An increase in wind or water erosion is not anticipated for Site 7.

3. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
   Our response: Yes, the subject alley is unimproved with a natural canyon on the north end, a resistant ridge in the central portion and a steep slope with debris into a natural canyon at the south end. These conditions may subject the improvements to unknown geologic instability for Site 7, if subsurface geologic conditions are not verified.

Mitigation Recommendation for Site 7: A geotechnical investigation is recommended to confirm groundwater and characterize the subsurface soils prior to final design for the Site 7 water main replacement improvements.

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The City Guidelines for Geotechnical Reports (2018) for discretionary projects request geologic input for the environmental document to address any geologic issues in accordance with the following Environmentally Sensitive Lands Regulations (ESL, 2020):

1. Could the project impact or require mitigation for the following types of ESL: Steep Hillsides, Coastal Beaches, Sensitive Coastal Bluffs and Special Flood Hazard Areas (except V Zones)?
   Our response: No impacts or mitigation for these types of ESL are anticipated for Site 7.

12. SITE 8 – MID CITY HEIGHTS (SYCAMORE & SHAMROCK ST)

12.1 Site History

Our review of historic aerial photographs and historic topographical maps in the area of the proposed Site 8 water main replacements show that these improvements will be located along existing improved portions of Sycamore and Shamrock Streets. Based on the 1941 topographic map, residential development and road improvements were first constructed in the area. Based upon the 1953 aerial photos, several residential homes existed, and several were under construction along Site 8 roads. The 1964 photos show the subject roads were fully improved and the residential lots were built out. In the 1953 photos Interstate 805 had not been constructed. In the 1980 photos Interstate 805 was constructed to the west of Site 8.

12.2 Local Geology, Soil Conditions and Groundwater

Based upon our review of published geologic maps and our field surface reconnaissance, Site 8 is predominantly underlain by the 930,000-year-old Tierra Santa Terrace (Qvop8). This terrace material is described as Very Old Paralic Deposits, Unit 8, middle to early Pleistocene. The material is considered poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate. Underlying these surficial deposits are sediments associated with the early-Pleistocene- and late-Pliocene-aged San Diego Formation (Tsd). This unit is predominantly yellowish-brown and gray, fine to medium grained, poorly indurated fossiliferous marine sandstone and reddish-brown, transitional marine and nonmarine pebble and cobble conglomerate (Kennedy and Tan, 2008). The excavations for Site 8 may or may not be deep enough to encounter the San Diego Formation. See Figure 2G for an estimated distribution of the geologic units.

Based on our field reconnaissance at Site 8, we note the proposed water main replacement would be located within the improved portions of Sycamore and Shamrock Streets. Existing topography ranged between 260 and 280 feet. Excavations for the water main replacement are anticipated to be within existing pipeline backfill and/or Very Old Paralic Deposits. Seepage or shallow groundwater was not observed during our site visit.

12.3 Geologic Hazards

Site 8 is located in the City of San Diego's Geologic Hazards Category 52 based upon sheets 17 and 18 of the City's Seismic Safety Study Geologic Hazards and Faults (2008). Geologic Category 52 is characterized as "Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk" (see Figure 3G). The closest potentially active faults located near the site are the Texas Street Fault to the west, and the La Nacion Fault to the

east. The project site is not located on a known active or potentially active fault based on a review of published geologic and fault maps. The site is not located within a currently designated California Geological Survey (CGS) Earthquake Fault Special Study Zone. The site is not located within a mapped landslide or a high susceptible landslide zone. No landslides were observed on or near the site and the State map, OFR 95-03 Plate 33E, placed a classification symbol of 2 and 3-1, Marginally and Generally Susceptible (CGS, 1995), for the potential for landslide hazards. Where adverse geological conditions exist, we have identified those potential significant impacts and any recommended mitigation in the following section.

12.4 CEQA Significance & Mitigation

The City CEQA Significance Determination Thresholds for Geologic Conditions (2011) provide the following 3 City Initial Study Checklist questions for guidance to determine potential significance for geologic conditions:

1. Expose people or structures to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
   Our response: No known geologic hazards were encountered at Site 8.

2. Result in a substantial increase in wind or water erosion of soils, either on or off the site?
   Our response: An increase in wind or water erosion is not anticipated for Site 8.

3. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
   Our response: No known geologic instability is anticipated for Site 8.

The City Guidelines for Geotechnical Reports (2018) for discretionary projects request geologic input for the environmental document to address any geologic issues in accordance with the following Environmentally Sensitive Lands Regulations (ESL, 2020):

1. Could the project impact or require mitigation for the following types of ESL: Steep Hillsides, Coastal Beaches, Sensitive Coastal Bluffs and Special Flood Hazard Areas (except V Zones)?
   Our response: No impacts or mitigation for these types of ESL are anticipated for Site 8.

13. SITE 9 – MID CITY HEIGHTS (LAUREL & ROSEVIEW)

13.1 Site History

A review of historic aerial photographs and historic topographical maps in the area of the proposed Site 9 water main and storm drain replacements show these improvements are to be located along existing and unimproved right of ways. Based upon the 1953 aerial photos, no development had occurred in the area of Site 9. In the 1964 photo residential development had begun and the same improved and unimproved right of ways exist today. A small section of the east-west portion of Laurel Street, a short section of the north-south portion of Highland Ave, and the northern portion of Roseview Place were all improved. A natural canyon divides the road improvements between Laurel Street/Highland Ave and Roseview Place.

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13.2 Local Geology, Soil Conditions and Groundwater

Based upon our review of published geologic maps and our field surface reconnaissance, Site 9 is predominantly underlain by the sediments associated with the early-Pleistocene- and late-Pliocene-aged San Diego Formation (Tsd). This unit is predominantly yellowish-brown and gray, fine to medium grained, poorly indurated fossiliferous marine sandstone and reddish-brown, transitional marine and nonmarine pebble and cobble conglomerate (Kennedy and Tan, 2008). This unit is mapped along the sections of Laurel Street, Highland Ave, and the canyon. In the upper northeastern area of the Site 9 improvements at the southern end of Roseview Place, excavations might encounter the surficial deposits of the 930,000-year-old Tierra Santa Terrace (Qvop8). This terrace material is described as Very Old Paralic Deposits, Unit 8, middle to early Pleistocene. The material is considered poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate. See Figure 2H for an estimated distribution of the geologic units.

Based on our field reconnaissance at Site 9, we note the proposed water main and storm drain replacements will be located within the improved portions of Laurel Street, Highland Ave, Roseview Place, and within the steep open space canyon that separates these roadways. The existing roadways terminate at the canyon edge, though the water and storm drain improvements continue through these unimproved road right-of-ways. Existing topography ranges between 190 and 250 feet. Excavations for the water main and storm drain replacement are anticipated to be within existing pipeline backfill, San Diego Formation, and canyon slope wash. Seepage was not observed during our site visit. Groundwater was encountered in the bottom of the canyon drainage at the intersections of the unimproved portions of Roseview Place and Laurel Street. Significant surface storm water erosion has occurred in the canyon carving an approximate 4-foot-deep ravine at the base.

13.3 Geologic Hazards

The site is located in the City of San Diego's Geologic Hazards Category 52 based upon sheet 18 of the City's Seismic Safety Study Geologic Hazards and Faults (2008). Geologic Category 52 is characterized as "Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk" (Figure 3H). The closest potentially active faults located near the site are the Texas Street Fault to the west, and the La Nacion Fault system to the east. The project site is not located on a known active or potentially active fault based on a review of published geologic and fault maps. The site is not located within a currently designated California Geological Survey (CGS) Earthquake Fault Special Study Zone. The site is not located within a mapped landslide or a high susceptible landslide zone and the State map, OFR 95-03 Plate 33E, placed a classification symbol of 3-1, Generally Susceptible (CGS, 1995), for the potential for landslide hazards. Though no landslides are mapped, or were directly observed on or near the site, the mature canyon vegetation limited our site exposures to determine any slope stability issues. Based on the significant surface erosion that has occurred in the canyon, surficial slope failures could exist. Where adverse geological conditions exist, we have identified those potential significant impacts and any recommended mitigation in the following section:

13.4 CEQA Significance & Mitigation

The City CEQA Significance Determination Thresholds for Geologic Conditions (2011) provide the following three City Initial Study Checklist questions for guidance to determine potential significance for geologic conditions:

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1. Expose people or structures to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
   Our response: The geologic landslide and slope stability hazards are unknown at this time for Site 9. Based on the site reconnaissance, the mature canyon vegetation limited our site exposures to determine any slope stability issues. Based on the significant surface erosion that has occurred in the canyon, surficial slope failures could exist. No subsurface geologic data is available to determine slope stability.

2. Result in a substantial increase in wind or water erosion of soils, either on or off the site?
   Our response: An increase in wind or water erosion is not known at this time for Site 9. Based on the significant surface erosion that has occurred in the canyon, surficial slope failures could exist. No subsurface geologic data is available to determine slope stability and erosion potential.

3. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
   Our response: No subsurface geologic data is available to determine slope stability and erosion potential for geologic instability at Site 9.

Mitigation Recommendation for Site 9: A geotechnical investigation is recommended to confirm landslides, slope stability, erosion, groundwater, and characterize the subsurface soils prior to final design for the Site 9 water main and storm drain replacement improvements.

The City Guidelines for Geotechnical Reports (2018) for discretionary projects request geologic input for the environmental document to address any geologic issues in accordance with the following Environmentally Sensitive Lands Regulations (ESL, 2020):

1. Could the project impact or require mitigation for the following types of ESL: Steep Hillsides, Coastal Beaches, Sensitive Coastal Bluffs and Special Flood Hazard Areas (except V Zones)?
   Our response: The existing steep slopes in the canyon exceed 50 feet in height and appear to require an analysis by the City for ESL Steep Hillsides. The City Municipal Code definition for ESL Steep Hillsides is: Steep hillsides means all lands that have a slope with a natural gradient of 25 percent (4 feet of horizontal distance for every 1 foot of vertical distance) or greater and a minimum elevation differential of 50 feet, or a natural gradient of 200 percent (1 foot of horizontal distance for every 2 feet of vertical distance) or greater and a minimum elevation differential of 10 feet. If ESL Steep Hillsides apply, no subsurface data is available to determine slope stability for steep hillsides at this time for Site 9. Any future subsurface investigation in the canyon would need to be approved by the City to assure sensitive habit is not impacted.

Mitigation Recommendation for Site 9: If ESL Steep Hillsides apply, a geotechnical investigation is recommended to confirm landslides, slope stability, erosion, groundwater, and characterize the subsurface soils prior to final design for the Site 9 water main and storm drain replacement improvements. Any future subsurface geotechnical investigation in the canyon would need to be approved by the City to assure sensitive habit is not impacted.

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14. SITE 10 - PENINSULA

14.1 Site History

Our review of historic aerial photographs and historic topographical maps in the area of the proposed Site 10 water main replacements show these improvements are to be located along existing improved portions of Kellogg Drive. Based upon the 1953 aerial photos, the current large lot residential community existed. This gated community is located at the top of the central portion of the Point Loma ridgeline. Access from the east side is via the public Kellogg Street, and the west side via the public Silvergate Avenue.

14.2 Local Geology, Soil Conditions and Groundwater

Based upon our review of published geologic maps and our field surface reconnaissance, Site 10 is predominantly underlain by the 975,000-year-old Mira Mesa Terrace (Qvop7). This terrace material is described as Very Old Paralic Deposits, Unit 7, middle to early Pleistocene. The material is considered poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate. Underlying these surficial deposits are sediments associated with the upper Cretaceous Cabrillo Formation (Kcs) described as a mostly massive medium grained sandstone (Kennedy and Tan, 2008). See Figure 2l for an estimated distribution of the geologic units.

Based on our field reconnaissance at Site 10, we note that the proposed water main replacement would be located within the improved portions of Kellogg Drive. A small section of the improvements includes a new water service at the southern end of Site 10. The design plans note this small section is not part of the water main; rather, it is a 2-inch-diameter copper water service to the adjacent private residence. This small section is not included in this analysis. Existing topography along the alignment for Site 10 ranged between 300 and 355 feet. Excavations for the water main replacement are anticipated to be within existing pipeline backfill and/or Very Old Paralic Deposits. The excavations for Site 10 may or may not be deep enough in the southeastern area to encounter the Cabrillo Formation. Seepage or shallow groundwater was not observed during our site visit.

14.3 Geologic Hazards

Site 10 is located in the City of San Diego's Geologic Hazards Categories 51 and 53 based upon sheets 16 of the City's Seismic Safety Study Geologic Hazards and Faults (2008). Geologic Category 51 is characterized as "Level mesas, underlain by terrace deposits and bedrock, nominal risk." Geologic Category 53 is characterized as "Level or sloping terrain, unfavorable geologic structure, Low to moderate risk" (Figure 3l). The closest mapped faults located near the site are on the west and east sides of the site. The closest active fault is the Rose Canyon Fault Zone located to the east of the site. The project site is not located on a known active or potentially active fault based on a review of published geologic and fault maps. The site is not located within a currently designated California Geological Survey (CGS) Earthquake Fault Special Study Zone. The site is not located within a mapped landslide or a high susceptible landslide zone. No landslides were observed on or near the site and the State map, OFR 95-03 Plate 33D, placed a classification symbol of 3-1 and 4-1, Marginally and Most Susceptible (CGS, 1995), for the potential for landslide hazards. Although a portion of the site is mapped in a Most Susceptible classification, the classification appears to reflect the steep topography versus the geology. Significant cut slopes were created for constructing Kellogg Drive prior to the 1953 aerial photos. Those slopes have been subject to erosion, no deep-seated failures were noted during our site reconnaissance. Where adverse geological conditions

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exist, we have identified those potential significant impacts and any recommended mitigation in the following section.

14.4 CEQA Significance & Mitigation

The City CEQA Significance Determination Thresholds for Geologic Conditions (2011) provide the following three City Initial Study Checklist questions for guidance to determine potential significance for geologic conditions:

1. Expose people or structures to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?
   Our response: No known geologic hazards were encountered at Site 10.

2. Result in a substantial increase in wind or water erosion of soils, either on or off the site?
   Our response: An increase in wind or water erosion is not anticipated for Site 10.

3. Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
   Our response: No known geologic instability is anticipated for Site 10.

The City Guidelines for Geotechnical Reports (2018) for discretionary projects request geologic input for the environmental document to address any geologic issues in accordance with the following Environmentally Sensitive Lands Regulations (ESL, 2020):

1. Could the project impact or require mitigation for the following types of ESL: Steep Hillsides, Coastal Beaches, Sensitive Coastal Bluffs and Special Flood Hazard Areas (except V Zones)?
   Our response: No impacts or mitigation for these types of ESL are anticipated for Site 10.

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15. REFERENCES

California Division of Mines & Geology, 1991, Fault Evaluation Report, Rose Canyon Fault Zone, San Diego County, CA, FER-216, January 25 and Supplement No. 1 August 30.

California Division of Mines & Geology, 2002, Fault Evaluation Report, Silver Strand Fault, Coronado Fault, Spanish Bight Fault, San Diego Fault And Downtown Graben, Southern Rose Canyon Fault Zone, San Diego County, CA, FER-245, June 17 and Supplement No. 1 April 22, 2003.

City of San Diego, 2008, *Seismic Safety Study Geologic Hazards and Faults Maps,* updated

City of San Diego, 2011, *California Environmental Quality Act, Significance Determination Thresholds*, January.

City of San Diego, 2018, Guidelines for Geotechnical Reports, updated.

City of San Diego, 2019, *Cycle Issues draft, Environmental Review prepared by LDR-Geology, Cycle 2, Project No. 630996,* October 30.

City of San Diego, 2019, *Plans for the Construction of Water and Storm Drain Group 968* (100% Design), Drawing Number 38719, 21 Sheets, print dated October.

City of San Diego, 2020, *Environmentally Sensitive Lands Regulations*, San Diego Municipal Code, Chapter 14, Article 3, Division 1, current Web Site Version.

Department of Conservation, California Geological Survey, 2018, Earthquake Fault Zones, A Guide For Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards In California, Revised Special Publication 42.

Department of Conservation, California Geological Survey, 2020, Regulatory Hazard Zones Maps for Earthquake Faults, Liquefaction, Landslide, Tsunami Zones, current website.

FEMA, 2020, on-line Flood Hazard Areas, Flood Insurance Rate Maps.

Google Earth, 2020, Aerial Photographs, via website.

Historic Aerials, 2020, Historic Topographic Maps and Aerial Photographs, online database.

Jennings, C.W., and Bryant, W.A., 2010, Fault Activity Map of California, Scale 1:750,000, California Geological Survey, Geologic Data Map No. 6

Kennedy, M. P., and Peterson, G.L., 1975, Geology of the San Diego Metropolitan Area, California Division of Mines and Geology, Bulletin 200.

Kennedy, M.P., and Tan, S.S., 2008, Geologic Map of the San Diego 30' X 60' Quadrangle, California, 1:100,000 Scale, California Geological Survey.

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Lindvall, S. C., and Rockwell, T.K., 1995, Holocene activity of the Rose Canyon fault, San Diego, California: Journal of Geophysical Research, v. 100, no. B12, p. 24121-24132.

Rockwell, T.K., et.al., 1991, Minimum Holocene Slip Rate for the Rose Canyon Fault in San Diego, California, in Environmental Perils in the San Diego Region (P.L. Abbott and W.J. Elliott, editors): San Diego Association of Geologists, pp. 37-46.

Rockwell, T.K., et.al., 2018, USGS Final Technical Report, Mid to Late Holocene Rupture History of the Rose Canyon Fault in San Diego, California, Department of Geological Sciences San Diego State University, dated April.

Singleton, D.M., Rockwell, T.K., Murbach, D., Murbach, M., Maloney, J., Freeman, T., and Levy, Y., 2019, Late-Holocene Rupture History of the Rose Canyon Fault in Old Town, San Diego: Implications for Cascading Earthquakes on the Newport-Inglewood- Rose Canyon Fault System, Bulletin of the Seismological Society of America, Vol. 109, No. 3, pp. 855–874, June.

SONGS, 2012, *Paleoseismic Assessment of the Late Holocene Rupture History of the Rose Canyon Fault in San Diego*, prepared for Southern California Edison San Onofre Nuclear Generating Station Seismic Source Characterization Research Project, December.

Tan, S.S., 1995, Landslide Hazards in the Southern Part of the San Diego Metropolitan Area, San Diego County, California, Landslide Hazard Identification Map No. 33, California Division of Mines and Geology, Open-File Report 95-03.

Treiman, J.A., 1993, The Rose Canyon Fault Zone, Southern California, California Division of Mines and Geology, Open-File Report 93-02.

Twining, 2018, *Preliminary Geotechnical Investigation for City of San Diego Task 15GT15 – Manzanita Canyon Water and Storm Drain Group 968*, Project No. 180325.2, September 28.

USGS, 2020, Topographic Maps, online database.

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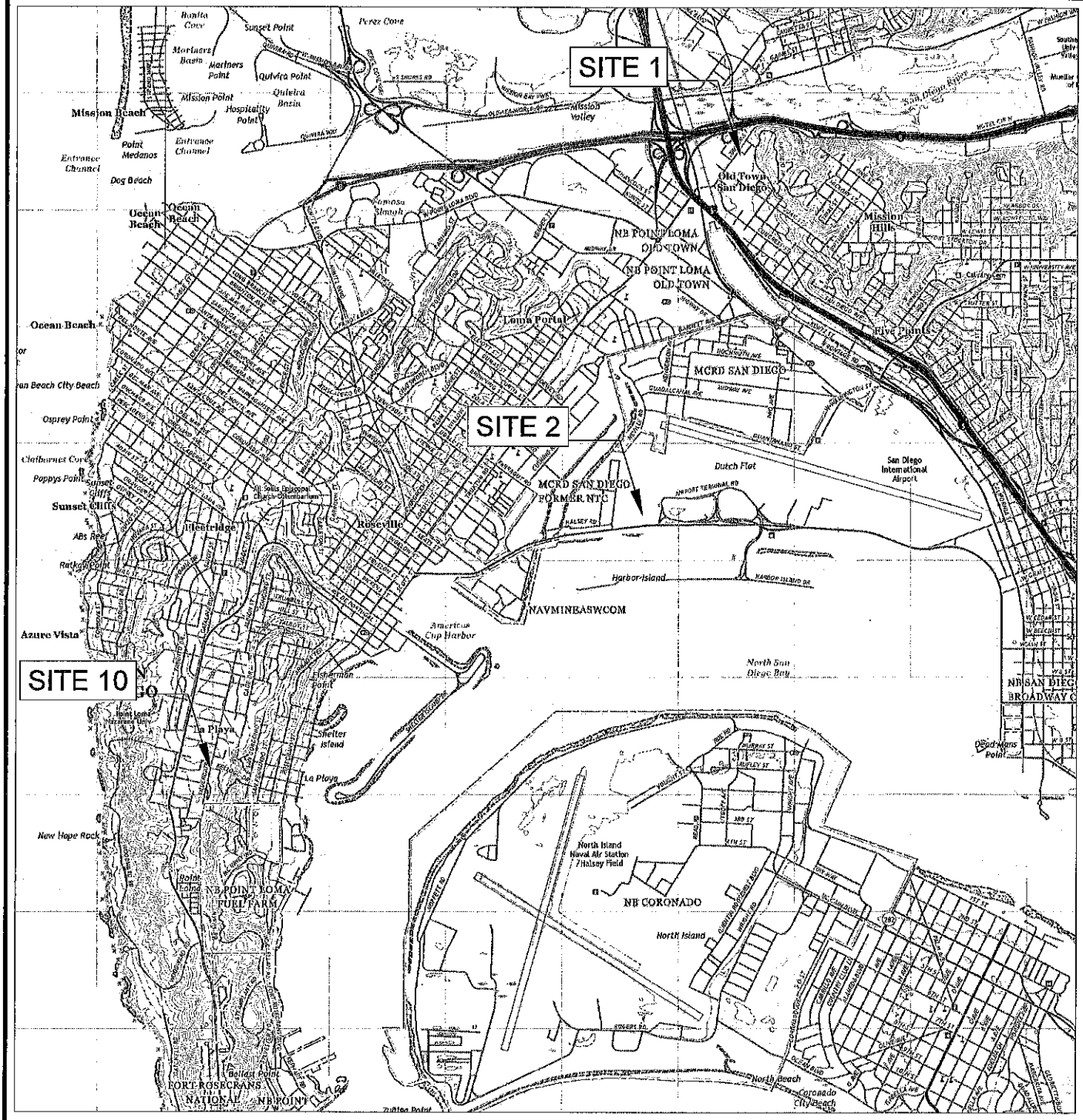
FIGURES



REFERENCE: USGS (2018)

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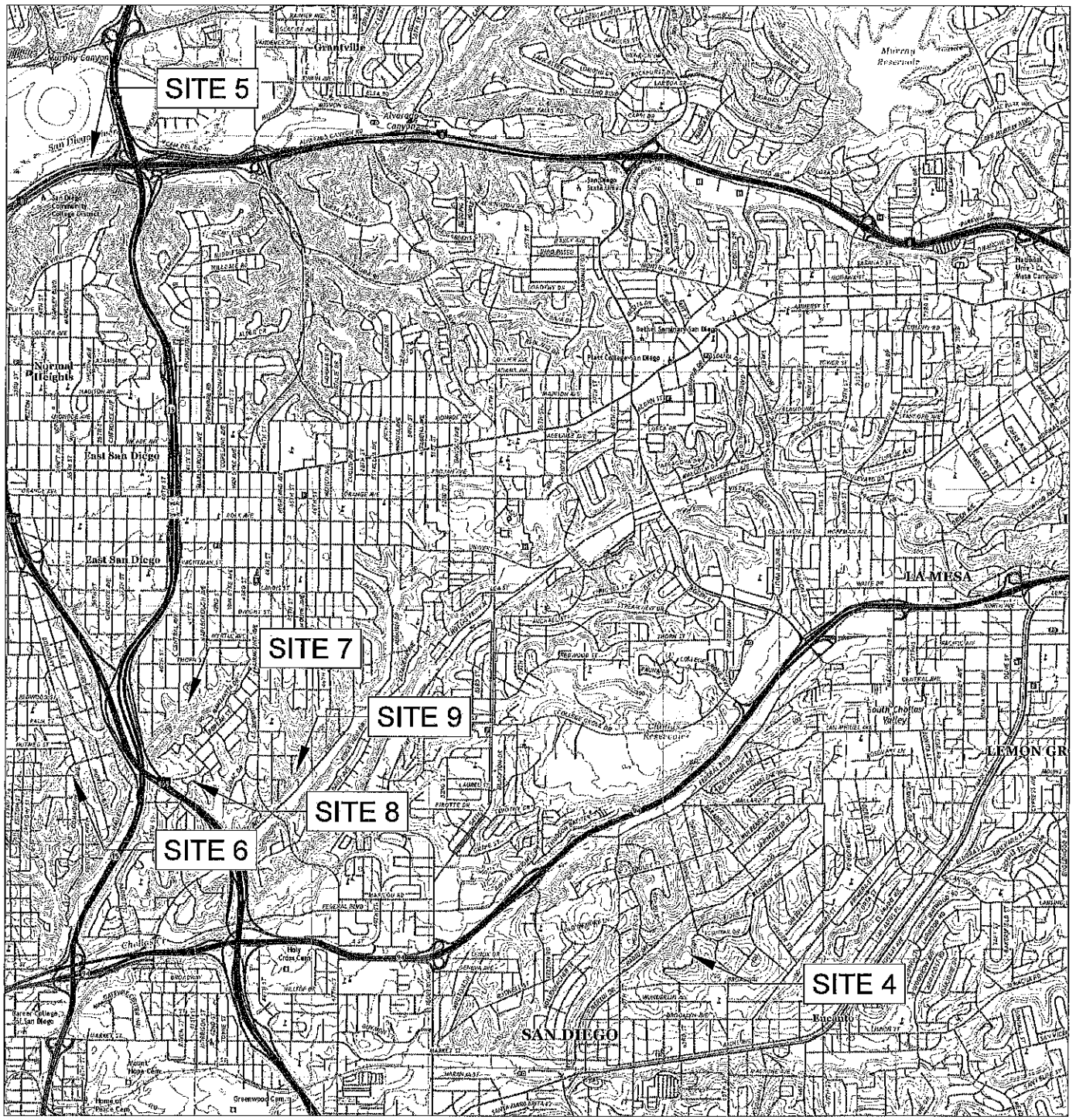
SITE LOCATION MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE
200055.2	February 2020	FIGURE 1A



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SCALE IN FEET

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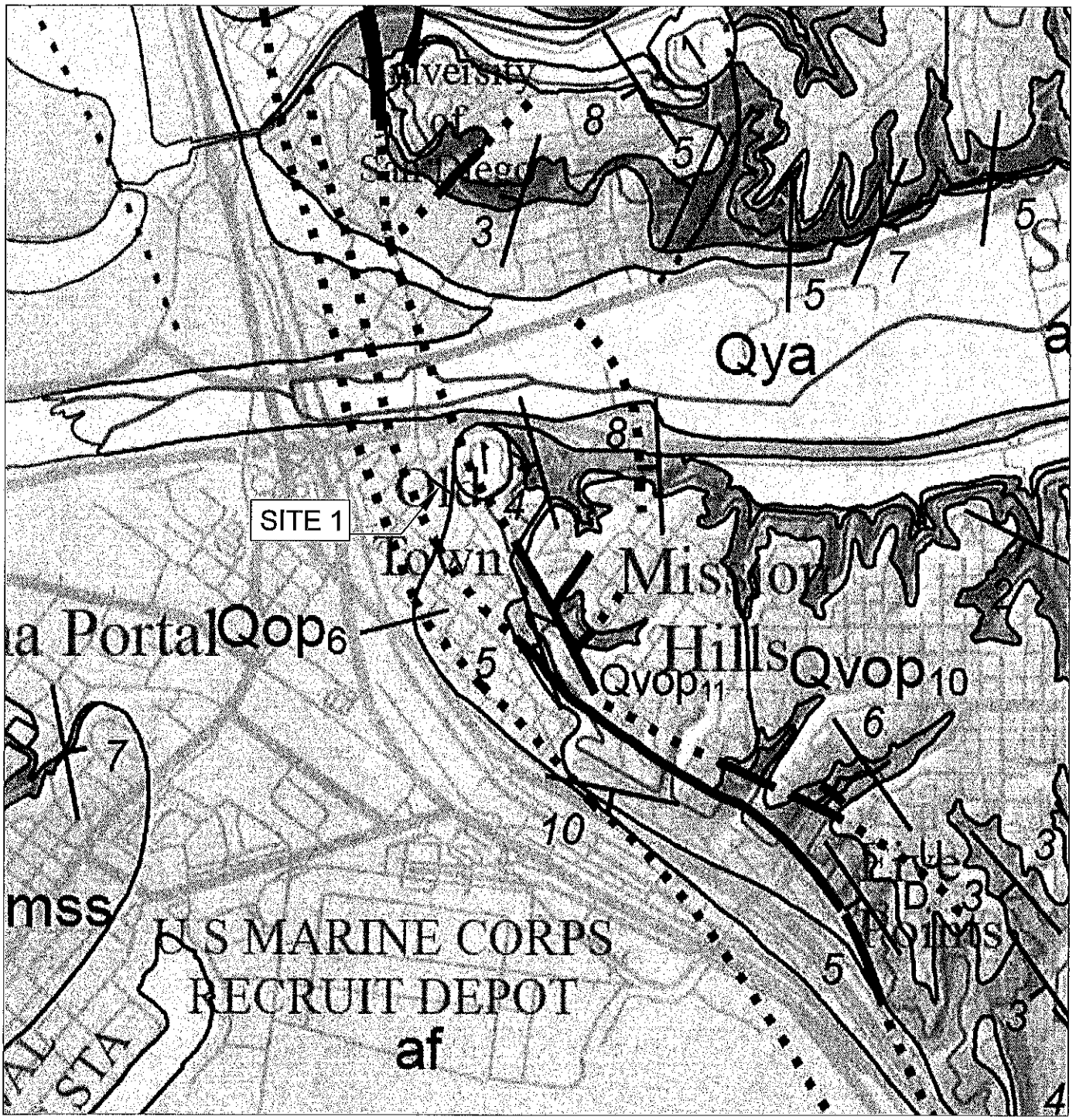
REFERENCE: USGS (2018)

TWINING

SITE LOCATION MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE
200055.2	February 2020	FIGURE 1B



FAULT - SOLID WHERE WELL DEFINED; DASHED - WHERE INFERRED

PROPOSED ALIGNMENT

af	ARTIFICIAL FILL
Qya	YOUNG ALLUVIAL FLOOD-PLAIN DEPOSITS
Qop	OLD PARALIC DEPOSITS
Qvop	VERY OLD PARALIC DEPOSITS

SCALE IN FEET

0 2000 4000

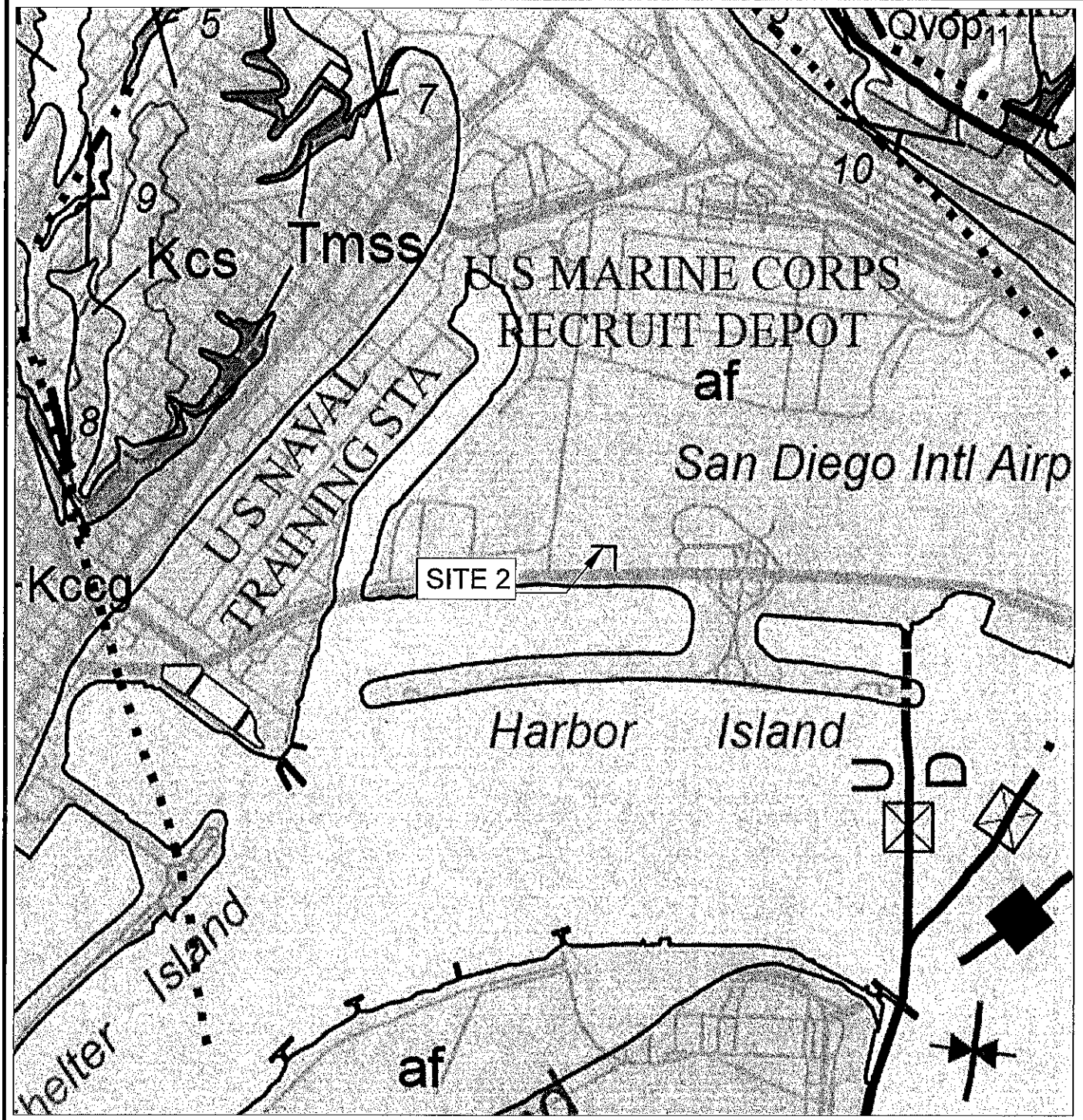
REFERENCE: KENNEDY AND TAN (2008)

TWINING

GEOLOGIC MAP

PRELIMINARY GEOLOGIC HAZARD STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE
200055.2	February 2020	FIGURE 2A



FAULT - SOLID WHERE WELL DEFINED; DASHED - WHERE INFERRED

PROPOSED ALIGNMENT

af	ARTIFICIAL FILL
Tmss	MOUNT SOLEDAD FORMATION - SANDSTONE
Kcs	CABRILLO FORMATION - SANDSTONE
Kccg	CABRILLO FORMATION - CONGLOMERATE

SCALE IN FEET

0 2000 4000

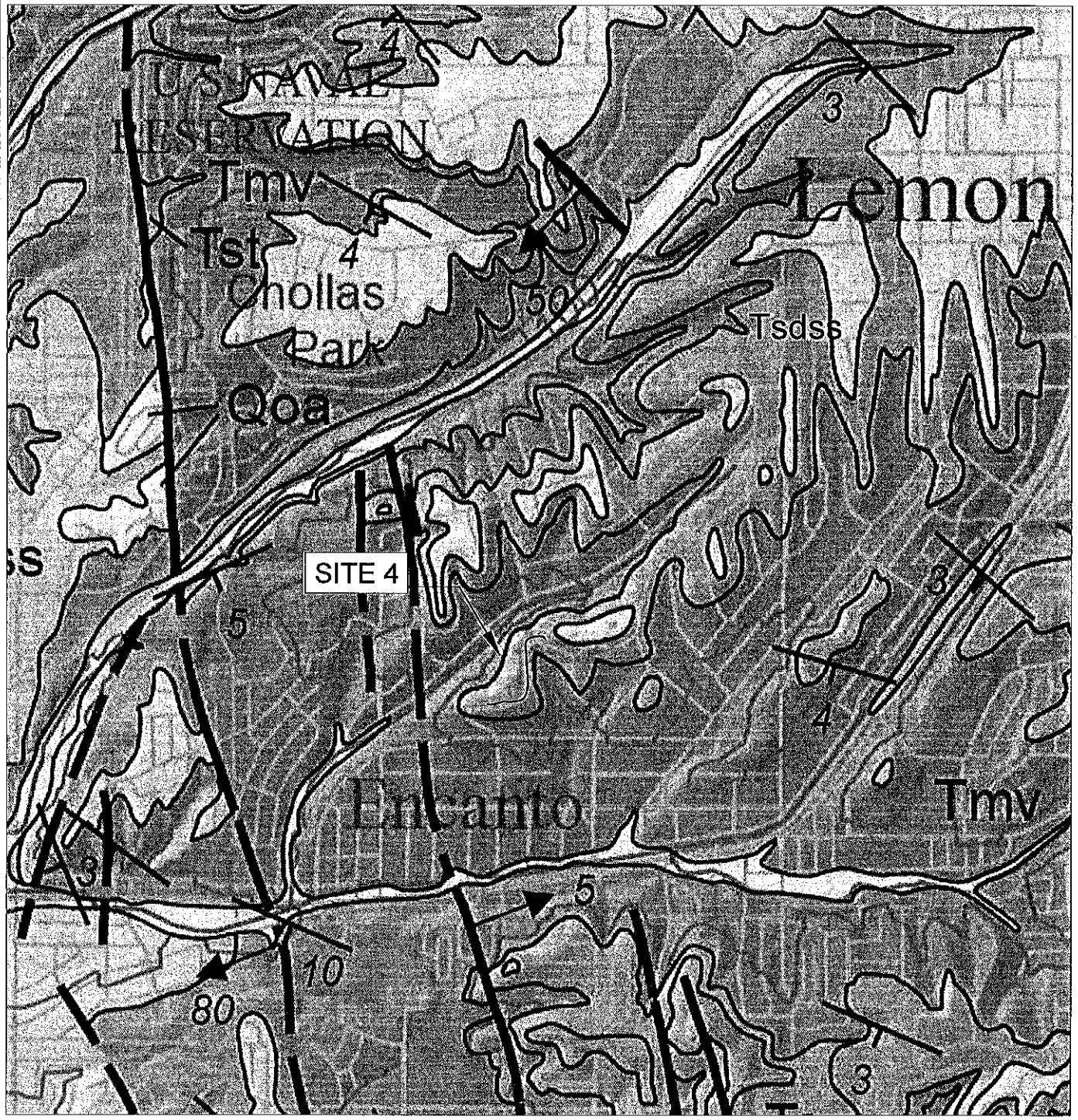
REFERENCE: KENNEDY AND TAN (2008)

TWINING

GEOLOGIC MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE
200055.2	February 2020	2B



FAULT - SOLID WHERE WELL DEFINED; DASHED - WHERE INFERRED

PROPOSED ALIGNMENT

Qoa OLD ALLUVIAL FLOOD-PLAIN DEPOSITS

Tsdss SAN DIEGO FORMATION - MARINE SANDSTONE

Tmv MISSION VALLEY FORMATION

Tst STADIUM CONGLOMERATE

N

SCALE IN FEET

0 2000 4000

REFERENCE: KENNEDY AND TAN (2008)

TWINING

GEOLOGIC MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE 2C
200055.2	February 2020	

FAULT - SOLID WHERE WELL DEFINED; DASHED - WHERE INFERRED

PROPOSED ALIGNMENT

Qya	YOUNG ALLUVIAL FLOOD-PLAIN DEPOSITS
Qoa	OLD ALLUVIAL FLOOD-PLAIN DEPOSITS
Qyc	YOUNG COLLUVIAL DEPOSITS
Qvop	VERY OLD PARALIC DEPOSITS

SCALE IN FEET

0 2000 4000

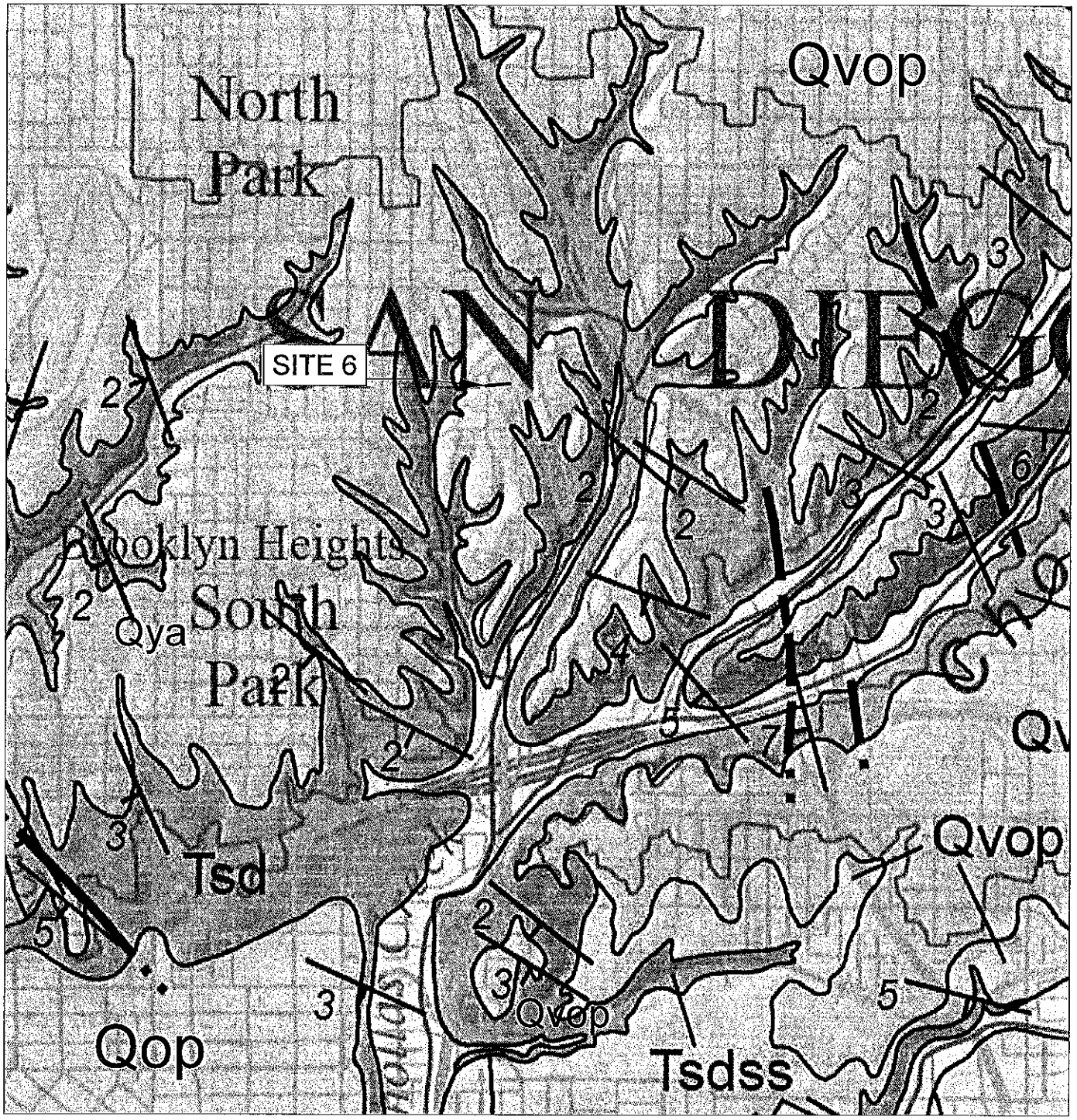
REFERENCE: KENNEDY AND TAN (2008)

TWINING

GEOLOGIC MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE
200055.2	February 2020	FIGURE 2D



FAULT - SOLID WHERE WELL DEFINED; DASHED - WHERE INFERRED

PROPOSED ALIGNMENT

Tsd SAN DIEGO FORMATION - UNDIVIDED

Tsdss SAN DIEGO FORMATION - MARINE SANDSTONE

Qop OLD PARALIC DEPOSITS

Qvop VERY OLD PARALIC DEPOSITS

SCALE IN FEET

0 2000 4000

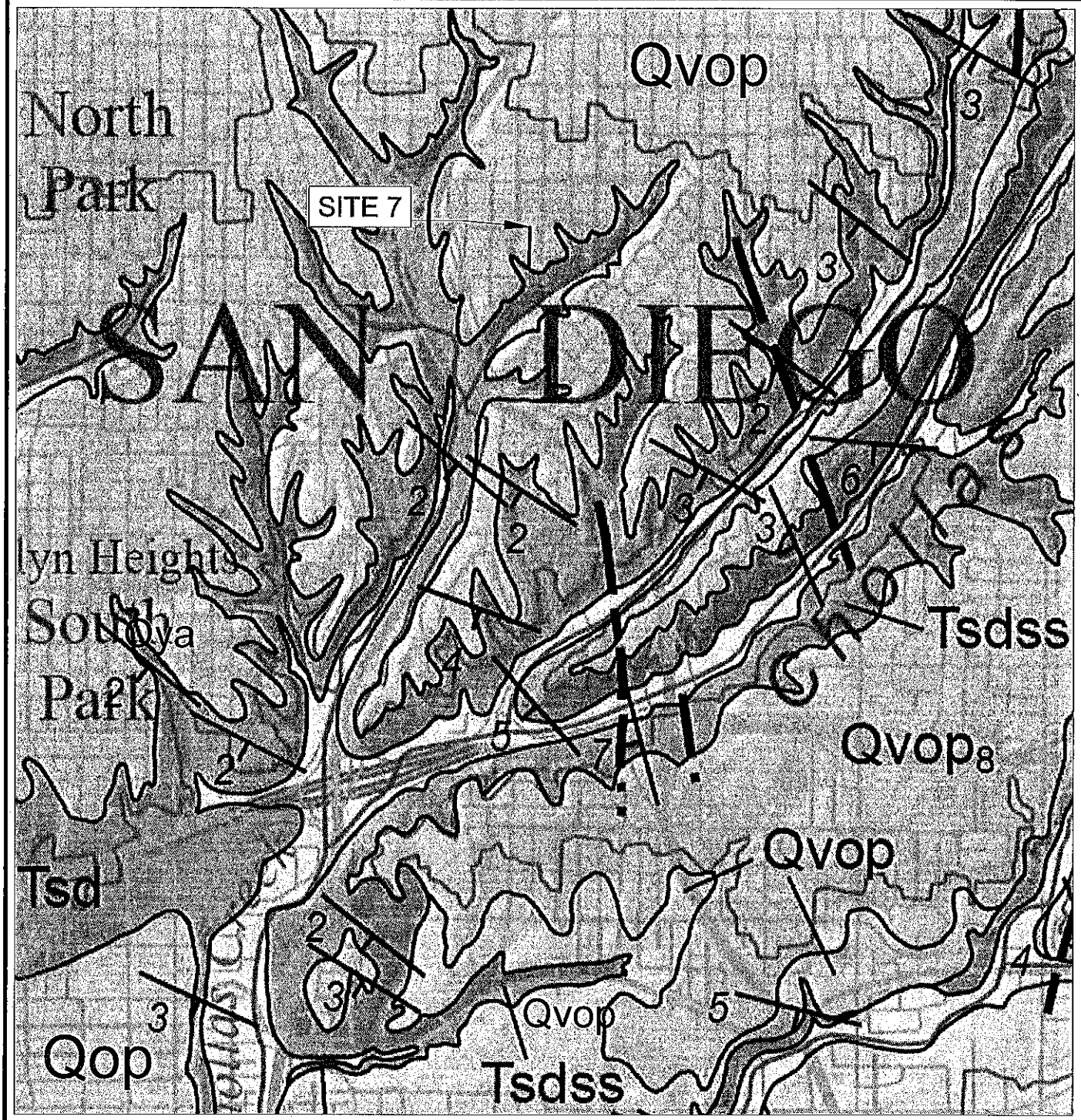
REFERENCE: KENNEDY AND TAN (2008)

TWINING

GEOLOGIC MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE
200055.2	February 2020	FIGURE 2E



FAULT - SOLID WHERE WELL DEFINED; DASHED - WHERE INFERRED

PROPOSED ALIGNMENT

Tsd SAN DIEGO FORMATION - UNDIVIDED

Tsdss SAN DIEGO FORMATION - MARINE SANDSTONE

Qop OLD PARALIC DEPOSITS

Qvop VERY OLD PARALIC DEPOSITS

SCALE IN FEET

0 2000 4000

REFERENCE: KENNEDY AND TAN (2008)

TWINING

GEOLOGIC MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE
200055.2	February 2020	FIGURE 2F

FAULT - SOLID WHERE WELL DEFINED;
DASHED - WHERE INFERRED

PROPOSED ALIGNMENT

N

Tsdss	SAN DIEGO FORMATION - MARINE SANDSTONE
Qop	OLD PARALIC DEPOSITS
Qvop	VERY OLD PARALIC DEPOSITS

SCALE IN FEET
0 2000 4000

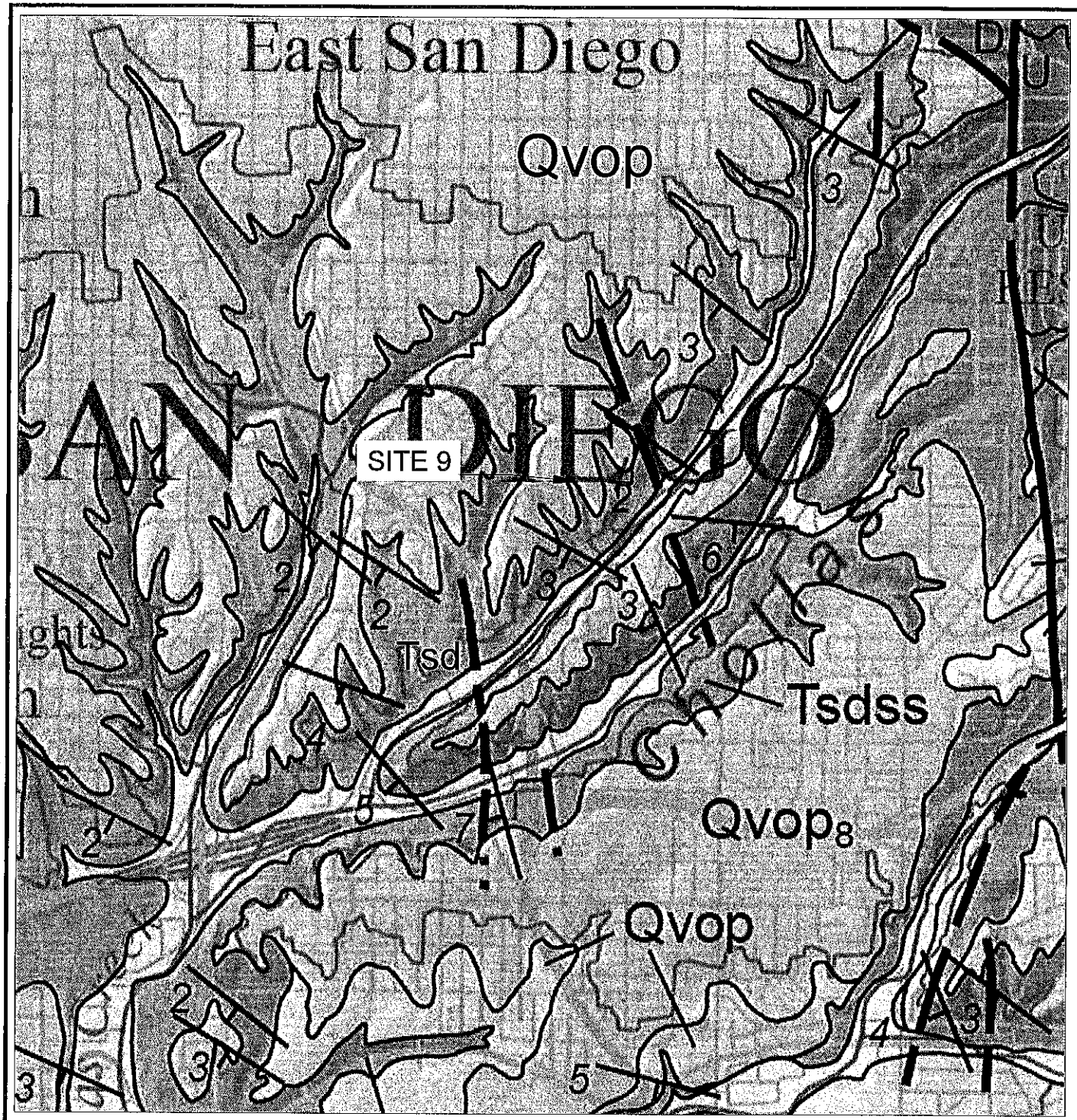
REFERENCE: KENNEDY AND TAN (2008)

TWINING

GEOLOGIC MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE 2G
200055.2	February 2020	



FAULT - SOLID WHERE WELL DEFINED; DASHED - WHERE INFERRED

PROPOSED ALIGNMENT

Tsd	SAN DIEGO FORMATION
Tsdss	SAN DIEGO FORMATION - MARINE SANDSTONE
Qop	OLD PARALIC DEPOSITS
Qvop	VERY OLD PARALIC DEPOSITS

SCALE IN FEET

0 2000 4000

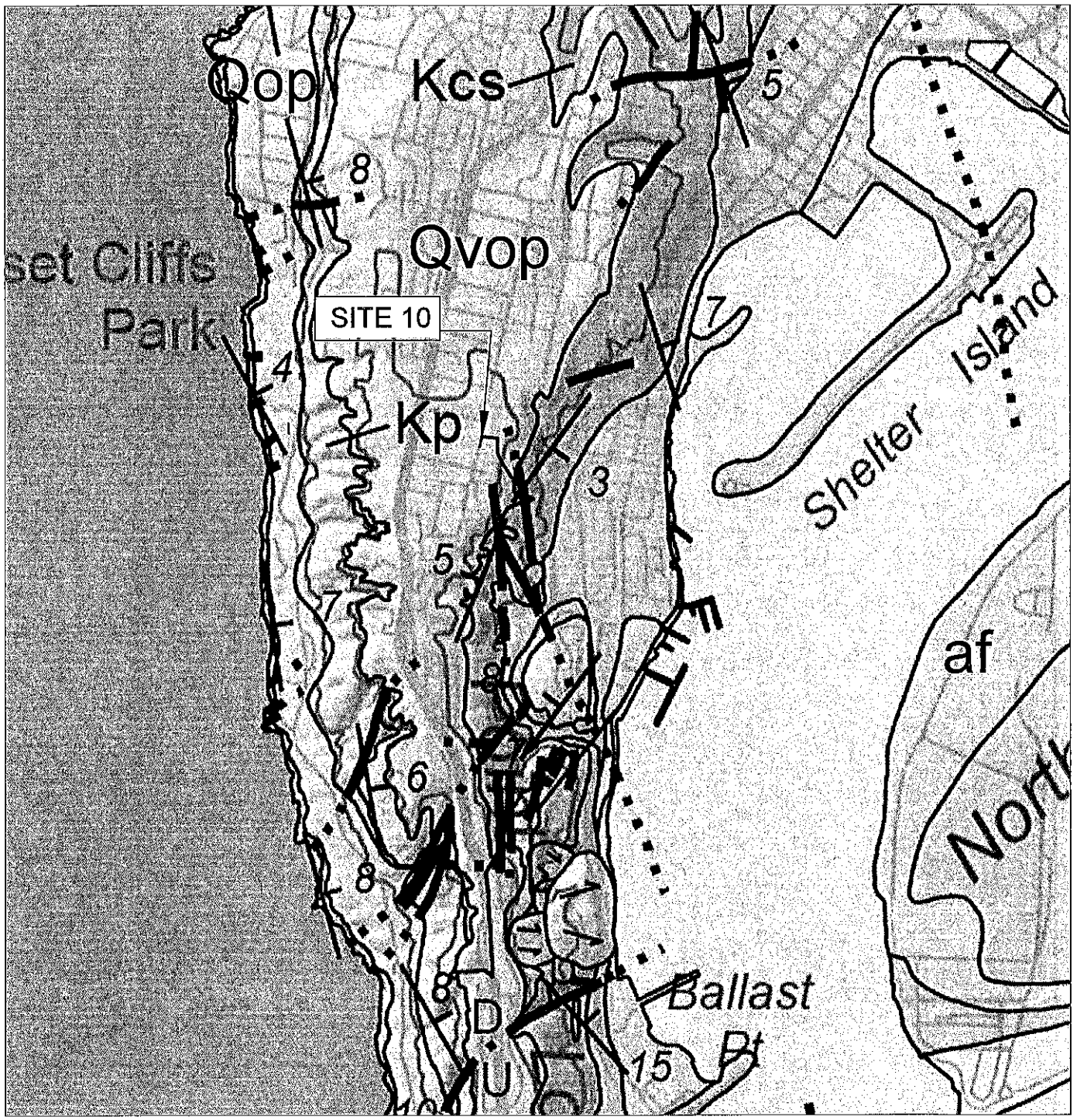
REFERENCE: KENNEDY AND TAN (2008)

TWINING

GEOLOGIC MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE
200055.2	February 2020	FIGURE 2H



FAULT - SOLID WHERE WELL DEFINED; DASHED - WHERE INFERRED

PROPOSED ALIGNMENT

Kp POINT LOMA FORMATION

Kcs CABRILLO FORMATION - SANDSTONE

Qop OLD PARALIC DEPOSITS

Qvop VERY OLD PARALIC DEPOSITS

af ARTIFICIAL FILL

SCALE IN FEET

0 2000 4000

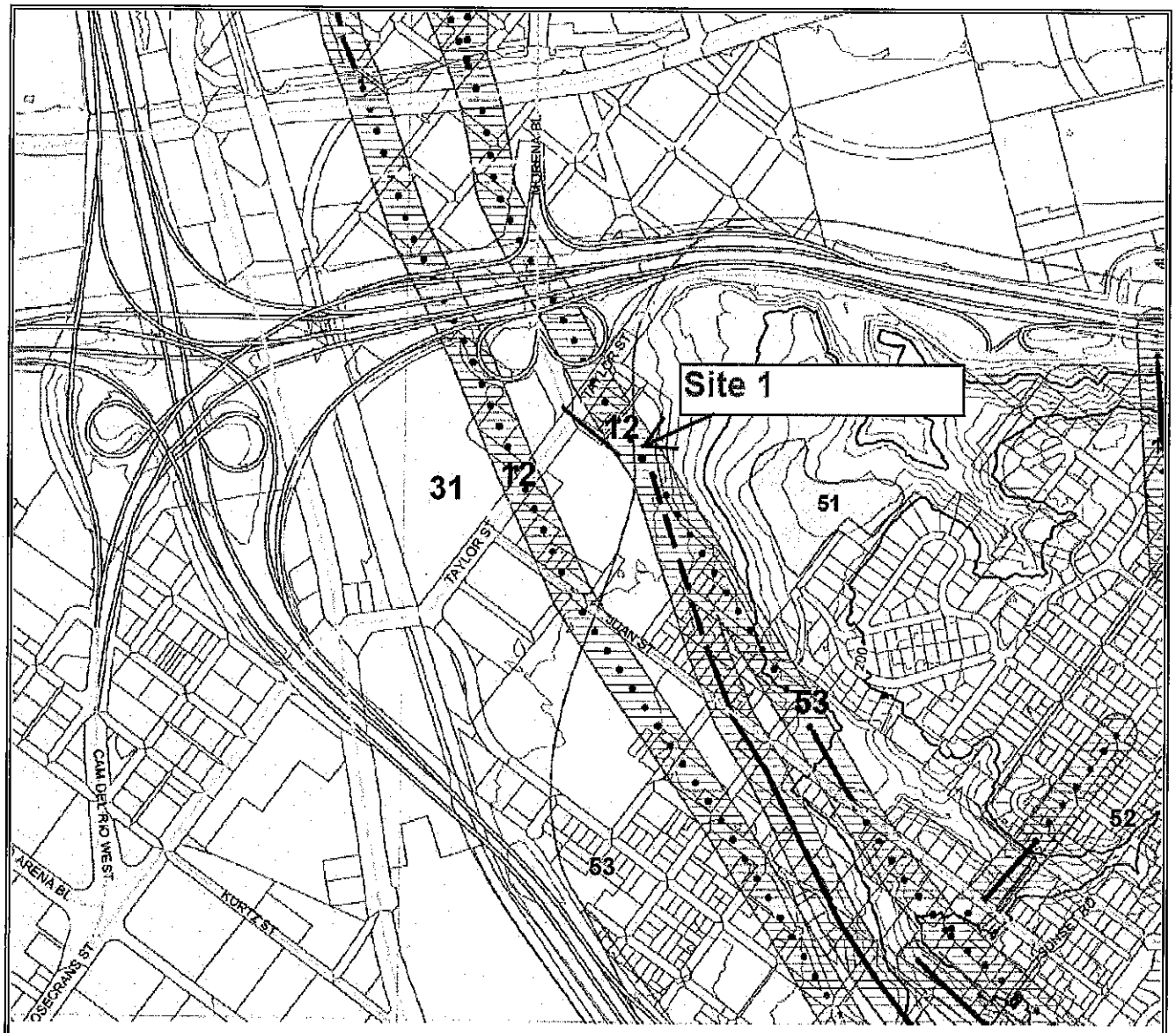
REFERENCE: KENNEDY AND TAN (2008)

TWINING

GEOLOGIC MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE 2I
200055.2	February 2020	



LEGEND

- 51 Level mesas -- underlain by terrace deposits and bedrock nominal risk
- 52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk
- 53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk
- 54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk
- 55 Modified terrain (graded sites) Nominal risk

FAULT ZONES

- 11 Active, Alquist-Priolo Earthquake Fault Zone
- 12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown
- 13 Downtown special fault zone
- 31 High Potential -- shallow groundwater major drainages, hydraulic fills
- 32 Low Potential -- fluctuating groundwater minor drainages

N

SCALE 1" = 600'

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

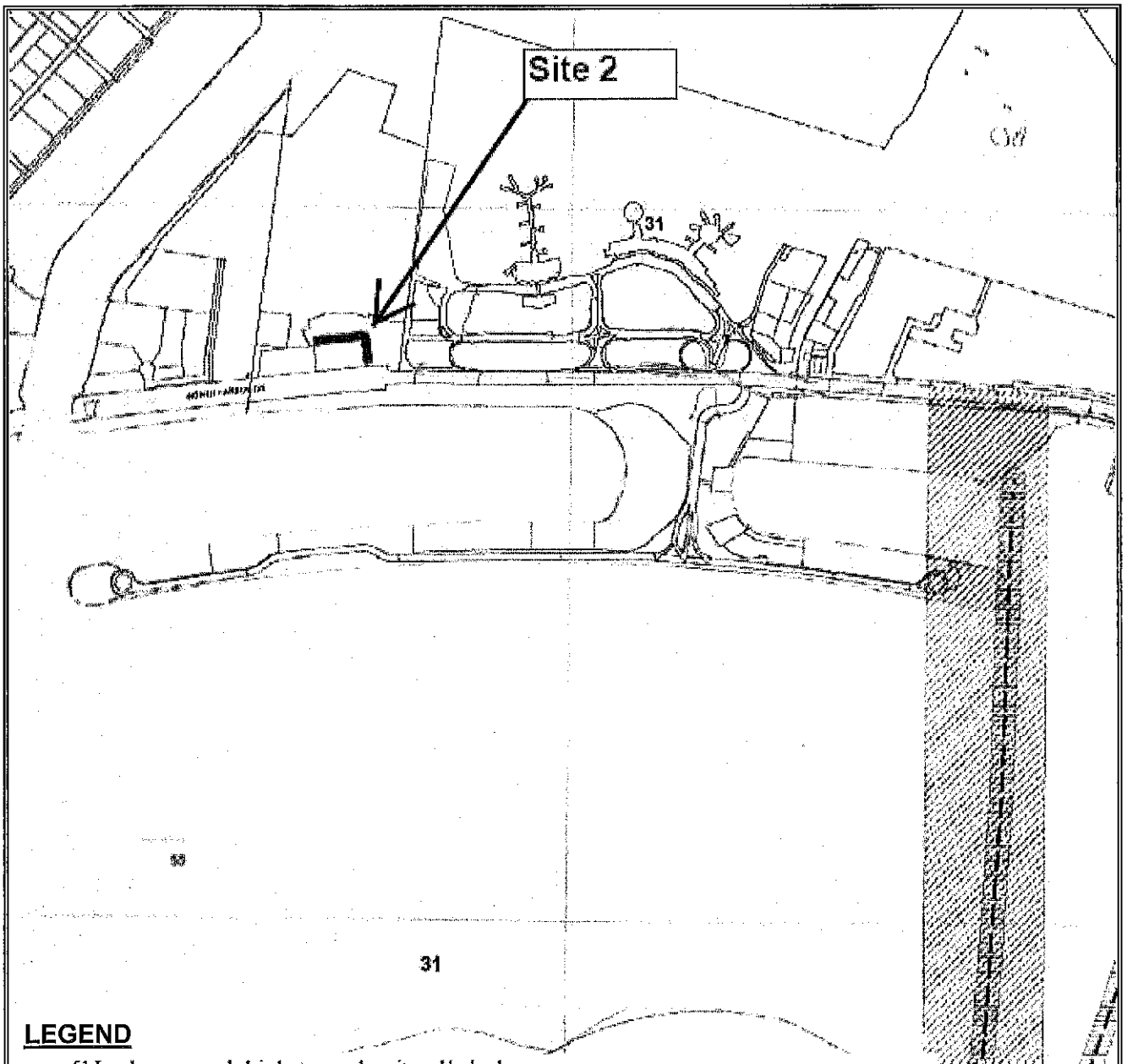
REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP(2008)

TWINING

SEISMIC SAFETY MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 – WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.:	REPORT DATE:	FIGURE 3A
200055.2	February 2020	



LEGEND

51 Level mesas -- underlain by terrace deposits and bedrock ; nominal risk

52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk

53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk

54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk

55 Modified terrain (graded sites) Nominal risk

FAULT ZONES

11 Active, Alquist-Priolo Earthquake Fault Zone

12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown

13 Downtown special fault zone

31 High Potential -- shallow groundwater major drainages, hydraulic fills

32 Low Potential -- fluctuating groundwater minor drainages

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

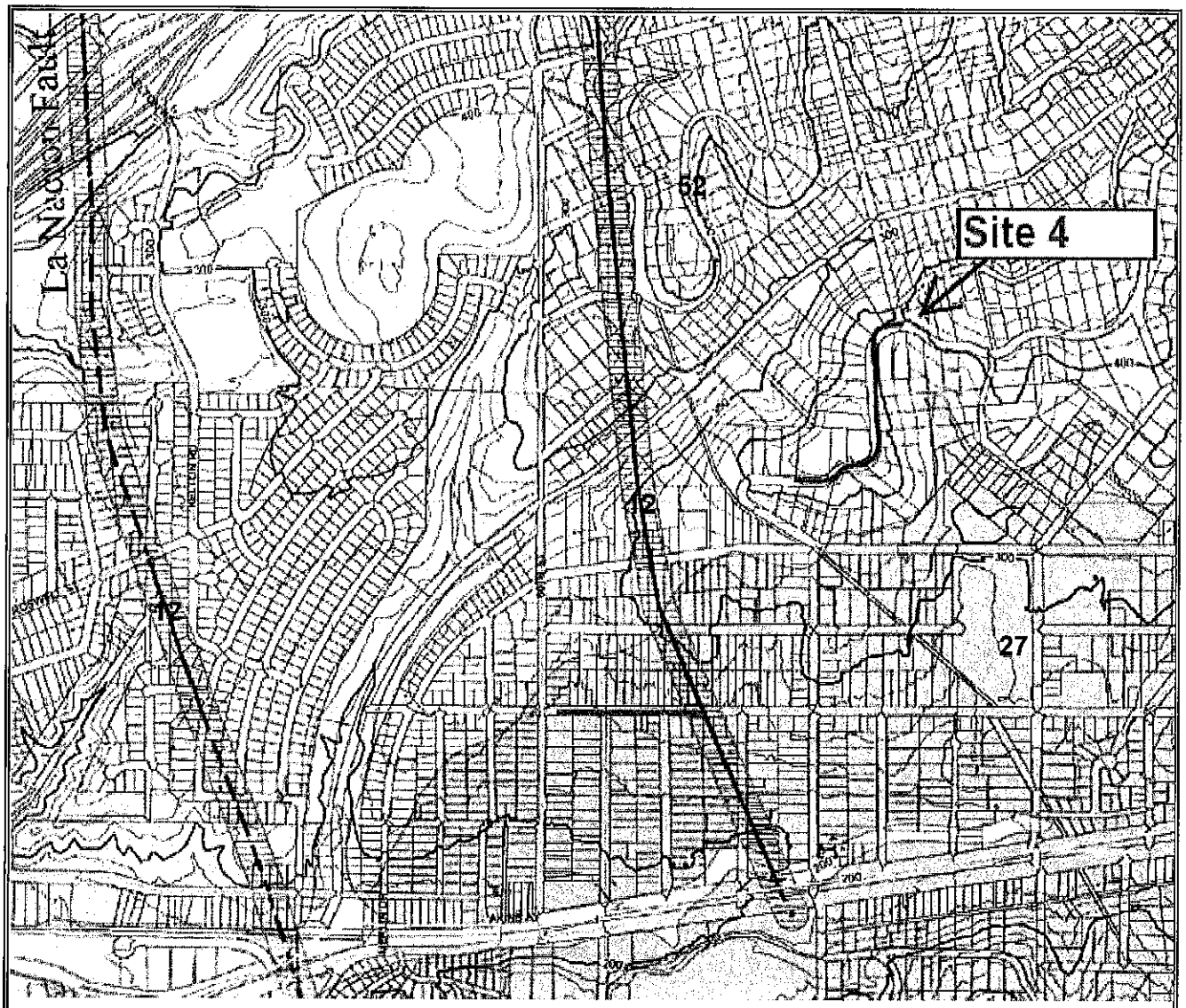
REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP(2008)

TWINING

SEISMIC SAFETY MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 -- WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.:	REPORT DATE:	FIGURE 3B
200055.2	February 2020	



LEGEND

- 51 Level mesas -- underlain by terrace deposits and bedrock nominal risk
- 52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk
- 53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk
- 54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk
- 55 Modified terrain (graded sites) Nominal risk

FAULT ZONES

- 11 Active, Alquist-Priolo Earthquake Fault Zone
- 12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown
- 13 Downtown special fault zone
- 25 Ardath: neutral or favorable geologic structure
- 26 Ardath: unfavorable geologic structure
- 27 Otay, Sweetwater, and others

N

SCALE 1" = 800'

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

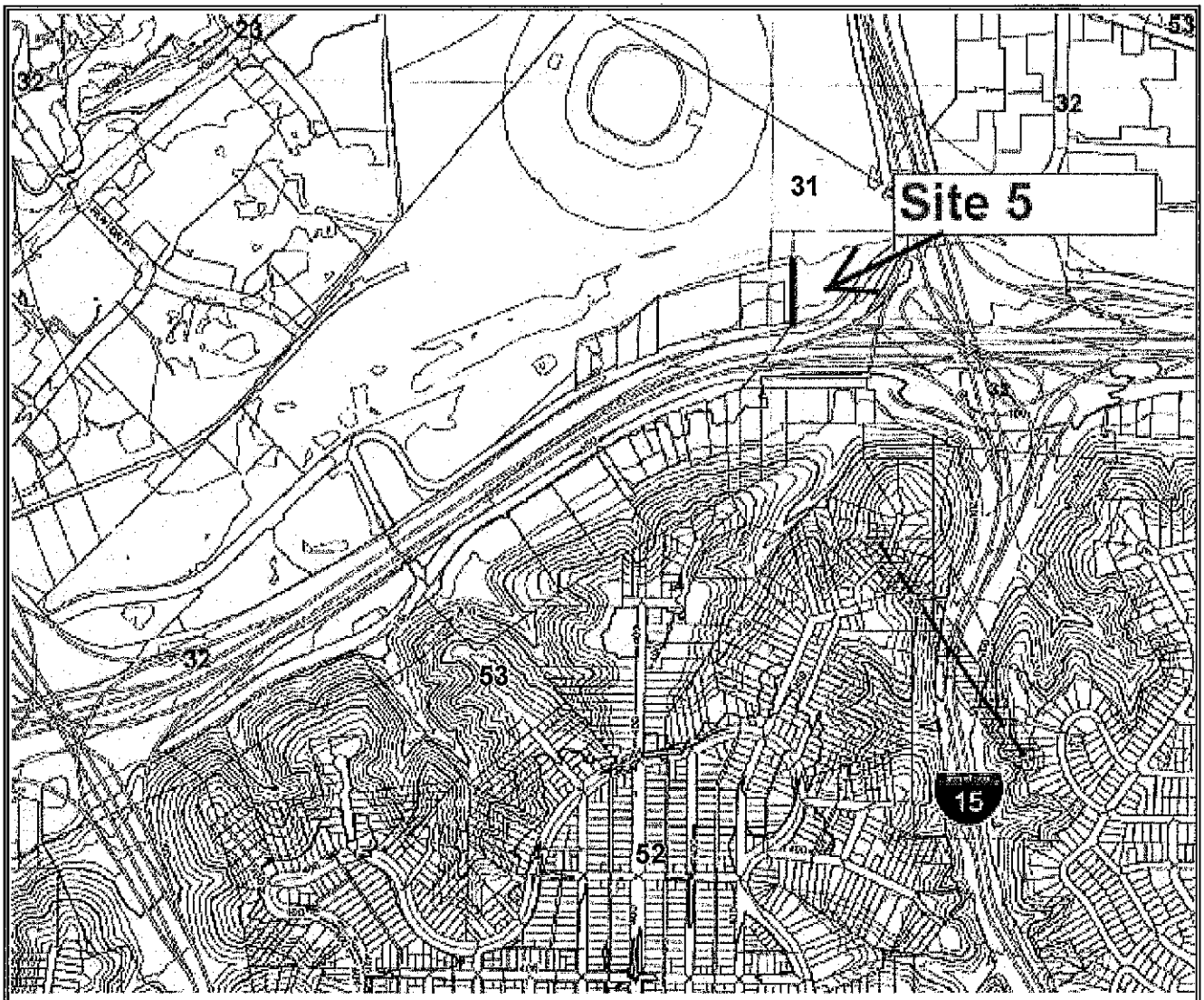
REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP(2008)

TWINING

SEISMIC SAFETY MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 – WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.:	REPORT DATE:	FIGURE 3C
200055.2	February 2020	



LEGEND

- 51 Level mesas -- underlain by terrace deposits and bedrock nominal risk
- 52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk
- 53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk
- 54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk
- 55 Modified terrain (graded sites) Nominal risk

FAULT ZONES

- 11 Active, Alquist-Priolo Earthquake Fault Zone
- 12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown
- 13 Downtown special fault zone
- 23 Friars: neutral or favorable geologic structure
- 24 Friars: unfavorable geologic structure
- 31 High Potential -- shallow groundwater major drainages, hydraulic fills
- 32 Low Potential -- fluctuating groundwater minor drainages

N

SCALE 1" = 900'

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

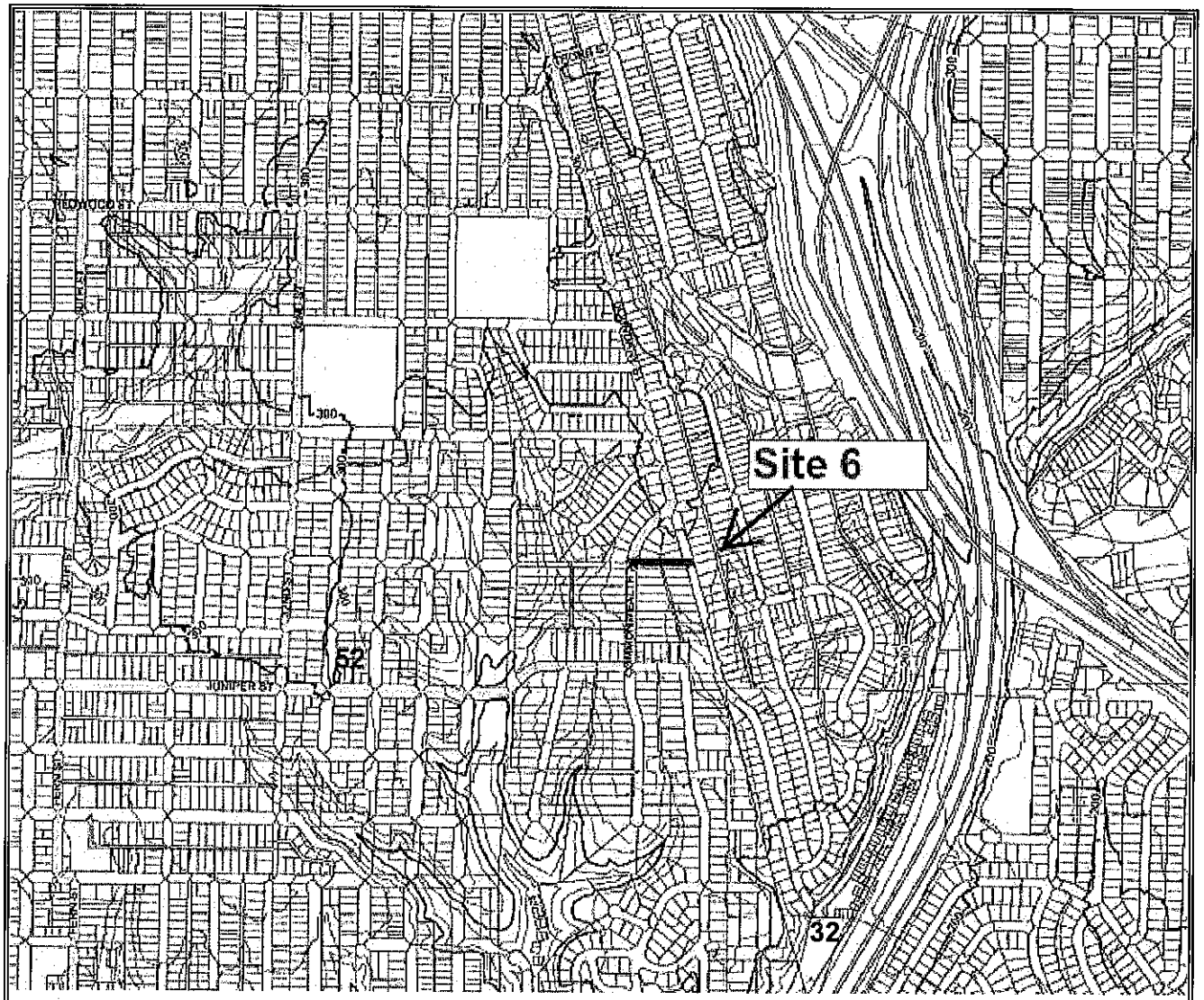
REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP(2008)

TWINING

SEISMIC SAFETY MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 – WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.:	REPORT DATE:	FIGURE 3D
200055.2	February 2020	



LEGEND

51 Level mesas -- underlain by terrace deposits and bedrock nominal risk

52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk

53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk

54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk

55 Modified terrain (graded sites) Nominal risk

FAULT ZONES

11 Active, Alquist-Priolo Earthquake Fault Zone

12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown

13 Downtown special fault zone

23 Friars: neutral or favorable geologic structure

24 Friars: unfavorable geologic structure

31 High Potential -- shallow groundwater major drainages, hydraulic fills

32 Low Potential -- fluctuating groundwater minor drainages

N

SCALE 1" = 900'

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

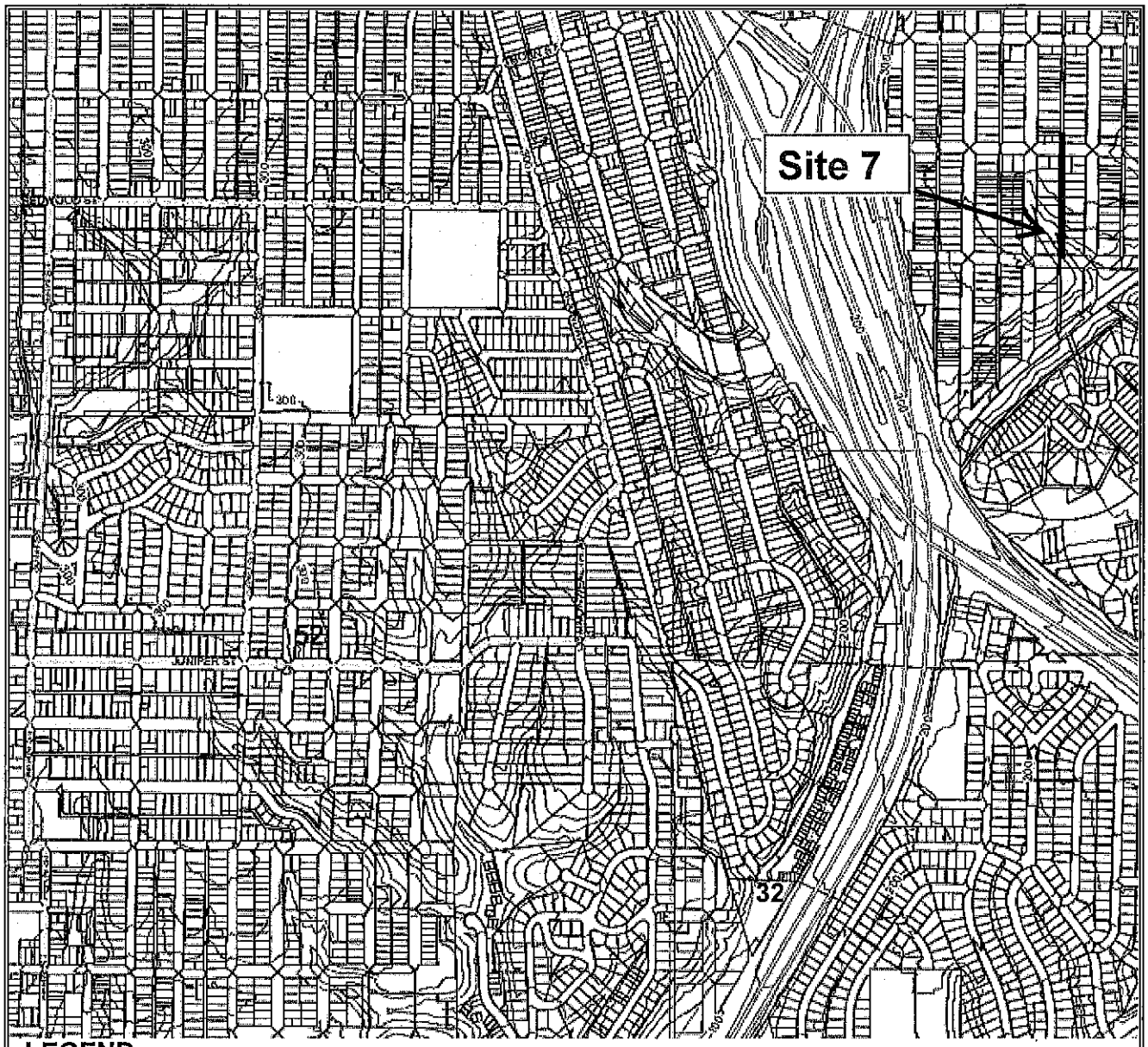
REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP(2008)

TWINING

SEISMIC SAFETY MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 – WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.:	REPORT DATE:	FIGURE 3E
200055.2	February 2020	



LEGEND

- 51 Level mesas -- underlain by terrace deposits and bedrock nominal risk
- 52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk
- 53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk
- 54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk
- 55 Modified terrain (graded sites) Nominal risk

FAULT ZONES

- 11 Active, Alquist-Priolo Earthquake Fault Zone
- 12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown
- 13 Downtown special fault zone
- 31 High Potential -- shallow groundwater major drainages, hydraulic fills
- 32 Low Potential -- fluctuating groundwater minor drainages

N

SCALE 1" = 900'

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

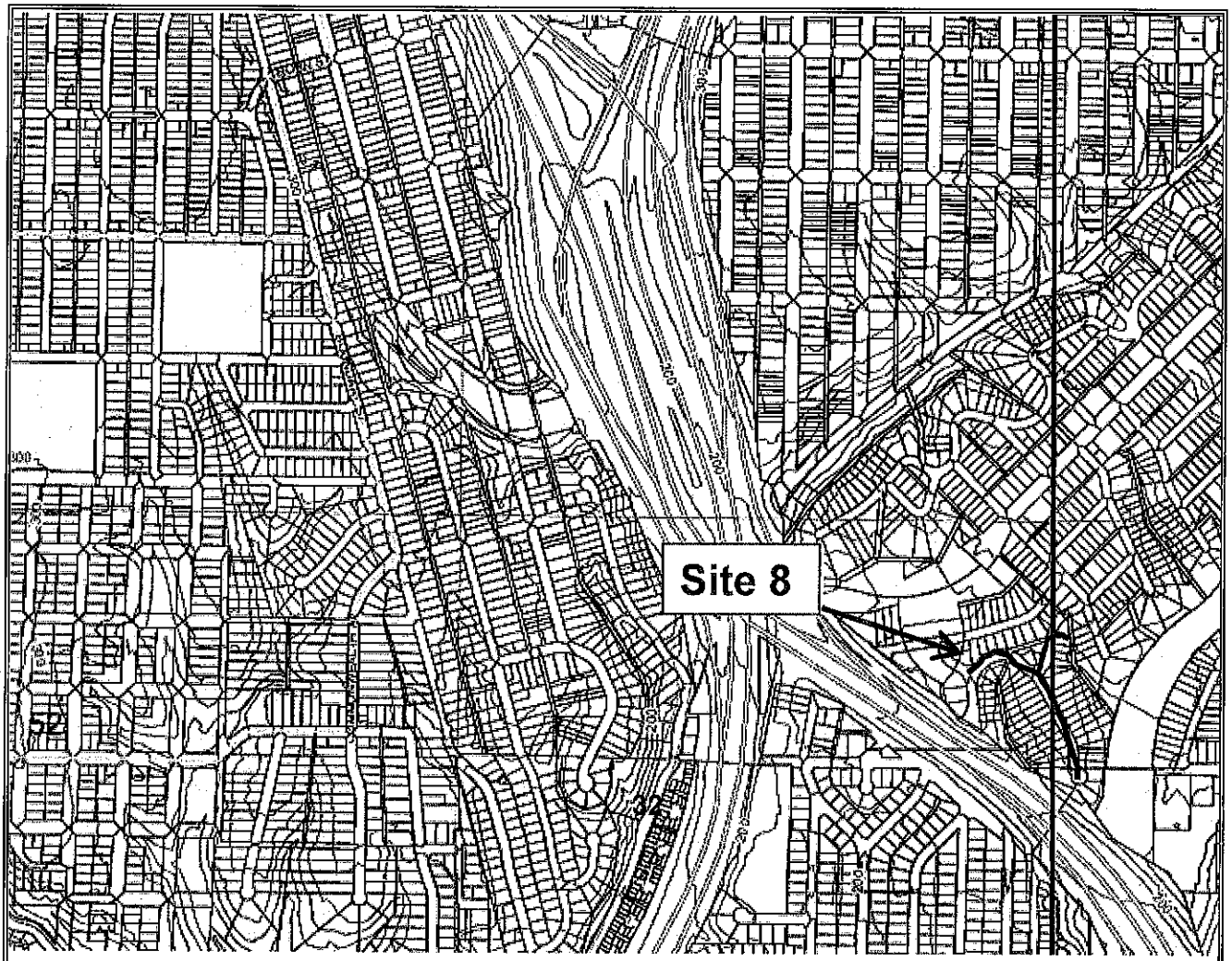
REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP(2008)

TWINING

SEISMIC SAFETY MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 – WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.:	REPORT DATE:	FIGURE 3F
200055.2	February 2020	



LEGEND

- 51 Level mesas -- underlain by terrace deposits and bedrock nominal risk
- 52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk
- 53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk
- 54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk
- 55 Modified terrain (graded sites) Nominal risk

FAULT ZONES

- 11 Active, Alquist-Priolo Earthquake Fault Zone
- 12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown
- 13 Downtown special fault zone
- 31 High Potential -- shallow groundwater major drainages, hydraulic fills
- 32 Low Potential -- fluctuating groundwater minor drainages

N

SCALE 1" = 1000'

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

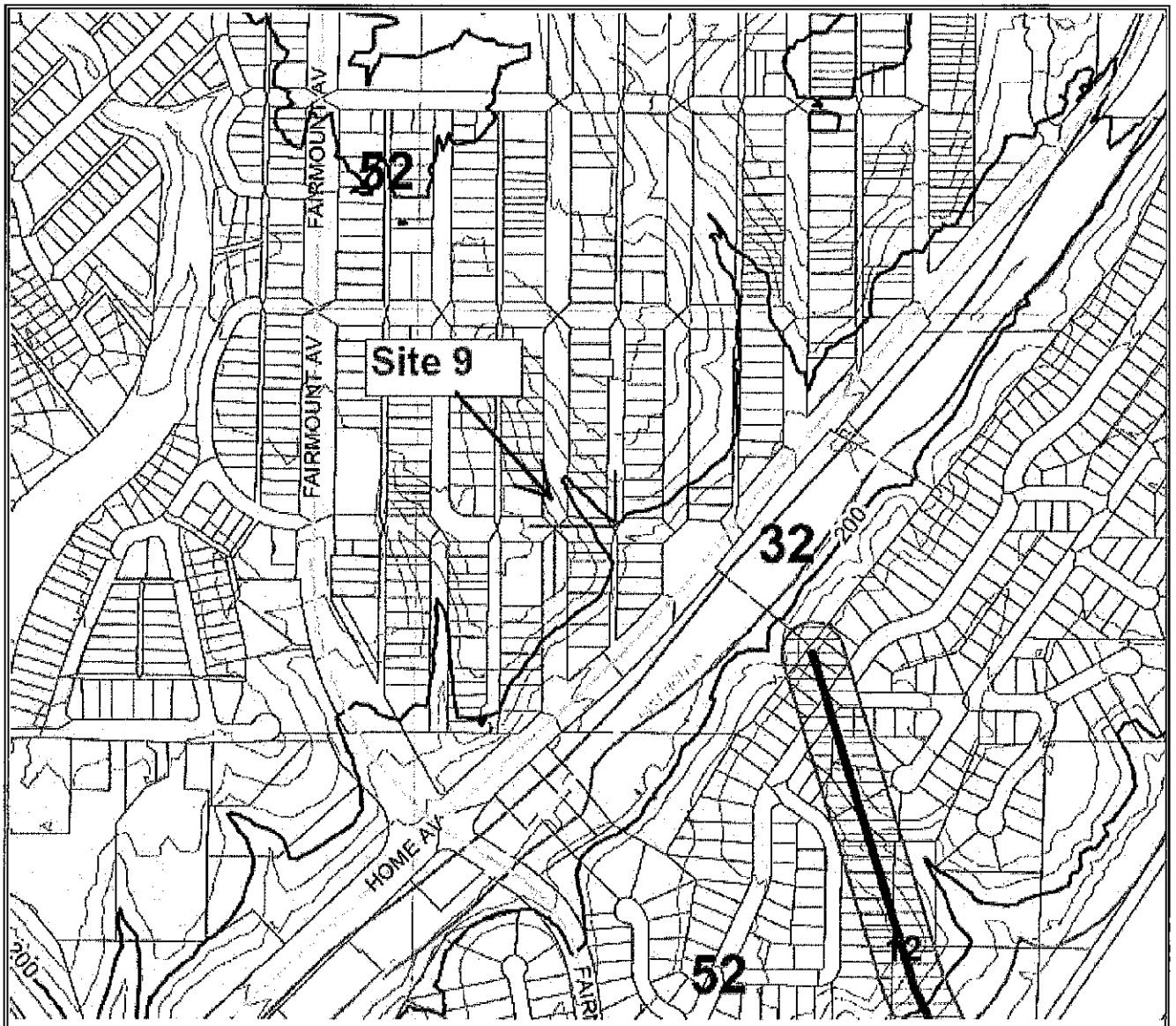
REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP(2008)

TWINING

SEISMIC SAFETY MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 – WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.:	REPORT DATE:	FIGURE 3G
200055.2	February 2020	



LEGEND

51 Level mesas -- underlain by terrace deposits and bedrock nominal risk

52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk

53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk

54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk

55 Modified terrain (graded sites) Nominal risk

FAULT ZONES

11 Active, Alquist-Priolo Earthquake Fault Zone

12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown

13 Downtown special fault zone

31 High Potential -- shallow groundwater major drainages, hydraulic fills

32 Low Potential -- fluctuating groundwater minor drainages

N

SCALE 1" = 550'

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

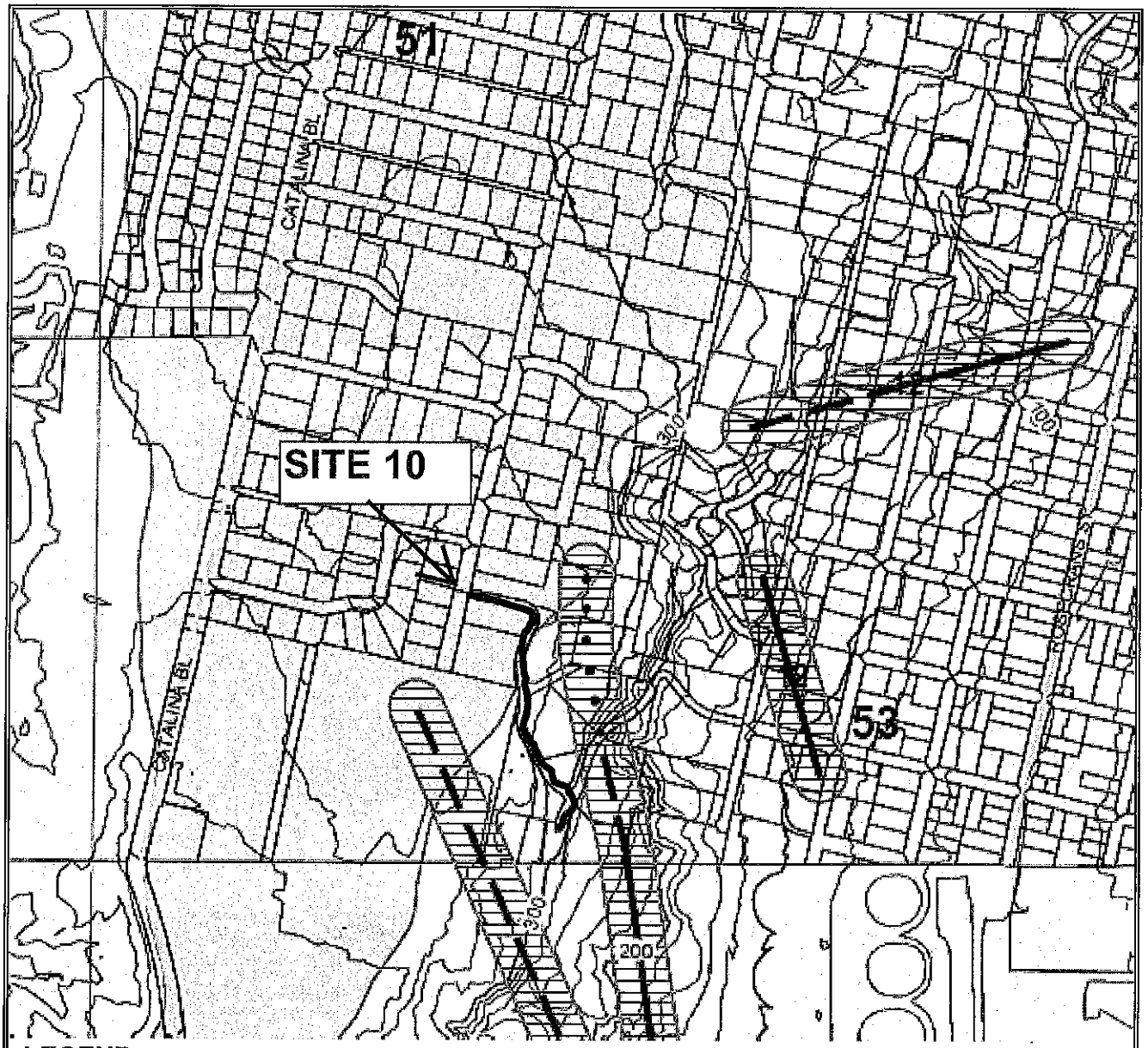
REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP(2008)

TWINING

SEISMIC SAFETY MAP

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 -- WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.:	REPORT DATE:	FIGURE 3H
200055.2	February 2020	



LEGEND

51 Level mesas -- underlain by terrace deposits and bedrock nominal risk

52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk

53 Level or sloping terrain, unfavorable geologic structure, Low to moderate risk

54 Steeply sloping terrain, unfavorable or fault controlled geologic structure, Moderate risk

55 Modified terrain (graded sites) Nominal risk

FAULT ZONES

11 Active, Alquist-Priolo Earthquake Fault Zone

12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown

13 Downtown special fault zone

N

SCALE 1" = 600'

NOTE: ALL DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

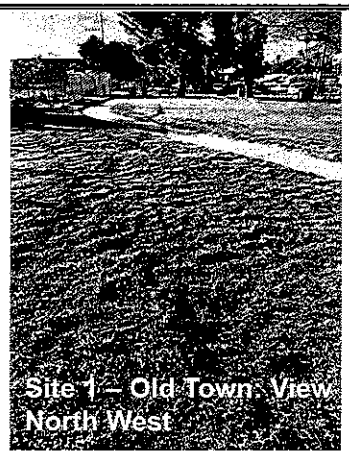
REFERENCE: CITY OF SAN DIEGO SEISMIC SAFETY STUDY MAP(2008)

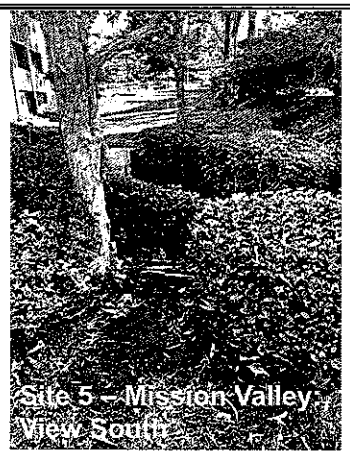
TWINING

SEISMIC SAFETY MAP

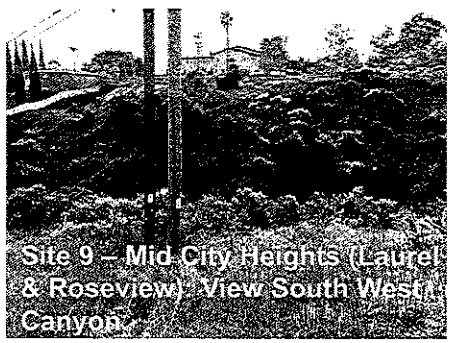
PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 – WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

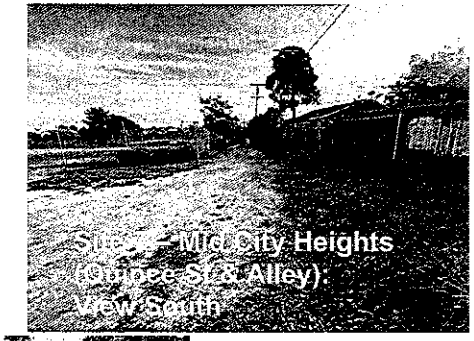
PROJECT NO.:	REPORT DATE:	FIGURE 3I
200055.2	February 2020	


Site 1 – Old Town: View North West

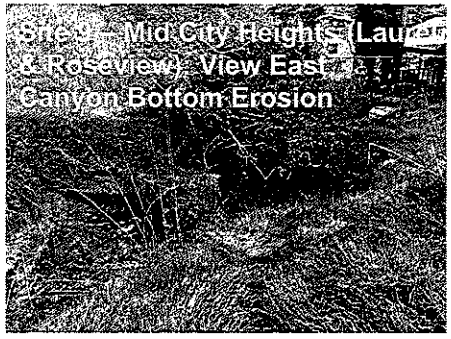

Site 5 – Mission Valley: View South

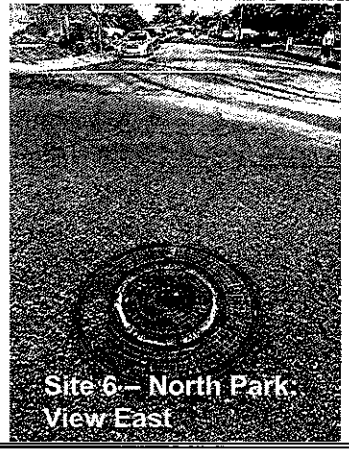

Site 2 – Airport: View East

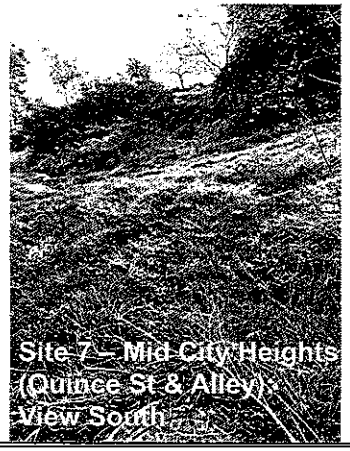

Site 9 – Mid City Heights (Laurel & Roseview): View South West: Canyon

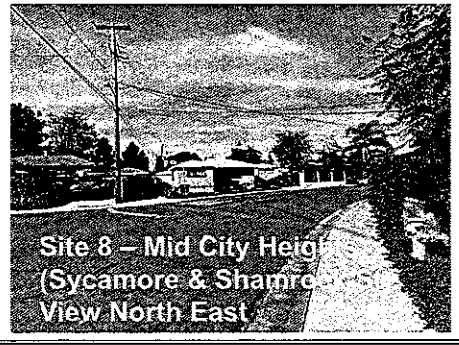

Site 3 – Mid City Heights (Quince St & Alley): View South

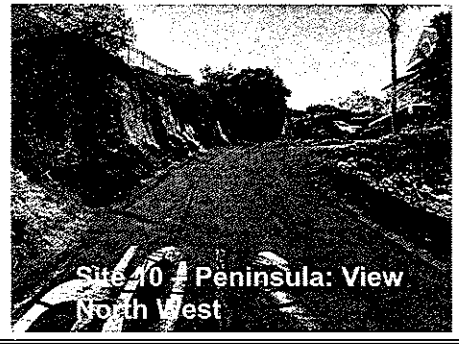

Site 4 – Encanto: View South


Site 9 – Mid City Heights (Laurel & Roseview): View East: Canyon Bottom Erosion


Site 6 – North Park: View East


Site 7 – Mid City Heights (Quince St & Alley): View South


Site 8 – Mid City Heights (Sycamore & Shamrock): View North East


Site 10 – Peninsula: View North West

TWINING

PHOTOS FROM RECONNAISSANCE

PRELIMINARY GEOLOGIC HAZARDS STUDY
TASK 15GT15 WATER AND STORM DRAIN GROUP 968
SAN DIEGO, CALIFORNIA

PROJECT NO.	REPORT DATE	FIGURE 4
200055.2	February 2020	